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**FIELD MANUAL**

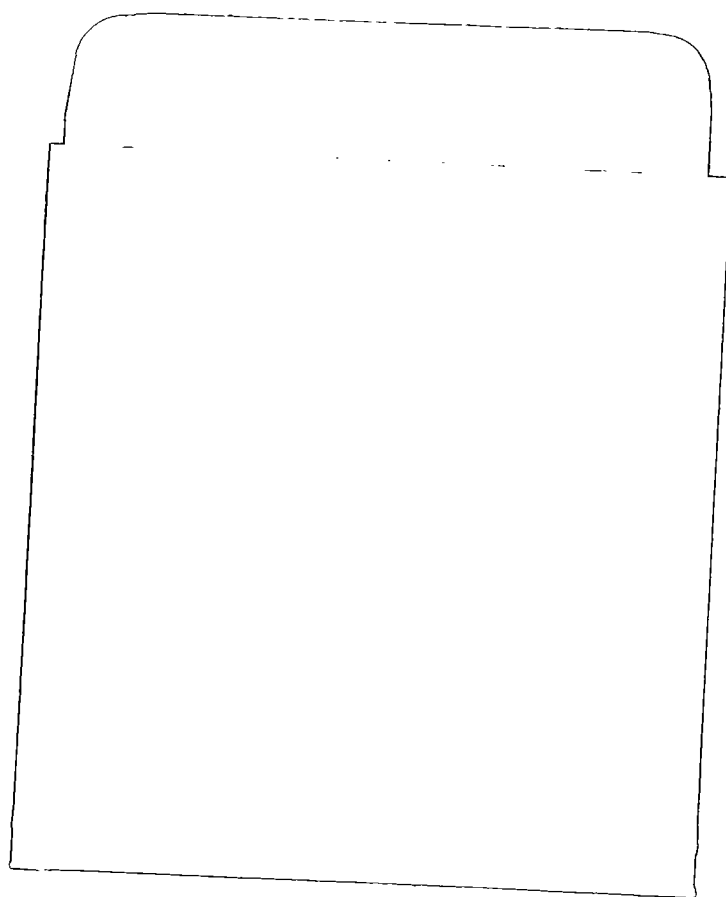
# **QUALIFICATION TESTS FOR SPECIALISTS**

## **FIELD ARTILLERY**

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**HEADQUARTERS, DEPARTMENT OF THE ARMY**  
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FIELD MANUAL }  
No. 6-125

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
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## QUALIFICATION TESTS FOR SPECIALISTS, FIELD ARTILLERY

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\*This manual together with FM 6-162, 12 March 1969, FM 6-161, 26 June 1969, and FM 6-2, 19 June 1970 supersede FM 6-125, 23 April 1963.



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## CHAPTER 1

### GENERAL

#### 1-1. Purpose and Scope

a. This field manual prescribes tests to be used in determining the relative proficiency and qualifications of individual specialists assigned to the field artillery. The tests are designed primarily as training aids to assist the battery commander in evaluating the relative proficiency of individuals and the professional fitness of sections to perform normal combat functions. The material presented herein is applicable without modification to both nuclear and nonnuclear warfare.

b. The prescribed tests are qualification tests; however they are not to be used as a basis for determining the qualifications of individual specialists for promotion or for determining the relative proficiency of batteries or higher units.

c. Qualification tests for field artillery personnel not included in this manual are presented in publications pertinent to specific career fields. For example, gunners and missilemen qualification tests are included in the appropriate service-of-the-piece manuals.

d. The tests included in this manual may also be useful as a study reference for specialists who are preparing for MOS evaluation tests. As MOS evaluation tests are not available on an annual basis to Reserve and National Guard units, the tests presented herein may be used as *guides* to verify the primary military occupational specialties (MOS) of specialists in such units.

e. The word "artillery" used herein relates to field artillery unless otherwise specified.

#### 1-2. Definitions of Terms

a. *Ability*—Used herein to refer to the performance of a specific task; for example the *ability* to splice field wire. A candidate's ability to perform a specific task is determined by a practical test.

b. *Candidate*—The individual being tested.

c. *Knowledge*—Used in this manual to specify

an understanding of a subject. In this sense, having knowledge of a specific operation does not necessarily include having the *ability* to actually perform that operation. A candidate's knowledge is determined by means of oral or written tests.

d. *Minimum Standard*—The specific level of proficiency that is adequate for qualification of an individual, a team, or a unit.

e. *Time of Performance Standard*—The length of time specified as the standard time required by an individual, a team, or a unit to perform a specific operation with a specified degree of proficiency.

#### 1-3. Awards of Qualification Badges

Successful completion of the tests in this manual, except those described in chapters 6 and 7 will form the basis for award of the appropriate qualification badges with the field artillery bar as described in AR 672-5-1; however, badges will be awarded only upon approval from the Department of the Army.

a. Awards for drivers and mechanics are described in paragraph 110, AR 672-5-1.

b. Each eligible artillery mechanic will take the applicable gunner's qualification tests for the unit to which he is assigned.

#### 1-4. Performance Tests

a. *General Instructions*. The qualification tests for specialists contained herein are to be used as a *guide* in testing specialists in field artillery units. The nature of the job classification of certain specialists necessitates the inclusion of written and oral tests in this manual. Exact scoring of which type test is often difficult and is not always truly indicative of the individual's ability. In utilizing such tests that require oral answers, the unit commander may, at his discretion, modify the test material and grading procedures based on the educational level of the

individual and his ability to express himself orally.

*b. Examiners.* An officer, a warrant officer, or an enlisted man who is fully qualified and experienced in the subject covered by a particular test will be detailed as "examiner" to administer that test.

*c. Assistance.* The candidate will receive no unauthorized assistance during the tests. Each candidate may select assistants as authorized in the tests. If an assistant or the examiner causes the candidate to fail a test, the test will be disregarded and the candidate will be given another test of the same nature.

*d. Time.* When time limits are specified for a test, the time will start at the last word of the examiner's command to the candidate and will end at the last word of the candidate's report or at the candidate's last action in the operation that he is performing. The candidate may begin each test after the first word of the first command.

*e. Scoring.* Scoring will be in accordance with the subparagraphs titled "Penalties" and "Credit" for each test. No penalty in excess of the maximum allowable credit will be assessed for any test. *When the total penalty assessed for a test equals the total credit allowed for that test, the candidate will be declared disqualified in that test and the examiner will proceed to the next test.*

*f. Preparation for Tests.* Before the qualification tests, examiner will familiarize himself with the tests, including the authorized penalties and credits. He will insure that all materials and equipment required for the tests are prepared, are readily accessible, and are in good operating condition. He will insure that the candidate understands the requirements of each test and will

require the candidate to report I AM READY before each test. For those tests that require a detailed explanation by the candidate, checklists based on information presented in specific reference material should be prepared. A detailed checklist will provide uniformity in scoring procedures that are influenced not only by the performance of the candidate but also by the difference in proficiency standards of various examiners.

*g. Qualification Scores.* Percentage scores required for qualification in the tests are as follows:

<i>Individual classification</i>	<i>Percentage score</i>
Expert .....	93 to 100 percent
First-class specialist .....	86 to 92 percent
Second-class specialist .....	76 to 85 percent
Third-class specialist .....	70 to 75 percent

## 1-5. References

Applicable references are listed in the appendix. Before preparation of each qualification test, examiners should consult Department of the Army pamphlets of the 310-series for latest revisions, supersessions, and rescissions of reference material.

## 1-6. Changes and Comments

Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons will be provided for each comment to insure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commandant, US Army Field Artillery School, ATTN: ATSFA-PL-MO, Fort Sill, Oklahoma 73503.

## CHAPTER 2

### OPERATIONS SPECIALISTS

#### 2-1. General

In order to be considered fully qualified as operations specialists, operations personnel in all artillery echelons must successfully complete the

tests presented in paragraphs 2-3 through 2-14 of this chapter. Tests that should be administered to operations personnel a division artillery, field artillery group, or higher echelon are presented in paragraphs 2-15 and 2-16.

#### 2-2. Outline of Tests

Paragraph No.	Subject	Number of tests	Points each	Maximum credit	
				Battery and battalion	Higher echelons
2-3	Preparation of firing charts .....	1	5	5	--
2-4	Determination of data from the firing chart .....	3	4	12	--
2-5	Determination of site .....	1	6	6	--
2-6	Computation of fire commands .....	3	2	6	--
2-7	Computation of corrections from meteorological data ..	2	--	11	--
	Test 1 .....	(1)	7	(7)	
	Test 2 .....	(1)	4	(4)	
2-8	Computation of corrections from a high-burst (or mean-point-of-impact) registration .....	1	5	10	--
2-9	Map reading .....	5	2	10	10
2-10	Replot of targets .....	1	5	5	--
2-11	Computation of photo scale .....	3	--	10	10
	Test 1 .....	(1)	5	(5)	(5)
	Test 2 .....	(1)	3	(3)	(3)
	Test 3 .....	(1)	2	(2)	(2)
2-12	Restitution .....	1	10	10	10
2-13	Fire capabilities chart .....	1	6	6	--
2-14	Communication .....	10	--	10	10
	Tests 1 through 10 .....	(10)	1	(10)*	(10)
2-15	Fire direction procedures for higher artillery headquarters .....	4	--	--	45
	Tests 1 and 3 .....	(2)	15	--	(30)
	Test 2 .....	(1)	5	--	(5)
	Test 4 .....	(1)	10	--	(10)
2-16	Counterbattery activities .....	1	15	--	15
	Total .....	37	--	101	100

\*Battery and battalion operations personnel will not be required to take test 3 of paragraph 2-14.

#### 2-3. Preparation of Firing Charts

*a. Scope of Test.* One test will be conducted to determine the candidate's ability to prepare a firing chart for use in the fire direction center.

*b. Special Instructions.*

(1) The candidate will be furnished the coordinates and altitude each of the following locations:

(a) The battery centers of batteries A, B, and C.

(b) The registration point.

(c) An observation post (01).

(d) Two targets within transfer limits of the registration point.

(2) The candidate will be provided with the following material and equipment:

- (a) A grid sheet appropriately numbered for plotting.
- (b) A target grid.
- (c) A boxwood scale.
- (d) A range-deflection protractor prepared

- with appropriate deflection and azimuth markings.
- (e) Plotting equipment, including pencils of the appropriate type and color.
- (3) The firing chart prepared for this test may be used for subsequent tests.

c. Outline of Test.

Examiner commands—	Action of candidate
YOU ARE THE HORIZONTAL CONTROL OPERATOR. THE SURVEY SECTION HAS JUST HANDED YOU THE COORDINATES AND ALTITUDES OF THE BATTERY CENTERS, REGISTRATION POINT 1, OBSERVATION POST (01), AND TWO TARGETS WITHIN TRANSFER LIMITS OF REGISTRATION POINT 1. THE GRID AZIMUTH FROM 01 TO REGISTRATION POINT 1 IS 1230. ALL BATTERIES ARE LAID ON AN AZIMUTH THAT PASSES THROUGH REGISTRATION POINT 1. PREPARE THE FIRING CHART FOR USE IN THE FIRE DIRECTION CENTER.	Completes chart to include— <ul style="list-style-type: none"><li>a. Plotting all coordinates received from the survey section.</li><li>b. Drawing and labeling deflection indexes.</li><li>c. Drawing three azimuth indexes from 01. (See FM 6-40.)</li></ul>

d. Penalties.

- (1) If the location of any surveyed position is plotted in error by more than 20 meters, a penalty of 2 points will be assessed for each incorrect location.
- (2) If a deflection index or one of the azimuth indexes from 01 is in error by more than 2 mils, a penalty of 2 points will be assessed.
- (3) No credit will be allowed if the candidate requires more than 25 minutes to complete the test.

e. Credit. Subject to the penalties assessed in

c. Outline of Tests.

d above, credit will be awarded as indicated in paragraph 2-2.

2-4. Determination of Data From the Firing Chart

- a. Scope of Tests. Three tests will be conducted to determine the candidate's ability to determine data from the firing chart and to announce these data to the computers.
- b. Special Instructions. The candidate will use the equipment and materials furnished for the preceding test. Only those targets previously plotted on the firing chart will be used.

Test No.	Examiner commands—	Action of candidate
1	YOU ARE THE HORIZONTAL CONTROL OPERATOR. DETERMINE AND ANNOUNCE THE DATA TO TARGET _____ (one of the targets previously plotted) BASED ON THE FOLLOWING ORDER: BATTALION _____, USE GFT, LOT _____, CHANGE _____, FUZE _____, 2 ROUNDS, TARGET _____.	Determined and announces all data normally announced by the horizontal control operator. (See FM 6-40.)
2	THE FOLLOWING CALL FOR FIRE HAS JUST BEEN RECEIVED: FIRE MISSION, FROM TARGET _____, DIRECTION _____, RIGHT (LEFT) _____, ADD (DROP) _____, 2 MACHINEGUNS FIRING, ADJUST FIRE. (Examiner gives a target location within 1,000 meters of plotted target). DETERMINE AND ANNOUNCE FIRING DATA BASED ON THE FOLLOWING FIRE ORDER: BATTALION _____, USE GFT, LOT _____, CHARGE _____, 3 ROUNDS, TARGET _____.	Orients the target grid and plots the target location. Determines and announces all data normally announced by the horizontal control operator to the adjusting battery. (See FM 6-40.)
3	THE FOLLOWING CALL FOR FIRE HAS JUST BEEN RECEIVED: FIRE MISSION, DIRECTION _____, DISTANCE _____, INFANTRY IN OPEN, TIME IN EFFECT, ADJUST FIRE. DETERMINE FIRING DATA BASED ON THE FOLLOWING FIRE ORDER: BATTALION _____, USE GFT, LOT _____, CHARGE _____, 3 ROUNDS, TARGET _____.	Orients the target grid and plots the target location. Determines and announces all data normally announced by the horizontal control operator to the adjusting battery. (See FM 6-40.)



*d. Penalties.*

(1) *Test 1.* A penalty of 2 points will be assessed for each—

(a) Error in range in excess of 30 meters.

(b) Error in deflection in excess of 3 mils.

(2) *Tests 2 and 3.*

(a) For each error in location of target in excess of 20 meters, a penalty of 2 points will be assessed; for each error in excess of 30 meters, 3 points will be assessed; and for each error in excess of 40 meters, 4 points will be assessed.

(b) A penalty of 1 point will be assessed for each error of 10 mils or more in drawing the target grid azimuth index.

(c) A penalty of 1 point will be assessed for each error in deflection in excess of 3 mils.

*c. Outline of Test.*

(d) A penalty of 1 point will be assessed for each error in range in excess of 30 meters.

(e) If the candidate requires more than 1 minute to complete the test, no credit will be allowed.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 2-2.

**2-5. Determination of Site**

*a. Scope of Test.* One test will be conducted to determine the candidate's ability to compute site by using a graphical site table (GST).

*b. Special Instructions.*

(1) The candidate will be furnished a GST in addition to the materials listed in paragraph 2-3b(2).

(2) The site will be determined for each target plotted on the firing chart.

Examiner commands—

Action of candidate

DETERMINE THE SITE TO EACH OF THE FOLLOWING TARGETS.  
(Examiner gives previously prepared fire orders for both targets that have been plotted on the firing chart).

Determines and announces site for each designated battery. Altitudes of target and battery were previously plotted on firing chart. (See FM 6-40.)

*d. Penalties.*

(1) A penalty of 1 point will be assessed for an error of 1 mil in any site computed. If the computed site is close to 0.5 (such as 3.5), both answers of 3 or 4 are correct.

(2) Time penalties will be assessed as follows:

Time	Penalty
30 to 45 seconds	1 point
45 to 60 seconds	2 points
over 60 seconds	3 points

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 2-2.

**2-6. Computation of Fire Commands**

*a. Scope of Tests.* Three tests will be conducted to determine the candidate's ability to perform the duties of a battery computer.

*b. Special Instructions.*

(1) The candidate will be furnished a GFT, at least six FDC Computer's Records (DA Form 3622), and at least two Records of Precision Fire (DA Form 6-12).

(2) Prior to the start of the tests, the examiner will prepare the data to be determined by the horizontal control operator and announced to the computer during the missions. In addition, the examiner will prepare the fire order required for each mission.

(3) Test 1 will consist of an impact and time registration. The candidate will complete the registration to include computing the adjusted data, determining the GFT setting, and placing the correct GFT setting on the GFT. The GFT setting placed on the GFT will be used in test 2.

(4) Test 2 will consist of a normal area mission, using time fuze and the GFT setting determined in (3) above.

(5) Test 3 will consist of a high-angle mission in which the angle of site exceeds 30 mils.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	YOU ARE COMPUTER BRAVO. THE FOLLOWING CALL FOR FIRE HAS JUST BEEN RECEIVED: FIRE MISSION, REGISTRATION POINT 1. DIRECTION 4710, REGISTRATION, ADJUST FIRE. DETERMINE DATA BASED ON THE FOLLOWING FIRE ORDER: BRAVO, USE GFT, LOT _____, CHARGE _____, REGISTRATION POINT 1. THE ALTITUDE OF REGISTRATION POINT IS _____, AND THE ALTITUDE OF BATTERY B IS _____. (Examiner announces predetermined horizontal control operator data and observer corrections to the candidate for each round until the fire-for-effect phase. In fire for effect, the examiner furnishes the angle T and observer spottings).	Records appropriate data on the record of precision fire.
2	THE FOLLOWING CALL FOR FIRE HAS JUST BEEN RECEIVED: FIRE MISSION. FROM REGISTRATION POINT 1, DIRECTION _____, RIGHT (LEFT) _____, UP (DOWN) _____, ADD (DROP) _____, INFANTRY IN OPEN, TIME IN EFFECT, ADJUST FIRE. DETERMINE DATA BASED ON THE FOLLOWING FIRE ORDER: BATTALION, _____, USE GFT, LOT _____, CHARGE _____, 2 ROUNDS, TARGET _____. THE ALTITUDE OF BATTERY B IS _____. (Examiner announces previously prepared horizontal control operator's data and observer corrections for each round of the mission.	Records and computes the mission, adjusted deflection, elevation, and adjusted time; announces GFT setting and records GFT setting on the GFT. Determines total deflection and constructs the deflection correction scale. (See FM 6-40.)
3	THE FOLLOWING CALL FOR FIRE HAS JUST BEEN RECEIVED: FIRE MISSION, GRID _____, DIRECTION _____, 2 MACHINEGUNS FIRING, HIGH-ANGLE, ADJUST FIRE. THE FIRE ORDER IS AS FOLLOWS: BATTALION _____, USE GFT, LOT _____, INCLUDE SITE, FUZE VT, 2 ROUNDS, TARGET _____. (Examiner announces altitudes of the target and Battery B and previously prepared horizontal control operator's data—deflection correction, chart deflection, and range. The examiner announces above data and observer correction for each round of mission.)	Records fire mission and fire order. Records data announced by examiner and determines and records all data normally computed by the adjusting battery computer. (See FM 6-40.)

*d. Penalties.*(1) *Test 1.*

(a) Error in adjusted deflection, no credit allowed.

(b) Error in adjusted elevation, no credit allowed.

(c) Error in adjusted time, no credit allowed.

(d) Error in determining or announcing the GFT setting or in constructing the GFT setting on the GFT, 1 point.

(e) Error in procedure, 1 point.

(f) Error in recording data, 1 point.

(g) Error in preparing the deflection correction scale, 1 point.

(2) *Test 2.*

(a) Error in recording data, 1 point.

(b) Failure to use deflection correction scale or incorrect use of deflection correction scale, 1 point.

(c) Error in 20/R factor, 1 point.

(d) Failure to include 20/R, no credit allowed.

(e) Error in computation or application of observer's height-of-burst changes (up or down), 1 point.

(3) *Test 3.*

(a) Error in recording data, 1 point.

(b) Error in excess of 3 mils in the piece quadrant elevation, (QE fired) 1 point.

(c) Error in excess of 1 mil in the piece deflection, (deflection fired) 1 point.

*e. Credit.* Subject to the penalties assessed in *d* above, 2 points will be awarded for each test.

## 2-7. Computation of Corrections From Meteorological Data

*a. Scope of Tests.* Two tests will be conducted to determine the candidate's ability to compute corrections from a meteorological (met) message, to apply the corrections to the GFT, and to construct a deflection correction scale.

### *b. Special Instruction.*

(1) The candidate will be furnished a GFT, a tabular firing table, and a subsequent met message. He will be furnished the following information:

### *c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	COMPUTE THE MET MESSAGE FROM THE DATA GIVEN, AND ANNOUNCE THE CORRECTIONS OBTAINED.	Determines met corrections and announces all corrections.
2	DETERMINE THE MET PLUS VE GFT SETTING AND CONSTRUCT THE GFT SETTING ON THE GFT. CONSTRUCT THE DEFLECTION CORRECTION SCALE.	Determines the met plus VE GFT setting and constructs it on the GFT. Constructs a deflection correction scale on the GFT or on a card. (See FM 6-40.)

*d. Penalties.* Penalties will be assessed as follows:

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

(a) New range corrections are in error in excess of 10 meters.

(b) Met deflection correction is in error by 1 mil.

(c) Met message is computed incorrectly.

(2) *Test 2.* No credit will be allowed if the GFT setting or deflection correction scale is incorrect.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as follows.

(1) *Test 1.*

Time in minutes, exactly or

lest than ----- 10 11 12

Credit ----- 7 5 3

(2) *Test 2.* Correct GFT setting, 2 points.

(3) *Test 2.* Correct deflection scale, 2 points.

## 2-8. Computation of Corrections from a High-Burst or Mean-Point-of-Impact Registration

*a. Scope of Test.* One test will be conducted to determine the candidate's ability to compute

(a) Firing chart data to fire on the registration point.

(b) Necessary information from the battery.

(c) VE obtained from a registration and concurrent met message.

(d) QE obtained with the last GFT setting and site.

(e) Position deflection correction.

(2) Prior to the start of the tests, the candidate will be furnished a form for computation of the met message or will be given an opportunity to prepare his own form, whichever he desires.

corrections from a high-burst (HB) or mean-point-of-impact (MPI) registration.

*b. Special Instructions.* The following will be furnished the candidate:

(1) A firing chart on which 01, 02, and the battery center have been plotted; azimuth indexes of 01 and 02 have been plotted; and a deflection index has been constructed.

(2) Six usable azimuth readings each from observers 01 and 02.

(3) The data fired.

(4) The azimuth and distance from 01 to 02 base.

(5) The coordinates of 01.

(6) TM 6-230.

(7) DA Form 6-55.

(8) A range deflection protractor.

(9) A GFT.

(10) A GST.

(11) A boxwood scale.

(12) A military slide rule (if desired by the candidate).

(13) Plotting equipment.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	THE HIGH-BURST REGISTRATION WAS FIRED WITH CHARGE _____, DEFLECTION _____, RANGE _____, ELEVATION _____, AND SITE _____. THE FOLLOWING INFORMATION HAS BEEN REPORTED BY THE OBSERVERS. (Examiner announces the reported azimuths of 01 and 02, the reported vertical angles of 01, and the distance and azimuth from 01 to 02). COMPUTE ALTITUDE AND CHART LOCATION OF THE HIGH BURST. USE POLAR PLOT METHOD TO CHECK LOCATION. CONTINUE COMPUTATIONS ON DA FORM 6-55 AND COMPUTE COORDINATES AND ALTITUDE OF HIGH BURST.	Records on DA Form 6-55 the data fired and the observer information read by examiner. Averages azimuth and vertical angle readings. Computes coordinates and altitude of high-burst location. Using polar plot method, checks computed location and altitude of high burst.
2	DETERMINE DEFLECTION CORRECTIONS AND GFT SETTING FOR THE REGISTRATION.	Labels location correctly and determines registration corrections. (See FM 6-40.)

*d. Penalties.* Penalties will be assessed as follows:

*(1) Test 1.*

(a) Error in averaging azimuths and vertical angle, 1 point per error.

(b) Error in computing 01-HB distance, 2 points (for mathematical error only) or 5 points (for procedural error).

(c) Error in computing vertical interval (VI) and altitude, 1 point.

(d) Error in polar-plotted location in excess of 20 meters, no credit allowed.

(e) Error in computing coordinates and altitude of HB, 2 points.

*(2) Test 2.*

(a) Error in deflection correction, no credit allowed.

(b) Error in GFT setting determined, 1 point.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 2-2.

**2-9. Map Reading**

*a. Scope of Tests.* Five tests will be conducted to determine the candidate's ability to read maps, to plot and read coordinates, and to use conventional signs and symbols.

*b. Special Instructions.*

(1) The following materials and equipment will be furnished the candidate:

(a) Terrain map, 1:50,000 (declination diagram required).

(b) Appropriate scale, map pins, and protractor.

(2) The signs and symbols used in tests 1 and 2 should be those given in FM 21-30.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	IDENTIFY EACH OF THESE SIGNS OR SYMBOLS. (Examiner points out four military and four topographical symbols on terrain map).	Identifies signs and symbols.
2	DRAW THE FOLLOWING SYMBOLS AS EACH IS NAMED. (Examiner names four military and four topographical points).	Draws symbols as required.
3	GIVE THE GRID AZIMUTH AND THE MAGNETIC AZIMUTH FOR 19____. FROM POINT A TO POINT B. (Examiner indicates points A and B on the map. They should be more than 4 inches apart).	Measures and reports the grid-azimuth and the magnetic azimuth for the year designated by the examiner.
4	a. GIVE THE COORDINATES OF THIS POINT. (Examiner indicates the point on map). b. PLOT A POINT AT THE FOLLOWING COORDINATES: _____	a. Measures and reports coordinates. b. Plots the point.
5	GIVE THE ALTITUDE OF THE POINT AT THE FOLLOWING ORDINATES: _____	Plots point. Determines and reports altitude. (See FM 21-30.)

*d. Penalties.*(1) *Tests 1 and 2.*

(a) For each sign or symbol named or drawn incorrectly, 0.5 point.

(b) No credit will be awarded unless the candidate correctly draws or identifies at least five symbols.

(2) *Test 3.*

(a) If the grid azimuth announced is in error in excess of 5 mils, 1.0 point.

(b) If the magnetic azimuth announced is in error in excess of 1 mil, 1.0 point.

(c) No credit will be allowed if the candidate requires more than 2 minutes to determine both azimuths.

(3) *Test 4.*

(a) No credit will be allowed for part *a* if the reported coordinates are in error in excess of 25 meters or if the candidate requires more than 3 seconds to determine the coordinates.

(b) No credit will be allowed for part *b* if the point plotted is in error in excess of 25 meters or if the candidate requires more than 30 seconds to plot the point.

(4) *Test 5.* No credit will be allowed if the announced altitude is in error in excess of 1/2 of the contour interval or if the candidate requires more than 2 minutes to determine the altitude.

*e. Credit.* Subject to the penalties assessed in *d*

*c. Outline of Test.*

above, credit will be awarded as indicated in paragraph 2-2.

**2-10. Report of Targets**

*a. Scope of Test.* One test will be conducted to determine the candidate's ability to replot targets. This ability will include determining altitude from a map, determining data for replot, and plotting the data on a chart.

*b. Special Instructions.*

(1) A mounted map of the target area will be furnished the candidate to determine replot altitude.

(2) Prior to the start of the test, the examiner will prepare a complete record of fire for several targets on FDC Computer's Records (DA Forms 3622). The examiner should use fire-for-effect (FFE) data for targets on which fuze quick, fuze time, and fuze variable time have been fired. These computer records will be given to the candidate so that he can determine the data announced in the fire order and the data fired in effect. The candidate will be directed to polar plot the fire-for-effect location of each target. The test begins when the candidate completes polar plotting fire-for-effect data.

(3) The site as shown on the FDC computer's record for each target will not be in error by more than 10 mils.

*Examiner commands—**Action of candidate*

DETERMINE FINAL REPLOT LOCATION OF EACH TARGET FROM FIRE-FOR-EFFECT DATA SHOWN ON COMPUTER'S RECORDS. DETERMINE AND ANNOUNCE FINAL REPLOT DATA. REPLOT TARGETS USING DATA DETERMINED. (Examiner uses FFE data for targets on which fuze quick, fuze time, and fuze variable time have been fired.)

Polar plots fire-for-effect data and puts pin in proper location for each target. Performs all procedures required by the vertical control operator, horizontal control operator, and computer to determine final data for replot and replots targets as prescribed in section IV, chapter 20, FM 6-40.

*d. Penalties.* A penalty of 1 point will be assessed for each—

(1) Error in altitude in excess of one-half of a contour interval.

(2) Error in final coordinates in excess of 10 meters.

(3) Error of 1 mil in site used to determine plot location.

(4) Error in announcement of final replot data.

(5) Target not properly and completely identified.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 2-2.

## 2-11. Computation of Photo Scale

*a. Scope of Tests.* Three tests will be conducted to determine the candidate's ability to compute the scale of a vertical photograph.

*b. Special Instructions.*

(1) The following materials and equipment will be furnished the candidate:

*c. Outline of Tests.*

- (a) Terrain map, scale 1:25,000 or 1:50,000.
- (b) Boxwood scale.
- (c) Two or more vertical photographs, scale between 1:10,000 and 1:15,000.
- (d) Military slide rule.

(2) Prior to the start of the tests, the examiner will select the points to be used and will mark them on the map and on the photographs.

Test No.	Examiner commands—	Action of candidate
1	SET UP THE MILITARY SLIDE RULE FOR PHOTO GROUND RELATIONSHIP AND DETERMINE PHOTO SCALE, (Examiner indicates to the candidate two points on the photo and tells him that the ground distance between them has been determined to be _____. Examiner should use odd figure between 1,000 and 2,000 meters).	Measures the photo distance. Sets up the slide rule, computes and announces the photo scale as prescribed or in paragraph 8-6, FM 21-26.
2	COMPUTE THE SCALE OF THE PHOTOGRAPH FROM THESE TWO POINTS (indicated on photograph and map).	Computes and announces the photo scale as prescribed in paragraph 8-6, FM 21-26.
3	COMPUTE THE SCALE OF THE PHOTOGRAPH. (Examiner tells the candidate that the information on the margin of the photograph indicates that the altitude of the aircraft was _____ above sea level and the focal length of the camera was _____).	Computes and announces the photo scale as prescribed in paragraph 8-6, FM 21-26.

*d. Penalties.* Penalties will be assessed as follows:

(1) *Test 1.*

(a) Error in computed scale in excess of 1 part in 200, 3 points.

(b) No credit will be allowed if the time required exceeds 3 minutes.

(2) *Test 2.* Error in computed scale in excess of 1 part in 200, 3 points.

(3) *Test 3.*

(a) Error in computed scale in excess of 1 part in 100, 2 points.

(b) No credit will be allowed if the time required exceeds 1 minute.

*e. Credit.* Subject to the penalties assessed in d above, credit will be awarded as follows:

(1) *Test 1.*

Time in minutes, exactly or			
less than _____	2	2.5	3
Credit _____	5	3	2

(2) *Test 2.*

Time in minutes, exactly or			
less than _____	2	2.5	3
Credit _____	3	2	1

(3) *Test 3.* Maximum credit, 2 points.

## 2-12. Restitution

*a. Scope of Test.* One test will be conducted to determine the candidate's ability to reconstitute points from an aerial photograph.

*b. Special Instructions.* The following materials and equipment will be furnished the candidate:

(1) Map or chart, 1:25,000 or 1:50,000, on which three restitution points have been plotted.

(2) Vertical photograph on which the three restitution points can be identified. One target will be marked on the photograph.

(3) Tracing paper and plotting equipment.

Examiner commands—	Action of candidate
FIND THE CHART LOCATION OF THE TARGET INDICATED ON THE PHOTOGRAPH. (Examiner explains that the three points marked on the photograph are plotted on the chart).	Restitutes the target to the chart, using any method he desires (FM 6-40).

*d. Penalties.* Penalties will be assessed as follows:

(1) Error in location of more than 50 meters but less than 75 meters, 3 points.

(2) Error in location of more than 75 meters but less than 100 meters, 5 points.

(3) No credit will be given if the location of the target is in error in excess of 100 meters or if the time required exceeds 10 minutes.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as follows:

Time in minutes, exactly or  
less than ----- 8 9 10

*c. Outline of Test.*

Credit ----- 10 8 5

## 2-13. Fire Capabilities Chart

*a. Scope of Test.* One test will be conducted to determine the candidate's ability to prepare a battalion fire capabilities chart.

*b. Special Instructions.* The candidate will be furnished the following materials and equipment:

- (1) Firing chart on which Batteries A, B, and C and deflection indexes have been plotted.
- (2) Plotting equipment.
- (3) Tracing paper.

Examiner commands--			Action of candidate
YOU ARE THE BATTALION OPERATIONS SERGEANT. THE BATTERY EXECUTIVES REPORT THE FOLLOWING FIRE CAPABILITIES:			Prepares fire capabilities overlay.
RIGHT	LEFT	MINIMUM	
DF	DF	RANGE	
THE MAXIMUM RANGE FOR ALL BATTERIES IS _____. PREPARE AN OVERLAY OF BATTALION FIRE CAPABILITIES TO BE SENT TO THE HIGHER HEADQUARTERS AS AN OFFICIAL REPORT.			

*d. Penalties.*

(1) Error in range of more than 30 meters, 3 points.

(2) Error in deflection of more than 3 mils, 3 points.

(3) Failure to include all essential parts of title, heading, and authentication, 1 point.

(4) Failure to place identification marks on the overlay, 3 points.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as follows:

- (1) Accuracy of overlay, 3 points.
- (2) Neatness and legibility of overlay, 2 points.

*c. Outline of Tests.*

(3) Overlay title, heading, and authentication, 1 point.

## 2-14. Communication

*a. Scope of Test.* Ten tests will be conducted to determine the candidate's ability to meet the security procedures and operational requirements of the operations section.

*b. Special Instructions.* The candidate will be furnished the following materials:

- (1) Authentication table prepared as it appears in the CEOI.
- (2) Numeral code prepared as it appears in the CEOI.
- (3) Equipment indicated in each test.

Test No.	Examiner commands--	Action of candidate
1	YOU ARE THE OPERATIONS NCO OF THE _____ DIVISION ARTILLERY. AT THE DIRECTION OF YOUR COMMANDER, YOU DRAFT THE FOLLOWING MESSAGE. "MEET ME POINT XRAY AT 1300." PREPARE THIS MESSAGE FOR RADIO TRANSMISSION TO THE _____ USING THE OPERATIONS CODE, APPROPRIATE AUTHENTICATION SYSTEM, AND THE DIVISION ARTILLERY COMMAND/FIRE DIRECTION NET, FM.	Encodes message, determines authentication system from the CEOI.

Test No.	Examiner commands—	Action of candidate
2	THE FOLLOWING MESSAGE HAS ARRIVED AT YOUR HEAD-QUARTERS: "MOVING TO _____ ZNB _____." DE-CODE THE MESSAGE USING THE NUMERAL CODE AND CHECK THE AUTHENTICATION USING THE APPROPRIATE AUTHENTICATION SYSTEM. (EXAMINER PROVIDES CODED MESSAGE AND AUTHENTICATION FOR BLANK SPACES).	Decodes message, determines if authentication is correct, and replies.
3	THE FOLLOWING MESSAGE HAS BEEN HANDED TO YOU FOR TRANSMISSION BY RADIO: "PRIORITY, OVER, BREAK, REPORT TO POINT BRAVO, LUCID BEACON 11, THIS IS OTHER BARBS 11, TIME 121516S, MESSAGE FOLLOWS." ARRANGE THIS MESSAGE IN THE PROPER SEQUENCE FOR RADIO TRANSMISSION.	Arranges message in the proper format and replies.
4	YOU ARE LISTENING TO A RADIO NET AND HEAR THE FOLLOWING TRANSMISSION: "LUCID BEACON 90, THIS IS LUCID BEACON 79, OVER . . . LUCID BEACON 79, THIS IS LUCID BEACON 90, WHAT DO YOU NEED, OVER . . . LUCID BEACON 90, THIS IS LUCID BEACON 79, PICK UP SUPPLY OF SMALL ARMS AND DELIVER TO ALFA BTRY, 1ST BN, 3D ARTY, AT COORDINATES 480982. THEY EXPECT IT BY 1400 HOURS . . . THIS IS LUCID BEACON 90, ROGER, WILCO OUT." INDICATE ANY VIOLATIONS OF COMMUNICATION SECURITY NOTED AND/OR ANY INCORRECT PROCEDURE USED.	Describes violations of communication security and incorrect procedures used.
5	YOU ARE TOLD TO SET UP AN AN/VRC-46 FOR INITIAL OPERATION ON 35.50 MCS. YOU ARE OPERATING IN A NET COMPOSED ENTIRELY OF AN/VRC-12 RADIO SETS. PLACE EACH OF THE FOLLOWING SWITCHES, CONTROLS, OR KNOBS IN THE PROPER POSITION: POWER HIGH-LOW OFF BREAKER RESET, SQUELCH, MC-TUNE, KC-TUNE, BAND, SPEAKER, ON-OFF VOLUME (AN/VRC-46).	Prepares the radio set for initial operation.
6	YOU ARE GIVEN A RADIO SET AN/GRC-125 (OR AN/GRC-160) AND REQUIRED TO SET UP THE RADIO SET AN/VRC-53 (OR AN/VRC-64) FOR INITIAL OPERATION ON A FREQUENCY 62.00 MCS. PLACE EACH OF THE FOLLOWING SWITCHES CONTROLS, OR KNOBS IN THE PROPER POSITION: REC-TRANS FREQUENCY, BAND, OFF-ON-SQUELCH-RETRANSLITE. ANT FREQ CONTROL, PWR-OFF-ON, SPKR-ON-OFF, (AN/GRC-125, AN/GRC-160).	Prepares the radio set for initial operation.
7	THE DIVISION ARTILLERY S3 REQUIRES YOU TO REMOTE HIS RADIO SET AN/VRC-46 INTO THE OPERATIONS CENTER USING THE RADIO SET CONTROL GROUP AN/GRA-39. PREPARE THE RADIO FOR REMOTE OPERATION. (AN/VRC-46, AN/GRA-39, 12 BA-30, 3 WD-1/TT).	Remotes the radio set AN/VRC-46.
8	YOU HAVE DETERMINED THAT YOUR TELEPHONE SET TA-312/PT IS DEFECTIVE, BUT YOU HAVE NO OTHER WIRE EQUIPMENT WITH WHICH TO TEST THE TELEPHONE CIRCUITS. TEST AS MANY CIRCUITS AS POSSIBLE (TA-312/PT, two BA-30).	Tests the talking, listening, and generator circuits.
9	YOU ARE REQUIRED TO PREPARE A TELEPHONE SET TA-312-PT FOR OPERATION WITH A SWITCHBOARD SB-22/PT. PLACE THE SWITCHES AND CONTROLS IN THE PROPER POSITION FOR OPERATION AND SIGNAL THE SWITCHBOARD OPERATOR (SB-22/PT, TA-312/PT, BA-30, WD-1TT).	Prepares the telephone set for operation and signals the switchboard.
10	YOU ARE ASSIGNED AS THE OPERATIONS NCO OF THE 1st BN, 3D ARTY, WHICH HAS A MISSION OF DIRECT SUPPORT OF THE 1ST INF BDE. YOUR CO DIRECTS YOU TO PLACE THE PRIORITY WIRE LINES ON HIS MAP AFTER INSTALLATION HAS BEEN COMPLETED. WHAT WIRE LINES WILL YOU PLACE ON HIS MAP?	Names the priority wire lines of a direct support artillery battalion (see FM 6-10.)



*d. Penalties.*

(1) *Tests 1 through 3 and 5 through 10.* No credit will be allowed unless the candidate responds correctly to all items.

(2) *Test 4.* A penalty of 0.2 point will be assessed for each error not detected.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 2-2.

## 2-15. Fire Direction Procedures for Higher Artillery Headquarters

*a. Scope of Tests.* Four tests will be conducted to determine the candidate's ability to perform the operations involved in the processing and transmission of fire missions in the headquarters of a field artillery group, division artillery, or corps artillery.

*b. Special Instructions.*

(1) It will be assumed that the headquarters concerned in these tests controls the following units:

(a) 1st Battalion, 20th Field Artillery (105-mm howitzer).

(b) 2nd Battalion, 20th Field Artillery (105-mm howitzer).

*c. Outline of Tests.*

(c) 1st Battalion, 26th Field Artillery (155-mm howitzer).

(d) 2nd Battalion, 26th Field Artillery (155-mm howitzer).

(2) Prior to the start of test 3, the troop list presented in (1) above will be prepared and placed where it will be readily available for reference by the candidate.

(3) The following materials and equipment will be furnished the candidate:

(a) Plotting equipment.

(b) Tracing paper.

(c) Chart or map of a scale no smaller than 1:50,000.

(d) Fire capability templates.

(4) Prior to the start of the tests, battalion position areas and limits of fire should be selected so that a complete fire capabilities overlay can be made from one chart.

(5) Two targets will be plotted on the chart. Target 1 will be located so that it can be reached by only two or three battalions; target 2 will be located so that it can be reached by all battalions.

(6) The examiner will use at least three methods of announcing battalion fire capabilities in test 1 (as described in FM 6-20-2).

Test No.	Examiner commands—	Action of candidate
1	PREPARE THE FIRE CAPABILITIES CHART FOR THIS HEADQUARTERS AND AN OVERLAY FOR REPORTING OUR FIRE CAPABILITIES TO HIGHER HEADQUARTERS. (Examiner gives the candidate the location and fire capabilities of each battalion).	Plots battalion locations and fire capabilities. Prepares overlay showing fire capabilities.
2	<p>a. DEFINE AND GIVE THE PURPOSE OF A NO-FIRE LINE.</p> <p>b. PLOT THE NO-FIRE LINE, USING THESE COORDINATES:</p>	<p>a. Defines no-fire line and states its purpose.</p> <p>b. Plots and labels no-fire line.</p>
3	<p>a. THE FOLLOWING MESSAGE HAS JUST BEEN RECEIVED FROM THE 101ST FIELD ARTILLERY BATTALION: "THIS IS THE 101ST FA BATTALION, NOW ADJUSTING ON (nature of target) APPROXIMATE COORDINATES _____, ALTITUDE _____ TARGET NUMBER _____. REQUEST ADDITIONAL FIRE." YOU, AS CHIEF COMPUTER, RECEIVE THE FOLLOWING FIRE ORDER: "FIRE THE 102D AND 104TH BATTALIONS, 5 ROUNDS, SHELL HE, FUZE QUICK, CENTER RANGE, AT MY COMMAND." SEND THE NECESSARY COMMANDS TO THE BATTALIONS CONCERNED.</p> <p>b. A SECOND MESSAGE FROM THE 101ST FIELD ARTILLERY BATTALION IS AS FOLLOWS: "TARGET NUMBER _____, ADJUSTED COORDINATES _____, ALTITUDE _____, NOW FIRING FOR EFFECT."</p>	<p>a. Plots target and sends necessary commands to battalions. (See FM 6-40.)</p> <p>b. Plots adjusted locations of target. Sends commands to fire the other two battalions.</p>

Test No.	Examiner commands—	Action of candidate
	SEND THE APPROPRIATE COMMANDS TO THE BATTALIONS.	
	c. THE THIRD MESSAGE FROM THE 101ST FIELD ARTILLERY BATTALION IS AS FOLLOWS: "TARGET HAS MOVED _____ METERS WEST (EAST), REQUEST ADDITIONAL FIRE." S3 DIRECTS FIVE ROUNDS WHEN READY. SEND THE NECESSARY COMMANDS.	c. Sends commands for additional fire on the target in its new location.
	d. GIVE THE FIRE ORDER FOR FIVE ROUNDS PER BATTALION ON TARGET 1 WITHOUT ADJUSTMENT.	d. Determines battalions to fire and gives the orders.
	e. FIRE A TIME-ON-TARGET MISSION ON TARGET 2. USE FIVE ROUNDS PER BATTALION, SHELL HE, FUZE VT.	e. Issues orders to the battalions.
4	PREPARE A PROGRAM OF TARGET IN THE FORM OF AN OVERLAY ORDER FOR THE FOLLOWING MISSIONS: (Examiner coordinates of five targets.) ALL TARGETS ARE ON CALL FOR ALL BATTALIONS.	Plots targets. Prepares overlay including title, heading, and authentication for signature. (See FM 6-20-2 and FM 6-40.)

d. *Penalties.* Penalties will be assessed as follows:

e. *Credit.* Subject to the penalties assessed in d above, credit will be awarded as follows:

(1) *Test 1.*

(a) Accuracy of overlay, 5 points.

(b) Correctness of overlay title and authentication, 3 points.

(c) Correct identification of battalions, 5 points.

(d) Neatness and legibility, 2 points.

(2) *Test 2.*

(a) Accuracy, 3 points.

(b) Neatness and legibility, 2 points.

(3) *Test 3.* Maximum credit of 3 points will be awarded for each part of the test (a, b, c, d, and e).

(4) *Test 4.*

(a) Accuracy, 5 points.

(b) Completeness of overlay, 3 points.

(c) Neatness and legibility, 2 points.

## 2-16. Counterbattery Activities

a. *Scope of Test.* One test will be conducted to determine the candidate's ability to perform operations required in counterbattery activities.

b. *Special Instructions.*

(1) Prior to the start of the test, the ex-

c. *Outline of Test.*

aminer will prepare a series of Artillery Counterfire Information forms (ACIF), DA Form 2185-R, that will allow the candidate to perform activities related to counterbattery operations as described in FM 6-121. At least 10 forms should be completed that will lead the candidate to at least four confirmed weapons locations. The examiner should include information from radar, sound, and flash sources; shelling reports; and air and ground observer reports.

(2) The candidate will plot on an overlay all the appropriate information from the ACIF's. These forms should be numbered consecutively, and the information from the forms should be plotted successively.

(3) Before presenting the test, the examiner will inform the candidate of the counterbattery status and criteria.

(4) The following materials will be furnished the candidate:

(a) Map, 1:50,000, suitable for use as a hostile battery chart.

(b) Overlay paper.

(c) Hostile Battery File cards (DA Forms 2186-R).

(d) Prepared ACIF's (DA Forms 2185-R).

(e) Plotting equipment to include appropriate type and color pencils.

Examiner commands—	Action of candidate
PERFORM COUNTERBATTERY OPERATIONS USING THE INFORMATION PROVIDED. PLOT INFORMATION AND FILL OUT HOSTILE BATTERY CARDS. (Examiner gives the candidate the completed ACIF's in numerical order. Candidate should properly plot and mark the appropriate chart and fill the appropriate chart and fill out the hostile battery file cards. Candidate will be graded on his association of the information provided and his actions during the plotting process.	Plots information from ACIF's. Assigns proper symbols. Updates information as successive ACIF's are plotted.

*d. Penalties.*

(1) Plotting errors of more than 50 meters or 7 mils, 2 points.

(2) Improper labeling of locations or rays, 1 points.

(3) Improperly completed hostile battery file card, 2 points.

(4) Improper association of information from ACIP's, 5 points.

(5) Procedural error (erasure of rays from shell reports, plotting suspect locations on hostile battery chart, etc.), 5 points.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 2-2.



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## CHAPTER 3

### SOUND RANGING SPECIALISTS

#### 3-1. General

The tests presented in this chapter were designed to determine the ability of sound ranging

personnel to install, operate, test, and maintain sound ranging equipment. In addition, these tests were designed to determine the ability of personnel to plot and compute sound ranging data.

#### 3-2. Outline of Tests

Paragraph No.	Subject	Number of tests	Points each	Maximum credit
3-3	Installation of sound ranging set GR-8	1	4	4
3-4	Operation of sound ranging set GR-8	2	--	7
	Test 1	(1)	2.5	(2.5)
	Test 2	(1)	4.5	(4.5)
3-5	Preventive maintenance of sound ranging equipment	2	--	6
	Test 1	(1)	0.5	(0.5)
	Test 2	(1)	5.5	(5.5)
3-6	Installation of microphone T-23	1	3	3
3-7	Equipment testing	3	0.5	1.5
3-8	Electrical circuits	3	1	3
3-9	Adjustment of sound ranging set GR-8	1	5	5
3-10	Operation and maintenance of the .5 KW generator set and storage battery	2	2.5	5
3-11	Outpost operation	3	--	3
	Tests 1 and 2	(2)	0.5	(1)
	Test 3	(1)	2	(2)
3-12	Computation of standard sound bases	2	5	10
3-13	Record reading	1	5	5
3-14	Computation of corrected time intervals	3	--	16
	Tests 1 and 3	(2)	5	(10)
	Test 2	(1)	6	(6)
3-15	Preparation of final plotting chart (grid sheet)	2	5	10
3-16	Plotting final time intervals on grid sheet	2	2.5	5
3-17	Special corrections and plotting	1	4.5	4.5
3-18	Sound-on-sound adjustment	1	7	7
3-19	Plotting and computing weather data for sound ranging	3	--	5
	Tests 1 and 3	(2)	1	(2)
	Test 2	(1)	3	(3)
	Total	33	--	95.5

#### 3-3. Installation of Sound Ranging Set GR-8

*a. Scope of Test.* One test will be conducted in which the candidate will be required to properly connect all units listed below and prepare the set for preoperation tests.

*b. Special Instructions.*

(1) The following equipment will be available to the candidate:

(a) One sound ranging set GR-8.

(b) One telephone (tested).

(c) One headset HS-30.

(d) One chest set TD-1.

(e) One ground rod MS-148/G.

(f) A 12-volt DC source.

(g) One roll of recording paper.

(h) One lineman's kit and wire.

(i) One pickax, 4-pound.

(2) Two sets of outpost equipment with wire circuits will be installed prior to the test.

Candidate will be required to connect wires to recorder as part of test.

(3) A wire line will be laid to a previously installed sound ranging microphone.

c. Outline of Test.

Examiner commands—	Action of candidate
INSTALL SOUND RANGING SET .....	Installs sound ranging set as prescribed in TM 11-5895-213-10.

d. Penalties.

- (1) A penalty of one-half point will be assessed for each of the following:
  - (a) Plate supply-timer is not on shock mounting.
  - (b) Recorder is not on shock mounting.
  - (c) High- or low-voltage cables are connected improperly.
  - (d) 12-volt source is connected improperly.
  - (e) Headset and chest set and telephone are connected improperly.
  - (f) Paper is loaded incorrectly.
  - (g) Ground connection is made improperly.
  - (h) Microphone and outpost unit wire lines are connected improperly.
- (2) Time penalties will be assessed as follows:

Time in minutes, exactly					
or less than .....	5	6	7	8	9
Penalties .....	0	1	2	3	4

c. Outline of Tests.

Test No.	Examiner commands—	Action of candidate
1	TEST SOUND RANGING SET .....	Places all control switches in operating position. Performs, identifies, and states results of pre-operation tests as prescribed in TM 11-5895-213-10. Moved the MAIN SWITCH to OFF.
2	OPERATE SOUND RANGING SET .....	Moves the MAIN SWITCH to ON. Positions all controls for operation. Performs and explains the operation of the set as prescribed in TM 11-5895-213-10.

d. Penalties.

- (1) Test 1.
  - (a) A penalty of 0.5 point will be assessed for each of the following errors:
    - 1. Any, but not each, meter reading incorrectly reported or not reported.

e. Credit. If the candidate performs the test correctly within the minimum time limit, a maximum credit of 4 points will be awarded.

3-4. Operation of Sound Ranging Set GR-8

- a. Scope of Tests. Two tests will be conducted in which the candidate will be required to test and operate the sound ranging equipment.
- b. Special Instructions.
  - (1) A reduced-scale six-microphone sound base with two outposts will be installed before the test.
  - (2) The outposts will be manned.
  - (3) The command post equipment will consist of the following:
    - (a) One plate supply and timer unit PE-244.
    - (b) One recorder BC-1337-( ).
    - (c) Two 12-volt DC sources.
    - (d) One telephone with head and chest set.

- 2. Failure to report necessary adjustments.
- 3. Unnecessary reporting of adjustments.
- 4. Failure to check telephone communication with the outpost operator.

5. Failure to instruct the outpost operator to start the sound ranging set.

(b) Time penalties will be assessed as follows:

Time in minutes, exactly or less than -----	10	12	14	16
Penalties -----	0	0.5	2.0	2.5

(2) Test 2. A penalty of 0.5 point will be assessed for each of the following errors:

(a) Any, but not each, control placed in an incorrect position.

(b) Failure to correct or explain how to correct defects detected during the preoperation test.

(c) Failure to explain why a reserve storage battery must be kept nearby.

(d) Failure to inspect spare fuzes and vibrators.

(e) Failure to inform outpost operator that the set is ready to operate.

(f) Using improper procedure with outpost operator.

(g) Failure to adjust attenuators, when necessary, after recording sound.

(h) Cleaning galvanometer styluses improperly.

(i) Failure to explain how to check the frequency of the tuning fork.

#### *c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	IDENTIFY MAINTENANCE MATERIALS AND TOOLS .....	Identifies the materials and tools prescribed in TM 11-5895-213-20.
2	PERFORM PREVENTIVE MAINTENANCE .....	Performs the itemized preventive maintenance prescribed in TM 11-5895-213-20 and explains each step.

#### *d. Penalties.*

(1) Test 1. A penalty of 0.5 point will be assessed if the candidate fails to properly identify all the tools and materials required for maintenance or if the candidate requires more than 3 minutes to complete the test.

#### (2) Test 2.

(a) A penalty of 5.5 points will be assessed if it becomes evident that the candidate may damage the equipment if he continues the test. In this case, the examiner will stop the test.

(b) A penalty of 0.5 point will be assessed if any preventive maintenance action listed in TM 11-5895-213-10 is performed incor-

#### *e. Credit.*

(1) Subject to the penalties imposed in *d* above, credit will be awarded as indicated in paragraph 3-2.

(2) No credit will be awarded if total penalties exceed 4 points.

### **3-5. Preventive Maintenance of Sound Ranging Equipment**

*a. Scope of Tests.* Two tests will be conducted in which the candidate will be required to identify maintenance material and tools and to perform preventive maintenance.

#### *b. Special Instructions.*

(1) The following equipment and materials will be made available to the candidate:

(a) One sound ranging set.

(b) One microphone.

(c) Maintenance materials and tools.

(2) For test 2, the candidate will be furnished a copy of TM 11-5895-213-20 for his reference during the test. For maintenance tasks that require considerable time, such as tinning a soldering iron, the candidate will be required only to describe the preventive measures required.

rectly. No more than 0.5 point will be assessed for each listed action.

*e. Credit.* Subject to the penalties imposed in *d* above, credit will be awarded as indicated in paragraph 3-2.

### **3-6. Installation of Microphone T-23**

*a. Scope of Test.* One test will be given in which the candidate will be required to install a microphone T-23.

#### *b. Special Instructions.*

(1) The equipment listed below will be furnished the candidate:

- (a) One microphone T-23.
- (b) One microphone shelter BE-66A.
- (c) One shovel.
- (d) One pick.
- (e) One ground rod GP-16 with heavy wire.

- (f) One lineman's kit with field wire.
- (g) One telephone with test clips.

(2) Ground selected for the test will be average soil. If digging is extremely difficult in the spot selected for the test, the minimum time shown in *d*(2) below must be extended accordingly.

### c. Outline of Test.

Examiner commands—	Action of candidate
INSTALL MICROPHONE .....	Installs microphone as prescribed in TM 11-5895-213-20.

### d. Penalties.

(1) A penalty of 0.5 point will be assessed for each of the following errors:

- (a) Failing to dig a hole of the correct dimensions (allowable tolerance of 2 inches).
- (b) Connecting field wire incorrectly.
- (c) Incorrectly connecting or installing the ground rod.
- (d) Suspending the microphone incorrectly.
- (e) Failing to pack dirt around the edge of the microphone shelter and to place 2 to 3 inches of dirt on top of the shelter.
- (f) Failing to call CP and make the "wave" test.

(2) Time penalties will be assessed as follows:

Time in minutes, exactly			
or less than .....	20	22	24
Penalties .....	0	1	3

### e. Credit.

### c. Outline of Tests.

Test No.	Examiner commands—	Action of candidate
1	MEASURE AND RECORD VOLTAGE AND RESISTANCE OF RECORDER TERMINALS 2 TO 5 AND 8 TO 12.	Measures and records the voltage and resistance.
2	MEASURE AND RECORD THE VOLTAGE AND RESISTANCE OF TIMER TERMINALS 2 TO 8, 10, AND 11.	Measures and records the voltage and resistance.
3	PRETEST MICROPHONE T-23 .....	Pretests microphone T-23 as prescribed in TM 11-5895-213-10.

### d. Penalties.

(1) A penalty of 0.5 point will be assessed for each test or measurement performed incorrectly.

(2) The total time for three tests must not exceed the time limits given in the following table:

Time in minutes, exactly				
or less than .....	18	21	24	27
Penalties .....	0	1	2	3

*e. Credit.* Subject to the penalties imposed in *d* above, credit will be awarded as indicated in paragraph 3-2.



### 3-8. Electrical Circuits

*a. Scope of Tests.* Three tests will be conducted in which the candidate will be required to draw, trace, and explain electrical symbols

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	<b>DRAW THE ELECTRICAL SYMBOLS FOR THE FOLLOWING:</b> (Examiner selects eight items from the following list: Fixed resistor, voltmeter, battery, capacitor, single-pole single-throw switch, iron core transformer, variable resistor, ammeter, fuze, air core transformer).	Draws symbols.
2	<b>DRAW AND EXPLAIN THIS CIRCUIT.</b> (Examiner selects one circuit from the following list: Series, parallel, series-parallel).	Draws and explains the circuit.
3	<b>TRACE AND EXPLAIN THESE CIRCUITS.</b> (Examiner selects one circuit from the following list: Time motor and tuning fork circuit, microphone-voltage regulator circuit, microphone T-23 circuit).	Traces in the equipment and explains the circuit. Reference to circuit diagrams on the equipment is authorized.

*d. Penalties.*

(1) *Test 1.* A penalty of 0.125 point will be assessed for each symbol incorrectly drawn.

(2) *Test 2.* A penalty of 1 point will be assessed if the circuit is drawn or explained incorrectly or if the candidate requires more than 4 minutes to complete the operation.

(3) *Test 3.* A penalty of 1 point will be assessed for each circuit incorrectly traced or explained.

*e. Credit.*

(1) Subject to the penalties imposed in *d*

*c. Outline of Test.*

Examiner commands—	Action of candidate
<b>PERFORM FIVE ADJUSTMENTS ON THE SOUND RANGING SET.</b> (Examiner selects five of the following adjustments: Adjusting the tuning fork contact screw, adjusting the tuning fork one-hundredth second contacts, stylus pressure adjustment, stylus zero position adjustment, time marking stylus alinement adjustment, printer latch adjustment, stylus time coordination adjustment.)	Performs the five adjustments as prescribed in TM 11-5895-213-10.

*d. Penalties.*

(1) Penalty of 1 point will be assessed for each adjustment incorrectly performed:

(2) Time penalties will be as follows:

Time in minutes, exactly				
or less than	15	16	17	18
Penalties	0	2	4	5

*e. Credit.*

(1) If the candidate performs the test cor-

and circuits.

*b. Special Instructions.* A sound ranging set GR-8, a microphone T-23, and pencil and paper will be made available to the candidate.

above, credit will be awarded as indicated in paragraph 3-2.

(2) If total penalties exceed 2 points, no credit will be awarded.

### 3-9. Adjustment of Sound Ranging Set GR-8

*a. Scope of Test.* One test will be conducted in which the candidate will be required to make adjustments on the sound ranging set GR-8.

*b. Special Instructions.* A sound ranging set GR-8 will be installed and ready for operation by the candidate.

rectly within the minimum time limit, a maximum credit of 5 points will be awarded.

(2) If total penalties exceed 4 points, no credit will be awarded.

### 3-10. Operation and Maintenance of .5 KW Generator Set and Storage Batteries

*a. Scope of Tests.* Two tests will be conducted

in which the candidate will be required to install and operate power unit .5 KW generator and to demonstrate and explain the functioning and maintenance of storage batteries.

*b. Special Instructions.* The equipment and material listed below will be furnished the candidate.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	INSTALL AND OPERATE POWER UNIT (Examiner directs candidate to—prepare the fuel mixture and fill the tank, start the motor, connect and start charging the battery, check the voltmeter and ammeter readings, increase and decrease the charging rate, stop the engine and disconnect the battery, demonstrate preventive maintenance procedures, explain corrective action when the engine is flooded, explain corrective action when the engine fails to start, describe safety precautions.)	Performs the operations directed as prescribed in TM 9-6140-200-14.
2	DEMONSTRATE AND EXPLAIN THE FUNCTIONING AND MAINTENANCE OF STORAGE BATTERIES. (Examiner requires candidate to— (1) Explain the following: Preparation of a new battery for use, charging rate, variation of hydrometer reading temperature changes, terminal voltage, ratings, effects of freezing, effect of impurities in electrolyte. (2) Describe the storage cell and the applicable precautions. (3) Demonstrate how to mix and replenish electrolyte in a cell.)	Demonstrate operations and explains functions as directed.

*d. Penalties.*

(1) *Test 1.*

(a) A penalty of 0.25 point will be assessed for each requirement incorrectly performed.

(b) If candidate shows an obvious lack of knowledge of the .5 KW generator, the examiner will stop the test and no credit will be awarded.

(2) *Test 2.* A penalty of 0.25 point will be assessed for each requirement incorrectly performed.

*e. Credit.*

(1) Subject to the penalties imposed in *d* above, credit will be awarded as indicated in paragraph 3-2.

(2) No credit will be allowed if total penalties exceed 3.5 points.

### 3-11. Outpost Operation

*a. Scope of Tests.* Three tests will be con-

(1) One power unit .5 KW in good working order.

(2) One 12-volt battery.

(3) One hydrometer.

(4) Two battery charging cables.

(5) Battery test set.

(6) Gasoline and oil.

ducted in which the candidate will be required to set up and operate the outpost.

*b. Special Instructions.*

(1) The equipment listed below will be made available to the candidate:

(a) One telephone TA-213/PT.

(b) One outpost connecting box BE-71.

(c) One outpost switch unit SA-45/G.

(d) One reel unit RL-39 with wire WD-

1.

(e) One lineman's kit.

(f) One terminal strip TM-184.

(2) The location for the outpost will be designated; the location will be within 100 feet of the sound ranging set to save time in wire laying.

(3) A sound ranging set will be set up and prepared for operation.

(4) The equipment necessary for the test will be placed at the designated location of the outpost.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	LAY WIRE LINE FROM SOUND RANGING SET TO OUTPOST AND CONNECT OUTPOST UNIT.	Connects lines to sound ranging set and terminal strip, lays line to outpost, and connects outpost unit as prescribed in TM 11-5895-213-10.
2	PERFORM OUTPOST TEST .....	Performs outpost test prescribed in TM 11-5895-213-10.
3	DESCRIBE SELECTION OF OUTPOST POSITION AND DUTIES OF OUTPOST OBSERVER.	Described selection of outpost-and duties of observer as outlined in FM 6-122.

*d. Penalties.*

(1) *Test 1.* A penalty of 0.5 point will be assessed if the candidate performs the test incorrectly.

(2) *Test 2.* A penalty of 0.5 point will be assessed if the candidate performs the test incorrectly or if he requires more than 1 minute to perform the test.

(3) *Test 3.* A penalty of 0.5 point will be assessed for each error in description.

*e. Credit.* Subject to the penalties imposed in *d* above, credit will be awarded as indicated in paragraph 3-2.

**3-12. Computation of Standard Sound Bases**

*a. Scope of Tests.* Two tests will be conducted in which the candidate will be required to compute one straight regular base and one irregular base.

*b. Special Instructions.**c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	TYPE OF BASE: SIX-MICROPHONE _____-METER STRAIGHT BASE; COORDINATES OF M3, _____; AZIMUTH OF BASE, _____ MILS. COMPUTE THE SOUND BASE.	Computes sound base as prescribed in FM 6-122.
2	TYPE OF BASE: SIX-MICROPHONE IRREGULAR BASE; COORDINATES OF MICROPHONES, M1 _____ M4 _____ M2 _____ M5 _____ M3 _____ M6 _____ COMPUTE AZIMUTH AND DISTANCE FOR EACH SUBBASE.	Computes azimuth and length of each subbase on DA Form 6-1. (This information will be used by the sound platoon to obtain wind and curvature corrections for the irregular sound base).

*d. Penalties.*

(1) *Computation errors.* A penalty of 1 point will be assessed for each error in computation made in either test.

*(2) Time penalties.*

(1) The equipment listed below will be furnished the candidate:

(a) One book of seven-place logarithmic tables. TM 6-231.

(b) Forms or blank paper for computations.

(2) The data listed below will be supplied to the candidate by the examiner:

(a) *Straight regular base.*

1. Type of base.
2. Coordinates of one microphone.
3. Azimuth of base.

(b) *Irregular base.*

1. Type of base.
2. Coordinates of six microphones.

(3) When the candidate's computations are graded, a penalty will be assessed only once for each mistake, even though the mistake causes the results of subsequent computations to be incorrect. If subsequent computations carry the error but the candidate uses correct computational procedures, full credit will be awarded for computations made subsequent to the error.

*(a) Test 1.*

Times in minutes,  
exactly or

less than .....	20	25	30	35
Penalties .....	0	2	4	5

(b) *Test 2.*

Time in minutes,

exactly or

less than --- 75 80 85 90 95

Penalties ----- 0 1 2 4 5

e. *Credit.*

(1) Subject to penalties imposed in *d* above, maximum credit will be awarded as indicated in paragraph 3-2.

(2) No credit will be awarded if total penalties exceed 7 points.

### 3-13. Record Reading

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

c. *Outline of Test.*

Examiner commands—

Action of candidate

READ, RECORD; COMPUTE AND RECORD THE TIME INTERVALS --- Reads record. Computes and records time intervals.

d. *Penalties.*

(1) A penalty of 5 points will be assessed for either of the following errors:

(a) Time arrivals not interpolated to the nearest 0.003 second.

(b) Time intervals not correct (subtraction error).

(2) Time penalties will be assessed as follows:

Time in minutes, exactly	Over
or less than -----	5 6 6
Penalties -----	0 3 5

e. *Credit.* Subject to the penalties imposed in *d* above, credit will be awarded as indicated in paragraph 3-2.

### 3-14. Computation of Corrected Time Intervals

a. *Scope of Tests.* Three tests will be conducted in which the candidate will be required to compute final time intervals.

b. *Special Instructions.*

(1) The equipment listed below will be furnished the candidate:

(a) Appropriate blank forms.

(b) Pencil and paper.

(c) One DA Form 6-4 with five uncor-

rected time intervals (that will result in a rough plot in the form of a polygon not more than 200 meters in length) from a straight regular base (to be used in tests 1 and 2 below).

b. *Special Instructions.*

(1) The equipment listed below will be made available to the candidate:

(a) One record from a six-microphone straight regular base.

(b) One record reader.

(c) Proper forms.

(d) Paper and pencil.

(2) The pattern of breaks on the record furnished will be distinct and typical of the regular base used.

(d) One DA Form 6-4 with five uncorrected time intervals (that will result in a rough plot in the form of a polygon not more than 200 meters in length) from an irregular base (to be used in test 3 below).

(e) One M1 wind corrector.

(f) Temperature and asymptote correction charts.

(g) One 4-second subbase plotting fan.

(h) One all-subbase plotting fan.

(i) All-subbase wind and asymptote correction charts.

(j) One Monroe calculator.

(k) Three improvised plotting boards.

(l) FM 6-122.

(2) The following data will be furnished the candidate:

(a) Meteorological sound ranging message.

(b) Survey data for the following:

1. A six-microphone 4-second straight base (to be used in tests 1 and 2 below).

2. Five subbase azimuths and distances for a six-microphone irregular base (to be used in test 3 below).

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	COMPUTE FINAL TIME INTERVALS USING STANDARD CORRECTION CHARTS.	Computes final time intervals as prescribed in FM 6-122.
2	COMPUTE FINAL TIME INTERVALS USING THE CALCULATOR.	Computes final time intervals as prescribed in FM 6-122.
3	COMPUTE WEATHER CORRECTED TIME INTERVALS USING ALL-SUBBASE CORRECTION CHARTS.	Computes weather corrected time intervals as prescribed in FM 6-122.

*d. Penalties.*(1) *Test 1.*

(a) A penalty of 1 point will be assessed for each time interval incorrectly computed. (Allowable tolerance of error is 0.005 second.)

(b) Time penalties will be assessed as follows (time required to prepare the plotting charts will not be counted):

Time in minutes	Over	5	6	7	8
Penalties		0	2	3	5

(2) *Test 2.*

(a) A penalty of 1 point will be assessed for each time interval incorrectly computed. (Allowable tolerance of error is 0.002 second.)

(b) A penalty of 1 point will be assessed if the calculator is set up incorrectly.

(c) Time penalties will be assessed as follows:

Time in minutes,					
exactly or					
less than	6	7	8	9	
Penalties	0	2	4	6	

(3) *Test 3.*

(a) A penalty of 1 point will be assessed for each time interval incorrectly computed. (Allowable tolerance of error is 0.005 second.)

(b) Time penalties will be assessed as follows:

Time in minutes,					
exactly or					
less than	15	16	17	18	

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	CONSTRUCT FINAL PLOTTING CHART FOR STRAIGHT REGULAR BASE.	Constructs gridded plotting chart as prescribed in FM 6-122.
2	CONSTRUCT FINAL PLOTTING CHART FOR IRREGULAR BASE.	Constructs gridded plotting chart as prescribed in FM 6-122.

*d. Penalties.*(1) *Test 1.*

(a) A penalty of 1 point will be assessed

Penalties ..... 0 2 3 5

*e. Credit.*

(1) Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 3-2.

(2) No credit will be awarded if total penalties exceed 12 points.

**3-15. Preparation of Final Plotting Chart (Grid Sheet)**

*a. Scope of Tests.* Two tests will be conducted in which the candidate will be required to construct a sound base on a grid sheet for plotting final time intervals.

*b. Special Instructions.*

(1) The candidate will be furnished the following data:

- (a) Coordinates of the microphones.
- (b) Azimuth of the base.

(2) The equipment listed below will be furnished the candidate:

- (a) Drafting pencils.
- (b) Plotting scales.
- (c) One 4-second subbase plotting fan.
- (d) One all-subbase plotting fan.
- (e) Two grid sheets, 1:25,000 meters.
- (f) Map pins, thumbtacks, and a map board/

for each error of more than 20 meters in plotting a midpoint or normal point.

(b) Time penalties will be as follows:

Time in minutes, exactly or					
less than ----	30	32	34	36	
Penalties ----	0	1	2	3	5

**(2) Test 2.**

(a) A penalty of 1 point will be assessed for each error of more than 20 meters in plotting a midpoint or normal point.

(b) Time penalties will be as follows:

Time in minutes, exactly or					Over
less than ---	33	37	38	40	40
Penalties ----	0	1	2	3	5

**e. Credit.**

(1) If the candidate performs the tests correctly within the minimum time limits, a maximum credit of 5 points for each test will be awarded.

(2) No credit will be awarded if total penalties exceed 7 points.

**c. Outline of Tests.**

Test No.	Examiner commands—	Action of candidate
1	PLOT FINAL TIME INTERVALS FOR STRAIGHT BASE AND RECORD CORRECTED COORDINATES.	Performs operations as prescribed in FM 6-122.
2	PLOT FINAL TIME INTERVALS FOR IRREGULAR BASE AND RECORD CORRECTED COORDINATES.	Performs operations as prescribed in FM 6-122.

**d. Penalties.**

Penalties ----- 0 0.5 1.5 2.5

**(1) Test 1.**

(a) A penalty of 2.5 points will be assessed if the candidate fails to report the corrected coordinates within 30 meters of the true location.

(b) Time penalties will be assessed as follows:

Time in minutes, exactly or				
less than ----	3	4	5	6
Penalties -----	0	0.5	1.5	2.5

**(2) Test 2.**

(a) A penalty of 2.5 points will be assessed if the candidate fails to report the corrected coordinates within 30 meters of the true location.

(b) Time penalties will be assessed as follows:

Time in minutes, exactly or				
less than ----	4	5	6	7

**3-16. Plotting Final Time Intervals on Grid Sheet**

*a. Scope of Tests.* Two tests will be conducted in which the candidate will be required to plot the corrected time intervals supplied and record the corrected coordinates of the sound source.

*b. Special Instructions.* The equipment and data listed below will be furnished the candidate.

(1) One grid sheet on which a straight regular base has been plotted.

(2) One grid sheet on which an irregular base has been plotted.

(3) One DA Form 6-4 with five corrected time intervals (which will result in a polygon not over 50 meters in length) frp, a six-microphone straight regular base.

(4) One DA Form 6-4 with five corrected time intervals (which will result in a polygon not over 50 meters in length) from a six-microphone irregular base.

(5) One set of plotting fans.

(6) One plotting scale, 1:25,000 meters.

*e. Credit.* If the candidate performs the tests correctly within the minimum time limits, a maximum credit of 2.5 points for each test will be awarded.

**3-17. Special Correction and Plotting**

*a. Scope of Test.* One test will be conducted in which the candidate will be required to apply all corrections to a missing trace plot.

*b. Special Instructions.* The equipment and data listed below will be furnished the candidate:

(1) One DA Form 6-4 with five arrival times from a six-microphone 4-second straight regular base recorded (with arrival time for microphone 3 missing).

(2) Standard correction charts.

(3) One 4-second subbase plotting fan.

(4) Prepared rough plot chart.

*c. Outline of Test.*

Examiner commands—	Action of candidate
DETERMINE ALL CORRECTIONS FOR MISSING TRACT PLOT .....	Determines corrections as prescribed in FM 6-122.

*d. Penalties.*

(1) A penalty of 1.5 points will be assessed for each correction that is in error by more than  $\pm 0.003$ .

(2) Time penalties will be assessed as follows:

Time in minutes, exactly or less than .....	15	16	17	18	18
Penalties .....	0	1.0	2.0	3.0	4.5

*e. Credit.* If the candidate performs the test correctly within the minimum time limit, a maximum credit of 4.5 points will be awarded.

**3-18. Sound-on-Sound Adjustment**

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

*c. Outline of Test.*

which the candidate will be required to conduct a sound-on-sound adjustment.

*b. Special Instructions.*

(1) The equipment listed below will be furnished the candidate:

- (a) One 4-second subbase plotting fan.
- (b) Prepared rough plot chart.
- (c) One aluminum coordinate scale, 1:25,000 yards.
- (d) Map pins, thumbtacks, and a map board.

(2) The following information will be furnished the candidate:

- (a) Azimuth of base (2,500 mils).
- (b) Four-microphone hasty base (approximately 4 seconds in size).
- (c) Time intervals for a hostile gun.
- (d) Time intervals for a registration point.

Examiner commands—	Action of candidate
PLOT HOSTILE WEAPON .....	Plots hostile weapon on chart as prescribed in FM 6-122.
ADJUST CENTER NORMAL .....	Adjusts center normal as prescribed in FM 6-122.
SUBMIT CALL FOR FIRE .....	Submits a call for fire to the fire direction center. (Examiner may act as computer in FDC.)
PLOT REGISTRATION POINT .....	Plots registration point as prescribed in FM 6-122.
CONDUCT ADJUSTMENT (Examiner furnishes time intervals required to plot succeeding rounds. The adjustment should be completed with three adjusting rounds.)	Measures deflection and range shifts and sends corrections to FDC until adjustment is complete.

*d. Penalties.*

(1) A penalty of 1 point will be assessed for each of the following:

- (a) One or more errors in plotting the hostile weapon.
- (b) One or more errors in adjusting center normal.
- (c) One or more errors in submitting the call for fire.
- (d) One or more errors in plotting the registration point.
- (e) One or more errors in any one of the

succeeding rounds, or errors in measurements in deflection and range shifts.

(2) *Time penalties.* The following table applies to total time the candidate requires to complete the test.

Time in minutes, exactly or less than .....	20	22	24	26
Penalties .....	0	3	5	7

*e. Credit.* If the candidate performs the test correctly within the minimum time limit, a maximum credit of 7 points will be awarded.

3-19. Plotting and Computing Weather Data for Sound Ranging

a. *Scope of Tests.* Three tests will be conducted in which the candidate will be required to plot the readings on a 30-gram balloon, determine the effective wind, and determine the effective temperature.

b. *Special Instructions.*

(1) The following equipment will be furnished the candidate:

- (a) One plotting board ML-122.
- (b) One rule ML-126-A.

c. *Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	PLOT READINGS .....	Plots the readings as prescribed in FM 6-15.
2	DETERMINE THE EFFECTIVE WIND DIRECTION AND SPEED.	Scales and weights the winds. Determines the effective wind direction and speed as prescribed in FM 6-15.
3	DETERMINE THE EFFECTIVE TEMPERATURE .....	Determines the effective temperature as prescribed in FM 6-15.

d. *Penalties.*

(1) *Test 1.* A penalty of 0.5 point will be assessed for each error made in plotting.

(2) *Test 2.* A penalty of 1.5 points each will be assessed for the following errors:

- (a) Wind direction in error by more than  $\pm 20$  mils.
- (b) Wind speed in error by more than  $\pm 1$  knot.

(3) *Test 3.* A penalty of 1 point will be assessed if the effective temperature is in error by more than  $\pm 0.5^{\circ}$  C.

(4) *Time penalties.*

(a) *Test 1.*

Time in minutes,			
exactly or			
less than .....	5	6	7
Penalties .....	0	0.5	1.0

(c) One scale ML-577/UM.

(d) One DA Form 6-48, Weather Data for Sound Ranging.

(e) Two 3H pencils, one art gum eraser, and one sandboard.

(f) One FM 6-16.

(2) The following data will be furnished the candidate:

(a) Dry bulb temperature, and wet bulb temperature.

(b) A set of readings on a 30-gram balloon through 3 minutes 54 seconds of ascent to include time, elevation angle, and azimuth angle.

(b) *Test 2.*

Time in minutes,				
exactly or				
less than .....	10	12	14	16
Penalties .....	0	1	2	3

(c) *Test 3.*

Time in minutes,			
exactly or			
less than .....	3	4	7
Penalties .....	0	0.5	1.0

e. *Credit.* Subject to the penalties assessed in d above, maximum credit of 1 point for tests 1 and 3 and 3 points for test 2 will be awarded.



## CHAPTER 4

### FLASH RANGING SPECIALISTS

#### 4-1. General

The tests presented in this chapter were designed to determine the ability of flash ranging personnel to install, operate, test, and maintain equip-

ment used for flash ranging. In addition, these tests were designed to determine the ability of personnel to compute information and perform the graphical solutions for flash ranging problems.

#### 4-2. Outline of Test

Paragraph No.	Subject	Number of tests	Points each	Maximum credit
4-3	Nomenclature, assembly, and leveling of the battery commander's (BC) telescope M65 .....	2	2	4
4-4	Care and maintenance of the battery commander's telescope M65 .....	1	2	2
4-5	Operation of BC telescope M65 .....	5		24
	Test 1 .....	(1)	3	(3)
	Test 2 .....	(1)	4	(4)
	Test 3 .....	(1)	5	(5)
	Test 4 and 5 .....	(2)	6	(12)
4-6	Reporting .....	1	2	2
4-7	Assembling, nomenclature, manning, and maintenance of plotting board M5 .....	4		6
	Tests 1 and 3 .....	(2)	1	(2)
	Tests 2 and 4 .....	(2)	2	(4)
4-8	Operation of plotting board M5 .....	4	6	24
4-9	Computation of registration .....	1	6	6
4-10	Graphical solution of three-point resection .....	1	6	6
4-11	Graphical intersection .....	1	5	5
4-12	Computation of azimuth, distance, and vertical angle .....	1	7	7
4-13	Nomenclature of flash ranging set AN/GTC-1 .....	1	1	1
4-14	Installation, testing, and operation of flash ranging set AN/GTC-1 .....	3	2	6
4-15	Duties of switchboard operator .....	3		4
	Tests 1 and 2 .....	(2)	1	(2)
	Test 3 .....	(1)	2	(2)
4-16	Maintenance of flash ranging set AN/GTC-1 .....	1	3	3
		29	--	100

#### 4-3. Nomenclature, Assembly, and Leveling of the Battery Commander's Telescope M65

*a. Scope of Tests.* Two tests will be conducted during which the candidate will be required to

name the parts of the BC telescope M65 and to assemble and level the instrument.

*b. Special Instructions.* One BC telescope M65 with tripod, accessories, and carrying case will be furnished the candidate.

Test No.	Examiner commands—	Action of candidate
1	NAME PARTS DESIGNATED. (Examiner points to 10 of the following parts: Instrument light M28, filter selector knob, interpupillary distance knob, elevating knob, head window plug, telescope release knob, locating bushing, upper vertical spindle, level vial (circular), interpupillary scale, notation strip, azimuth scale, azimuth micrometer, azimuth knob, orienting knob, diopter scale,	Announces the name of each part designated by the examiner.

Test No.	Examiner commands—	Action of candidate
	angle of site micrometer, angle of site scale index, angle of site scale, angle of site level vial.)	
2	ASSEMBLE AND LEVEL INSTRUMENT .....	Sets up tripod over a point designated by the examiner. Removes the instrument from the carrying case and places the instrument on the tripod. Levels the instrument.

*d. Penalties.*

(1) *Test 1.* A penalty of 0.2 point will be assessed for each error in naming the parts designated.

(2) *Test 2.*

(a) A penalty of 0.5 point will be assessed for—

1. Failure to seat the tripod legs firmly in the ground.

2. Failure to center the instrument over the designated point.

3. Failure to level the instrument.

4. Failure to check leveling by turning the instrument through 3,200 mils.

(b) Time penalties will be assessed as follows:

Time, exactly			
or less			
than .....	1 min	1 min	1 min
	40 sec	50 sec	50 sec
Penalties ....	0	1	2

*e. Credit.* If the candidate performs the tests

*c. Outline of Test.*

correctly within the minimum time limit, a maximum credit of 2 points for each test will be awarded.

#### 4-4. Care and Maintenance of the Battery Commander's Telescope M65

*a. Scope of Test.* One test will be conducted in which the candidate will be required to demonstrate the care and maintenance of the battery commander's telescope M65.

*b. Special Instructions.*

(1) The following equipment will be furnished the candidate:

(a) One battery commander's telescope M65 with accessories.

(b) One small screwdriver.

(c) Lens paper.

(d) Lubricants.

(e) Lens cleaning fluid.

(2) The azimuth micrometer scale of the instrument will be adjusted to read a value other than zero when the azimuth scale reading is zero.

Examiner commands—	Action of candidate
DEMONSTRATE CARE AND MAINTENANCE OF THE BC TELESCOPE M65.	Demonstrates the care and maintenance as prescribed in the preventive maintenance schedule.

*d. Penalties.* A penalty of 0.25 point will be assessed for each of the following errors:

(1) Failure to use proper method and materials in cleaning the lenses.

(2) Failure to use proper lubricating materials.

(3) Failure to check azimuth and orienting mechanisms.

(4) Failure to check elevation mechanism.

(5) Failure to check angle of site mechanism.

(6) Failure to check zero of scales and microimeters.

(7) Failure to adjust micrometer scale to read zero.

(8) Failure to check interpupillary distance knob.

*e. Credit.* If the candidate performs the test correctly, a maximum credit of 2 points will be awarded.

#### 4-5. Operation of the Battery Commander's Telescope M65

*a. Scope of Tests.* Five tests will be conducted in which the candidate will be required to operate the BC telescope M65.

*b. Special Instructions.*

(1) *Tests 1 through 5.* A battery commander's telescope M65, with accessories, will be set up and leveled for the candidate's use.

*(2) Tests 4 and 5.*

(a) The examiner will choose three targets, each between 1 and 2 mils in diameter, and

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	READ AZIMUTH AND ANGLE OF SITE SCALES .....	Reads the azimuth scale and the angle of site scale and micrometer for each target on which the examiner positions the instrument.
2	ORIENT INSTRUMENT .....	Orients the instrument using three orienting points and three azimuths designated by the examiner as prescribed in TM 9-1240-368-12.
3	MEASURE HORIZONTAL AND VERTICAL ANGLES .....	Checks the level of the instrument. Measures two horizontal and two vertical angles designated by the examiner.
4	READ RETICLE .....	Announces the reticle reading for each target on which the examiner positions the instrument.
5	ANNOUNCE HORIZONTAL AND VERTICAL READINGS .....	Mentally applies the reticle reading to the scale readings and announces the combined reticle and scale readings to the designated point.

*d. Penalties.*

(1) *Test 1.* A penalty of 0.5 point will be assessed for each error of more than 1 mil in reading the azimuth and angle of site scales.

*(2) Test 2.*

(a) A penalty of 1 point will be assessed for each of the following errors:

1. Orientation error of more than 1 mil.
2. Failure to take up lost motion in the same direction each time. (A maximum penalty of 1 point will be assessed for this error.)

(b) Time penalties will be assessed as follows for each orientation trial:

Time, exactly or less	
than ..... 1 min.	1 min. 15 sec.
1 minute,	
30 seconds	
over .....	1 min. 30 sec.
Penalties ... 0	0.5 1.0 2.0

*(3) Test 3.*

(a) A penalty of 1 point will be assessed for each of the following errors:

1. Failure to verify the level of the instrument before starting the measurements.
2. An error of more than 1 mil in meas-

identify them to the candidate through the instrument.

(b) The examiner then will position the instrument on each target, in succession, so that the target is in the field of view but not in the center of the reticle. He will note the readings on the horizontal and vertical scales for each target setting.

uring the horizontal angles or an error of more than 2 mils in measuring the vertical angles.

3. Failure to take up lost motion each time an angle is measured.

(b) Time penalties will be assessed as follows in the measurement of each angle:

Time, ex-	
actly	
or less	
than ..	1 min. 30 sec. 1 min. 45 sec.
over	1 minute 45 seconds
Penalties	0 0.5 1

(4) *Tests 4 and 5.* A penalty of 1 point will be assessed for—

(a) Each error of more than 2 mils in horizontal readings.

(b) Each error of more than 2 mils in vertical readings.

*e. Credit.*

(1) If the candidate performs the tests correctly, maximum credit will be awarded as indicated in paragraph 4-2.

(2) No credit will be awarded if total penalties for all tests exceed 16 points.

**4-6. Reporting**

*a. Scope of Test.* One test will be conducted in which the candidate will be required to report a target to the switchboard operator.

*b. Special Instructions.*

(1) One battery commander's telescope M65 will be furnished the candidate.

*c. Outline of Test.*

Examiner commands—	Action of candidate
REPORT .....	Render four-item report as prescribed in FM 6-122.

*d. Penalties.* A penalty of 2 points will be assessed if the candidate fails to report exactly as prescribed in FM 6-122.

*e. Credit.* If the candidate performs the test correctly, a maximum credit of 2 points will be awarded.

**4-7. Assembling, Nomenclature, Manning, and Maintenance of Plotting Board M5**

*a. Scope of Tests.* Four tests will be conducted in which the candidate will be required to assemble the plotting board, give its nomenclature, name and describe the duties of the members of

(2) The examiner will position the instrument and inform the candidate that the flash of a medium gun has been observed to an accuracy of 2 mils at the indicated position. The switchboard operator has just called for a report on this observation.

the plotting team, and demonstrate maintenance and adjustment of the instrument.

*b. Special Instructions.*

(1) The following equipment will be made available to the candidate.

- (a) One plotting board M5 with accessories in the packing chest.
- (b) One screwdriver.
- (c) One wrench.
- (d) Lubricant.

(2) One assistant will be made available to help the candidate assemble the plotting board.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	ASSEMBLE PLOTTING BOARD .....	Removes plotting board from the packing chest and assembles it.
2	NAME THE PARTS DESIGNATED. (Examiner points to the following parts: Drafting machine, plotting disk, table legs, vernier, azimuth scale, slow motion knob, brake lever, clamping thumbscrew, adjusting thumbscrew.)	Announces the name of each designated part.
3	NAME THE MEMBERS OF THE PLOTTING TEAM AND DESCRIBE THEIR DUTIES.	Names the three members of the plotting team. Briefly describe their duties as prescribed in FM 6-122.
4	DEMONSTRATE AND DESCRIBE CARE, MAINTENANCE, AND ADJUSTMENT OF PLOTTING BOARD.	Describes the proper methods of handling the plotting board and demonstrates the adjustments, lubrication, and storage of the plotting board and precautions to be observed in using the board.

*d. Penalties.*

(1) *Test 1.* A penalty of 1 point will be assessed for handling the parts of the plotting board improperly or for setting up the plotting board improperly.

(2) *Test 2.* A penalty of 0.2 point will be assessed for each error in naming the parts of the plotting board.

(3) *Test 3.* A penalty of 1 point will be assessed for failing to name all members of the plotting team, or for being unable to briefly describe the duties of each member.

(4) *Test 4.* A penalty of 0.25 point will be assessed for each error or omission in performing the required actions.

(5) *Time penalties.* The following table of time penalties applies only to test 1. (No time penalties will be assessed for tests 2, 3, and 4).

Time in min- utes, exactly or less than -----	5	6	over 6
Penalties ----	0	0.5	1.0

*e. Credit.*

(1) Subject to the penalties imposed in *d* above, credit will be awarded as indicated in paragraph 4-2.

(2) No credit will be awarded if total penalties exceed 4 points.

#### 4-8. Operation of Plotting Board M5

*a. Scope of Tests.* Four tests will be conducted in which the candidate will be required to operate the plotting board M5.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	NUMBER THE GRID .....	Numbers the grid and plots the observation posts as prescribed in FM 6-122.
2	PLOTS OBSERVATION POSTS .....	Plots the four observation posts as prescribed in FM 6-122.
3	ACT AS ARMSETTER: OP 1 _____ OP 2 _____ OP 3 _____ OP 4 _____	Sets the arm after each command as prescribed in FM 6-122 and announces SET.
4	ACT AS DRAFTSMAN: OP 1 _____ OP 2 _____ OP 3 _____ OP 4 _____	Plots the target and announces its grid reference, accuracy, and distance as prescribed in FM 6-122.

*d. Penalties.*

(1) *Test 1.*

(a) A penalty of 3 points will be assessed for each of the following errors:

1. Failing to place each of the observation posts to achieve maximum distance in ranging.

2. Failing to number the grid properly.

(b) Time penalties will be assessed as follows:

Time in minutes, exactly or less
---

*b. Special Instructions.*

(1) The following equipment will be furnished the candidate:

- (a) One plotting board M5.
- (b) Two pencils, 2H or 3H.
- (c) One eraser.
- (d) One boxwood scale.

(2) The examiner will furnish the candidate the coordinates of four observation posts and the direction of ranging.

(3) The plotting board will be assembled before test 1 begins.

(4) For tests 2, 3, and 4 the candidate will be provided an assembled plotting board that has been gridded and grid numbered.

(5) The following assistants will be provided the candidate:

- (a) Draftsman (for test 3).
- (b) Armsetter and recorder (for test 4).

					Over
than ....	10	11	12	13	14
Penalties ..	0	1	2	3	4

(2) *Test 2.*

(a) A penalty of 1 point will be assessed for each error of more than 20 meters in plotting an observation post.

(b) A penalty of 0.5 point will be assessed for each observation post incorrectly labeled.

(c) Time penalties will be assessed as follows:

Time in minutes, exactly or less
---

					Over	
than	10	11	12	13	14	14
Penalties	0	1	2	3	4	6

**(3) Test 3.**

(a) A penalty of 1.5 points will be assessed for each error of more than 0.5 mil in setting the arm.

(b) Time penalties for each setting:

Time in						Over
seconds,						
exactly						
or less						
than	20	25	30	35	40	40
Penalties	0	1	2	3	4	6

**(4) Test 4.**

(a) A penalty of 0.25 point will be assessed for each of the following errors:

1. Plotting for the wrong observation posts.

2. Failing to have the scale of the drafting machine within 10 meters of the observation post when the ray is drawn.

3. Failing to measure and announce the distances from two observation posts correctly.

(b) A penalty of 1 point will be assessed for failure to estimate accuracy of grid reference correctly.

(c) A penalty of 2 points will be assessed if the grid reference of the target announced by the draftsman is in error by more than 20 meters.

(d) The time penalties given in the following table apply to the total time required for plotting from the four observation posts.

Time in  
minutes,

**c. Outline of Test.****Examiner commands—**

DETERMINE THE GRID REFERENCE AND HEIGHT OF THE HIGH-BURST REGISTRATION.

**Action of candidate**

Performs the necessary computations and plotting to determine the grid reference and height to the mean point of burst of the high-burst registration as prescribed in FM 6-122.

**d. Penalties.**

(1) A penalty of 1 point will be assessed for each averaged azimuth or vertical angle from an observation post incorrectly computed.

(2) A penalty of 2 points will be assessed if the grid reference of the center of burst of the high-burst registration is not accurate within 20 meters.

(3) A penalty of 2 points will be assessed if

exactly  
or less

					Over	
than	3.0	3.5	4.0	4.5	5.0	5.0
Penalties	0	1	2	3	4	6

**e. Credit.**

(1) If the candidate performs the test correctly within the minimum time limit, a maximum credit of 6 points for each test will be awarded.

(2) If total penalties for the four tests exceed 16 points, no credit will be awarded.

**4-9. Computation of Registration**

**a. Scope of Test.** One test will be conducted in which the candidate will be required to use the plotting board M5 to determine the grid reference and height to the mean point of burst of a high-burst registration. The candidate will be given the clamping azimuths and vertical angles from four observation posts and the horizontal and vertical deviations to six usable rounds.

**b. Special Instructions.**

(1) The following equipment will be furnished the candidate.

(a) Plotting board M5, assembled and gridded, with four observation posts plotted.

(b) Pencil (2H or 3H) and paper.

(2) One armsetter will be available as an assistant.

(3) The examiner will furnish the candidate with the clamping azimuths and vertical angles from four observation posts and the horizontal and vertical deviations to six usable rounds.

the height of the center of burst of the high-burst registration is not accurate within 1 meter.

(4) Time penalties will be assessed as follows:

Time in							Over
minutes,							
exactly							
or less							
than	20	22	24	26	28	30	30
Penalties	0	1	2	3	4	5	6

*e. Credit.*

(1) If the candidate performs the test correctly within the minimum time limit, a maximum credit of 6 points will be awarded.

(2) No credit will be awarded if the total penalties exceed 4 points.

#### 4-10. Graphical Solution of Three-Point Resection

*a. Scope of Test.* One test will be conducted in which the candidate will be required to solve a three-point resection problem, using the plotting board M5.

*b. Special Instructions.*

*c. Outline of Test.*

Examiner commands—

Action of candidate

LOCATE UNKNOWN POINT .....	Performs the necessary plotting and announces the grid reference and height of the unknown point as prescribed in FM 6-122.
----------------------------	---

*d. Penalties.*

(1) A penalty of 2 points will be assessed if the grid reference of the unknown point determined by the candidate is not within 30 meters of the correct grid reference.

(2) A penalty of 2 points will be assessed if the height of the unknown point determined by the candidate is not accurate within 1 meter.

(3) Time penalties will be assessed as follows:

Time in minutes, exactly or less						Over
than .....	20	22	24	26	28	28
Penalties ....	0	1	2	3	4	6

*e. Credit.*

(1) If the candidate performs the test correctly within the minimum time limit, a maximum credit of 6 points will be awarded.

(2) No credit will be awarded if total penalties exceed 4 points.

#### 4-11. Graphical Intersection

*a. Scope of Test.* One test will be conducted in which the candidate will be required to use the

(1) The following equipment will be furnished the candidate:

(a) One plotting board M5, assembled and gridded.

(b) Pencil (2H or 3H) and paper.

(2) One armsetter will be available as an assistant.

(3) The examiner will furnish the candidate the coordinates of three known points, the angles from the unknown point to the three known points, and vertical angles measured from the unknown point to the known points.

(4) The candidate may make a freehand sketch on scratch paper and may erase thereon; however, the time taken to make the sketch will be included in the test time.

plotting board M5 to locate an observation post. The candidate will be given the location of another observation post, the location of a point in the target area, the azimuth from the known observation post to the unknown observation post and the azimuth from the unknown observation post to the known point in the target area.

*b. Special Instructions.*

(1) The following equipment will be furnished the candidate:

(a) Plotting board M5, assembled and gridded, with one observation post and a point in the target area plotted.

(b) Pencil (2H or 3H) and paper.

(2) One armsetter will be available as an assistant.

(3) The examiner will furnish the candidate with the azimuth from the known observation post to the unknown observation post.

(4) The examiner will then act as the observer at the unknown observation post. When the candidate gives the observer the orienting azimuth to the known observation post and instructs him to report the azimuth to the known point in the target area, the examiner (observer) will report the azimuth from the unknown observation post to the known point.

*c. Outline of Test.*

Examiner commands—	Action of candidate
LOCATE UNKNOWN OBSERVATION POST. (After giving command, the examiner will act as the observer at the unknown observation post. When oriented by the candidate, and upon his request, the examiner will report azimuth to the known point in the target area.)	Performs the necessary plotting and issues instructions to the observer at the unknown OP to determine the location of the unknown OP; announces the grid reference of the unknown observation post as prescribed in FM 6-122.

*d. Penalties.*

(1) A penalty of 2 points will be assessed if the grid reference of the unknown OP determined by the candidate is not within 20 meters of the correct grid reference. A penalty of 4 points will be assessed if the grid reference is not accurate within 40 meters, and no credit will be awarded if the grid reference is in error by more than 50 meters.

(2) Time penalties will be assessed as follows:

Time in minutes, exactly or less	Less than	Over
than -----	5 6 7 8 9	9
Penalties -----	0 1 2 3 4	5

*e. Credit.*

(1) If the candidate performs the test cor-

rectly within the minimum time limit, a maximum credit of 5 points will be awarded.

(2) No credit will be awarded if total penalties exceed 3 points.

**4-12. Computation of Azimuth, Distance, and Vertical Angle**

*a. Scope of Test.* One test will be conducted in which the candidate will be required to compute grid azimuth, distance, and vertical angle from an observation post to a point of which the coordinates are known.

*b. Special Instructions.*

(1) The following equipment will be furnished the candidate:

- (a) TM 6-230.
- (b) DA Form 6-1, pencil, and paper.

(2) The following information will be furnished the candidate: The coordinates and heights of the observation post and the distant point.

*c. Outline of Test.*

Examiner commands—	Action of candidate
COMPUTE AZIMUTH, DISTANCE, AND VERTICAL ANGLE FROM THE OP TO THE DISTANT POINT.	Computes the grid azimuth, distance, and vertical angle from the observation post to the distant point as prescribed in TM 6-230.

*d. Penalties.*

(1) A penalty of 1 point will be assessed for each error made in computing the azimuth, distance, and vertical angle. When the candidate's computations are being graded, a penalty will be assessed only once for each mistake, even though the mistake causes the results of subsequent computations to be incorrect. If subsequent computations carry the error but the candidate uses correct computational procedures, full credit will be awarded for computations made subsequent to the error.

(2) Time penalties will be assessed as follows:

Time in minutes, exactly or less	Over
than -----	10 12 14 14
Penalties -----	0 2 4 6

*e. Credit.*

(1) If the candidate performs the test correctly within the minimum time limit, a maximum credit of 7 points will be awarded.

(2) No credit will be awarded if total penalties exceed 5 points.



#### 4-13. Nomenclature of Flash Ranging Set AN/GTC-1

*a. Scope of Test.* One test will be conducted in which the candidate will be required to name the

*c. Outline of Test.*

Examiner commands—	Action of candidate
NAME THE PARTS DESIGNATED. (Examiner points to 10 of the following parts: Line lamp, fuze holder, talk-ring switch, link switches, emergency telephone binding posts, battery switch, power changeover switches, emergency operation switch, incoming line binding posts, control box C-100, ground rod GP-16, battery case CY-386.)	Names designated parts as prescribed in TM 11-5516.

*d. Penalties.* A penalty of 0.1 point will be assessed for each error in naming the designated parts.

*e. Credit.* If the candidate performs the test correctly, a maximum credit of 1 point will be awarded.

#### 4-14. Installation, Testing, and Operation of Flash Ranging Set AN/GTC-1

*a. Scope of Tests.* Three tests will be conducted in which the candidate will be required to install, test, and operate the flash ranging set AN/GTC-1.

*b. Special Instructions.*

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	INSTALL FLASH RANGING SET WITH ONE OBSERVATION POST.	Installs the flash ranging set as prescribed in TM 11-5516.
2	TEST FLASH RANGING SET .....	Performs the six peroperation tests as prescribed in TM-5516. Announces the status of each part tested.
3	OPERATE FLASH RANGING SET .....	Operates the flash ranging set as prescribed in TM 11-5516.

*d. Penalties.*

(1) *Test 1.* A penalty of 0.33 point will be assessed for each error made in installing the flash ranging set.

(2) *Test 2.* A penalty of 0.33 point will be assessed for each test performed incorrectly or for failure to correctly report the status of each part tested.

(3) *Test 3.* A penalty of 0.5 point will be assessed for each error in demonstrating the operation of the flash ranging set.

*e. Credit.* If the candidate performs the tests

parts of the flash ranging set AN/GTC-1 designated by the examiner.

*b. Special Instructions.* One complete flash ranging set AN/GTC-1 will be furnished the candidate.

(1) The following equipment will be furnished the candidate:

(a) One complete flash ranging set AN/GTC-1.

(b) Ground wire (30 feet).

(c) Field wire for observation lines (100 feet).

(2) Three trained assistants will be provided to assist during the tests and operation.

(3) The locations of the flash ranging set and observation posts will be designated to the candidate.

(4) Three additional observation posts will be connected to the switchboard for test 3.

correctly, a maximum credit of 2 points will be awarded for each test.

#### 4-15. Duties of Switchboard Operator

*a. Scope of Tests.* Three tests will be conducted in which the candidate will be required to test communications, orient observers, and receive and record a report on the flash target.

*b. Special Instructions.*

(1) The following equipment will be furnished the candidate:

(a) One complete flash ranging set AN/GTC-1.

(b) Two DA Forms 6-3a (Flash-Ranging Record).

(c) One pencil.

(2) The flash ranging set will be installed and four observation post will be connected before the test is begun.

(3) Four assistants will be provided to act as observers.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	TEST COMMUNICATIONS .....	Tests communications as prescribed in FM 6-122.
2	ORIENT OBSERVERS .....	Orients observers as prescribed in FM 6-122.
3	RECEIVE AND RECORD REPORT ON A FLASH TAGET .....	Receives the report, records it, and announces it as prescribed in FM 6-122.

*d. Penalties.*

(1) *Test 1.* A penalty of 0.25 point will be assessed for each error in procedure in testing communications.

(2) *Test 2.* A penalty of 0.25 point will be assessed for each error made in orienting the observation posts.

(3) *Test 3.* A penalty of 0.5 point will be assessed for each error made in recording and announcing the report.

*e. Credit.* Subject to the penalties imposed in

*c. Outline of Test.*

Examiner commands—	Action of candidate
DEMONSTRATE MAINTENANCE OF THE FLASH RANGING SET .....	Performs the nine maintenance procedures prescribed in TM 11-5516.

*d. Penalties.* A penalty of 0.04 point will be assessed for each error in demonstrating maintenance of the flash ranging set.

(4) Predetermined data will be redundant furnished the four observers before the test is begun.

(5) Orienting azimuths and vertical angles for the four observers will be provided the candidate.

*d* above, credit will be awarded as indicated in paragraph 4-2.

**4-16. Maintenance of Flash Ranging Set AN/GTC-1.**

*a. Scope of Test.* One test will be conducted in which the candidate will be required to demonstrate the maintenance of flash ranging set AN/GTC-1.

*b. Special Instructions.* A flash ranging set AN/GTC-1 will be installed and connected with four observation posts for the use of the candidate during this test.

*e. Credit.* If the candidate performs the test correctly, a maximum credit of 3 points will be awarded.

## CHAPTER 5

### COMMUNICATION SPECIALISTS

#### Section I. GENERAL

##### 5-1. General

a. The tests for qualification of communication personnel are divided into four categories as follows:

- (1) Tests for communication personnel, general.
- (2) Tests for message center personnel.
- (3) Tests for wire personnel.

(4) Tests for radio personnel.

b. To qualify as communication specialists all candidates are required to satisfactorily complete the tests for communication personnel, general, and the tests for two of the following categories:

- (1) Message center personnel.
- (2) Wire personnel.
- (3) Radio personnel.

#### Section II. COMMUNICATION PERSONNEL, GENERAL

##### 5-2. Outline of Tests

Paragraph No.	Subject	Number of tests	Maximum credit
5-3	Phonetic alphabet .....	1	2
5-4	Authentication .....	2	4
5-5	Message writing .....	1	5
5-6	Operations code .....	2	4
5-7	Numeral code .....		
5-8	Radiotelephone procedure .....	4	10
5-9	Test, operation, and maintenance of remote control unit .....	4	6
5-10	Map reading .....	6	6
5-11	Panel code .....	5	5
5-12	Pyrotechnics .....	2	4
	Total .....	27	46

##### 5-3. Phonetic Alphabet

a. *Scope of Test.* One test will be conducted to test the candidate's knowledge of the phonetic alphabet.

c. *Outline of Test.*

b. *Special Instructions.* The candidate will be furnished a printed message containing at least 20 characters.

Examiner commands—	Action of candidate
READ ALOUD THIS MESSAGE USING THE PHONETIC ALPHABET ....	Reads aloud the message using the phonetic alphabet.

d. *Penalties.* A penalty of 0.5 point will be assessed for each phonetic equivalent given erroneously. Repetition of an error will not be counted as an additional error.

e. *Credit.* If the candidate reads all characters correctly, 2 points will be awarded.

##### 5-4. Authentication

a. *Scope of Tests.* Two tests will be conducted to determine the proficiency of the candidate in the use of authentication systems.

b. *Special Instructions.* The candidate will be furnished an authentication table.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	LOCATE IN THE CEOI THE PROPER AUTHENTICATION TABLE FOR THIS DATE.	Locates the table in the CEOI.
2	AUTHENTICATE _____. (Examiner will give the challenge consisting of two letters).	Determine the correct authentication from the CEOI and replies to the challenge.

*d. Penalties.*

(1) A penalty of 2 points will be assessed for—

(a) Failure to locate the authentication table in the communication-electronics operation instructions (CEOI).

(b) Selecting improper authentication from the table.

(2) A penalty of 1 point will be assessed for failure to use the authentication table of the proper date.

*e. Credit.* If the candidate finds the proper au-

thentication table in the CEOI and correctly replies to the challenge, 4 points will be allowed.

**5-5. Message Writing**

*a. Scope of Test.* The candidate will be tested in the use of the message book.

*b. Special Instructions.*

(1) The candidate will be furnished a message book.

(2) The examiner will create a situation requiring a message to be sent in the clear to another unit.

*c. Outline of Test.*

Examiner commands—	Action of candidate
SEND THE FOLLOWING MESSAGE TO: _____. (Examiner announces the unit designation, precedence, classification, and contents of the message.)	Prints message on the forms furnished.

*d. Penalties.*

(1) A penalty of 2 points will be assessed if message is not printed.

(2) A penalty of 3 points will be assessed if message is not legible.

(3) A penalty of 1 point will be assessed for each of following elements that are in error.

(a) Date and time signed.

(b) Classification.

(c) Precedence.

(d) Signature authorizing message sent in the clear.

(e) Addressee.

(f) Text.

(g) Originator.

(h) Grade and title of writer.

*e. Credit.* If the candidate writes all elements of the message correctly, 5 points will be allowed.

**5-6. Operations Code**

*a. Scope of Tests.* Two tests will be conducted to determine the proficiency of the candidate in the use of the operations code.

*b. Special Instructions.* The candidate will be furnished a copy of an operations code, a message book, an encoded message, and a clear text message.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	ENCODE THE CLEAR TEXT MESSAGE .....	Encodes the message using the operations code.
2	DECODE THE ENCODED MESSAGE .....	Decodes the encoded message.

*d. Penalties.*

(1) A penalty of 1 point will be assessed for each error in encoding or decoding.

(2) A penalty of 2 points will be assessed for each message not printed legibly.

*e. Credit.* If the candidate completes both operations correctly, 4 points will be allowed.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	ENCODE THE MAP COORDINATES GIVEN IN THE CLEAR ....	Encodes the map coordinates using the numeral code.
2	DECODE THE ENCODED MAP COORDINATES .....	Decodes the coordinates using the numeral code.

*d. Penalties.*

(1) A penalty of 1 point will be assessed for each error in encoding or decoding.

(2) A penalty of 2 points will be assessed for each message not printed legibly.

*e. Credit.* If the candidate completes both operations correctly, 4 points will be awarded.

**5-8. Radiotelephone Procedure**

*a. Scope of Tests.* Four tests will be conducted to determine the candidate's knowledge of radiotelephone procedure.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	OPEN THE NET .....	Opens net using procedure specified in ACP-125( ).
2	TRANSMIT THIS ENCODED MESSAGE .....	Transmits message using procedure specified in ACP-125( ).
3	TRANSMIT THIS CLEAR TEXT MESSAGE .....	Transmits message using procedure specified in ACP-125( ) and KAG codes.
4	CLOSE THE NET .....	Closes the net using the procedure as specified in ACP-125( ).

*d. Penalties.*

(1) A penalty of 3 points will be assessed for failure to open or close the net properly.

(2) A penalty of 3 points will be assessed for failure to authenticate when necessary.

(3) A penalty of 1 point will be assessed for each repetition of authenticator.

**5-7. Numeral Code**

*a. Scope of Tests.* Two tests will be conducted to determine the proficiency of the candidate in the use of the numeral code.

*b. Special Instructions.* The candidate will be furnished a copy of a numerical code, a message book, a message containing encoded map coordinates, and a message containing map coordinates in the clear.

*b. Special Instructions.*

(1) Only one candidate should be tested at one time. The instructor will operate as all other stations in the net.

(2) Each candidate will be furnished—

- (a) A call sign.
- (b) A list of call signs in the net.
- (c) An authentication table.
- (d) The designation of each station in the net.
- (e) A serviceable FM radio.
- (f) An encoded message.
- (g) A clear text message.
- (h) A message book.

(4) A penalty of 0.5 point will be assessed for—

- (a) Each unnecessary repetition of a call.
- (b) Each error in transmission.

*e. Credit.* If the candidate successfully completes tests 1 and 4, 3 points will be allowed for each test. If he successfully completes tests 2 and 3, 2 points will be allowed for each test.

## 5-9. Test, Operation, and Maintenance of Remote Control Unit

*a. Scope of Tests.* Four tests will be conducted to determine the candidate's knowledge of the duties of a radiotelephone operator using a remote control unit.

### *b. Special Instructions.*

(1) The candidate will be furnished the following equipment:

### *c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	PREPARE REMOTE CONTROL EQUIPMENT FOR OPERATION WITH VISUAL SIGNALING.	Installs six BA-30 batteries and replaces battery compartment cover. Sets BUZZER VOLUME control to the OFF position. Connects handset.
2	DEMONSTRATE AND EXPLAIN THE FUNCTION OF THE REMOTE CONTROL EQUIPMENT WHEN THE SELECTOR SWITCH IS IN EACH OF THE THREE POSITIONS.	Sets the selector switch to each of the three positions and explains the operation in each position (as indicated in TM 11-5820-477-12).
3	INSTALL THE REMOTE CONTROL UNIT FOR USE WITH RADIO PROVIDED AND FOR USE WITH AUDIBLE SIGNALING.	Turns BUZZER VOLUME control to LOUD position. Connects field wire to remote unit. Turns POWER switch to ON position.
4	USING THE EQUIPMENT PROVIDED, PERFORM THE FOLLOWING OPERATIONS: <i>a.</i> DEMONSTRATE THE USE OF THE REMOTE CONTROL AS A TELEPHONE. <i>b.</i> DEMONSTRATE push-to-talk OPERATION OF RADIO SET WITH LOCAL CONTROL C-2329/GRA-39. <i>c.</i> CONTACT THE BASE SET. BASE SET CALL SIGN IS _____. YOUR CALL SIGN IS _____. (Examiner will provide call signs).	<i>a.</i> Sets selector switch to TEL position and signals the local operator. <i>b.</i> Presses the handset push-to-talk switch to transmit. Releases the switch to receive. Returns selector switch to TEL position at end of demonstration. <i>c.</i> Turns the selector switch to RAD/SPKR position. Contacts the base set using procedures specified in ACP-125 ( ). <i>d.</i> Turns selector switch to TEL position. Signals local operator with buzzer.

*d. Penalties.* A penalty of 0.2 point will be assessed for failure to properly perform any operation in each test.

*e. Credit.* If the candidate performs all operations in all tests properly, 6 points will be allowed.

## 5-10. Map Reading

*a. Scope of Tests.* Six tests will be conducted to determine the candidate's ability to read maps, to plot and read coordinates, and to use conven-

- 39.
- (a) One remote control unit G-2328/GRA-
  - (b) One handset H-138/U.
  - (c) Six batteries BA-30.
  - (d) A field lineman's tool kit.
  - (e) A 10-foot length of field wire.
- (2) The examiner will have radio set AN/VRC-46 with control C-2329/GRA-39. A radio operator will be available at the local control.

tional military and topographical signs and symbols.

### *b. Special Instructions.*

(1) A 1:50,000 coordinate scale and a terrain map, 1:50,000 with complete marginal data will be furnished the candidate.

(2) In test 3, the candidate will satisfy the requirements by naming any four items of marginal information; however if the candidate fails to include the scale and the declination diagrams in the items named, the examiner should ask leading questions to bring about their inclusion.

Graphical scale and representative fraction are considered as two separate items of marginal information.

(3) The signs and symbols used in these tests will be those presented in FM 21-30 and FM 21-31.

### c. Outline of Tests.

Test No.	Examiner commands—	Action of candidate
1	IDENTIFY EACH OF THESE SIGNS OR SYMBOLS: (Examiner points out 10 signs and symbols on the terrain map.)	Identifies each designated sign and symbol.
2	DRAW THE SYMBOLS FOR THE FOLLOWING ITEMS AS EACH IS NAMED: (Examiner names five units, military activities, boundaries, or weapons.)	Draws symbols as required.
3	NAME FOUR ITEMS OF INFORMATION FOUND IN THE MARGINAL DATA OF A MAP.	Names four items without referring to a map. (See b(2) above.)
4	a. LOCATE THE FOLLOWING POINT ON THE TERRAIN MAP: COORDINATES: _____  b. FIND THE COORDINATES OF THIS POINT (Examiner indicates point on map.)	a. Locates the point at the designated coordinates, using an appropriate scale. b. Measures and reports coordinates.
5	GIVE THE ELEVATION OF _____ (any prominent point.)	Determine the elevation from the contour lines on the terrain map; reports the elevation.
6	INDICATE THE BEST ROUTE BETWEEN _____ AND _____ (any two points.)	Traces the best route on the terrain map.

### d. Penalties.

#### (1) Test 1.

(a) A penalty of 0.1 point will be assessed for each sign or symbol named incorrectly.

(b) No credit will be allowed unless the candidate correctly identifies six or more signs or symbols.

#### (2) Test 2.

(a) A penalty of 0.2 point will be assessed for each sign or symbol drawn incorrectly.

(b) No credit will be awarded unless the candidate draws three or more signs or symbols correctly. (Symbols that are not drawn neatly and legibly will be considered as drawn incorrectly.)

(3) Test 3. No penalties are provided for this test. Maximum credit of 1 point will be allowed if candidate names four items correctly.

#### (4) Test 4.

(a) No credit will be allowed for part a if the point is located in error in excess of 50 meters, or if the candidate requires more than 30 seconds to locate the point.

(b) No credit will be allowed for part b if the reported coordinates are in error in excess

of 50 meters, or if the candidate requires more than 30 seconds to report coordinates.

(c) For each part the candidate completes satisfactorily, 0.5 point credit will be allowed.

(5) Test 5. No credit will be allowed if the reported elevation is in error in excess of one-half the contour interval, or if the candidate requires more than 2 minutes to report the elevation. Maximum credit of 1 point will be allowed.

(6) Test 6. No penalties are provided for this test. Maximum credit of 1 point will be allowed.

e. Credit. Subject to the penalties listed in d above, a maximum of 1 point will be awarded for each test.

### 5-11. Panel Code

a. Scope of Tests. Five tests will be conducted to test the candidate in the use of panels and to determine his familiarity with the combined panel system.

b. Special Instructions. The candidate will be furnished a copy of the CEOI and thirteen 2- by 6-inch miniature panels cut from paper or cloth.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	LOCATE THE PANEL RECOGNITION CODE IN THE CEOI .....	Locates the correct item in the CEOI.
2	DISPLAY THE FLASH INDEX, LETTER INDICATOR, AND FIGURE INDICATOR.	Displays indicators as shown in the CEOI.
3	DISPLAY NUMERALS 1 THROUGH 9 .....	Displays indicators as shown in the CEOI.
4	DISPLAY THE NUMBER _____ (Examiner will supply a three-digit number.)	Displays indicators as shown in the CEOI.
5	DISPLAY SIX DIFFERENT LETTERS OF THE ALPHABET .....	Displays indicators as shown in the CEOI.

*d. Penalties.* A penalty of 1 point will be assessed for each display made incorrectly.

*e. Credit.* If the candidate makes all displays correctly, 5 points will be allowed.

**5-12. Pyrotechnics**

*a. Scope of Tests.* Two tests will be conducted.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	LOCATE IN THE CEOI AN ITEM THAT REFERS TO THE USES OF PROTECHNICS.	Locates the item in the CEOI.
2	DEMONSTRATE THE PROPER METHOD OF FIRING PYROTECHNICS.	Demonstrates the proper handling and proper method of firing.

*d. Penalties.*

(1) A penalty of 2 points will be assessed for failure to locate the specified item in the CEOI.

(2) A penalty of 1 point will be assessed—

(a) If the candidate does not properly

The first will test the candidate's ability to locate an item on pyrotechnics in the CEOI. The second tests his knowledge of firing pyrotechnics.

*b. Special Instructions.* The candidate will be furnished a copy of the CEOI and appropriate equipment for firing pyrotechnics.

handle and/or properly assemble the pyrotechnic device.

(b) If the candidate does not demonstrate the proper firing of the pyrotechnic.

*e. Credit.* If the candidate proves that he is familiar with the CEOI and the proper use of pyrotechnics, 4 points will be allowed.

**Section III. MESSAGE CENTER PERSONNEL****5-13. Outline of Tests**

Paragraph No.	Subject	Number of tests	Maximum credit
5-14	Message center procedure .....	2	10
5-15	Test of field telephones .....	3	20
5-16	Maintenance of field telephone .....	1	16
5-17	Codes and authentications .....	3	4
	Total .....	9	50

**5-14. Message Center Procedure**

*a. Scope of Tests.* Two tests will be conducted to determine the proficiency of the candidate in—

(1) Maintaining the message center log.

(2) Processing messages.

(3) Using the route delivery list.

*b. Special Instructions.*

(1) The candidate will be furnished the following materials:



- (a) Message center log.
- (b) Route delivery list.
- (c) Message book.
- (d) Pencil.

(2) The candidate will be given information as to the means of communication and time each was established.

(3) The candidate will be given a list of

message center numbers of 10 outgoing messages—five of which have been receipted and five have not.

(4) The candidate will be required to process one message for the next higher headquarters and one for a lower headquarters. These messages will be handed to the candidate after the tests have been explained to him.

### c. Outline of Tests.

Test No.	Examiner commands—	Action of candidate
1	FROM THE INFORMATION AVAILABLE COMPLETE THE MESSAGE CENTER LOG.	Completes message center log from information given.
2	PROCESS THESE MESSAGES. (Examiner will create a situation requiring that one message be sent by radio.)	Processes the two messages.

d. *Penalties.* A penalty of 2 points will be assessed for each incorrect entry of operation.

e. *Credit.* If the candidate completes all entries and performs all operations correctly, 10 points will be allowed.

## 5-15. Test of Field Telephones

a. *Scope of Tests.* One test will be conducted to determine the candidate's proficiency in testing field telephones.

b. *Special Instructions.*

### c. Outline of Test.

Examiner commands—	Action of candidate
TEST THE TELEPHONES PROVIDED AND ANNOUNCE THE FAULT FOUND IN EACH.	Tests the test telephone. Connects the test telephone to the first telephone to be tested. Indicates that he is ready. Tests and announces the fault in the telephone. Tests each of the other telephones in turn, following the above procedure in each case.

d. *Penalties.* Penalties will be assessed as follows:

- (1) 2 points for failure to test telephone.
- (2) 2 points for failure to determine the fault in each telephone within 3 minutes, or the announcement of a fault other than that which exists for each telephone.

e. *Credit.* 4 points will be allowed for each telephone tested correctly at 3 minutes per phone.

(1) The candidate will be furnished a test telephone, serviceable batteries, field wire, a lineman's kit, and five telephones (same type as the test telephone) which are known to contain faults.

(2) Three minutes will be allowed to test each of the five telephones that have known faults. Before testing each telephone, other than the test telephone, the candidate will indicate that he is ready. Three minutes after the candidate indicates he is ready, the examiner will command STOP and require the candidate to announce the fault in that telephone.

## 5-16. Maintenance of Field Telephone

a. *Scope of Tests.* One test will be conducted to determine the candidate's proficiency in the maintenance of the field telephone.

b. *Special Instructions.* The candidate will be furnished a field telephone, a lineman's kit, and TM 11-5805-201-12.

*c. Outline of Test.*

Examiner commands—	Action of candidate
PERFORM THE OPERATOR MAINTENANCE OF THE FIELD TELEPHONE.	Performs operator maintenance as prescribed in paragraph 4-2, TM 11-5805-201-12.

*d. Penalties.* 2 points for failure to perform checks and services outlined in paragraph 4-2, TM 11-5805-201-12.

*e. Credit.* 2 points will be allowed for each test and service completed satisfactorily.

**5-17. Codes and Authentication**

*a. Scope of Tests.* Three tests will be conducted to determine the candidate's ability to meet the security requirements of the message center section.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	YOU ANSWER THE TELEPHONE AND IDENTIFY YOURSELF. THE CALLING PARTY SAYS "THIS IS RAG 3. AUTHENTICATE HOTEL MIKE." ANSWER THE CHALLENGE.	Determines authentication from table and replies.
2	GIVE THE MAP LOCATIONS OF THESE POINTS: _____ IN NUMERAL CODES. (Examiner gives the coordinates of two points.)	Locates and reports map locations (see FM 21-26).
3	USING THE OPERATIONS CODE, ENCODE THE FOLLOWING MESSAGE: _____ (Examiner gives message in vocabulary of code, six code groups.)	Encodes message.

*d. Penalties.* No credit will be allowed if the candidate fails to give correct response for Test Items 1 thru 3.

*e. Credit.* 1 point will be allowed for Tests no 1 and 2, and 2 points for Test no 3 if tests are completed satisfactorily.

**Section IV. WIRE PERSONNEL****5-18. Outline of Tests**

Paragraph No.	Subject	Number of tests	Maximum credit
5-19	Test of field telephones .....	1	6
5-20	Maintenance of field telephones .....	1	2
5-21	Installation of field switchboard .....	3	7
5-22	Maintenance of field switchboard .....	3	4
5-23	Operation of field switchboard .....	6	7
5-24	Line route maps .....	1	6
5-25	Installation of wire circuits .....	1	18
	Total .....	16	50

**5-19. Test of Field Telephones**

*a. Scope of Test.* One test will be conducted to determine the candidate's proficiency in testing field telephones.

*b. Special Instructions.*

(1) The candidate will be furnished a test telephone, serviceable batteries, field wire, a line-man's kit, and four telephones (of the same type

as the test telephone) that are known to contain faults.

(2) The candidate will be allowed 3 minutes to test each of the four telephones that have known faults. Before testing each telephone, other

than the test telephone, the candidate will indicate that he is ready. Three minutes after the candidate indicates that he is ready, the examiner will command STOP and require the candidate to announce the fault in the telephone.

### c. Outline of Test.

Examiner commands—	Action of candidate
TEST THE TELEPHONES PROVIDED AND ANNOUNCE THE FAULT	Tests the test telephone. Connects the test telephone to the first telephone to be tested. Indicates that he is ready. Tests and announces the fault in the telephone. Tests each of the other telephones, in turn, following the above procedure in each case.

### d. Penalties.

(1) A penalty of 2 points will be assessed for failure to test each telephone.

(2) A penalty of 1 point will be assessed for failure to determine the fault in each telephone within 3 minutes or for announcing a fault other than the existing fault in each telephone.

e. *Credit.* If the candidate tests each telephone

correctly within the prescribed time limits, 6 points will be allowed.

## 5-20. Maintenance of Field Telephone

a. *Scope of Test.* One test will be conducted to determine the candidate's proficiency in the maintenance of the field telephone.

b. *Special Instructions.* The candidate will be furnished a field telephone and a lineman's kit.

### c. Outline of Test.

Examiner commands—	Action of candidate
PERFORM THE OPERATOR MAINTENANCE OF THE FIELD TELEPHONE.	Performs operator maintenance as prescribed in the applicable TM.

d. *Penalties.* No penalties are provided for this test.

e. *Credit.* For each test that the candidate completes satisfactorily, 1 point will be allowed.

## 5-21. Installation of Field Switchboard

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

### c. Outline of Tests.

to determine the candidate's ability to install a field switchboard of the type with which his unit is equipped.

b. *Special Instructions.* The candidate will be furnished two switchboards, batteries, two operator headsets, three field telephones, field wire, a wireman's tool kit, and two ground rods.

Test No.	Examiner commands—	Action of candidate
1	INSTALL BOTH SWITCHBOARDS WITH TWO TRUNK CIRCUITS AND ONE LOCAL CIRCUIT EACH.	Sets up and tests switchboard as prescribed in the applicable technical manual.
2	ASSUMING THAT THE OPERATOR'S TELEPHONE CIRCUIT IS OUT, CONNECT A FIELD TELEPHONE FOR EMERGENCY OPERATION.	Connects field telephone as prescribed in the applicable technical manual.
3	CONNECT TWO SWITCHBOARDS FOR PARALLEL OPERATION.	Installs switchboards as prescribed in the applicable technical manual.

*d. Penalties.* A penalty of 2 points will be assessed for each test performed incorrectly.

*e. Credit.* If the candidate completes all tests satisfactorily, 7 points will be allowed.

## 5-22. Maintenance of the Field Switchboard

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

*c. Outline of Tests.*

Test No.	Examiner commands--	Action of candidate
1	EXPLAIN THE PREPARATION OF THE SWITCHBOARD FOR TRANSPORTATION OR STORAGE.	Explains and, when appropriate, demonstrates the preparation of the switchboard for transportation or storage.
2	REMOVE AND REPLACE A LINE PACK .....	Removes the unit and replaces it as prescribed in the applicable technical manual.
3	DEMONSTRATE CLEANING OF CORDS, PLUGS, JACKS, AND TERMINALS.	Cleans items specified as prescribed in the applicable technical manual.

*d. Penalties.* A penalty of 1 point will be assessed for each error or omission.

*e. Credit.* If the candidates all tests satisfactorily, 4 points will be allowed.

## 5-23. Operation of Field Switchboard

*a. Scope of Tests.* Six tests will be conducted to determine the proficiency of the candidate in switchboard operation.

*b. Special Instructions.*

(1) Several candidates may be tested at one

*c. Outline of Tests.*

Test No.	Examiner commands--	Action of candidate
1	MAKE A TRAFFIC DIAGRAM FOR THE BOARD YOU ARE NOW OPERATING.	Finds directory names from the CEOI and makes traffic diagram.
2	PLACE A LOCAL CALL .....	Places a call using the procedure prescribed in ACP 134 ( ).
3	PLACE A TRUNK CALL .....	Do.
4	PLACE A CONFERENCE CALL .....	Do.
5	FIRE MISSION ON A CIRCUIT NOW IN USE .....	Do.
6	PLACE AN URGENT CALL OVER A CIRCUIT ALREADY IN USE.	Do.

*d. Penalties.* A penalty of 1 point will be assessed for each operation or phase that the candidate performs incorrectly.

*e. Credit.* If the candidate performs all operations correctly, 7 points will be allowed.

to determine the candidate's proficiency in performing maintenance of the field switchboard.

*b. Special Instructions.* The candidate will be furnished a field switchboard and a lineman's kit.

time. Each will be scored on his individual performance.

(2) Each candidate will be furnished a copy of the CEOI.

(3) A minimum of three switchboards, each having three locals, will be installed and prepared for operation before the beginning of the tests.

(4) Each switchboard and phone will be given a directory name and number corresponding to designation listed in the CEOI.

(5) The examiner will provide operators for the local telephones.

## 5-24. Line Route Maps

*a. Scope of Test.* One test will be conducted in which the candidate will be required to answer questions concerning the use and construction of line route maps.

*b. Special Instructions.* The candidate will be furnished a line route map on a photomap, a map, or a sheet of overlay paper, marked with the loca-

tions of various installations between which circuits are assumed to be installed.

*c. Outline of Test.*

Examiner commands—	Action of candidate
EXPLAIN THE LINE ROUTE MAP (Examiner asks candidate at least four questions pertaining to a line route map.)	Answers questions, using the line route map furnished by examiner, when necessary.

*d. Penalties.* A penalty of 2 points will be assessed for each question answered incorrectly.

*e. Credit.* If the candidate answers question correctly, 6 points will be allowed.

**5-25. Installation of Wire Circuits**

*a. Scope of Test.* One test will be conducted to determine the candidate's knowledge of laying, servicing, and picking up wire circuits and his ability to perform these operations. The candidate will be tested in the duties of all members of a wire crew (except those of the wire team chief and driver.)

least one wire laying device of each type authorized for the candidate's unit, with each type of wire used by the unit, and with telephones, tags, tape, seizing wire, stakes (wooden), pike poles, lance poles, and lineman's kits (one per candidate).

(2) Several candidates (but not more than six) will be assigned to the truck as a wire crew. Each candidate will perform all the duties involved in laying, servicing, and picking up wire circuits (see *a* above). Each type of crossing will be installed.

(3) At appropriate intervals, the examiner will stop the test and order the candidates to change posts. The test will continue until each candidate has been tested in all operations.

*b. Special Instructions.*

(1) A wire truck will be provided with at

*c. Outline of Test.*

Examiner commands—	Action of candidate
INSTALL THE WIRE NET. (Examiner designates the type of wire net to be laid, giving the locations of unit switchboards.) (Examiner rotates candidates in the various jobs during installation of the wire net so that each candidate will perform all duties in each phase of the installation.)	Performs his assigned duties as the team of candidates installs the designated wire net.

*d. Penalties.* A penalty of 2 points will be assessed for—

- (1) Failure to leave sufficient slack.
- (2) Improper operation of reel units.
- (3) Faulty splices, tying, or tagging.
- (4) Failure to test wire before using it.
- (5) Failure to test wire at the end of each reel.

(6) Failure to tie, tag, and test wire and turn over wire to the switchboard operator.

- (7) Failure to use proper type of crossing.
- (8) Use of excessive time in performing duties.

*e. Credit.* Each candidate who performs all operations and duties will be allowed 18 points.

**Section V. RADIO PERSONNEL**

**5-25. Outline of Tests**

Paragraph No.	Subject	Number of tests	Maximum credit
5-26	FM radio sets	5	10
5-27	AM radio sets	2	10
5-28	Radioteletype operations	5	12
5-29	Cipher machine TSEC/KW-7	1	9
5-30	Speech security equipment TSEC/KY-8 or TSEC/KY-38	3	9
	Total	16	50

**5-26. FM Radio Sets**

*a. Scope of Tests.* Five tests will be given to determine the candidate's proficiency in installing, testing, and adjusting FM radio sets.

*b. Special Instructions.*

(1) The candidate will be furnished the un-

*c. Outline of Tests.*

assembled components and ancillary equipment of radio sets AN/VRC-47 and AN/VRC-49.

(2) One radio AN/PRC-25 (or AN/PRC-77) and control unit AN/GRA-39 will be furnished for test 5.

(3) The examiner will provide an additional radio set, with a qualified operator, to serve as the base set.

Test No.	Examiner commands—	Action of candidate
1	USING THE COMPONENTS PROVIDED, ASSEMBLE RADIO SET AN/VRC-49.	Assembles radio set AN/VRC-49 as prescribed in TM 11-5820-401-10.
2	USING THE COMPONENTS PROVIDED, ASSEMBLE RADIO SET AN/VRC-47.	Assembles radio set AN/VRC-47 as prescribed in TM 11-5820-401-10.
3	PERFORM THE FOLLOWING OPERATIONS WITH RADIO SET AN/VRC-47. <i>a.</i> PROVIDE POWER TO ENTIRE RADIO SET -----  <i>b.</i> SET THESE FREQUENCIES ON RADIO SET AN/VRC-47. ASSIGNED FREQUENCY IS _____. YOUR ALTERNATE FREQUENCY IS _____. <i>c.</i> CONTACT BASE SET ON YOUR ASSIGNED FREQUENCY. HAVE THE BASE SET CALL YOU ON YOUR ALTERNATE FREQUENCY AND ANSWER THE CALL.	<i>a.</i> Turns the power switch to LOW or HIGH and turns on the receiver R-442. <i>b.</i> Sets assigned frequency on RT-524/VRC. Sets alternate frequency on R-442/VRC. <i>c.</i> Calls base set and requests them to call back on frequency given. Turns RT-524 to alternate frequency and answers call using procedure prescribed in ACP-125 ( ).
4	PERFORM THE FOLLOWING OPERATIONS WITH RADIO SET AN/VRC-49. <i>a.</i> FROM THE FOLLOWING FOUR FREQUENCIES, SELECT TWO THAT WILL WORK FOR RETRANSMISSION: _____ <i>b.</i> CONNECT AND OPERATE RADIO SET AN/VRC-49 AS A RETRANSMISSION STATION.	<i>a.</i> Using chart in TM 11-5820-401-10, check "useability" of frequencies. <i>b.</i> Connects and operates radio set as a retransmission station.
5	PERFORM THE FOLLOWING OPERATIONS WITH RADIO SET AN/PRC-25 (or AN/PRC-77): <i>a.</i> PLACE RADIO SET AN/PRC-25 (or AN/PRC-77) IN OPERATION FREQUENCY _____.  <i>b.</i> CONNECT THE AN/GRA-39 FOR REMOTE OPERATION ..	<i>a.</i> Installs battery BA-386 and places the PWR ON-OFF switch in the ON position. Turns the frequency controls to the proper frequency. <i>b.</i> Connects remote control unit to the radio set.

*d. Penalties.*

(1) *Tests 1 and 2.* A penalty of 2 points will be assessed for each test performed incorrectly.

(2) *Tests 3, 4, and 5.* A penalty of 1 point will be assessed for each operation performed incorrectly.

*e. Credit.* If the candidate performs all operations correctly, 10 points will be allowed.

**5-27. AM Radio Sets**

*a. Scope of Tests.* Two tests will be conducted to determine the candidate's proficiency in installing and adjusting AM radios.

*b. Special Instructions.*

(1) For test 2 a radioteletype set AN/GRC-142 will be furnished the candidate. Any AM

radio set issued to the candidate's organization may be used if the AN/GRC-142 is not available.

(2) Another capable AM radio set manned by a competent operator will be used as the base set.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	USING THE COMPONENTS FURNISHED, PERFORM THE FOLLOWING OPERATIONS: a. INTERCONNECT COMPONENTS OF RADIO TELETYPE-WRITER SET AN/GRC-142 FOR VOICE OPERATION.  b. CALIBRATE RECEIVER AND TUNE TO YOUR ASSIGNED FREQUENCY WHICH IS _____.	a. Installs and interconnects all components. Makes appropriate settings for voice operation. b. Follows procedure given in the applicable technical manual.

*d. Penalties.* One point will be assessed for each part of each test not performed satisfactorily.

*e. Credit.* Six points will be awarded if all operations are completed in a satisfactory manner.

### 5-28. Radioteletype Procedures

*a. Scope of Tests.* Seven tests will be conducted to determine the candidate's knowledge of radioteletype procedure.

*b. Special Instructions.*

(1) Several candidates should be tested at one time, each being scored as he completes his transmissions.

(2) Each candidate will be furnished an AM radio set of the type used in his unit. All sets must be capable of operating in the same net.

(3) Each candidate will be designated as a radio operator at a particular station. He will be furnished a list indicating the units in the net, a CEOI, an authentication system, and a call sign.

(4) The examiner will provide each candidate with a prepared encoded message of not less than 15 five letter groups and a clear text message of approximately 15 words. No two candidates will be furnished the same message.

(5) In test 5, the examiner should be provided with a qualified operator, who will call each station in the net in turn. In calling, he will blur the call sign of the calling station.

(6) Jamming will be simulated in test 6 and the candidate will be questioned to test his knowledge of antijamming techniques.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	EXPLAIN THE DUTIES OF THE NET CONTROL STATION OPERATOR.	Explains duties of net control station operator.
2	YOU ARE NET CONTROL STATION OPERATOR. ORGANIZE THE NET.	Organizes the net following procedure prescribed in ACP 124( ).
3	SEND THIS CRYPTOGRAPHIC MESSAGE .....	Sends message by procedure described in ACP 124( ).
4	SEND THIS CLEAR TEXT MESSAGE .....	Sends message using procedures prescribed in ACP 124( ).
5	ANSWER A STATION WHOSE CALL SIGN YOU WERE NOT ABLE TO UNDERSTAND.	Answers station using procedure prescribed in ACP 124( ).
6	ASSUME THAT OPERATION IS BEING JAMMED. EXPLAIN HOW YOU WOULD CONTINUE OPERATION.	
7	CLOSE THE NET .....	Closes net using procedure prescribed in ACP 124( ).

*d. Penalties.* A penalty of 1 point will be assessed for each of the following:

(1) Failure to know the duties of the net control station operator.

- (2) Failure to open net properly.
- (3) Unnecessary repetition of calls.
- (4) Transmitting faster than slowest operator in the net.
- (5) Failure to keep a proper log.
- (6) Making an error in transmission.
- (7) Use of improper procedure.
- (8) Failure to authenticate when necessary.
- (9) Repetition of authentication groups.
- (10) Failure to close net properly.

*c. Outline of Test.*

Examiner commands—	Action of candidate
PREPARE THIS MACHINE FOR CIPHER OPERATION .....	Prepares machine for operation by following procedures given in the applicable technical manual.

*d. Penalties.* A penalty of 1 point will be assessed for each incorrect procedure.

*e. Credit.* If the candidate performs all procedures correctly, 9 points will be allowed.

**5-30. Speech Security Equipment TSEC/KY-8 or TSEC/KY-38**

*a. Scope of Tests.* Three tests will be conducted to determine the candidate's proficiency in the use of the speech security equipment TSEC/KY-8 or TSEC/KY-38.

*c. Outline of Tests*

Test No.	Examiner commands—	Action of candidate
1	PREPARE THIS MACHINE FOR OPERATION IN THE SECURE POSITION.	Follows procedure prescribed in the applicable technical manual.
2	SEND THE FOLLOWING MESSAGE IN SECURE MODE .....	Sends the message to the examiner within 5 minutes.
3	TAKE THIS MACHINE OUT OF OPERATION AND ZERO IT ....	Follows procedure prescribed in the applicable technical manual.

*d. Penalties.* A penalty of 2 points will be assessed—

- (1) For failure to transmit a message in secure mode to the examiner within 5 minutes.

*e. Credit.* If the candidate performs all operations correctly, 12 points will be allowed.

**5-29. Cipher Machine TSEC/KW-7**

*a. Scope of Test.* One test will be conducted to determine the candidate's proficiency in operating the TSEC/KW-7.

*b. Special Instructions.* Candidate will be provided one TSEC/KW-7 and ancillary equipment with appropriate key list.

*b. Special Instruction.* The candidate will be furnished speech security equipment TSEC/KY-8 of TSEC/KY-38 with the appropriate key list and a VRC-46 radio. He will be required to extract the necessary information from the appropriate key list before operating the machine.

*Note.* The examiner should have a second machine TSEC/KY-8 or TSEC/KY-38 (and VRC-46 radio) operational in the secure position to receive the candidate's secure transmissions. If the TSEC/KY-38 is used, one changer key KYK-28/TSEC must be provided.

- (2) For failure to zero the machine.

*e.* If the candidate performs all operations correctly, 9 points will be allowed.



## CHAPTER 6

### FIELD ARTILLERY MECHANICS

#### Section I. GENERAL

##### 6-1. General

a. Tests for qualification of artillery mechanics are divided into tests relating to the primary weapons; those relating to boresighting, periodic tests, and on-carriage fire control equipment; those relating to ammunition; and those relating to publications, forms, and records.

b. In cannon artillery firing units, the artillery mechanic is usually responsible for organizational maintenance of the primary weapons of the unit. To qualify as an artillery mechanic, a candidate must complete the tests presented in paragraph 90 through 98.

c. The tests in this chapter will not be used as a basis for award of the field artillery qualification badge. Field artillery mechanics desiring to compete for the field artillery qualification badge must take the gunner's or missilemen tests appropriate for the unit to which they are assigned.

d. The applicable technical manual for each of the primary weapons will be available for the candidates use in the tests on primary weapons; however, the candidate will be permitted to use the manual only for those tests in which adjustments to given specifications are required.

#### Section II. PRIMARY WEAPONS

##### 6-2. Towed 105-MM Howitzer M101A1

a. *Scope of Tests.* Six tests will be conducted to determine the candidate's knowledge of the functioning, nomenclature, and maintenance of the M101A1, to include the—

- (1) Barrel and breech.
- (2) Recoil and pneumatic respirator.
- (3) Cradle lock strut and traveling lock brackets.
- (4) Equilibrators and elevating mechanism.

c. *Outline of Tests.*

(5) Brakes.

(6) Wheel bearings.

b. *Special Instructions.* Unit will furnish candidate with an M101A1 on which the cradle lock strut, traveling lock brackets, and wheel bearings have been improperly adjusted and the tools that the candidate will need to establish the oil reserve and to adjust the cradle lock strut, traveling lock brackets, and wheel bearings.

Test No.	Examiner commands—	Action of candidate
1	EXPLAIN REMOVAL OF BARREL GROUP .....	Explains the correct procedures as outlined in TM 9-1015-203-12.
2	ESTABLISH PROPER RECOIL OIL AND ADJUST PNEUMATIC RESPIRATOR.	Explains the correct procedure as outlined in TM 9-1015-203-12.
3	DISASSEMBLE AND ASSEMBLE THE BREECH MECHANISM AND FIRING LOCK.	Disassembly and assembly the breech mechanism and firing lock as outlined in TM 9-1015-203-12.
4	a. EXPLAIN PROPER ADJUSTMENT OF EQUILIBRATORS	Explains proper adjustment as outlined in TM 9-1015-203-12.
	b. TRACE POWER TRAIN OF ELEVATING MECHANISM FROM THE HANDWHEEL TO THE ELEVATING ARC.	Traces power train from the handwheel to the elevating arc.
5	EXPLAIN ADJUSTMENT AND MAINTENANCE OF BRAKE MECHANISM.	Explains proper adjustment and maintenance as outlined in TM 9-1015-203-12.
6	ADJUST WHEEL BEARINGS .....	Adjusts wheel bearings as outlined in TM 9-1015-203-12.

*d. Penalties.*

(1) *Tests 1, 4, and 5.* If the candidate fails to explain the required procedures as outlined in the indicated references, the examiner will award a grade commensurate with the knowledge of the candidate.

(2) *Test 2.* No credit will be allowed unless the candidate knows the correct oil reserve that is to be established.

(3) *Test 3.* No credit will be allowed if the candidate fails to disassemble or assemble the breech mechanism and firing lock properly.

(4) *Test 6.* No credit will be allowed if the candidate fails to adjust the wheel bearings properly.

*e. Credit.* Subject to penalties assessed in *d*

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	DISASSEMBLING THE BREECH MECHANISM. EXPLAIN MAINTENANCE OF TUBE BEFORE AND AFTER FIRING.	Candidate disassembles and assembles breech mechanism as outlined in TM 9-1015-234-12.
2	ESTABLISH AND EXPLAIN OIL RESERVE .....	Candidate establishes oil reserve in recuperator as outlined in TM 9-1015-234-12.
3	DESCRIBE THE FOLLOWING MAJOR COMPONENTS OF THE M102 AND EXPLAIN THE FUNCTIONING AND MAINTENANCE OF EACH COMPONENT: BOX TRAILS, FIRING PLATFORM, SUSPENSION ASSEMBLY, CRADLE (TO INCLUDE FIRING MECHANISM ASSEMBLY). TRAVERSING MECHANISM, AND ELEVATING MECHANISM.	Candidate describes the major components and explains the functioning (and maintenance) of each of the components as outlined in TM 9-1015-234-12.

*d. Penalties.*

(1) *Test 1.* If the candidate fails to explain the procedures outlined in the reference, the examiner will award a grade commensurate with the knowledge of the candidate.

(2) *Test 2.* No credit will be allowed unless the candidate knows how to correctly establish the oil reserve.

(3) *Test 3.* If the candidate fails to explain the functioning and maintenance procedures as outlined in the reference for each major component, examiner will award a grade commensurate with the knowledge of the candidate.

*e. Credit.* Subject to penalties assessed in *d* above, maximum credit of 8 points each will be awarded for tests 1 and 2; maximum credit of 24 points (4 points per major component) will be awarded for test 3.

above, maximum credit of 6 points each will be awarded for tests 1 and 5; maximum of credit of 7 points each will be awarded for tests 2, 3, 4, and 6.

**6-3. Towed 105MM Howitzer M102**

*a. Scope of Tests.* Three tests will be conducted to determine the candidate's knowledge of the functioning, nomenclature, and maintenance of the M102, to include the—

- (1) Barrel and breech mechanism.
- (2) Recoil mechanism.
- (3) Howitzer components.

*b. Special Instructions.* Unit will furnish candidate with one M102 howitzer and the necessary tools. Weapon will have low oil reserve.

**6-4. Towed 155-MM Howitzer M114A1**

*a. Scope of Tests.* Six tests will be conducted to determine the candidate's knowledge of the functioning, nomenclature, and maintenance of the M114A1, to include the—

- (1) Barrel and breech.
- (2) Recoil.
- (3) Major components of the howitzer.
- (4) Equilibrator and elevating and traversing mechanisms.
- (5) Brakes.
- (6) Wheel bearings.

*b. Special Instructions.* Unit will furnish candidate with a towed 155-mm howitzer M114-A1 and necessary tools.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	DISASSEMBLE AND ASSEMBLE THE BREECH MECHANISM AND DEMONSTRATE PROPER USE OF HEADSPACE GAGE. EXPLAIN PROPER MAINTENANCE OF TUBE BEFORE AND AFTER FIRING.	Candidate disassembles and assembles breech mechanism as prescribed in TM 9-1025-200-12 and demonstrates use of headspace gage as outlined in TM 9-1025-200-12.
2	ESTABLISH REPLENISHER OIL RESERVE AND EXPLAIN PROPER PROCEDURE FOR ESTABLISHING RECUPERATOR OIL RESERVE.	Candidate establishes replenisher oil reserve and explains procedure for establishing recuperator oil reserve as outlined in TM 9-1025-200-12.
3	DESCRIBE AND GIVE THE FUNCTIONING OF THE MAJOR COMPONENTS OF THE HOWITZER.	Candidate describes and explains the functioning of the major components as outlined in TM 9-1025-200-12.
4	EXPLAIN THE PROPER CHECK FOR BACKLASH IN THE ELEVATING AND TRAVERSING MECHANISM.	Candidate explains the proper check for backlash as outlined in TM 9-1025-200-12.
5	TESTS AIRBRAKES TO INCLUDE: a. TESTING FOR AIR LEAKAGE. b. DRAINING WATER FROM EMERGENCY TANK AND AIR. c. CLEANING AIR FILTERS. d. TESTING AUTOMATIC EMERGENCY BRAKING FEATURE. e. ADJUST PUSH ROD TRAVELS.	Candidate performs tests as outlined in TM 9-1025-200-12.
6	ADJUST WHEEL BEARINGS .....	Candidate adjusts wheel bearings as described in TM 9-1025-200-12.

*d. Penalties.*

(1) *Test 1.* A penalty of 8 points will be assessed if the candidate fails to disassemble or assemble the breech mechanism properly. A penalty of 4 points will be assessed if he fails to space gage properly or fails to explain the proper maintenance.

(2) *Test 2.* A penalty of 6 points will be assessed if the candidate fails to establish replenisher oil reserve. A penalty of 3 points will be assessed if he fails to explain the proper procedure.

(3) *Tests 3 and 4.* If the candidate fails to explain functioning and procedures as outlined in the indicated references, the examiner will award a grade commensurate with the knowledge of the candidate.

(4) *Test 5.* A penalty of 2 points will be assessed for each part of the test performed incorrectly.

(5) *Test 6.* No credit will be allowed if the candidate fails to adjust wheel bearings properly.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	DISASSEMBLE AND ASSEMBLE THE BREECH MECHANISM AND FIRING LOCK. EXPLAIN PROPER MAINTENANCE OF THE TUBE AND BREECH MECHANISM, BEFORE AND	Candidate disassembles and assembles breech mechanism and firing lock as prescribed in TM 9-2350-217-10.

*e. Credit.* Subject to penalties assessed in *d* above, maximum of 8 points will be awarded for test 1; maximum credit of 6 points each will be awarded for tests 2, 3, 4, and 6. Maximum credit of 8 points will be awarded for test 5 (parts *a* and *b*, 1 point each; parts *c*, *d*, and *e*, 2 points each).

**6-5. Self-Propelled 155-MM Howitzer M109**

*a. Scope of Tests.* Five tests will be conducted to determine the candidate's knowledge of functioning, nomenclature, and maintenance of the self-propelled 155-mm howitzer M109 to include the—

- (1) Barrel and breech.
- (2) Recoil.
- (3) Hydraulic system.
- (4) Equilibrator.
- (5) Power rammer.

*b. Special Instructions.* Unit will furnish candidate with one M109 and the necessary tools. Weapon will have improperly adjusted equilibrator and low oil reserve.

Test No.	Examiner commands—	Action of candidate
	AFTER FIRING, AND THE MUZZLE BREAK AND CHAMBER EVACUATOR.	
2	ESTABLISH OIL RESERVE IN THE REPLENISHER .....	Candidate establishes oil reserve in the replenisher as outlined in TM 9-2350-217-10.
3	EXPLAIN THE CHECK OF THE HYDRAULIC SYSTEM .....	Candidate explains the proper procedure for checking the hydraulic system as outlined in TM 9-2350-217-20.
4	ADJUST THE EQUILIBRATOR .....	Candidate adjusts the equilibrator as described in TM 9-2350-217-10.
5	CHECK THE POWER RAMMER .....	Checks the power rammer for operation as outlined in TM 9-2350-217-10.

*d. Penalties.*

(1) *Test 1.* A penalty of 7 points will be assessed, if the candidate fails to disassemble or assemble the breech mechanism, firing lock, muzzle break, and chamber evacuator properly. A penalty of 4 points will be assessed if he fails to explain the proper maintenance.

(2) *Test 2.* A penalty of 7 points will be assessed if the candidate fails to establish the proper replenisher oil reserve.

(3) *Test 3, 4, & 5.* If candidate fails to explain functioning and procedures as outlined in references, examiner will award a grade commensurate with the knowledge of the candidate.

(4) *Test 5.* No credit will be allowed if candidate fails to adjust equilibrator properly.

*e. Credit.* Subject to penalties assessed in *d* above, maximum credit of points each will be awarded for tests 1 through 5.

*c. Outline of Tests.*

## 6-6. Self-Propelled 175-MM Gun M107 and 8-Inch Howitzer M110

*a. Scope of Tests.* Seven tests will be conducted to determine candidate's knowledge of the functioning, nomenclature, and maintenance of the 175-mm gun M107 and 8-inch howitzer M110 to include the—

- (1) Barrel and breech.
- (2) Recoil.
- (3) Elevating and traversing mechanism (power).
- (4) Maintenance of the power system.
- (5) Equilibrators.
- (6) Power rammer and ammunition hoist.
- (7) Traveling lock.

*b. Special Instructions.* Unit will furnish candidate with one 175-mm gun and the necessary tools. Weapon will have improperly adjusted equilibrators.

Test No.	Examiner commands—	Action of candidate
1	DISASSEMBLE AND ASSEMBLE THE OBTURATOR SPINDLE ASSEMBLY TO INCLUDE THE FIRING LOCK. EXPLAIN PROPER MAINTENANCE OF THE TUBE AND BREECH MECHANISM BEFORE AND AFTER FIRING.	Candidate disassembles and assembles the obturator spindle assembly to include firing lock as outlined in TM 9-2300-216-10.
2	EXPLAIN PURPOSE OF REPLENISHER AND OIL RESERVE IN RECUPERATOR AND EXPLAIN HOW TO ESTABLISH THE OIL RESERVE.	Candidate explains purpose of replenisher and oil reserve in recuperator and explain procedure for establishing the oil reserve as outlined in TM 9-2300-216-10.
3	TRACE THE POWER TRAIN OF THE ELEVATING AND TRAVERSING MECHANISM FROM THE HANDWHEELS TO THE BASE RING AND RACE AND THE ELEVATING ARC.	Candidate traces the flow of power of the power elevating and traversing mechanism as outlined in TM 9-2300-216-10.
4	EXPLAIN THE MAINTENANCE OF THE HYDRAULIC SYSTEM AND DISCUSS MAJOR COMPONENTS.	Candidate discusses the major components of the hydraulic system and explains the maintenance of the

Test No.	Examiner commands--	Action of candidate
		system as outlined in TM 9-2300-216-10 and TM 9-2300-216-20.
5	ADJUST EQUILIBRATORS .....	Candidate adjusts equilibrators as outlined in TM 9-2300-216-10.
6	CHECK POWER RAMMER AND AMMUNITION HOIST .....	Candidate checks the power rammer and ammunition hoist as outlined in TM 9-2300-216-10.
7	EXPLAIN PURPOSE AND ADJUSTMENT OF TRAVELING LOCK.	Candidate explains purpose and adjustment of traveling lock as outlined in TM 9-2300-216-20.

*d. Penalties.*

(1) *Test 1.* A penalty of 7 points will be assessed if the candidate fails to disassemble or assemble the obturator spindle assembly or the firing lock properly; if he fails to explain the proper maintenance, a penalty of 3.5 points will be assessed.

(2) *Tests 2, 3, 4, and 7.* If candidate fails to explain functions and procedures as outlined in the specified references, examiner will award

a grade commensurate with the knowledge of the candidate.

(3) *Tests 5 and 6.* No credit will be given if candidate fails to adjust equilibrators and rammer properly.

*e. Credit.* Subject to penalties assessed in *d* above, maximum credit of 7 points each will be awarded for tests 1, 2, 4, and 5; maximum credit of 6 points each will be awarded for test 3 and 6.

### Section III. BORESIGHTING, PERIODIC TESTS, AND ON-CARRIAGE FIRE CONTROL EQUIPMENT

#### 6-7. Boresighting, Periodic Tests, and On-Carriage Fire Control Equipment

*a. Scope of Tests.* Three tests will be conducted to determine the candidate's knowledge of boresighting, periodic tests, and unit main-

tenance of on-carriage fire control equipment.

*b. Special Instructions.* The candidate will be furnished an artillery piece assigned the unit, boresighting equipment, and on-carriage fire control equipment.

*c. Outline of Tests.*

Test No.	Examiner commands--	Action of candidate
1	BORESIGHT USING TWO METHODS APPLICABLE TO UNIT'S PRIMARY WEAPON.	Candidate boresights weapon.
2	PERFORM BASIC PERIODIC TESTS .....	Candidate levels trunnions, makes end-for-end test of gunner's quadrant, tests sight mount and panoramic telescope, tests elbow telescope and range quadrant.*
3	DEMONSTRATE THE PROPER METHOD OF CLEANING ON-CARRIAGE FIRE CONTROL EQUIPMENT AND EXPLAIN CARE EXERCISED WHEN UNUSUAL WEATHER CONDITIONS PREVAIL.	Candidate demonstrates proper method for cleaning fire control equipment as outlined in TM 9-254.

\*On applicable weapons.

*d. Penalties.* Penalties will be assessed as follows:

(1) *Tests 1 and 2.* No credit will be allowed if candidate fails to boresight or perform basic periodic tests in the proper manner.

(2) *Test 3.* If the candidate fails to explain

functioning and procedures as outlined in references, examiner will award a grade commensurate with the knowledge of the candidate.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as indicated below.

(1) *Test 1.* For each method of boresighting performed correctly, 5 points; maximum credit, 10 points.

(2) *Test 2.* Maximum credit, 6 points.

(3) *Test 3.* Maximum credit, 4 points.

## Section IV. PUBLICATIONS FORMS, AND RECORDS

### 6-8. Publications, Forms, and Records

*a. Scope of Tests.* Two tests will be conducted to determine the candidate's knowledge of publications, forms, and records and their use.

*b. Special Instructions.*

*c. Outline of Tests.*

(1) The examining officer will slowly read each question to the candidate two times.

(2) The candidate will be allowed 2 minutes, if desired, to consider the question, before he answers.

(3) Candidate will be furnished a copy of a -20PTM applicable to his unit.

Test No.	Examiner commands—	Action of candidate
1	ANSWER THE FOLLOWING QUESTIONS: (Examiner reads the following questions aloud). <i>a.</i> What DA publications prescribe training for the individual soldier? <i>b.</i> What DA publication is used to record the history of an artillery weapon? <i>c.</i> Repair or changes to an item of equipment to add safety features or to improve the efficiency of the equipment are directed by what publications? <i>d.</i> What number identifies technical manuals to be used by an organization (battery or company) to determine its authorization of spare parts and equipment? <i>e.</i> Field manuals of what series pertain to field artillery? ..... <i>f.</i> What DA publications list the prescribed lubricants and the interval of their use? <i>g.</i> What DA publications prescribe organizational maintenance of materiel? <i>h.</i> Maintenance allocation charts, which designate the overall responsibility for the maintenance function, are presented in which technical manuals? <i>i.</i> What DA publication contains the basic issue items list? ..... <i>j.</i> Preventive maintenance checks and services are listed in what DA publications? <i>k.</i> A listing of operator and organizational maintenance technical manuals is presented in what DA publication? <i>l.</i> Which DA pamphlet lists field manuals? .....	Candidate replies— <i>a.</i> Field manuals. <i>b.</i> The equipment logbook. <i>c.</i> Modification work orders (MWO). <i>d.</i> -20P. <i>e.</i> The FM 6-series. <i>f.</i> Lubrication orders (LO). <i>g.</i> -20 technical manuals (TM). <i>h.</i> -20 TM. SPs 12 TM Towed. <i>i.</i> Operator's TM, or -10 or -12. <i>j.</i> -20 TM. SPs -12 for towed. <i>k.</i> DA Pam 310-4. <i>l.</i> DA Pam 310-3.
2	USING A -20P TM, GIVE THE STOCK NUMBER AND AUTHORIZATION OF EACH OF THE FOLLOWING REPAIR PARTS OR ITEMS OF EQUIPMENT: (Examiner selects four items from the -20P TM and gives the names of the items to the candidate.)	Candidate will determine the information from the -20P TM provided by the examiner.

*d. Penalties.* A penalty of 1 point will be assessed for each incorrect or incomplete answer.

*e. Credit.* Subject to penalties assessed in *d* above, credit will be given the candidate as indicated below:

(1) *Test 1.* 0.75 point for each correct answer; maximum credit, 6 points.

(2) *Test 2.* 1 point for each correct answer; maximum credit, 4 points.

## CHAPTER 7

### MOTORS PERSONNEL

#### Section I. GENERAL

##### 7-1. General

a. Tests for qualification of motors personnel are divided into tests for drivers, general (section II), tests for drivers of wheeled vehicles (section III) tests for drivers of tracked vehicles (section IV), tests for wheeled-vehicle mechanics (section V), and tests for tracked-vehicle mechanics (section VI).

b. Before taking the tests prescribed in sections II, III, and IV of this chapter, driver candidates must qualify as drivers under the provisions of TM 21-300 or TM 21-301 and AR 600-55. Each driver candidate will be required to complete the tests prescribed in section II for drivers, general. In addition, the candidate will be required to satisfactorily complete the tests prescribed in section III or those prescribed

in section IV, depending on the type of vehicle for which he is to qualify.

c. Each candidate for driver qualification will be tested on the vehicle used as a prime mover in his particular unit. A candidate from a headquarters battery, service battery, or other unit not having towed weapons will be tested on the largest wheeled vehicle used for towed loads with which his unit is equipped.

d. Each candidate for mechanic qualification must complete the tests prescribed in section V or those prescribed in section VI, depending on the type of vehicle for which he is to qualify. To qualify as a wheeled-vehicle mechanic, a candidate will be tested on all types of wheeled vehicles used in his unit. A candidate for qualification as a tracked-vehicle mechanic will be tested on all types of tracked vehicles used in his unit.

#### Section II. DRIVERS, GENERAL

##### 7-2. Outline of Tests

Paragraph No.	Subject	Number of tests	Points each	Maximum credit
7-3	Driver information .....	3	--	15
	Test 1 .....	(1)	4	(4)
	Test 2 .....	(1)	8	(8)
	Test 3 .....	(1)	3	(3)
7-4	Map Reading .....	6	--	20
	Test 1, 2, 3, 5, and 6 .....	(5)	3	(15)
	Test 3 .....	(1)	5	(5)
	Total .....	9	--	35

##### 7-3. Driver Information

a. *Scope of Tests.* Three tests will be conducted to determine the candidate's—

- (1) Knowledge of the rules of the road.
- (2) Ability to give and understand hand signals.

(3) Ability to complete the required driver's forms.

b. *Special Instructions.*

(1) *Tests 1 and 2.* A street diagram and a number of model vehicles will be provided for these tests.

(2) *Test 3.*

(a) The candidate will be furnished the following forms:

1. Vehicle and equipment operational records (equipment log book with DA Form 2400 and DA Form 2404).

2. Operator's Report of Motor-Vehicle Accident, Standard Form 91.

3. Accident—Identification Card, (DD Form 518).

(b) A wheeled vehicle and/or a truck vehicle of any type will be available to the candidate.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	GIVE 12 RULES OF THE ROAD. (When possible, the examiner, using model vehicles, sets up a situation for each rule.) (See TM 21-305 and/or TM 21-306.)	Moves model vehicles to demonstrate rules, or answers questions orally.
2	a. DEMONSTRATE THE FOLLOWING HAND SIGNALS: (Examiner calls off eight signals to be given.) b. EXPLAIN THE MEANING OF EACH OF THESE HAND SIGNALS. (Examiner gives eight hand signals.) (See TM 21-305 or TM 21-306.)	a. Demonstrates signals announced by the examiner. b. Explains meaning of each signal given by examiner.
3	a. COMPLETE THIS VEHICLE AND EQUIPMENT OPERATIONAL RECORD. (Examiner gives candidate a mission, indicates vehicle, and equipment operational record.) (See TM 38-750.) b. COMPLETE THIS ACCIDENT REPORT AND EXPLAIN THE DISPOSITION OF THE REPORT. (Examiner sets up assumed accident, using street diagram and model vehicles, and gives the candidate a Standard Form 91.) (See TM 21-305 or TM 21-306.)	a. Completes the vehicle and equipment taking actual data from vehicle. b. Completes accident report and explains disposition.

*d. Penalties.* No penalties are provided for these tests.

*e. Credit.*

(1) *Test 1.* A credit of one-third point will be allowed for each rule of the road correctly demonstrated or explained.

(2) *Test 2.* A credit of 0.5 point will be allowed for each hand signal correctly demonstrated or explained.

(3) *Test 3.* A credit of 1.5 points will be allowed for each form correctly completed.

**7-4. Map Reading**

*a. Scope of Tests.* Six tests will be conducted to determine the candidate's ability to read road maps and military maps.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	a. LOCATE THE FOLLOWING POINT ON THE MAP: (Examiner gives reference numbers and letters of a selected point.) b. GIVE THE APPROXIMATE COORDINATES OF THIS POINT: (Examiner indicates a point on the military map.)	a. Indicates the specified point on the road map. b. Estimates and reports coordinates.
2	DETERMINE THE DISTANCE BETWEEN THESE TWO POINTS. (Examiner indicates two points on either map.)	Estimates distance to nearest 0.2 mile.
3	GIVE THE MEANINGS OF THESE CONVENTIONAL SIGNS. (Examiner points out 10 signs on either map.)	Identifies signs as examiner points them out.

*b. Special Instructions.*

(1) The candidate will be furnished a road map and a military map of a scale not smaller than 1:50,000.

(2) In tests involving direction or distance, considerable latitude will be allowed. Directions will be given as points of the compass (for example, northeast, southwest) rather than azimuths. Distances will be given in miles and tenths of a mile; coordinates, to the nearest 100 meters.

(3) In test 3, the selected conventional signs will be those of particular interest to a driver, such as signs for various types of roads, railroads, and bridges.



Test No.	Examiner commands—	Action of candidate
4	YOU ARE AT POINT A. (Examiner indicates point A on map.) STATE THE DIRECTION OF POINT B FROM POINT A. (Examiner indicates point B on map.)	Estimates and reports direction.
5	DETERMINE, BY INSPECTION OF THE MAP, THE BEST ROUTE BETWEEN THESE TWO POINTS. (Examiner indicates two widely spaced points.)	Traces the best route on the map.
6	DEFINE A STRIP MAP AND EXPLAIN ITS PURPOSE. (See TM 21-305.)	Describes strip map and explains its

*d. Penalties.* No penalties are provided for these tests.

*e. Credit.*

(1) *Test 1.* A credit of 1.5 points will be allowed for each part of the test correctly performed or answered.

(2) *Tests 2, 4, 5, and 6.* Maximum credit of 3.0 points will be allowed for each test completed successfully.

(3) *Test 3.* A credit of 0.5 point will be allowed for each conventional sign correctly identified.

### Section III. DRIVERS, WHEELED VEHICLES

#### 7-5. Outline of Tests

Paragraph No.	Subject	Number of tests	Points each	Maximum credit
7-6	Nomenclature .....	6	--	20
	Tests 1 and 2 .....	(2)	5	(10)
	Tests 3 and 5 .....	(2)	3	(6)
	Tests 4 and 6 .....	(2)	2	(4)
7-7	Maintenance .....	4	5	20
7-8	Driving .....	5	5	25
	Total .....	15	--	65

#### 7-6. Nomenclature

*a. Scope of Tests.* Six tests will be conducted to determine the candidate's knowledge of the nomenclature of the vehicles of his unit and the nomenclature of the tools and equipment used with each vehicle.

*c. Outline of Tests.*

*b. Special Instructions.* A prime mover will be furnished the driver for these tests. When possible, a stripped chassis should be provided. The vehicles will be at the place where the tests are to be conducted.

Test No.	Examiner commands—	Action of candidate
1	TRACE THE POWER TRAIN AND POINT OUT THE PRINCIPAL ELEMENTS OF THE TRAIN.	Traces the power train and points out the clutch, transmission, propeller shafts and universal joints, transfer case, differential, and axles.
2	TRACE THE IGNITION SYSTEM FROM THE SOURCE OF POWER TO THE SPARK PLUGS AND POINT OUT THE PRINCIPAL ELEMENTS OF THE SYSTEM.	Traces the ignition system and points out the battery, ignition switch, ignition coil, condenser, and distributor.
3	POINT OUT THE PRINCIPAL PARTS OF THE FUEL SYSTEM AND SHOW HOW THE FUEL GETS FROM THE TANK TO THE ENGINE.	Traces fuel system from the fuel tank through the fuel pump and carburetor to the engine and points out principal parts of the fuel system.
4	POINT OUT THE WATER PUMP AND THE FAN AND EXPLAIN THE FUNCTION OF EACH.	Points out parts named and explains their functions.

Test No.	Examiner commands—	Action of candidate
5	POINT OUT THE OIL FILLER PIPE, BREATHER, OIL GAGE (DIPSTICK), AND OIL PRESSURE GAGE. STATE WHAT OIL LEVEL SHOULD BE MAINTAINED AND WHAT OIL PRESSURE SHOULD REGISTER ON THE GAGE.	Points out parts named and states the correct oil level and oil pressure.
6	NAME THESE PARTS. (Examiner points, in turn, to the steering gear, pitman arm, drag link, and tie rod and requires the candidate to name each part.)	Names parts indicated.

d. *Penalties.* Penalties in tests 4 and 5 will be assessed as follows:

(1) *Test 4.* No credit will be allowed if candidate fails to specify the correct water level

to be maintained in the radiator.

(2) *Tests 5.* No credit will be allowed if the candidate fails to specify the correct oil level to be maintained.

e. *Credit.* Credit will be awarded as follows:

Test No.	Maximum credit	Number of major elements correctly named						Additional credits
		6	5	4	3	2	1	
1	5	5	4	3	2	1	0	Correct explanation of functions—1 point.
2	5	5	4	3	2	1	0	
3	3	--	--	--	3	2	1	
4	2	--	--	--	--	1	0	
5	3	--	--	3	2	1	0	
6	2	--	--	2	1.5	1	0	

## 7-7. Maintenance

a. *Scope of Tests.* Four tests will be conducted to determine the candidate's knowledge of maintenance and his ability to care for his vehicle and tools.

b. *Special Instructions.*

c. *Outline of Tests.*

(1) A prime mover will be furnished the driver for this test. The tools and equipment that normally accompany the vehicle will be laid out before the start of the tests. The driver will be furnished a vehicle, the vehicle equipment log-book, and DA Form 2404.

(2) In test 4, the examiner will note the manner in which the candidate uses his tools.

Test No.	Examiner commands—	Action of candidate
1	PERFORM THE BEFORE-OPERATION SERVICE .....	Performs before-operation service as prescribed in the applicable vehicle TM. Reports when service has been completed and remains seated in vehicle with the engine running.
2	PERFORM THE DURING-OPERATION SERVICE. (Examiner requires candidate to drive the vehicle over a short course.)	Performs during-operation service as prescribed in the applicable vehicle TM.
3	PERFORM THE AFTER-OPERATION SERVICE. (Examiner requires the candidate to return to the park before directing him to perform this operation.)	Performs after-operation service as prescribed in the applicable vehicle TM and explains use of DA Form 2404.
4	DEMONSTRATE THE USE OF EACH TOOL IN THE VEHICLE TOOL KIT.	Demonstrates use of tools.

*d. Penalties.*

(1) *Test 1.* No credit will be allowed if the candidate fails to inspect the fuel, oil, and water.

(2) *Test 4.* No credit will be allowed if the candidate uses pliers in tightening nuts.

*e. Credit.* A maximum credit of 5 points will be allowed for each test. The examiner will determine the credit to be allowed for each operation required by the equipment logbook and DA Form 2404, according to the importance of the operation.

**7-8. Driving**

*a. Scope of Tests.* Five tests will be conducted to determine the candidate's ability to drive a vehicle towing an artillery piece or other load and to employ a limited number of field expedients.

*b. Special Instructions.*

(1) The following equipment will be furnished the candidate:

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	DRIVE AND BACK THIS VEHICLE. (Examiner requires candidate to drive and back the vehicle with a towed load.)	Drives and backs vehicle as directed.
2	CONSTRUCT A DEADMAN. (Examiner selects favorable location.)	Constructs deadman as directed, using assistant as necessary.
3	USE THE WINCH TO ASSIST IN MOVING THE VEHICLE	Makes the winch cable fast to the deadman installed for test 2. Moves vehicle by means of the winch.
4	RIG THE SNATCH BLOCK TO INCREASE THE PULLING POWER OF THE WINCH.	Makes the snatch block fast to deadman. Rigs the cable through the block. Moves the vehicle by means of the winch. (See TM 21-305.)
5	DEMONSTRATE THE PRESCRIBED METHOD OF TOWING THIS VEHICLE. (Examiner indicates vehicle listed in (b)(1)(f) above.)	Attaches tow rope or chain and spreader bar, takes up the slack, and prepares to tow the vehicle.

*d. Penalties.*(1) *Test 1.*

(a) A penalty of 1 point will be assessed if—

1. The vehicle and towed load jack knife as they are backed.

2. The candidate turns the wheels in the wrong direction.

(b) If the candidate fails to request guidance in backing, a penalty of 3 points will be assessed.

(a) A prime mover with piece or loaded trailer coupled.

(b) A snatch block of the size issued to the candidate's unit.

(c) A tow rope or tow chain and material suitable for use as a spreader bar.

(d) A log or other material suitable for use as a deadman.

(e) Pioneer tools.

(f) A second vehicle of any type to be used in test 5.

(2) The candidate will be furnished one assistant to aid him in backing the vehicle, in handling the cable, and in constructing the deadman.

(3) If it is impracticable to use a deadman in test 3, the examiner may direct the use of another vehicle, a tree, or other suitable anchor. The candidate should be able, however, to explain the use and construction of a deadman.

(2) *Test 2.* If the deadman pulls out when used in test 3, no credit will be allowed.

(3) *Test 3.* If the winch shear pin breaks, no credit will be allowed.

(4) *Test 4.* No credit will be allowed if the winch shear pin breaks.

(5) *Test 5.* No credit will be allowed if the candidate fails to use a spreader bar.

*e. Credit.* Subject to the penalties assessed in *d* above, the candidate will be awarded a maximum credit of 5 points for each test that he completes successfully.

## Section IV. DRIVERS, TRACK VEHICLES

## 7-9. Outline of Tests

Paragraph No.	Subject	Number of tests	Points each	Maximum Credit
7-10	Nomenclature .....	5	--	19
	Tests 1, 2, and 3 .....	(3)	3	(9)
	Tests 4 and 5 .....	(2)	5	(10)
7-11	Maintenance .....	4	5	20
7-12	Driving and field expedients .....	5	--	25
	Test 1 .....	(1)	7	(7)
	Tests 2 and 3 .....	(2)	4	(8)
	Tests 4 and 5 .....	(2)	5	(10)
	Total .....	14	--	64

## 7-10. Nomenclature

*a. Scope of Tests.* Five tests will be conducted to determine the candidate's knowledge of the nomenclature of the track vehicles of his unit.

*b. Special Instructions.*

(1) The candidate will be required to name only principal components or assemblies. For

example, the principal components of the power train of a self-propelled 155-mm howitzer M109 and the engine, transmission, universal joints, and drive sprockets. (see technical manual applicable to the particular vehicle.)

(2) The candidate will be furnished a track vehicle of the type for which he is to qualify.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	GIVE THE NAME OF THIS TRACK VEHICLE AND THE VEHICLE'S GENERAL CHARACTERISTICS, INCLUDING HEIGHT, WIDTH, WEIGHT, FORDING DEPTH, AND NUMBER OF SPEEDS.	Names track vehicle and give its characteristics as specified in the applicable technical manual.
2	TRACE THE FLOW OF FUEL AND EXPLAIN THE FUNCTIONING OF THE ENGINE FROM THE START OF THE INTAKE STROKE UNTIL THE POWER IS DELIVERED TO THE TRANSMISSION.	Points out and names the fuel tank, pump, filter, and lines. Explains what happens within the engine during each of the two or four strokes of operation (depending on type of engine), using correct nomenclature for major parts, such as the cylinders, pistons, and crankshaft.
3	POINT OUT AND NAME THE PRINCIPAL COMPONENTS OF THE POWER TRAIN, AND EXPLAIN HOW POWER IS TRANSMITTED FROM THE ENGINE TO THE TRACKS.	Points out and names the principal components of the power train and traces the power train from the engine to the tracks.
4	<i>a.</i> NAME THE TYPES OF BRAKES WITH WHICH THIS VEHICLE IS EQUIPPED AND INDICATE HOW THEY ARE APPLIED.  <i>b.</i> POINT OUT THE TRACKS, IDLERS, TRACK SUPPORT ROLLERS, AND SPROCKETS.	<i>a.</i> Names types of brakes (air, electric, mechanical) and indicates method of applying them.  <i>b.</i> Indicates required parts.
5	NAME THE TYPE OF STEERING SYSTEM WITH WHICH THIS VEHICLE IS EQUIPPED AND EXPLAIN HOW THE STEERING SYSTEM FUNCTIONS.	Names and explains steering system in general terms.

*d. Penalties and Credit.* No penalties are provided for these tests. The maximum credit for each test is indicated in paragraph 7-9. Credit will be awarded on the basis of the percentage of correct answers to questions asked.

### 7-11. Maintenance

*a. Scope of Tests.* Four tests will be conducted to determine the candidate's knowledge of main-

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	PERFORM THE BEFORE-OPERATION SERVICE .....	Performs before-operation service as prescribed in the applicable technical manual. (Reports when service has been completed and leaves engine running.)
2	PERFORM THE DURING-OPERATION SERVICE. (Examiner requires candidate to drive the vehicle over the short course selected in (3) above.)	Performs the required service as prescribed in the applicable technical manual.
3	RETURN TO PARK AND PERFORM THE AFTER-OPERATION SERVICE.	Performs the prescribed service.
4	DEMONSTRATE THE USE AND MAINTENANCE OF EACH TOOL IN THE VEHICLE TOOL KIT.	Demonstrates use of tools and explains maintenance required for each.

*d. Penalties.* In test 1, a penalty of 5 points will be assessed if the candidate fails to inspect the fuel, oil, and elevating system. If he fails to inspect the tracks for proper tension, a penalty of 2 points will be assessed.

*e. Credit.* Maximum credit allowed for each test is indicated in paragraph 7-9. The examiner will determine the credit to be allowed for each operation required by the equipment logbook and DA Form 2404 appropriate technical manual on a percentage basis, according to their application to the particular vehicle.

### 7-12. Driving and Field Expedients

*a. Scope of Tests.* Five tests will be conducted

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	DRIVE AND BACK THIS VEHICLE. (Examiner requires the candidate to drive the track vehicle over a short course, and to back the vehicle.)	Drives and backs track vehicle.
2	DEMONSTRATE THE PRESCRIBED METHOD OF TOWING THIS VEHICLE. (Examiner indicates vehicle listed in <i>b</i> (5) above.)	Attaches tow cable. Demonstrates towing the vehicle.
3	USE THE WINCH TO ASSIST IN MOVING THE TRACK VEHICLE.	Makes the winch cable fast to a tree or other anchor. Moves track vehicle with assistance of winch.

tenance and his ability to care for his vehicle and tools.

*b. Special Instructions.*

(1) The tools and equipment that normally accompany the vehicle will be placed on the vehicle.

(2) Before the tests, the examiner will map out a short driving course.

to determine the candidate's ability to drive a track vehicle.

*b. Special Instructions.* The following equipment and personnel will be furnished the candidate:

(1) A track vehicle with piece or loaded trailer coupled.

(2) A tow cable.

(3) Pioneer tools.

(4) One assistant to aid the candidate in backing the vehicle and in handling the cable.

(5) A second vehicle of any type for use in test 2.

Test No.	Examiner commands—	Action of candidate
4	THIS ROAD WHEEL IS BROKEN. (Examiner points to wheel.) USE A FIELD EXPEDIENT TO PERMIT THIS TRACK VEHICLE TO CONTINUE IN OPERATION UNTIL REPAIR CAN BE MADE.	Removes road wheels and secures support arm.
5	DEMONSTRATE A METHOD OF ASSISTING THE TRACK VEHICLE TO CLIMB THE HILL WITHOUT USING THE WINCH.	Makes one end of cable fast to a suitable anchor and fastens the other end to a track. Demonstrates method of moving track vehicle by braking one track. (See TM 21-306)

*d. Penalties.*

(1) *Test 1.* A penalty of 1 point will be assessed if the candidate brakes the wrong track in steering.

(2) *Test 2.* If the candidate fails to use cables correctly, no credit will be allowed.

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

(a) Candidate tries to move the track vehicle with winch alone.

(b) Winch shear pin breaks under stress.

*e. Credit.* Subject to the penalties assessed in *d* above, maximum credit as shown in paragraph 7-9 will be awarded for each test successfully completed.

## Section V. MECHANICS, WHEELED VEHICLES

### 7-13. Outline of Tests

Paragraph No.	Subject	Number of tests	Points each	Maximum credit
7-14	Maintenance .....	3	--	5
	Test 1 .....	(1)	1	(1)
	Tests 2 and 3 .....	(2)	2	(4)
7-15	Engine .....	9	--	20
	Tests 1, 3, 6, and 8 .....	(4)	2	(10)
	Test 6 .....	(1)	1	(1)
	Tests 2, 5, and 7 .....	(3)	3	(9)
7-16	Electrical system .....	15 or 16	--	31
	Test 1 .....	(1)	2	(2)
	Tests 2a, b, and c .....	(3)	2	(6)
	Tests 3a or b .....	(1)	2	(2)
	Test 3c .....	(1)	2	(2)
	Test 4a .....	(1)	2	(2)
	Test 4b .....	(1)	1	(1)
	Test 4c, d, e, or f (one test only) .....	(1)	2	(2)
	Test 4g or h (one test only) .....	(1)	2	(2)
	Test 4i* .....	(1)	3	--
	Tests 5a through d .....	(4)	2	(8)
	Test 5e or f .....	(1)	2	(2)
	Test 6 .....	(1)	2	(2)
7-17	Power train .....	10	--	24
	Test 1 .....	(1)	3	3
	Test 2 .....	(1)	2	(2)
	Test 3 .....	(1)	3	--
	Test 4 and 5 .....	(2)	3	(6)
	Test 6a .....	(1)	4	(4)
	Test 6b .....	(1)	3	(3)
	Test 6c** .....	(1)	2	--
	Test 6d** .....	(1)	5	--
7-18	Chassis .....	7	--	20
	Test 1a .....	(1)	4	(4)

\*For AC charging systems, use test 4i instead of 4b and 4c, d, e, or f.

\*\*Tests 6c and 6d can be given instead of tests 6a and 6b. Note the difference in the test values.

Paragraph No.	Subject	Number of tests	Points each	Maximum credit
	Test 1b or 1c .....	(1)	3	(3)
	Test 2a .....	(1)	3	(3)
	Test 2b .....	(1)	1	(1)
	Test 2c .....	(1)	2	(2)
	Test 2d or e .....	(1)	2	(2)
	Test 3 .....	(1)	5	(5)
	Total .....			103

#### 7-14. Maintenance

*a. Scope of Tests.* Three tests will be conducted to determine the candidate's general knowledge of the organization for maintenance, forms and

records, and the common terms used in maintenance.

*b. Special Instructions.* The candidate will be furnished one DA Form 2404.

#### *c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	NAME THE FOUR CATEGORIES OF MAINTENANCE AND EXPLAIN WHERE AND BY WHOM EACH IS PERFORMED.	Outlines, in his own words, the maintenance system and names the categories of maintenance as specified in AR 750-5.
2	COMPLETE DA FORM 2404. (Examiner selects five items from the preventive maintenance service outlined in the applicable TM and indicates the result of inspection and corrective measures taken on each item.)	Completes DA Form 2404 as prescribed in TM 38-750.
3	<p><i>a.</i> DEFINE THE FOLLOWING TERMS USED IN MAINTENANCE RECORDS: ADJUST, CLEAN, SPECIAL LUBRICATION, SERVICE AND TIGHTEN.</p> <p><i>b.</i> DEFINE THE FOLLOWING TERMS: TOP DEAD CENTER, FIRING ORDER, VALVE CLEARANCE, TIMING, FREE TRAVEL.</p>	<p><i>a.</i> Defines terms specified as prescribed by appropriate manual.</p> <p><i>b.</i> Defines terms specified as indicated in TM 9-8000.</p>

#### *d. Penalties and Credit.*

(1) No penalties are provided for these tests. Maximum credit will be awarded as indicated in paragraph 7-13.

(2) *Test 2.* A credit of 1 point will be allowed for each form correctly completed.

(3) *Test 3.* A credit of 0.2 point will be given for each term correctly defined.

#### 7-15. Engine

*a. Scope of Tests.* Eight tests will be conducted to determine the candidate's knowledge of the operation of liquid-cooled engines and his ability to perform engine maintenance properly.

#### *b. Special Instructions.*

(1) One wheeled vehicle, preferably a 5 ton or smaller vehicle must be provided for this test. In addition, training aids such as a cutaway engine, an engine, an engine mockup, or engine schematics and charts should be provided if the situation permits.

(2) Prior to the start of each test requiring adjustment of an item, the item will be adjusted improperly.

(3) The candidate will be furnished the following:

(a) A wheeled vehicle (5-ton or smaller) with applicable TM.

(b) TM 9-8000.

(c) Training aids (if available).

(d) A complete set of automotive mechanics tools as prescribed in the TOE applicable to the candidate's unit.

(e) Seasonal grade lubricating oil (1 quart minimum).

(f) Solvent (1 quart minimum).

(g) Rags or waste.

(h) One assistant to be used as the candidate desires.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	EXPLAIN THE THEORY OF ENGINE OPERATION AND DEMONSTRATE THE OPERATION BY USING THE TRAINING AIDS.	Points out and explains the four-stroke cycle engine operation.
2	PERFORM COMPRESSION CHECK .....	Tests compression as outlined in the applicable vehicle TM, making wet compression test if necessary, and reports the results. Recommends proper corrective action to be taken.
3	SERVICE AIR CLEANER .....	Performs the required operation as outlined in the applicable vehicle TM.
4	CHECK AND ADJUST VALVE CLEARANCE .....	Performs required operation as outlined in the applicable vehicle TM.
5	USING THE TRAINER, EXPLAIN HOW THE COOLING SYSTEM FUNCTIONS.	Explains function of cooling system components.
6	ADJUST FAN BELT .....	Performs the required operation as outlined in the applicable vehicle TM.
7	CHECK AND ADJUST CARBURETOR IDLE SPEED AND IDLE MIXTURE.	Performs the required operation with authorized testing equipment as outlined in the applicable TM.
8	PERFORM FUEL PUMP CHECKS .....	Performs checks with authorized testing equipment as outlined in the applicable TM and recommends necessary corrective action.

*d. Penalties.* In those tests for which specific penalties are not indicated below, proportional penalties will be assessed on the basis of the knowledge of the candidate.

(1) *Tests 2 and 8.* A penalty of 0.5 point will be assessed if the candidate does not correctly state what action should be taken.

(2) *Test 6.* No credit will be allowed unless the candidate explains at least four components.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 7-13.

## 7-16. Electrical System

*a. Scope of Tests.* (depending on the vehicle used). Tests will be given to determine the candidate's knowledge of automotive electrical system and his ability to perform organizational maintenance on the electrical systems of the wheeled vehicles of his unit.

### *b. Special Instructions.*

(1) Enlarged charts and schematics will be provided whenever possible to facilitate the candi-

date's explanation of the functions of the various items of electrical equipment.

(2) A wheeled vehicle, preferably a 5-ton or smaller vehicle, will be furnished for these tests.

(3) Only one test will be selected from tests 4*c*, 4*d*, 4*e*, and 4*f*.

(4) When a vehicle with an AC charging system is used, test 4*i* will be used instead of test 4*b*, 4*c*, 4*d*, 4*e*, or 4*f*.

(5) Either test 4*g* or 4*h* may be used.

(6) Either test 5*e* or 5*f* may be used.

(7) Any three of the following eight situations may be used as troubles in test 6:

(a) Starter turns too slowly or not at all. Trouble is in the battery, connections, or starter.

(b) Engine cranks but will not start. Trouble is in the ignition system.

(c) Engine runs roughly. Trouble is bad spark plugs.

(d) Engine is sluggish. Trouble is ignition timing.

(e) No generator charge rate is shown. Trouble is faulty regulator or faulty cutout relay.



(f) Generator charge rate is excessive. Trouble is faulty regulator.

(g) Charge rate on AC charging system is low. Trouble is regulator out of adjustment.

(h) Generator (AC or DC) output is low. Trouble is loose fan belt.

*Note.* Trouble will be introduced singly, and the candidate will be required to locate one trouble before the next one is placed in the system.

(8) An assistant will be furnished to be used as the candidate sees fit.

### *c. Outline of Tests.*

(9) The candidate will be furnished the following:

(a) A complete set of general mechanics tools as prescribed in the TOE applicable to the candidate's unit.

(b) One low-voltage circuit tester (LVCT).

(c) One battery hydrometer.

(d) One multimeter.

(e) One wheeled vehicle (5-ton or smaller) with TM.

Test No.	Examiner commands—	Action of candidate
1	DEFINE THE FOLLOWING TERMS VOLT, AMPERE, OHM, CURRENT, NEGATIVE, POSITIVE, DC, AC, OPEN CIRCUIT, GROUNDED CIRCUIT.	Defines terms.
2	BATTERIES -----  a. TEST THE SPECIFIC GRAVITY OF THE STORAGE BATTERIES.  b. DETERMINE THE ABILITY OF THE BATTERY TO FURNISH CURRENT.  c. REMOVE AND REPLACE THE BATTERIES -----	Performs the required operation with authorized testing equipment as outlined in the applicable vehicle TM.  a. Tests the specific gravity of the electrolyte, reports results, and states whether or not the battery should be recharged.  b. Tests battery voltage under load (either LVCT load bank or cranking motor).  c. Removes the batteries, cleans terminals and connections, and replaces the batteries.
3	CRANKING SYSTEM (Examiner will test candidate on <i>a</i> or <i>b</i> but not both. Test <i>c</i> will always be given.)  a. CHECK BATTERY-TO-STARTER CABLE -----  b. CHECK STARTING SYSTEM GROUND -----  c. REMOVE AND REPLACE THE STARTER -----	Performs the required operation with the authorized testing equipment as outlined in the applicable vehicle TM.  a. Checks for excessive resistance (voltage drop), reports results, and recommends action to be taken.  b. Checks for excessive resistance (voltage drop), reports results, and recommends action to be taken.  c. Performs the required operation.
4	CHARGING SYSTEM (See <i>b</i> (3), (4), and (5) above.) -----  a. POINT OUT THE COMPONENTS OF THE DC OR AC CHARGING SYSTEM (depending on the vehicle used) and explain the function of each.  b. POLARIZE A DC GENERATOR ----- <i>Note.</i> Only test <i>c</i> , <i>d</i> , <i>e</i> , or <i>f</i> will be used.  c. CHECK DC GENERATOR VOLTAGE -----	Performs the required operation with authorized testing equipment as outlined in the applicable vehicle TM.  a. Points out the components and explains the operation of the components of the charging system.  b. Uses vehicle battery to establish desired polarity of the DC generator.  c. Checks generator output voltage at idle speed.

Test No.	Examiner commands—	Action of candidate
	d. CHECK DC GENERATOR MAXIMUM CHARGE RATE ----	d. Checks the maximum charge to determine whether the current regulator is functioning properly and recommends action to be taken.
	e. CHECK VOLTAGE REGULATOR SETTING -----	e. Checks voltage output to determine whether voltage regulator is functioning properly and recommends action to be taken.
	f. CHECK CIRCUIT BREAKER CLOSING VOLTAGE. Only test g or test h.	f. Checks closing voltage of cut-out relay and recommends action to be taken.
	g. CHECK CHARGING SYSTEM GROUND CIRCUIT -----	g. Checks for excessive resistance (voltage drop) and recommends action to be taken.
	h. CHECK AND ADJUST THE VOLTAGE OUTPUT OF THE AC CHARGING SYSTEM.	h. Performs the required operation.
	i. CHECK THE RESISTANCE OF THE FIELD CIRCUIT THROUGH THE RECTIFIER OF THE AC CHARGING SYSTEM AND RECOMMEND THE PROPER CORRECTIVE ACTION. (This test is a substitute for test b and test c, d, e, or f above.)	i. Performs the required operation, reports results, and recommends the proper action to be taken.
5	IGNITION SYSTEM (See b(6) above.) -----	Performs the required operation with authorized testing equipment as outlined in the applicable vehicle TM and/or TM 9-8030.
	a. EXPLAIN THE FUNCTION OF THE COMPONENTS OF THE BATTERY IGNITION SYSTEM.	a. Traces the primary and secondary circuits and explains the function of at least four components of the primary circuit and three components of the secondary circuit.
	b. REMOVE AND REPLACE THE DISTRIBUTOR -----	b. Performs the required operation.
	c. CHECK AND ADJUST THE ENGINE TIMING -----	c. Performs the required operation.
	d. CLEAN AND ADJUST THE SPARK PLUGS. Only test e or test f will be given.	d. Performs the required operation.
	e. CHECK THE PRIMARY CIRCUIT RESISTANCE (continuity check).	e. Checks the primary ignition circuit for continuity and recommends action to be taken.
	f. CHECK BREAKER POINT RESISTANCE (breaker point condition).	f. Checks the breaker points for excessive resistance and recommends action to be taken.
6	TROUBLESHOOT THREE TROUBLES IN THE ELECTRICAL SYSTEM.	Troubleshoots the system with authorized testing equipment, reports results, and recommends action to be taken.

d. *Penalties.* In those tests for which specific penalties are not indicated below, proportional penalties will be assessed on the basis of the knowledge of the candidate.

(1) *Test 2.* A penalty of 0.5 point will be

assessed if the candidate does not correctly state whether or not battery needs recharging.

(2) *Tests 3a and b.* A penalty of 0.5 point will be assessed if the candidate fails to recommend the proper corrective action.

(3) *Tests 4a and 4d through i.* No credit will be allowed unless the candidate covers all components.

(4) *Tests 5a, c, and f.* No credit will be allowed unless the candidate covers at least four components of the primary circuit and three components of the secondary circuit.

(5) *Test 6.* A penalty of 0.5 point will be deducted for each trouble for which the candidate does not recommend the proper corrective action.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 7-13.

## 7-17. Power Train

*a. Scope of Tests.* Ten tests will be given to determine the candidate's knowledge of the power train system and his ability to perform the required maintenance of the system.

### *b. Special Instructions.*

(1) In all tests that require a demonstration of a method, the candidate will be required to point out and name the parts involved, point out

### *c. Outline of Tests.*

the tools to be used, and indicate the proper operation.

(2) Prior to the start of each test that involves adjustment of an item, the item will be adjusted improperly.

(3) A wheeled vehicle, preferably a 5-ton or smaller vehicle, with technical manual will be available for these tests.

(4) An assistant will be furnished to be used as the candidate sees fit.

(5) If the examiner desires, test 3 may be given instead of any two of the following tests: *2d, c, d, or e.* If the examiner does *not* desire to give test 3, all portions of test 2(*a-e*), is to be given.

(6) Either tests 6*a* and *b* or tests 6*c* and *d* will be given.

(7) Any three of the following tests may be given: tests 7*a, b, c, d, and e.*

(8) A tool kit, general mechanics, and an equipment lubrication order will be furnished each candidate.

(9) Special tools and/or equipment necessary for the performance of these tests will be furnished the candidate.

Test No.	Examiner commands—	Action of candidate
1	TRACE THE FLOW OF TORQUE FROM THE ENGINE TO THE WHEELS AND GIVE THE PRIMARY PURPOSE OF EACH MAJOR ASSEMBLY.	Explains how torque is transmitted from the engine, through the power train, to the wheels; names the major assemblies and explains the primary purpose of each. (Major assemblies include the clutch, transmission, transfer, propeller shaft assembly, and axle assemblies.)
2	INSPECT THE LUBRICANT IN THE TRANSMISSION AND INDICATE THE PROPER LUBRICANT AND LEVEL.	Inspects lubricant, announces proper lubricant, and indicates lubricant level.
3	CHECK AND ADJUST THE CLUTCH PEDAL FREE TRAVEL. (See <i>b(5)</i> above.)	Checks and adjusts free travel as prescribed in the applicable technical manual and announces correct amount of free travel.
4	EXPLAIN THE FUNCTION OF TRANSFER ASSEMBLY AND INDICATE THE PROPER LUBRICANT LEVEL.	Explains purpose of transfer assembly and indicates lubricant level.
5	DEMONSTRATE PROCEDURE FOR PROPER LUBRICATION OF PROPELLER SHAFT UNIVERSAL JOINTS.	Demonstrates operation as prescribed in the applicable technical manual.
6	Either tests 6 <i>a</i> and <i>b</i> or tests 6 <i>c</i> and <i>d</i> will be given. <i>a. NAME THE COMPONENTS OF REAR AXLE ASSEMBLY AND EXPLAIN FUNCTION OF EACH.</i>  <i>b. INSPECT THE DIFFERENTIAL FOR PROPER LUBRICATION AND STATE WHAT THE LUBRICANT LEVEL SHOULD BE.</i>	<i>a. Names the components of rear axle assembly and explains primary purpose of each.</i>  <i>b. Inspects differential and announces proper lubricant level.</i>

Test No.	Examiner commands—	Action of candidate
	c. EXPLAIN THE FUNCTION OF CONSTANT VELOCITY UNIVERSAL JOINTS.	c. Explains purpose of constant velocity universal joints.
	d. DEMONSTRATE PROCEDURE FOR CLEANING, INSPECTING, REPACKING, INSTALLING, AND ADJUSTING WHEEL BEARINGS.	d. Demonstrates operation (on one wheel only) as prescribed in the applicable technical manual.
7	Only three of the following five tests will be given.	
	a. TEST AND ADJUST THE WINCH DRAG BRAKE .....	a. Performs required operation as prescribed in the applicable technical manual.
	b. DEMONSTRATE THE PRESCRIBED METHOD OF ADJUSTING THE WINCH AUTOMATIC SAFETY BRAKE.	b. Performs required operation as prescribed in the applicable technical manual.
	c. DEMONSTRATE THE PRESCRIBED METHOD OF ADJUSTING THE WINCH STOP COLLAR.	c. Performs required operation as prescribed in the applicable technical manual.
	d. UNWIND, CLEAN, INSPECT, LUBRICATE, AND REWIND THE WINCH CABLE.	d. Performs required operation as prescribed in the applicable technical manual.
	e. EXPLAIN THE PURPOSE OF THE SHEAR PIN AND DEMONSTRATE ITS REPLACEMENT.	e. Explains the purpose of the shear pin and demonstrates replacement operation.

d. *Penalties.* In those tests for which penalties are not indicated below, proportional penalties will be assessed on the basis of the knowledge of the candidate.

(1) *Test 1.* No credit will be allowed if the candidate fails to—

(a) Trace the torque through the power train correctly.

(b) Explain the primary purpose of at least three of the major assemblies.

(2) *Test 6a.* No credit will be allowed unless the candidate names at least two components and explains the primary purpose of each.

e. *Credit.*

(1) *Test 1.*

(a) Credit of 1.5 points will be allowed for correct tracing of power train, 1.5 points.

(b) Credit of 0.2 point will be allowed for each correct primary purpose of a major assembly.

(2) *Test 2*—2 points.

(3) *Test 3*—3 points.

(4) *Test 4 and 5*—2 points each.

(5) *Test 6.*

(a) *Test 6a*—3 points.

(b) *Test 6b*—2 points.

(c) *Test 6c*—1 point.

(d) *Test 6d*—4 points.

(6) *Test 7.* For the 3 tests given, 1.5 points each.

## 7-18. Chassis

a. *Scope of Test.* Tests will be given to determine the candidate's knowledge of the chassis system and his ability to perform the required maintenance of the system.

b. *Special Instructions.*

(1) In all tests that require a demonstration of a method, the candidate will be required to point out and name the parts involved, point out the tools to be used, and demonstrate the proper procedure.

(2) Prior to the start of each test that involves adjustment of an item, the item will be adjusted improperly.

(3) A wheeled vehicle, preferably a 5-ton or smaller vehicle, applicable will be made available for these tests.

(4) A tool kit, general mechanics, will be furnished each candidate.

(5) Special tools and/or equipment necessary for the performance of these tests will be furnished the candidate.

(6) An assistant will be furnished to be used as the candidate sees fit.

(7) Tests 1a and 1b will be given to the

candidate if a 1/4-ton, 3/4-ton, or 2 1/2-ton vehicle is used. If a 5-ton vehicle is used, tests 1a and 1c will be given.

(8) If a 2 1/2-ton or larger vehicle is used, test 2e will be given instead of test 2d.

#### e. Outline of Tests.

Test no	Examiner commands—	Action of candidate
1	a. CHECK THE FRONT WHEELS FOR TOE-IN AND DEMONSTRATE THE ADJUSTMENT OF TOE-IN.	a. Checks the front wheels for toe-in and demonstrates toe-in adjustments as prescribed in the applicable technical manual.
	b. CHECK AND ADJUST STEERING GEAR .....	b. Performs required operations as prescribed in the applicable technical manual.
	c. NAME THE COMPONENTS OF HYDROPOWER STEERING SYSTEM AND EXPLAIN FUNCTION OF EACH.	c. Points out and names the components and gives the primary purpose of each.
2	a. CHECK AND ADJUST THE SERVICE BRAKE .....	a. Performs required operations (on one wheel only) as prescribed in the applicable technical manual.
	b. TEST AND ADJUST PARKING BRAKE .....	b. Performs required operations as prescribed in the applicable technical manual.
	c. DEMONSTRATE THE PRESCRIBED METHOD OF BLEEDING THE BRAKE SYSTEM.	c. Performs required operations as prescribed in the applicable technical manual. (Demonstrates either the manual method or pressure method.)
	d. CHECK AND ADJUST BRAKE PEDAL FREE TRAVEL ....	d. Performs required operations as prescribed in the applicable technical manual.
	e. DEMONSTRATE THE PRESCRIBED METHOD OF ADJUSTING AND CHECKING AIR COMPRESSOR GOVERNOR.	e. Performs required operations as prescribed in the applicable technical manual.
3	NAME THE COMPONENTS OF THE SUSPENSION SYSTEM AND EXPLAIN FUNCTION OF EACH.	Points out and names the components and gives the primary purpose of each. (Components include spring, spring shackles, rebound clips, center bolt, U-bolts, shock absorbers, and torque rods.)

#### d. Penalties.

(1) In those tests for which specific penalties are not indicated below, proportional penalties will be assessed on the basis of the candidate.

(2) In test 3, no credit will be allowed if the candidate fails to—

(a) Point out at least five components of the suspension system.

(b) Explain the primary purpose of at least three of the major components of the system.

e. *Credit.* Subject to the penalties assessed in d above, credit will be awarded as indicated in paragraph 7-13.

## Section VI. MECHANICS, TRACK VEHICLE

## 7-19. Outline of Tests

Paragraph No.	Subject	Number of tests	Points each	Maximum credit
7-20	Maintenance .....	3	--	5
	Test 1 .....	(1)	1	(1)
	Tests 2 and 3 .....	(2)	2	(4)
7-21	Engine .....	8	--	25
	Test 1 .....	(1)	2	(2)
	Tests 2, 4, and 5 .....	(3)	3	(9)
	Tests 3, 7, and 8 .....	(3)	4	(12)
	Test 6 .....	(2)	1	(2)
7-22	Electrical system .....	12	--	29
	Test 1 .....	(1)	4	(4)
	Tests 2, 3, and 4 .....	(3)	3	(9)
	Tests 5 through 12 .....	(8)	2	(16)
7-23	Power train .....	7	--	17
	Tests 1 and 5 .....	(2)	2	(4)
	Tests 2, 3, 4, and 7 .....	(4)	3	(12)
	Test 6 .....	(1)	1	(1)
7-24	Winch .....	4	--	7
	Tests 1, 2, and 3 .....	(3)	2	(6)
	Test 4 .....	(1)	1	(1)
7-25	Tracks and suspension system .....	6	--	10
	Tests 1, 2, 4, and 5 .....	(4)	1	(4)
	Tests 3, and 6 .....	(2)	3	(6)
7-26	Hull—fire extinguishers .....	3	--	5
	Tests 1 and 3 .....	(2)	1	(2)
	Test 2 .....	(1)	3	(3)
	Total .....	43	--	98

## 7-20. Maintenance

a. *Scope of Tests.* Three tests will be conducted to determine the candidate's general knowledge of the organization for maintenance, forms and records, and the common terms used in maintenance.

b. *Special Instructions.* The candidate will be furnished one DA Form 2404.

c. *Outline of Tests.* See paragraph 7-14c.

d. *Penalties and Credit.* See paragraph 7-14d.

## 7-21. Engine

a. *Scope of Tests.* Eight tests will be conducted to determine the candidate's knowledge of engines and his ability to perform engine maintenance properly.

b. *Special Instructions.*

(1) The administration of these tests depends upon the type of vehicle used and the number of vehicles available. A track-laying vehicle must be provided. In addition, the engine must be removed from the vehicle (except the M113-

A1) and an extension kit must be connected for test 10.

(2) The order in which the tests are performed depends on the type of vehicle used and will be prescribed by the examiner. Since the engine has to be removed before some of the tests can be completed, it is recommended that all tests be performed while the engine is removed from the vehicle.

(3) The candidate will be furnished—

(a) A track-laying vehicle.

(b) A complete set of tools as prescribed in the TOE applicable to the candidate's unit.

(c) Light lubrication oil (1 quart minimum).

(d) Drycleaning solvent (1 quart minimum).

(e) Waste of rags.

(f) One assistant to be employed as the candidate desires.

(4) Prior to starting the tests, the examiner will have the engine removed from the vehicle.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	DEMONSTRATE AND EXPLAIN THE THEORY OF ENGINE OPERATION.	Points out and explains the two-stroke cycle and valve action.
2	REMOVE, CLEAN, AND REPLACE THE AIR CLEANER(S) -----	Performs the required operation as prescribed in the applicable vehicle technical manual.
3	SERVICE OIL FILTER -----	Performs the required operation as outlined in the applicable vehicle technical manual.
4	EXPLAIN HOW COOLING SYSTEM FUNCTIONS -----	Explains functions of at least four components in either the liquid or air-cooled system.
5	ADJUST DRIVE BELTS. (Omit this test on engines having no drive belts.)	Performs the required operation (on one drive belt to be designated by the examiner) as outlined in the applicable technical manual.
6	CHECK AND ADJUST ACCELERATOR LINKAGE -----	Using only authorized testing equipment, performs the required operation as outlined in the applicable technical manual.
7	PERFORM FUEL PUMP CHECKS (diaphragm or electric) -----	Performs the required operation with authorized testing equipment as outlined in the applicable technical manual.
8	INSPECT THE MANIFOLDS AND RECOMMEND ANY CORRECTIVE ACTION REQUIRED.	Performs the required operation as outlined in the applicable technical manual.

*d. Penalties.* In those tests for which specific penalties are not indicated below, proportional penalties will be assessed on the basis to the knowledge of the candidate. In test 1, no credit will be allowed unless the candidate explains both strokes and the opening and closing of each valve.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 7-19.

## 7-22. Electrical System

*a. Scope of Tests.* Twelve tests will be conducted to determine the candidate's knowledge of track vehicle electrical systems and his ability to perform organizational maintenance on the electrical systems of unit vehicles.

### *b. Special Instructions.*

(1) A track laying vehicle will be provided for these tests.

(2) For test 2, the candidate will be furnished a hydrometer.

(3) For tests 3, and 6, the candidate will be furnished a low-voltage circuit tester.

(4) For tests 6, 7, and 12, the engine should be removed from the vehicle (air cooled engines only) and connected to the vehicle with an extension kit.

(5) The examiner may choose between tests 6a or 6b; he will not use both.

(6) For test 12, at least two troubles will be introduced into the electrical system. Troubles will be introduced singly, and the candidate will be required to locate one trouble before another is placed in the system. Suggested troubles are as follows—

(a) Batteries installed in reverse. (Use this test cautiously, since candidate error can cause equipment damage.)

(b) No residual magnetism in generator field circuit.

(c) Bad control box.

(d) High resistance in cranking (starter) circuit.

(e) Defective master relay.

(f) Defective neutral safety switch.

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	EXPLAIN THE MEANING OF EACH OF THE FOLLOWING TERMS: VOLTAGE AMPERE, OHM, HIGH TENSION, LOW TENSION, OPEN CIRCUIT, GROUNDED CIRCUIT, CIRCUIT BREAKER, RELAY AND CONTROL CIRCUIT.	Defines each term.
2	TEST THE SPECIFIC GRAVITY OF THE ELECTROLYTE IN THE STORAGE BATTERY AND STATE WHETHER BATTERY SHOULD BE RECHARGED.	Tests the specific gravity with the hydrometer, reports results, and states whether or not the battery should be recharged.
3	DETERMINE THE ABILITY OF THE BATTERY TO FURNISH CURRENT.	Using authorized testing equipment, tests battery voltage under load.
4	REMOVE, CLEAN, AND REPLACE THE BATTERIES .....	Removes batteries and cleans terminals. Cleans and paints battery box and correctly replaces batteries.
5	EXPLAIN THE FUNCTIONS OF THE COMPONENTS OF THE CRANKING MOTOR (STARTER) CIRCUIT.	Traces the control and power circuits and explains the function of the components in each circuit.
6	<p><i>a.</i> PERFORM A LINE LOSS CHECK OF THE CRANKING MOTOR (STARTER) CIRCUIT. (Engine should be removed for this test.)</p> <p><i>b.</i> PERFORM A GROUND LOSS CHECK OF THE CRANKING MOTOR (STARTER). (Engine should be removed.)</p>	<p><i>a.</i> Using authorized testing equipment, performs a line loss check between the batteries and cranking motor.</p> <p><i>b.</i> Using authorized testing equipment, performs a ground loss check between the grounded side of the cranking motor and the negative post of the batteries.</p>
7	REMOVE AND REPLACE THE CRANKING MOTOR (STARTER). (Engine should be removed.)	Performs the required operation as outlined in the applicable vehicle technical manual.
8	POINT OUT AND EXPLAIN THE FUNCTION OF THE COMPONENTS OF THE DC OR AC CHARGING SYSTEM (depending on the vehicle used).	Points out and explains the operation of the charging system components.
9	DEMONSTRATE THE PRESCRIBED METHOD OF POLARIZING THE GENERATOR. (Engine should be removed.)	Polarizes the generator using a jumper wire from the positive battery terminal to the generator field circuit. The generator has an external ground, therefore, the generator ground must be connected.
10	PERFORM A LINE LOSS CHECK OF THE CHARGING SYSTEM. (Engine should be removed.)	Performs the required operation with authorized testing equipment as outlined in the applicable vehicle technical manual.
11	PERFORM AN UNCONTROLLED VOLTAGE CHECK OF THE GENERATOR. (Engine should be removed.)	Performs the required operation with authorized testing equipment as outlined in the applicable vehicle technical manual.
12	TROUBLESHOOT TWO TROUBLES IN THE ELECTRICAL SYSTEM. (Engine should be removed.)	Troubleshoots the system with authorized testing equipment. Reports results and recommends proper corrective action.

*d. Penalties.* In those tests for which specific penalties are not indicated below, proportional penalties will be assessed on the basis of the knowledge of the candidate.

(1) *Test 1.* A penalty of 0.3 point will be assessed for each term not satisfactorily explained.

(2) *Test 2.* A penalty of 0.5 point will be assessed unless the candidate states whether or not the battery should be charged.

(3) *Test 5.* No credit will be allowed unless the candidate explains all components.

(4) *Test 6a or 6b.* The penalty for test 6 is the same as that for test 2.

(5) *Test 12.* A penalty of 1 point will be assessed for each trouble the candidate fails to detect and recommend corrective action.

*e. Credit.* Subject to the penalties assessed in



d above, credit will be awarded as indicated in paragraph 7-19.

### 7-23. Power Train

a. *Scope of Tests.* Seven tests will be conducted to determine the candidate's knowledge of a track-laying vehicle power train and his ability to perform power train maintenance properly.

b. *Special Instructions.*

(1) The administration of these tests depends upon the type of vehicle used and the number of vehicles available.

(2) The candidate will be furnished with the following:

(a) A track-laying vehicle.

(b) A complete set of tools as prescribed in the TOE applicable to his unit.

c. *Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	CHECK TRANSMISSION OIL LEVEL .....	Performs the required service as outlined in the applicable vehicle technical manual. Indicates the proper level.
2	ADJUST TRANSMISSION SHIFT CONTROL LINKAGE .....	Performs the required adjustment as outlined in the applicable vehicle technical manual. Announces correct position of shift lever and transmission shift control valve.
3	ADJUST TRANSMISSION STEER CONTROL LINKAGE .....	Performs the required adjustment as outlined in the applicable vehicle technical manual. Announces correct positions of the steer bar, shift lever, and transmission steer control valve.
4	ADJUST BRAKES .....	Performs the required brake adjustment as outlined in the applicable vehicle technical manual.
5	SERVICE OIL FILTERS .....	Performs the required service as outlined in the applicable vehicle technical manual.
6	CHECK OIL IN FINAL DRIVE ASSEMBLIES .....	Performs the required service as outlined in the applicable technical manual. Indicates the oil level.
7	CHECK UNIVERSAL JOINTS .....	Performs the required service as outlined in the applicable technical manual.

d. *Penalties.* In those tests for which specific penalties are not indicated below, proportional penalties will be assessed on the basis of the knowledge of the candidate.

(1) *Test 1.* No credit will be allowed if the candidate does not check the transmission for

(c) Required lubricants.

(d) Drycleaning solvent.

(e) Waste or rags.

(f) One assistant to be employed as the candidate desires.

(3) Prior to starting the tests, the examiner will have the vehicle moved into the shop. He will then—

(a) Improperly adjust the transmission shift control linkage.

(b) Improperly adjust the transmission steer control linkage.

(c) Improperly adjust the brakes.

(d) Cut the safety wire on the universal joint.

presence of oil and then warm up the vehicle and recheck for proper oil level.

(2) *Test 7.* No credit will be allowed unless the candidate properly checks the lubrication of the safety wires on the universal joints.

e. *Credit.* Subject to the penalties assessed in

*d* above, credit will be awarded as indicated in paragraph 7-19.

## 7-24. Winch

*a. Scope of Tests.* Four tests will be conducted to determine the candidate's knowledge of the winch.

### *c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	TEST AND ADJUST THE DRAG BRAKE .....	Performs required operation as prescribed in the applicable technical manual.
2	DEMONSTRATE THE PRESCRIBED METHOD OF ADJUSTING THE BRAKE BAND.	Demonstrates procedures as prescribed in the applicable technical manual.
3	EXPLAIN THE PURPOSE OF THE SHEAR PIN AND DEMONSTRATE ITS REPLACEMENT.	Explains purpose; demonstrates replacement operation.
4	UNWIND, CLEAN, INSPECT, LUBRICATE, AND REWIND THE CABLE. (See <i>b</i> above.)	Same as that for test 1 above.

### *d. Penalties.*

(1) In those tests for which specific penalties are not indicated below, proportional penalties will be assessed on the basis of the knowledge of the candidate.

(2) In test 3, no credit will be allowed if the candidate is unable to explain the purpose of the shear pin.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 7-19.

## 7-25. Tracks and Suspension System

*a. Scope of Tests.* Six tests will be conducted to determine the candidate's knowledge of the components of the suspension system and his ability to perform maintenance.

### *c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	INSPECT AND SERVICE THE TRACKS. EXPLAIN PROCEDURE.	Inspects and services tracks as prescribed in the applicable technical manual. Announces each inspection as he makes it and recommends corrective action. (Inspections will be made for worn track pads, worn center guides, and dead blocks.)
2	<i>a.</i> EXPLAIN THE PURPOSE OF THE SPROCKETS .....	<i>a.</i> Explains functions of the sprockets.
	<i>b.</i> INSPECT AND SERVICE THE SPROCKET .....	<i>b.</i> Inspects and services sprockets as prescribed in the applicable technical manual. Announces each in-

*b. Special Instructions.* One assistant should be provided to aid the candidate in test 4. In test 4, the cable should be unwound only to the extent necessary to determine the candidate's ability to perform the required maintenance.

### *b. Special Instructions.*

(1) The tests included are to be used as a guide in the testing of mechanics on all types of track-laying vehicles used by field artillery units.

(2) The candidate will be furnished—

- (a) A track-laying vehicle.
- (b) A complete set of tools as prescribed in the TOE applicable to the candidate's unit.
- (c) Required lubricants.
- (d) Drycleaning solvent.
- (e) Waste of rags.

(3) Prior to starting the testing, the examiner will have the vehicle moved into the shop and will insure that all necessary equipment is available.

Test No.	Examiner commands—	Action of candidate
		specation as he makes it and recommends corrective action. (Inspection should be made for tightness of mounting bolts; candidate should also measure sprocket wear and recommend reversal of replacement.)
3	REMOVE AND REPLACE ROAD WHEEL AND BEARING .....	Performs required operations and checks bearing torque as outlined in the applicable TM.
4	INSPECT SHOCK ABSORBERS AND STATE CORRECTIVE ACTION REQUIRED.	Inspects shock absorbers as outlined in the applicable technical manual. States the corrective action required.
5	CHECK FOR BROKEN TORSION BAR .....	Checks torsion bar as outlined in the applicable technical manual.
6	INSPECT AND ADJUST THE TRACK TENSION .....	Inspects and adjusts tension as prescribed in the applicable technical manual.

*d. Penalties and Credit.* No specific penalties are provided for these tests. Proportional penalties will be assessed on the basis of the knowledge of the candidate.

*e. Credit.* Subject to the penalties assessed, credit will be awarded as indicated in paragraph 7-19.

to determine the candidate's knowledge of methods of reaching various units for inspection and servicing and his ability to operate and service fire extinguishers.

*b.* The examiner will provide a track-laying vehicle that employs a fixed fire extinguisher system.

## 7-26. Hull—Fire Extinguishers

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

*c. Outline of Tests.*

Test No.	Examiner commands—	Action of candidate
1	EXPLAIN TYPE OF FIRE EXTINGUISHERS USED .....	Explains type used.
2	INSPECT AND SERVICE THE FIRE EXTINGUISHER .....	Performs required inspection and service as prescribed in the applicable technical manual. (Points out nozzles, lines, and cylinders.)
3	POINT OUT THE HULL DRAIN VALVES .....	Points out drain valves and indicates required maintenance as indicated in the applicable technical manual.

*d. Penalties.* No specific penalties are provided for these tests. Proportional penalties will be assessed on the basis of the knowledge of the candidate.

*e. Credit.* Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 7-19.



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## APPENDIX A

### REFERENCES

#### A-1. References for use With Chapter 1, General

AR 380-5	Safeguarding Defense Information.
AR 672-5-1	Awards.
DA Pam 310-series	Military publications indexes.

#### A-2. References for use With Chapter 2, Operations Specialists

FM 6-10	Field Artillery Communications.
FM 6-20-2	Field Artillery Techniques.
FM 6-40	Field Artillery Cannon Gunnery.
FM 6-121	Field Artillery Target Acquisition.
FM 21-26	Map Reading.
FM 21-30	Military Symbols.
FM 21-31	Topographic Symbols.

#### A-3. References for use With Chapter 3, Sound Ranging Specialists

FM 6-15	Artillery Meteorology.
FM 6-16	Tables for Artillery Meteorology.
FM 6-122	Artillery Sound Ranging and Flash Ranging.
TM 6-230	Logarithmic and Mathematical Tables.
TM 9-6140-200-14	Operator and Organizational, DS and GS Maintenance Manual, Storage Batteries Lead-Acid Type.
TM 11-5895-213-10	Operator's Manual, Sound Ranging Set GR-8.
TM 11-5895-213-20	Organizational Maintenance Manual, Sound Ranging Set, GR-8.
TM 11-6115-205-10P	Basic issue items list. Power unit PE-210, -210A, -210B, and -210C.

#### A-4. References for use With Chapter 4, Flash Ranging Specialists

(Chapter 4. Include those listed below for Chapter 5 plus the following:)

TM 9-6109	Ordnance Maintenance; Plotting Boards M5 and M5A2; Sound Ranging Plotting Boards M1 and M1A1 and Sound Ranging Wind Corrector M1.
TM 11-5516	Flash Ranging Set AN/GTC-1.

#### A-5. References for use With Chapter 5, Communication Specialists

(C) ACP 124 ( )	Communications Instructions—Radiotelegraph Procedures (U).
ACP 125 ( )	Communications Instructions—Radiotelephone Procedures (U).
(C) ACP 126	Communications Instructions—Teletypewriter (Teleprinter) Procedure (U).
ACP 131 ( )	Communications Instructions—Operating Signals.
ACP 134 ( )	Telephone Switchboard Operating Procedure.
FM 6-10	Field Artillery Communications.
FM 6-140	The Field Artillery Organizations.
FM 21-26	Map Reading.
FM 21-30	Military Symbols.

FM 21-31	Topographic Symbols.
FM 21-60	Visual Signals.
FM 24-16	Signal Orders, Records, and Reports.
FM 24-17	Tactical Communications Center Operations.
FM 24-18	Field Radio Techniques.
FM 24-20	Field Wire and Field Cable Techniques.
(C) AR 380-52	Codes, Nonmachine Ciphers, and Authentication Systems (U).
(C) JANAP 201 ( )	Status of Noncryptographic JANAP's and ACP's (U).
(C) KAO-83( )/TSEC	Operating Instructions for TSEC/KW-7 (U).
(C) KAO-153( )/TSEC	Operating Instructions for TSEC/KY-8/28/38 (U).
(C) DA Pam 310-9	Index of Communications Security (COMSEC) Publications (U).
TM 11-362	Reel Units RL-31, RL-31-B, RL-31-C, RL-31-D and RL-31-E.
TM 11-2134	Manual Telephone Switchboard SB-86/P, Installation and Operation.
TM 11-5805-201-12	Operator and Organizational Maintenance Manual Including Repair Parts and Special Tool Lists: Telephone Set, TA-312/PT.
TM 11-5815-206-12	Organizational Maintenance Manual: Teletypewriter Set AN/PGC-1 and Teletypewriters TT-4A/TG, TT-4B/TG, TT-4C/TG, T-335/TG, and TT-537/G.
TM 11-5815-238-12	Organizational Maintenance Manual, Including Repair Parts and Special Tool Lists: Teletypewriter Sets AN/GGC-3 and AN/GGC-3A and Teletypewriter Reperforator-Transmitter TT-76/GGC, TT-76A/GGC, TT-76B/GGC and TT-76C/GGC.
TM 11-5815-334-12	Operator and Organizational Maintenance Manual Including Repair Parts List: Radio Teletypewriter Sets AN/GRC-122 and AN/GRC-142.
TM 11-5820-398-12	Operator and Organizational Maintenance Manual, Including Repair Parts and Special Tool Lists: Radio Set AN/PRC-25.
TM 11-5820-401-10	Operator's Manual: Radio Sets AN/VRC-12, and AN/VRC-43, -44, -45, -46, -47, -48, and -49.
TM 11-5820-477-12	Organizational Maintenance Manual: Radio Set Control Groups AN/GRA-39 and AN/GRA-39A.
TM 11-5820-667-12	Operator and Organizational Maintenance Manual Including Repair Parts Lists: Radio Set AN/PRC-77.
TM 11-2240	Wire Dispenser MX-306 A/G.
TM 11-2546	Connecting and Switching Kit MX-155/GT.
TM 11-5038	Control Group AN/GRA-6.
TM 11-5805-210-10	Operator's Manual: Frequency Shift Converter CV-278/GR.
TM 11-5805-262-12	Operator's and Organizational Maintenance Manual: Switchboards, Telephone, Manual SB-22PT and SB-22A/PT.
TM 11-5815-204-10	Operator's Manual: Radio Teletypewriter Sets AN/GRC-46, AN/GRC-46A, AN/GRC-46B, and AN/VRC-29.
TM 11-5820-205-10	Operator's Manual: Radio Transmitter Modulator MD-203/GR.
TM 11-5820-334-10	Operator's Manual: Radio Receiver R-392/URR.

#### A-6. References for use With Chapter 6, Field Artillery Mechanics

FM 23-series	As applicable to the small arms issued the unit.
ORD-7	As applicable to the unit.
SNL	As applicable to the unit.
TM 9-series	As applicable to the artillery weapons issued the unit.
TM 9-1300-203	Artillery Ammunition.
TM 9-1300-206	Care, Handling, Preservation, and Destruction of Ammunition.
TM 9-1305-200	Small-Arms Ammunition.

**A-7. References for use With Chapter 7, Motors Personnel**

AR 600-55	Motor Vehicle Driver—Selection, Testing, and Licensing.
AR 746-1	Color and Marking and Preparation of Equipment for Shipment.
AR 750-5	Organization, Policies, and Responsibilities for Maintenance Operations.
TM 9-series	As applicable to the vehicle issued the unit.
TM 9-8000	Principles of Automotive Vehicles.
TM 21-300	Driver Selection and Training (Wheeled Vehicles).
TM 21-301	Driver Selection, Training, and Supervision, Tracked Vehicles.
TM 21-305	Manual for the Wheeled Vehicle Driver.
TM 21-306	Manual for the Tracked Combat Vehicle Driver.
TM 38-750	The Army Maintenance Management System (TAMMS).



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By Order of the Secretary of the Army:

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