7610-66-026-5523

AUSTRALIAN ARMY

TECHNICAL MANUAL,

Operator, Organizational, Field and Depot Maintenance Manual

Antenna Group AN/GRA-50,

TM 11-5820-467-15

FOR

5820-00-082-3491

RADIO SET, AN/GRC-106

Issued **Mar 78**

Authorised for use within the Australian Army by command of the Chief of the General Staff.

(J.D. STEVENSON)
Major General
General Officer Commanding
Logistic Command

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, FIELD, AND DEPOT MAINTENANCE MANUAL ANTENNA GROUP AN/GRA-50

Headquarters, Department of the Army, Washington 25, D. C.

19 July 1961

WARNING

DANGEROUS VOLTAGES EXIST ON THE ANTENNA WHEN IN OPERATION

Before working on any part of the antenna, be sure that all equipment has been disconnected from the power source.

DON'T TAKE CHANCES!

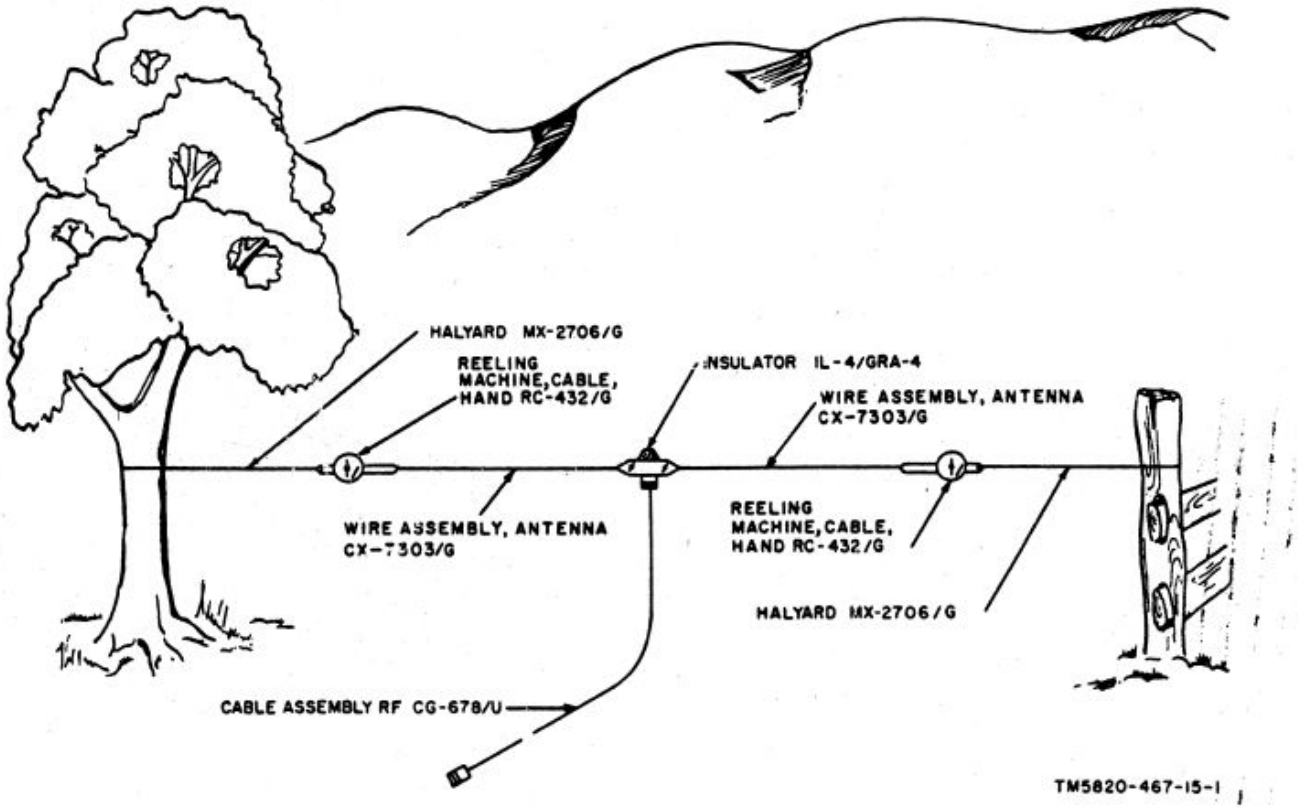

Figure 1. Antenna Group AN/GRA-50, typical installation.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

This manual describes Antenna Group AN/GRA-50 (fig. 1) and covers installation, maintenance, and theory of operation.

2. Forms and Records

a. Unsatisfactory Equipment Report.

(1) Fill out and forward DA Form 468 (Unsatisfactory Equipment Report) to Commanding Officer, U. S. Army Signal Materiel Support Agency, ATTN: SIGMS-ML, Fort Monmouth, N. J., as prescribed in AR 700-38.

(2) Fill out and forward AF TO Form 29 (Unsatisfactory Report) to the Commander, Air Materiel Command, Wright-Patterson Air Force Base, Ohio, as prescribed in AF TO 00-35D-54.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700-58 (Army), Navy Shipping Guide, Article 1850-4 (Navy), and AFR 71-4 (Air Force).

c. Preventive Maintenance Form. Prepare DA Form 11-238 (fig. 8 and 9) (Maintenance Check List for Signal Equipment (Sound Equipment, Radio, Direction Finding, Radar, Carrier, Radiosonde and Television)), in accordance with the instructions on the fom.

d. Parts List Form. Forward DA Form 2028 (Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8, or 9) direct to the Commanding Officer, U. S. Army Signal Materiel Support Agency, ATTN: SIGMS-ML, Fort Monmouth, N. J., with comments on appendixes II and III.

e. Comments on Manual. Forward all other comments on this publication direct to the Commanding Officer, U. S. Army Signal Materiel Support Agency, ATTN: SIGMS-PA2d, Fort Monmouth, N. J.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Purpose. Antenna Group AN/GRA-50 (fig. 1) is a doublet antenna assembly used for the transmission and reception of radio signals between 1.5 and 20 megacycles (mc).

b. Use. Antenna Group AN/GRA-50 is used primarily with Radio Set AN/GRC-19 for greater range and reliability than the standard 15-foot whip antenna provides. It can be used with any radio set that has the proper frequency range and a transmitter power output of less than 100 watts at an output impedance of approximately 50 ohms.

4. Technical Characteristics

Antenna type	Half wave doublet.
Frequency range	1.5 to 20 mc.
Power handling capability	100 watts (maximum).
Weight	11.75 lb.

5. Components (fig. 2)

Quantity	Component	Height (in.)	Depth (in.)	Width	Unit weight (lb)
1	Cable Assembly RF CG-678/U			75 ft 3 in. (lg)	2.4
1	Insulator IL-4/GRA-4	2	3-1/2	3-1/2 in.	0.6
2	Reeling Machine, Cable, Hand RC-432/G	2-3/4	4-1/2	12 in.	1
2	Wire Assembly, Antenna CX-7303/G			160 ft (lg)	0.6
1	Bag BG-175	9	8-1/2	9-1/2 in.	2
2	Halyard MX-2706/G		1/8 dia.	75 ft (lg)	1.1
1	Tape, measuring (nonconducting), 156 ft	1-1/4	7	7 in.	2.1
2	Technical Manual TM 11-5820-467-15				

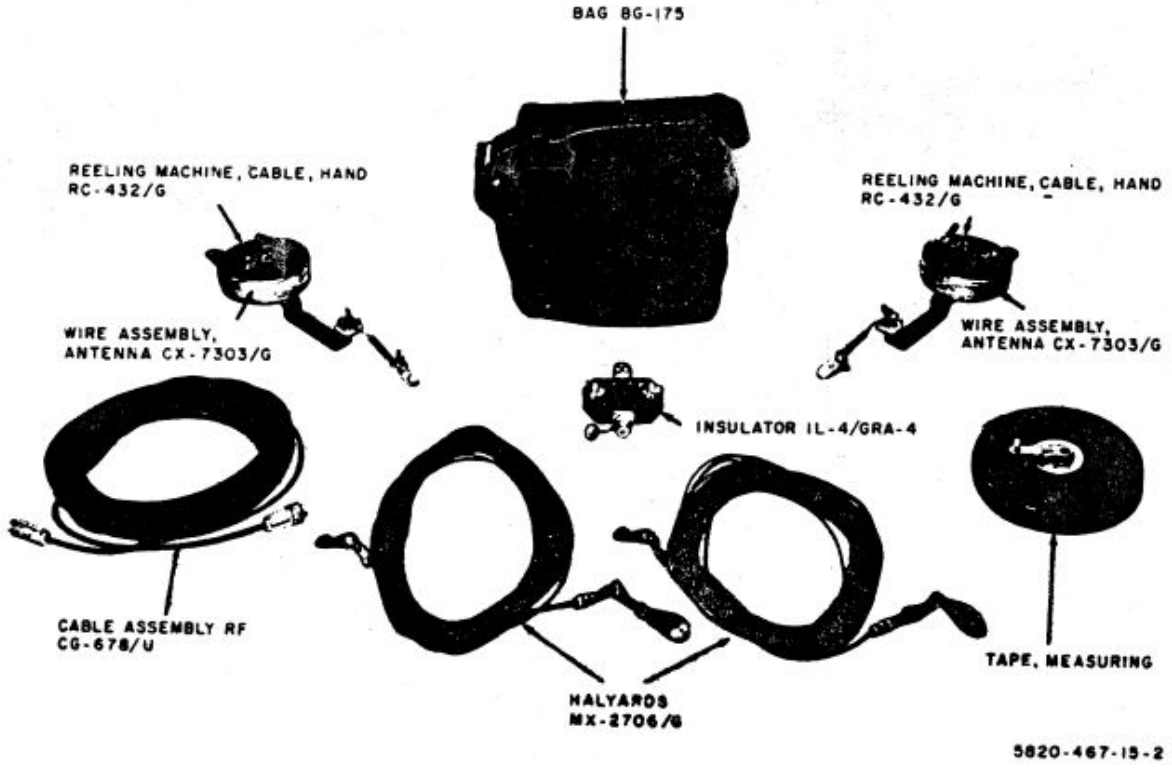

Figure 2. Antenna Group AN/GRA-50, components.

6. Common Names

Nomenclature	Common name
Antenna Group AN/GRA-50	Antenna assembly
Cable Assembly RF CG-678/U	Rf cable
Insulator IL-4/GRA-4	Insulator
Reeling Machine, Cable, Hand RC-432/G	Reel assembly
Wire Assembly, Antenna CX-7303/G	Antenna wire
Halyard MX-2706/G	Halyard
Tape, measuring (nonconducting), 156 ft	Tape measure

7. Description

(fig. 2)

a. Bag BG-175, made of heavy canvas, is used to store all components.

b. Each Reeling Machine, Cable, Hand RC-432/G consists of a reel on which 160 feet of Wire Assembly, Antenna CX-7303/G is wound. A terminal hook on the loose end of Wire Assembly, Antenna CX-7303/G attaches to Insulator IL-4/GRA-4. Halyard MX-2706/G is secured to a small hole in the Reeling Machine, Cable, Hand RC-432/G frame. A spring action handle on the outer flange of the spool facilitates winding.

c. Cable Assembly, RF CG-678/U is 75 feet 3 inches long and consists of cable RG-58A/U with a connector UG-536/U at each end. Cable Assembly RD CG-78/U connects between Insulator IL-4/GRA-4 and the radio set.

d. Insulator IL-4/GRA is a phenolic housing which has two terminals for connection of the antenna wires and a female coaxial fitting for connecting Cable Assembly RF CG-678/U. Insulator IL-4/GRA-4 is installed at the center of the antenna assembly.

e. Halyard MX-2706/G consists of 75 feet of 1/8-inch diameter Dacron rope. A snaphook fastener at one end of the rope connects to Reeling Machine, Cable, Hand RC-432/G, a snaphook fastener and a lead weight is attached to the other end.

f. The tape, measuring (tape measure), made of nonconducting woven fabric, is 156 feet long. It is calibrated on one side in feet and on the other side in frequency. It is used to measure the length of antenna necessary for operation at any given frequency. The tape measure is marked at each 100 kilocycles (kc) from 1.6 to 6 mc, at each 200 kc from 4 to 6 mc, at each 500 kc from 6 to 10 mc, and at each mc from 10 to 20 mc.

CHAPTER 2
INSTALLATION

8. Unpacking

a. Packaging Data. When packed for shipment, the components of the antenna assembly are individually enclosed in polyethylene envelopes and packed in Bag BG-175. Bag BG-175 is enclosed in a moistureproof barrier and sealed in a corrugated fiberboard carton. Packed for shipment, the carton weighs 13 pounds and is 10 inches high, 9 inches deep, and 10 inches wide; its volume is 0.5 cubic feet. A typical shipping carton and its contents are shown in figure 3.

b. Removing contents. To unpack the equipment, proceed as follows:

(1) Open the carton. Do not cut open the carton, because the equipment may become damaged.
(2) Open the moistureproof barrier and remove Bag BG-175.
(3) Open Bag BG-175 and remove its contents.
(4) Remove the components from the polyethylene evelopes.

9. Checking Unpacked Equipment

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, refer to paragraph 2.

b. See that the equipment is complete as listed on the packing slip. If a packing slip is not available, check the equipment against the table of components (para 5) or basic issue items list (appx II).

10. Siting

a. In areas, such as jungles, where vegetation is very dense, vertical antennas are inefficient because of the absorption of their radiation by the surrounding growth. The antenna assembly, however, provides more reliable communications than a vertical antenna in dense growth areas.

b. Locate the antenna in a clearing and assemble the antenna with the antenna wire broadside to the direction of the desired station. When communication is desired with two or more stations, orient the antenna assembly so that the antenna wire is broadside to the weakest station.

11. Installation

a. Determining Length of Antenna Wire.

(1) In the installation procedure in *b* below, use the tape measure to determine the proper length of antenna wire for the desired frequency of operation. Unroll the tape measure to the desired frequency marking and unroll an equal amount of antenna wire from each reel assembly (fig. 4). The length indicated on the tape measure opposite the desired frequency marking is half of the required total antenna length at that frequency.
(2) The following chart lists the length of each antenna wire (including the reel assembly frame) required for frequencies between 1.5 and 20 mc. When the tape measure is not available, use the chart to determine each antenna wire length. Pace off (one stride is approximately 3 feet) the indicated antenna length; make final adjustment by lengthening or shortening the antenna assembly for the best transmitter loading.

Frequency (mc)	Length of each antenna wire[a] (ft)	Frequency (mc)	Length of each antenna wire[a] (ft)	Frequency (mc)	Length of each antenna wire[a] (ft)
1.5	156.0	2.3	101.73	5.4	43.33
1.52	153.94	2.35	99.57	5.6	41.78
1.54	151.94	2.4	97.50	5.8	40:35
1.56	150.0	2.45	95.51	6.0	39.0

Frequency (mc)	Length of each antenna wire[a] (ft)	Frequency (mc)	Length of each antenna wire[a] (ft)	Frequency (mc)	Length of each antenna wire[a] (ft)
1.58	148.10	2.5	93.60	6.2	37.74
1.60	146.25	2.55	91.76	6.4	36.56
1.62	144.44	2.6	90.00	6.6	35.45
1.64	142.68	2.65	88.30	6.8	34.41
1.66	140.96	2.7	86.66	7.0	33.42
1.68	139.28	2.75	85.09	7.5	31.20
1.70	137.64	2.8	83.57	8.0	29.25
1.72	136.04	2.85	82.10	8.5	27.52
1.74	134.48	2.9	80.68	9.0	26.0
1.76	132.95	2.95	79.32	9.5	24.63
1.78	131.46	3.0	78.0	10.0	23.40
1.80	130.0	3.1	75.48	10.5	22.29
1.82	128.57	3.2	73.12	11.0	21.27
1.84	127.17	3.3	70.9	12.0	19.51
1.86	125.80	3.4	68.82	13.0	18.0
1.88	124.46	3.5	66.85	14.0	16.71
1.90	123.15	3.6	65.0	15.0	15.60
1.92	121.87	3.7	63.24	16.0	14.62
1.94	120.61	3.8	61.57	17.0	13.76
1.96	119.38	3.9	60.0	18.0	13.0
1.98	118.18	4.0	58.50	19.0	12.31
2.0	117.0	4.2	55.71	20.0	11.7
2.05	114.14	4.4	53.18		
2.1	111.42	4.6	50.86		
2.15	108.83	4.8	48.75		
2.2	106.36	5.0	46.80		
2.25	104.0	5.2	45.0		

[a]Each antenna wire length includes the reel assembly frame.

b. Installation Procedure.

(1) Connect the antenna wire terminal hooks to the thumb nuts on the opposite ends of the insulator (fig. 5).

(2) Temporarily fasten the insulator to one of the desired supports.

(3) Temporarily fasten the free end of the tape measure to the center of the insulator.

(4) Unwind the tape measure to the length corresponding to the desired frequency.

(5) Refer to figure 6 and unroll a like amount of wire from each reel assembly as follows:

(a) Grasp the reel assembly firmly in one hand and loosen the thumb nut at the center of the reel and the thumb nut on the wire clamp on the reel assembly frame.

(b) Move away from the antenna center slowly, keeping the wire taut at all times. Hold your thumb on the wire to prevent backlash.

(c) After unwinding the required amount of wire, tighten the thumb nut on the wire clamp.

(d) Tighten the thumb nut at the center of the reel.

(6) Unfasten the tape measure from the insulator, unfasten the insulator from the support, and lay the antenna wires out in a straight line.

(7) Check the overall length of the two wires plus the insulator and reel assemblies. The overall length will be twice the length indicated on the tape measure for the desired frequency or twice the length obtained from the chart in *a*(2) above. Adjust the antenna for an exact overall length. Be sure to keep the insulator centered.

(8) Attach each reel assembly to a halyard snaphook fastener (fig. 7).

(9) Tie the halyards to the best available supports (tree, fence post, vehicle, etc) at a height of 4 feet or higher.

Caution: **Allow the antenna assembly to sag at least 6 inches.**

(10) Connect the ends of the rf cable between the insulator connector (fig. 5) and the antenna connector

on the radio set. Shorten or lengthen the antenna assembly a few inches at a time when difficulty in transmitter loading is encountered.

Note. The rf cable should be at right angles to the antenna wires for the first few feet from the connection at the insulator. Lay the rf cable out as straight as possible; do not allow the cable to form loops.

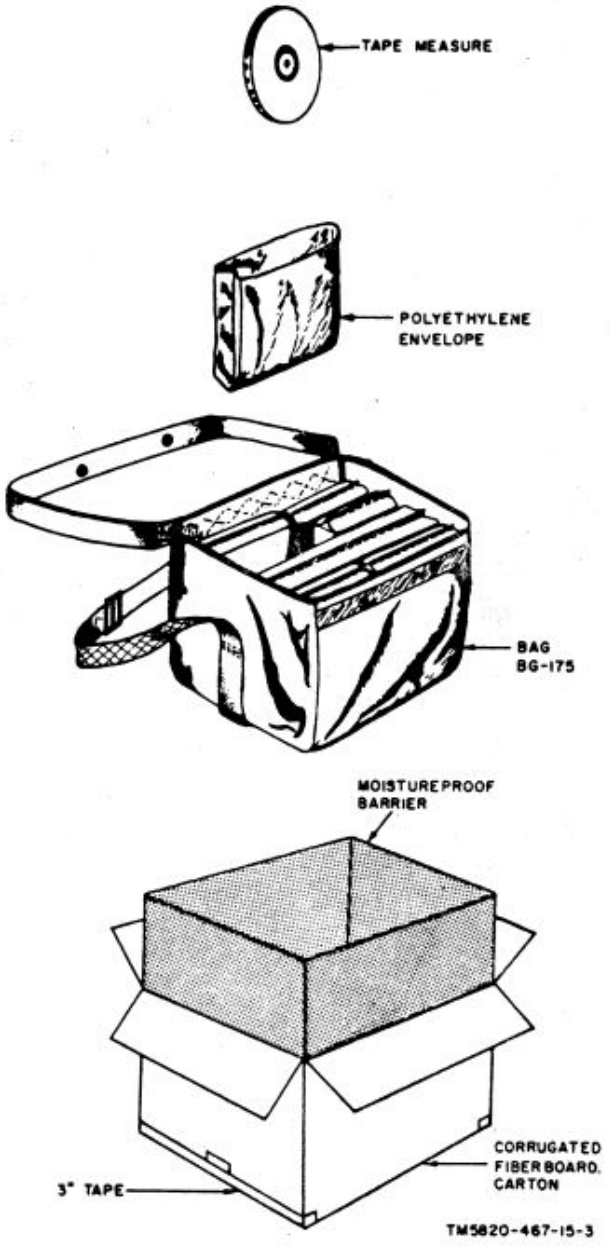

Figure 3. Typical packaging.

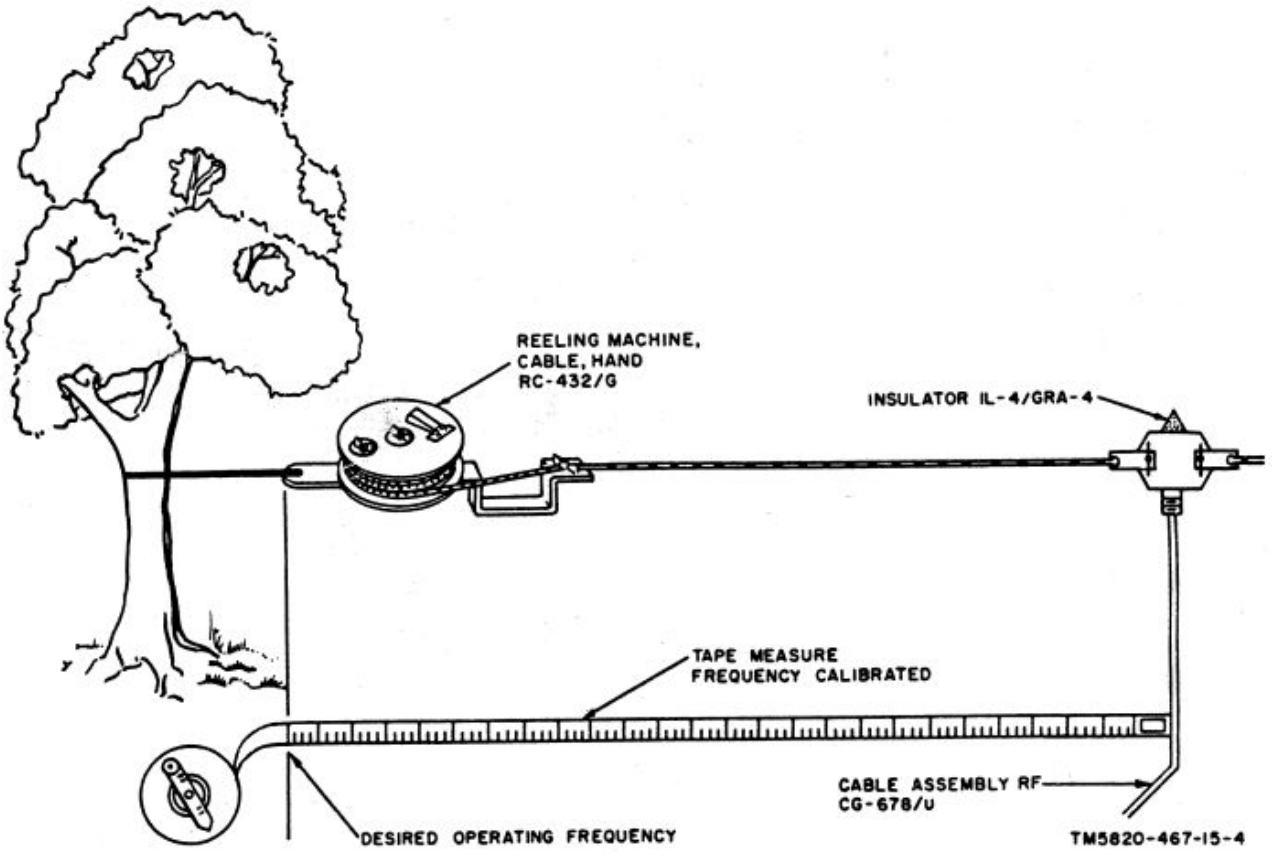

Figure 4. Use of tape measure to determine antenna wire length.

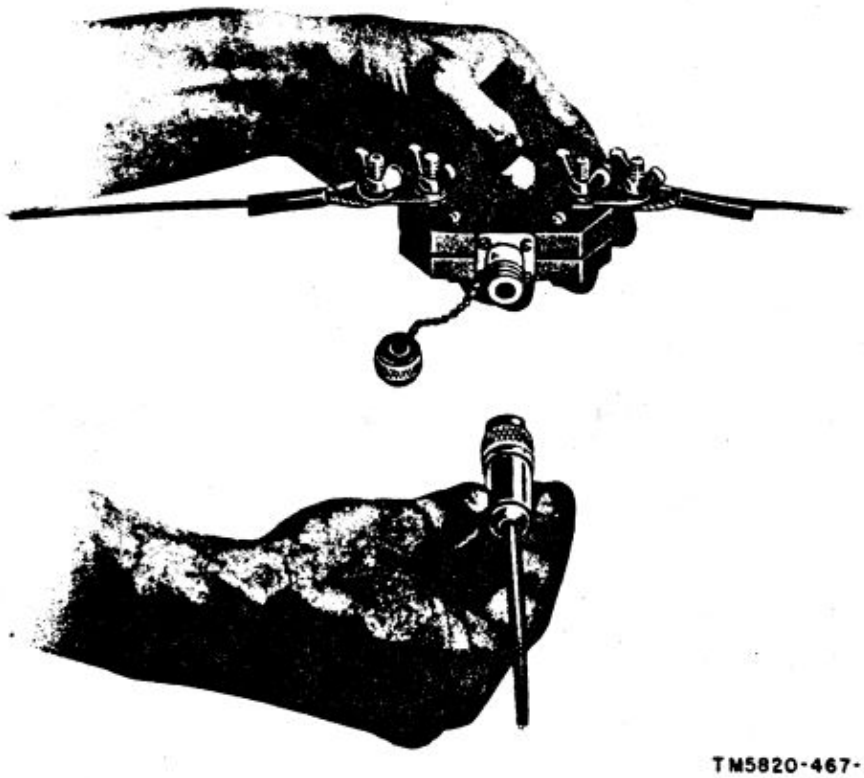

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Figure 5. Connecting rf cable to insulator (antenna wires shown connected).

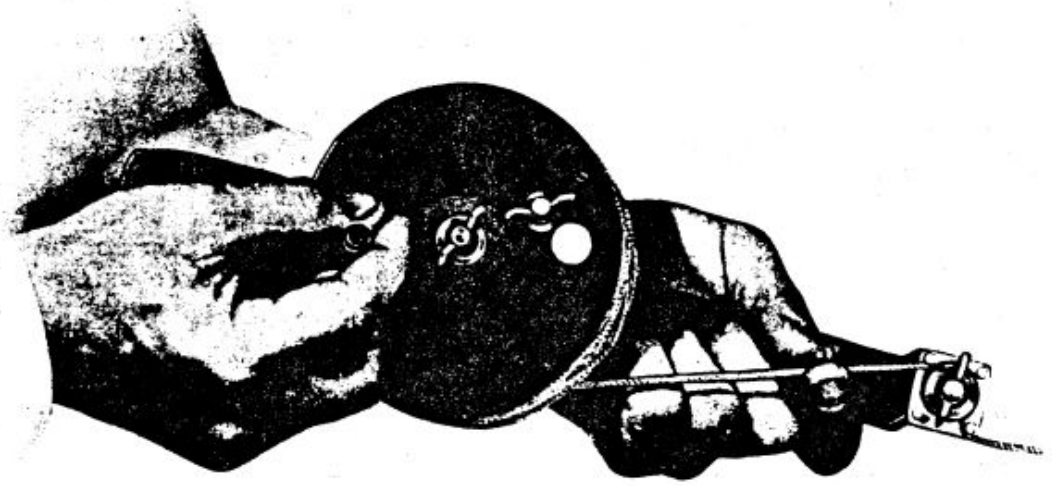

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Figure 6. Unwinding antenna wire from reel assembly.

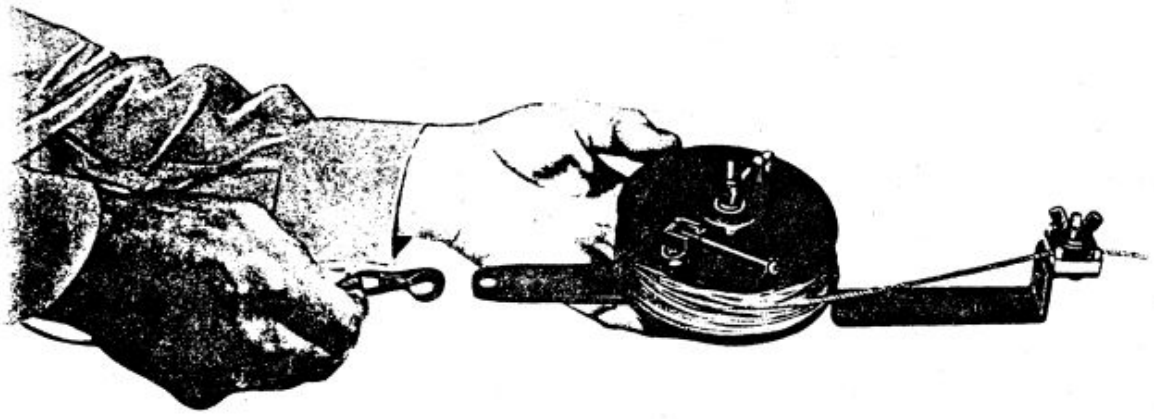

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Figure 7. Attaching halyard to reel assembly.

CHAPTER 3
MAINTENANCE

Section I. OPERATOR'S MAINTENANCE

12. Scope of Operator's Maintenance

a. The following is a list of maintenance duties normally performed by the operator of the antenna assembly. Special tools or test equipment is not required.

b. Operator's maintenance for the antenna assembly consists of the following:

(1) Preventive maintenance (para 13).

(2) Visual inspection (para 14).

13. Operator's Preventive Maintenance

DA Form 11-238 (fig. 8 and 9) is a preventive maintenance checklist to be used by the operator. Items not applicable to Antenna Group AN/GRA-50 are lined out in the figures. Instructions for the use of the form appear on the form.

14. Operator's Visual Inspection

When the antenna assembly fails to operate properly, disconnect the radio set from the power source and check the items given below. *Do not check any item with the power on.*

a. Inspect all electrical connections of the antenna assembly for tightness and corrosion.

b. Inspect the insulator for cracks or chips and dirt.

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
26. INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS ~~AND REPLACEMENT~~.	✓
27. CHECK FOR NORMAL OPERATION.	✓
28. ~~BEFORE SHIPPING OR STORING, REMOVE BATTERIES~~	

IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING THE INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

MAINTENANCE CHECK LIST FOR SIGNAL EQUIPMENT
SOUND EQUIPMENT, RADIO, DIRECTION FINDING
RADAR, CARRIER, RADIOSONDE AND TELEVISION
(AR 750-625)

EQUIPMENT NOMENCLATURE: ANTENNA GROUP AN/GRA-50

EQUIPMENT SERIAL NUMBER: 32

FOLD

INSTRUCTIONS

This form may be used for a period of one month by using the correct dates and weeks of the month. It is to be used as a Preventive Maintenance check list for Signal equipment in actual use, or for a check on equipment prior to issue.

1. For detailed Preventive Maintenance instructions see:
   a. The Technical Manual *(in TM 11 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   b. The Supply Bulletin *(SB 11-100 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   c. The Department of the Army Lubrication Order. *(See DA Pamphlet Number 310-4)*

2. The following action will be taken by either the Communications Officer/ Chief for 1st echelon, or the Inspector for higher echelon:
   a. Enter Equipment Nomenclature and Serial Number.
   b. Strike out items that do not apply to the equipment.

3. Operator/Inspector will enter in the columns entitled CONDITION, on the proper line, a notation regarding the condition, using symbols specified under LEGEND.

4. After operator completes each daily inspection he will initial over the appropriate dates under "Daily Condition for Month", then return form to his supervisor.

TYPE OF INSPECTION

OPERATOR	2/3 ECHELON	DATE	SIGNATURE
✓		1 JULY 1961	Pvt. Raymond Doe
	✓	7 JULY 1961	Sgt. Martin Roe

DA FORM 1 MAY 57 11-238

REPLACES DA FORMS 11-238, 1 NOV 55; 11-239, 11-244, 11-245, 11-246, 11-248, 11-250, AND 11-251; WHICH ARE OBSOLETE.

TM5820-467-15-8

Figure 8. DA Form 11–238, pages 1 and 4.

LEGEND for marking conditions:
Satisfactory, ✓.
Adjustment, Repair or Replacement required, X.
Defect corrected, (X).

DAILY CONDITION FOR MONTH OF JULY 1961

NO.	DAILY ITEM	1 / 17	2 / 18	3 / 19	4 / 20	5 / 21	6 / 22	7 / 23	8 / 24	9 / 25	10 / 26	11 / 27	12 / 28	13 / 29	14 / 30	15 / 31	16	2D 3D ECH-ELON
		RD	RD	RD	RD	RD	RD	RD										
1.	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT. ~~[illegible]~~ carrying cases, wire, cables, ~~[illegible]~~ spare parts, technical manuals).	✓	✓	✓	✓	✓	✓	✓										✓
2.	~~[illegible]~~																	
3.	~~[illegible]~~																	
4.	~~[illegible]~~																	

WEEKLY	CONDITION EACH WEEK 1ST	2D	3D	4TH	5TH	2D 3D ECH
5. ~~[illegible]~~						
6. ~~[illegible]~~						
7. INSPECT ~~CORDS~~, CABLE, WIRE, ~~[illegible]~~ FOR CUTS, KINKS, BREAKS, FRAYING, UNDUE STRAIN.	✓					✓
8. CHECK ANTENNA ~~GUY~~ WIRES FOR PROPER TENSION OR DAMAGE.	✓					✓
9. INSPECT CANVAS AND LEATHER ITEMS FOR MILDEW, TEARS, FRAYING.	✓					✓
10. INSPECT ACCESSIBLE ITEMS FOR LOOSENESS: ~~[illegible]~~, CONNECTORS, ~~[illegible]~~.	✓					✓
11. ~~[illegible]~~						
12. ~~[illegible]~~						

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
13. ~~[illegible]~~	
14. ~~[illegible]~~	

2

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
15. ~~[illegible]~~	
16. ~~[illegible]~~	
17. ~~[illegible]~~	
18. ~~[illegible]~~	
19. ~~[illegible]~~	
20. ~~[illegible]~~	
21. ~~[illegible]~~	
22. ~~[illegible]~~	
23. ~~[illegible]~~	
24. ~~[illegible]~~	
25. ~~[illegible]~~	

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GPO : 1957 O—427054

TM5820-467-15-9

Figure 9. DA Form 11–238, pages 2 and 3.

Section II. ORGANIZATIONAL AND FIELD MAINTENANCE (THIRD ECHELON)

15. Scope of Organizational Maintenance

The following is a list of maintenance duties performed by organizational maintenance personnel for the antenna assembly. The scope of these instructions has been determined by the available tools, materials, test equipment, spare parts, and the MOS of the repairman.

a. Preventive maintenance (para 17).
b. Troubleshooting (para 18).
c. Replacement of parts (para 19).

16. Tools, Materials, and Test Equipment Required

A list of parts normally stocked for organizational maintenance is contained in TM 11-5820-467-25P. The tools, materials, and test equipment required for organizational maintenance are listed below:

a. Tools. Tool Equipment TE-41.
b. Materials.
(1) Cleaning compound (Federal stock No. 7930-395-9542).
(2) Cleaning cloth, lint-free.
(3) Sandpaper No. 000.
c. Test Equipment. Multimeter AN/URM-105.

17. Organizational Preventive Maintenance

DA Form 11-238 (fig. 8 and 9) is a preventive maintenance checklist to be used by organizational maintenance personnel. Items not applicable to the equipment are lined out in the figures. Instructions for the use of the form appear on the form.

18. Troubleshooting

a. The troubleshooting chart is for use of second through fifth echelon maintenance personnel. Upon noting a defect in either transmission or reception, shut down the power at the transmitter/receiver, disconnect the rf cable from the transmitter/receiver antenna connector, and perform the appropriate procedure listed in the chart below.

b. Chart.

Item	Indication	Probable trouble	Procedure
1	No transmission from associated transmitter and no reception.	Rf cable open or shorted . . .	Check continuity between rf cable and antenna wires. Replace rf cable if open. Remove rf cable completely. Use Multimeter AN/URM-105 to check resistance between center contact and shell of either connector. Replace rf cable if resistance is less than 10 megohm.
2	Weak transmission from associated transmitter and weak reception.	Incorrect installation	Check for proper length of antenna at the operating frequency (para 11).
		Leakage path to ground	Check for foliage in contact with the antenna wires.
		Leakage in rf cable	Remove rf cable completely and check resistance between center contact and shell of either connector. Replace if resistance is less than 10 megohms.

19. Repair of Rf Cable (Third Echelon) (fig. 10)

The only item of the antenna assembly that can be readily repaired is the rf cable (*b* and *c* below).

a. Tools and Test Equipment Required.
(1) Tool Equipment TE-113.
(2) Multimeter TS-352/U.

b. Installation of Connector on End of Rf Cable.
(1) Remove three-quarters of an inch of the rf cable outer jacket.

(2) Disassemble the UG-536/U and lay out its parts in the order of disassembly.
(3) Slide the nut over the rf cable.
(4) Slide the washer over the rf cable.
(5) Slide the gasket over the rf cable, one-sixth of an inch beyond the edge of the rf cable outer jacket.
(6) Slide the flanged sleeve over the copper braid shield.
(7) Flare the shield around the flanged sleeve.
(8) Remove the excess shield braid so that it is even with the outer edge of the flanged sleeve.
(9) Remove three-sixteenths of an inch of insulation from the end of the conductor.
(10) Slide the contact over the conductor and solder through the hole in the contact. File the soldered area smooth.
(11) Insert the cable into the shell.
(12) Tighten the nut securely. When the cable and connector are properly assembled, the contact tip should be flush with, or not more than one thirty-second of an inch beneath the edge of the coupling.
(13) Use multimeter TS-352/U to check the rf cable for continuity and shorts.

c. Replacement of Cable RG-58A/U.

(1) Measure and cut off 75 feet of cable RG-58A/U.
(2) Install connector UG-536/U to each end of cable RG-58A/U as in *b* above.

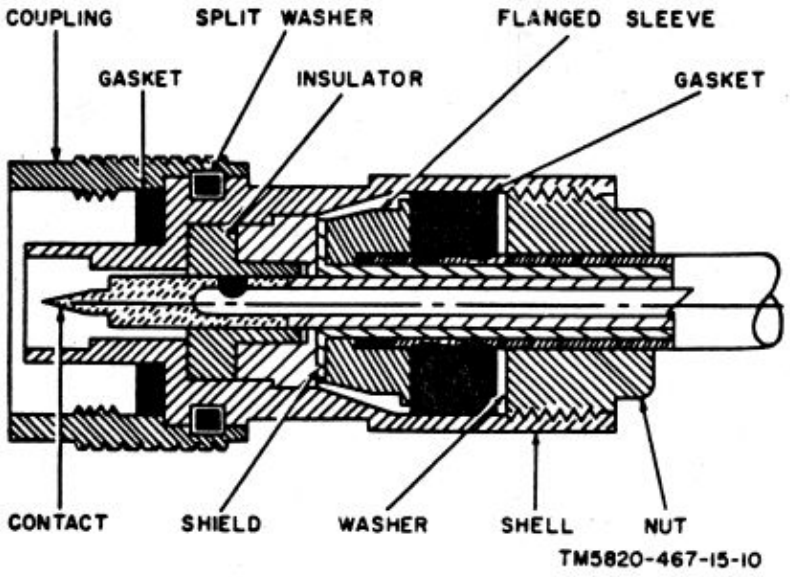

Figure 10. Cross section of rf cable and connector.

CHAPTER 4
THEORY

20. Antenna Theory

The characteristics of transmitting and receiving antennas are similar; a good transmitting antenna is also a good receiving antenna.

a. Basic Half Wave Antenna. During transmission, the rf current in the antenna wire produces a radiated field. During reception, a radiated field from a distant station antenna cuts the antenna wire and causes a current flow in the wire. In a half wave antenna, current is maximum at the center and minimum at the ends, while voltage is minimum at the center and maximum at the ends (fig. 11); therefore, impedance is minimum at the center and maximum at the ends. The impedance at the center of a basic half wave antenna is 72 ohms. The current distribution in the antenna is the same regardless of the amount of current flow; the amplitude of the current at any point on the antenna varies directly with the amplitude of the signal voltage.

b. Directional Pattern.

(1) Maximum radiation occurs at the center of a half wave antenna, because the current is greatest at that point. Minimum radiation takes place at the ends, because the current is least at the ends. Radiation is at right angles to the plane of the antenna wire and completely encircles the antenna wire. The resulting antenna directional pattern can be compared to a doughnut with the radiator passing through its center. Figure 12 shows a cross section of the doughnut shaped pattern. Although there is no radiation along the direct line of the antenna axis, there are different amounts of radiation at different angles to the axis. There is little radiation in direction OA, greater radiation in direction OB, and maximum radiation in direction OC.

(2) That part of the radiation field which travels upward, strikes the ionosphere, and is returned at a considerable distance from the radiating antenna is called a skywave. A horizontal half wave antenna is very broadly bidirectional in the horizontal plane. In practice, the antenna is oriented in the direction that provides maximum signal strength.

21. Theory of Antenna Assembly

The antenna assembly is a horizontal center-fed Hertz antenna (doublet). A center-fed Hertz is one-half wavelength long at the operating frequency and is fed at its physical center. The antenna assembly is adjustable and can be used for operating frequencies from 1.5 to 20 mc. It consists of two lengths of wire, each adjustable to a little less than a quarter wavelength at the operating frequency. The transmission line is a low-impedance coaxial cable that connects to the low-impedance point at the center of the antenna assembly. A certain amount of mismatch exists between the rf cable and the antenna, but it is not critical. Current and voltage distribution is the same as that described for a simple half wave antenna (para 20). The formula for determining the actual total length of the antenna assembly required for a particular operating frequency is:

$$\text{Length in feet} = \frac{468}{\text{Frequency in mc}}.$$

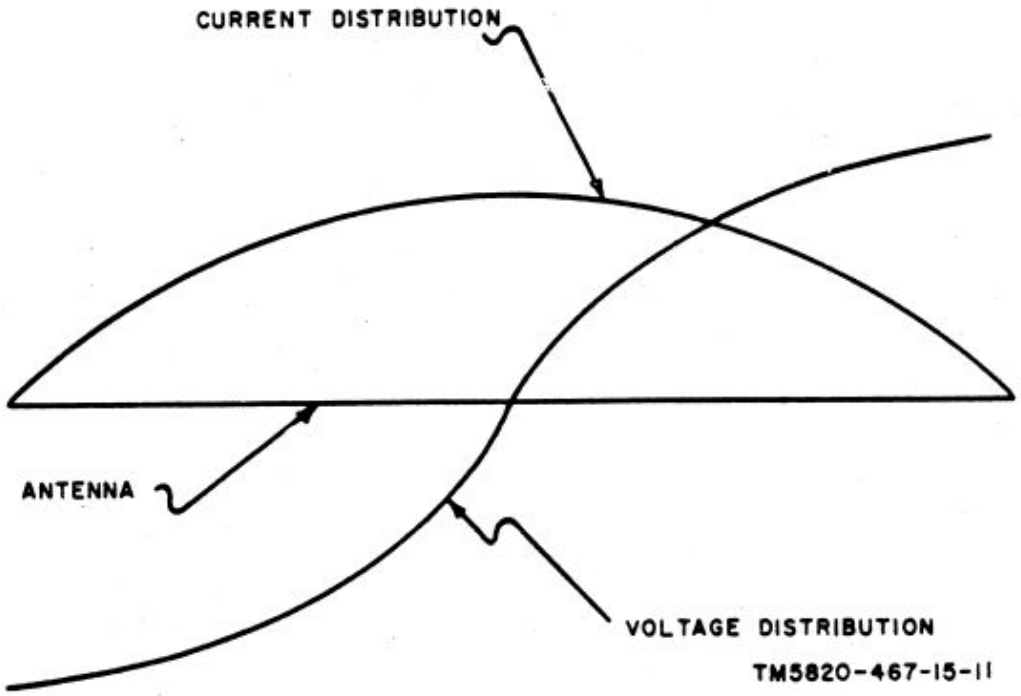

Figure 11. Current and voltage distribution in half wave antenna.

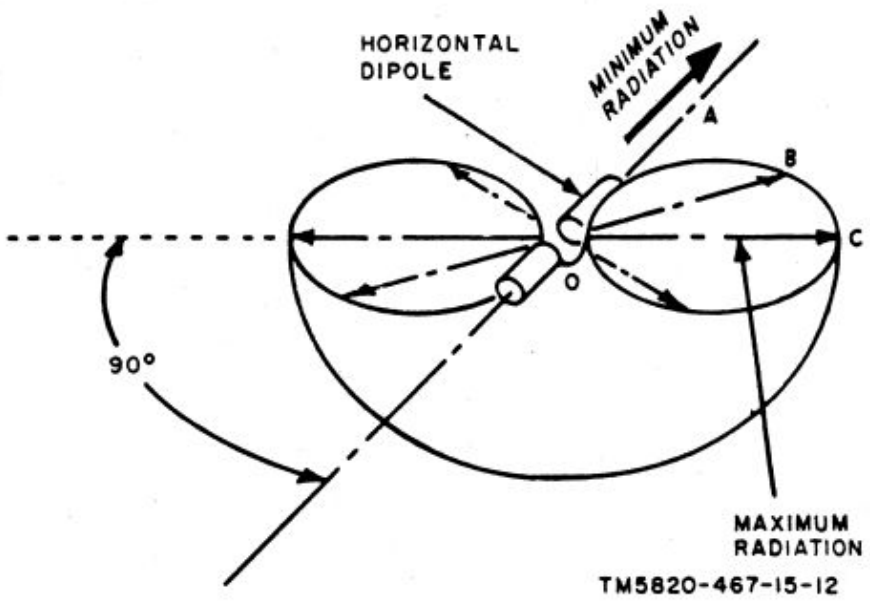

Figure 12. Radiation pattern of half wave antenna.

CHAPTER 5

SHIPMENT, LIMITED STORAGE, AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

22. Disassembly

Warning: Disconnect the equipment from the power source before performing any disassembly.

Disassemble the antenna assembly as follows:

a. Disconnect the rf cable from the transmitter.

b. Release the tied ends of the halyards and lower the antenna slowly; be careful not to damage the insulator.

c. Unfasten the antenna wire terminations from the insulator and unfasten the reel assemblies from the halyards.

d. Wind the antenna wire onto each reel assembly; use the index finger and thumb to help make a tight wind (fig. 6).

e. Unfasten the rf cable connector from the insulator and coil the cable as follows:

(1) Make one coil and tie the coil with friction tape.

(2) Coil the remainder of the cable.

f. Coil and bind the halyards.

23. Repacking for Shipment or Limited Storage

a. The exact procedure used in packing for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. The information concerning the original packing (para 8) will be helpful.

b. Pack the equipment as follows:

(1) Place the components in individual plastic bags and store them in Bag BG-175.

(2) Enclose and seal Bag BG-175 in a moistureproof paper envelope.

(3) Place the enclosed Bag BG-175 in a suitable carton.

(4) Place pads inside the carton to hold Bag BG-175 securely in place.

(5) Close and seal the carton with tape.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

24. Authority for Demolition

The destruction procedures given in paragraph 25 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon the order of the commander.

25. Methods of Destruction

Any or all of the following methods of destruction may be used. The time available will usually be the most important factor to consider in deciding which methods will be used, but the tactical situation must also be considered. If a number of antennas are in use in the same or nearby installations, it is better to demolish completely the same parts of all the antennas rather than to partially damage all the antennas.

a. Smash. Use sledges, axes, crowbars, and any other heavy tools available. First smash the reel assemblies then smash the insulator and the rf cable connectors.

b. Cut. Use any available sharp tools to cut the rf cable, the antenna wires, and the halyards in a number of places.

c. Burn. Burn as much of the equipment as is flammable. Pour gasoline over the instruction books, the rf cable, the insulator, and the halyards and ignite it.

d. Disposal. Bury or scatter all destroyed parts, or throw them into nearby waterways.

APPENDIX I

REFERENCES

Following is a list of applicable references that are available to the operator and unit repairman of Antenna Group AN/GRA-50.

SB 38-100	Preservation, Packaging, and Packing Materials, Supplies, and Equipment Used by the Army.
TM 11-5820-295-10	Operator's Manual: Radio Set AN/GRC-19.
TM 11-5820-295-20	Organizational Maintenance: Radio Set AN/GRC-19.
TM 11-5820-467-25P	Organizational, Field and Depot Maintenance Repair Parts and Special Tool Lists, Antenna Group AN/GRA-50.

APPENDIX II

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

1. General

a. This appendix lists items supplied for initial operation. The list includes tools, parts, and material issued as part of the major end item. The list includes all items authorized for basic operator maintenance of the equipment. End items of equipment are issued on the basis of allowances prescribed in equipment authorization tables and other documents that are a basis for requisitioning.

b. The columns are as follows:

(1) *Source, maintenance, and recoverability code.* Not used.

(2) *Federal stock number.* This column lists the 11-digit Federal stock number. In the absence of a Federal stock number, an interim number, for example ††L8Ra41C-12 in the description column, indicates that a Federal stock number is being processed for assignment. The L number may be used in emergencies to identify items.

(3) *Designation by model.* Not used.

(4) *Description.* Nomenclature or the standard item name and brief identifying data for each item are listed in this column. When requisitioning, enter the nomenclature and description.

(5) *Unit of issue.* Not used.

(6) *Expendability.* Nonexpendable items are indicated by NX.

(7) *Quantity authorized.* This column lists the quantity of items supplied for the initial operation of the equipment.

(8) *Illustrations.* The "Figure No." column lists the figure for identification of the items.

(1) SOURCE MAINTENANCE AND RECOVERABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION B, MODEL	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPENDABILITY	(7) QUANTITY AUTHORIZED	(8) ILLUSTRATIONS FIGURE NO	(9) ILLUSTRATIONS ITEM NO
			ANTENNA GROUP AN/GRA-50: provides transmitting and receiving facilities for med power vehicular Radio Set in freq range of 1.5 to 20 mc. † † L1Ral5-1				1	
			ITEMS COMPRISING AN OPERABLE EQUIPMENT					
			ANTENNA GROUP AN/GRA-50: (BASIC COMPONENT)		NX	1		
	Ord thru AGC		TECHNICAL MANUAL TM11-5820-467-15			2		
	6115-498-3973		BAG BG-175: f/storage of ant and components when not in use. (Not Installed)			1	2	
	5995-823-2176		CABLE ASSEMBLY RF CG-678/U (75 ft 3 in) uses cable RG-58A/U, connector UG-536/U ea end. (Not Installed)			1	2	
	5985-893-1438		HALYARD MX-2706/G			2	2	
	5970-405-8223		INSULATOR IL-4/GRA-4 (Not Installed)			1	2	
			REELING MACHINE, CABLE, HAND RC-432/G †† L1Ral5-4 (Not Installed)			2	2	
			TAPE, MEASURING: feet and inches; marked in freq reverse side; f/setting up ant; Arkay No. 859-501 †† L1Ral5-11 (Not Installed)			1	2	
			WIRE ASSEMBLY, ANTENNA CX-7303/G (160 ft 0 in) NOTE: stored and used with (but not p/o) Reel RC-432/G ††L1Ral5-6 (Not Installed)			2	2	
			RUNNING SPARES AND ACCESSORY ITEMS					
			NO PARTS AUTHORIZED FOR STOCKAGE AT FIRST ECHELON					

APPENDIX III

MAINTENANCE ALLOCATION

Section I. MAINTENANCE ALLOCATION

1. General

a. This section assigns maintenance functions and repair operations to be performed by the lowest appropriate maintenance echelon.

b. Columns in the maintenance allocation chart are as follows:

(1) *Part or component.* This column shows only the nomenclature or standard item name. Components and parts comprising a major end item are listed alphabetically.

(2) *Maintenance function.* This column indicates the various maintenance functions allocated to the echelon capable of performing the operations.

(a) Service. To clean and to preserve.

(b) Inspect. To verify serviceability and to detect incipient electrical or mechanical failure by scrutiny.

(c) Test. To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc.

(d) Replace. To substitute serviceable assemblies and parts for unserviceable components.

(e) Repair. To restore an item to serviceable conditions through correction of a specific failure or unserviceable condition. This function includes, but is not limited to, inspecting, cleaning, preserving, adjusting, replacing, welding, riveting, and straightening.

(3) *1st, 2d, 3d, 4th, 5th echelon.* The symbol X indicates the echelon responsible for performing that particular maintenance operation, but does not necessarily indicate that repair parts will be stocked at that level. Echelons higher than the echelon marked by X are authorized to perform the indicated operation.

(4) *Tools required.* This column indicates codes assigned to each individual tool equipment, test equipment, and maintenance equipment referenced. The grouping of codes in this column of the maintenance allocation chart indicates the tool, test, and maintenance equipment required to perform the maintenance function.

(5) *Remarks.* Entries in this column will be utilized when necessary to clarify any of the data cited in the preceding columns.

c. Columns in the allocation of tools for maintenance functions are as follows:

(1) *Tools required for maintenance functions.* This column lists the tools, test, and maintenance equipment required to perform the maintenance functions.

(2) *1st, 2d, 3d, 4th, 5th echelon.* The dagger (†) symbol indicates the echelons allocated the facility.

(3) *Tool code.* This column lists the tool code assigned.

2. Maintenance by Using Organizations

When this equipment is used by signal services organizations organic to theater headquarters or communications zones to provide theater communications, those maintenance functions allocated up to and including fourth echelon are authorized to the organization operating this equipment.

3. Mounting Hardware

The basic entries of the maintenance allocation chart do not include mounting hardware such as screws, nuts, bolts, washers, brackets, clamps, etc.

Section II. MAINTENANCE ALLOCATION CHART

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH	(4) 2ND ECH	(5) 3RD ECH	(6) 4TH ECH	(7) 5TH ECH	(8) TOOLS REQUIRED	(9) REMARKS
ANTENNA GROUP AN/GRA-50	service	X						
	inspect	X						
	test		X				1	Checking cable for leakage and continuity
				X			2	Checking cable for leakage and continuity
	repair		X				3	Replacement of components
	repair			X			4	Repair of components
CABLE ASSEMBLY RF	repair			X			4	
HALYARD MX-2706/G	replace		X				3	
	repair		X					Replacement of weight
				X			4	Repair of Halyard
INSULATOR IL-4/GRA-4	replace		X					
	repair			X			4	
REEL, CABLE	replace		X					
	repair			X			4	
WIRE ASSY ANT CX-7303/G	replace		X					
	repair			X			4	

Section III. ALLOCATION OF TOOLS FOR MAINTENANCE FUNCTIONS

(1) TOOLS REQUIRED FOR MAINTENANCE FUNCTIONS	(2) 1ST ECH	(3) 2ND ECH	(4) 3RD ECH	(5) 4TH ECH	(6) 5TH ECH	(7) TOOL CODE	(8) REMARKS
AN/GRA-50 (continued)							
MULTIMETER AN/URM-105		†				1	
MULTIMETER TS-352/U			†	†	†	2	
TOOL EQUIPMENT TE-41		†				3	
TOOL EQUIPMENT TE-113			†	†	†	4	

By Order of Secretary of the Army:

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USAOMC (3)
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Army Tml (1)
POE (OS) (1)
OSA (1)
AMS (1)
Sig Fld Maint Shops (3)
JBUSMC (2)
Units org under fol TOE:
10–105 (2)
10–106 (2)
10–107 (2)
10–445 (2)
11–7 (2)
11–16 (2)
11–57 (2)
11–98 (2)
11–117 (2)
11–155 (2)
11–500 (AA–AE) (4)
11–557 (2)
11–587 (2)
11–592 (2)
11–597 (2)

NG: State AG (3); Units — Same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

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