TECHNICAL MANUAL

OPERATOR'S MANUAL

RADAR SETS

AN/TPS-25, AN/TPS-25A AND

AN/TPS-25(X E-2)

(NSN 5840-00-082-4128)

This copy is a reprint which includes current pages from Change 1.

HEADQUARTERS, DEPARTMENT OF THE ARMY

October 31, 1985

CHANGE

No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 1 September 1987

OPERATOR'S MANUAL

RADAR SET AN/TPS-25, AN/TPS-25A

AND AN/TPS-25(XE-2)

(NSN 5840-00-082-4128)

TM 11-5840-217-10, 31 October 1985, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page. Added or revised illustrations are indicated by a vertical bar adjacent to the identification number.

Remove Pages	*Insert Pages*
A and B	A and B
i	i/(ii blank)
1-1 through 1-12	1-1 through 1-11/(1-12 blank)
1-21 and 1-22	1-21 and 1-22
1-27 and 1-28	1-27 and 1-28
2-3 through 2-8	2-3 through 2-8
2-21 through 2-28	2-21 through 2-28
2-37 and 2-38	2-37 and 2-38
2-43/(2-44 blank)	243/(2-44 blank)
2-49 through 2-54	2-49 through 2-54
2-57 and 2-58	2-57 and 2-58
2-61 and 2-63	2-61/(2-62 blank) and 2-63/(2-64 blank) (in back of manual)
2-65 through 2-70	2-65 and 2-67/(2-68 blank)
2-71 through 2-78	2-71 through 2-78
3-1 and 3-2	3-1 and 3-2
3-11 and 3-12	3-11 and 3-12
3-15 through 3-20	3-15 through 3-20
4-3 and 4-4	4-3 and 4-4
4-9 and 4-10	4-9 and 4-10
5-1 and 5-2	5-1 and 5-2
5-7 and 5-8	5-7 and 5-8
A-1/(A-2 blank)	A-1/(A-2 blank)
C-3/(C-4 blank)	C-3/(C4 blank)
Index 1, Index 2 and Index 3	Index 1, Index 2 and Index 3

2. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R.L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-36 literature requirements for AN/TPX-25; A; XE-2.

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1. DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL
2. IF POSSIBLE, TURN OFF THE ELECTRICAL POWER
3. IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL
4. SEND FOR HELP AS SOON AS POSSIBLE
5. AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

WARNING
DANGEROUS VOLTAGES EXIST IN
THIS EQUIPMENT

Be careful of the 300-volt plate and power supply circuits, and the 115-volt ac line connections.

DON'T TAKE CHANCES
EXTREMELY DANGEROUS VOLTAGES
EXIST IN THE FOLLOWING UNITS:

Radar Modulator MD-344/TPS-25	3,800 volts (pulse) dc, 7,600 volts (pulse) dc
Radar Receiver-Transmitter RT-500/ TPS-25	-750, -760 volts dc, 3,800 volts (pulse) dc, 16,000 volts (pulse) dc
Radar Set Control C-2715/TPS-25	2,000 volts dc
Power Supply PP-2166/TPS-25	845 volts ac
Servo Data Coordinator SN-2311 TPS-25	1,000 volts ac, 2,000 volts dc

GASOLINE HANDLING

Do not refuel the generator and heater and do not handle or leave open gasoline containers or plastic gasoline containers in the vicinity of the radar set while the radar transmitter is on. (para 2-18)

MICROWAVE RADIATION HAZARD

Do not stand in front of the antenna reflector while the radar set is operating. The transmitted energy can cause severe RF burns. Radiation levels, extremely dangerous to personnel, exist in the radar beam up to a distance of 40 feet from the antenna. Exposure of personnel to the stationary beam from the antenna at this distance should be limited to 10 minutes (see *warning*, ch. 2, sec. II).

RADIOACTIVITY HAZARD

Electron tube types TU-1271, OA2WA, 6627/OB2WA, and 5783WA, used in this radar set, are radioactive. Dangers of poisoning from the radioactive materials contained in the tubes exist when the tube is broken. For detailed instructions on handling, storing, and disposing of radioactive tubes, see TB SIG 225.

POISONOUS FUMES FROM
SELENIUM RECTIFIERS

Selenium rectifiers are used in Radar Receiver-Transmitter RT-500/TPS-25. The failure of selenium rectifiers can result in the liberation of poisonous fumes and the deposit of poisonous selenium compounds. If a rectifier burns out or arcs over, the odor is strong. Provide adequate ventilation immediately. *Avoid inhaling the fumes and do not handle the damaged rectifier until it has cooled.*

Technical Manual
No. 11-5840-217-10

HEADQUARTERS,
DEPARTMENT OF THE ARMY
Washington, DC, *31 October 1985*

OPERATOR'S MANUAL

RADAR SET AN/TPS-25, AN/TPS-25A

AND AN/TPS-25(XE-2)

(NSN 5840-00-082-4128)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSE-ME-MP, Fort Monmouth, New Jersey 07703-5000.
In either case, a reply will be furnished direct to you.

TABLE OF CONTENTS

This manual supersedes TM 11-5840-217-10, 10 June 1959, Including all changes.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual describes Radar Set AN/TPS-25, AN/TPS-25A and AN/TPS-25(XE-2), and covers its initial, operation, operator's maintenance, preparation for short distance movement, and destruction of the equipment. It includes operation under usual and unusual conditions, cleaning and inspecting the equipment, and replacement of parts available to first echelon maintenance. The maintenance allocation chart will appear in the second echelon portion of the technical manual.

NOTE

Official nomenclature that includes (*) is used to designate all models of the equipment covered in this manual.

1-2 Maintenance Forms, Records, and Reports

a. Reports of Maintenance and Unsatisfactory Equipment Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750 as contained in Maintenance Management Update.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73B/AFR 400-54/MCO 4430.3H.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.165.

1-3. Destruction of Army Materiel to Prevent Enemy Use

Instructions for destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

1-4. Administrative Storage

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage the PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in TM 740-90-1.

1-5. Consolidated Index of Army Publications and Blank Forms

Refer to the latest issue of DA Pam 25-30 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

1-6. Reporting Equipment Improvement Recommendations (EIR)

If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-PA-MA-D, Fort Monmouth, NJ 07703-5000. We'll send you a reply.

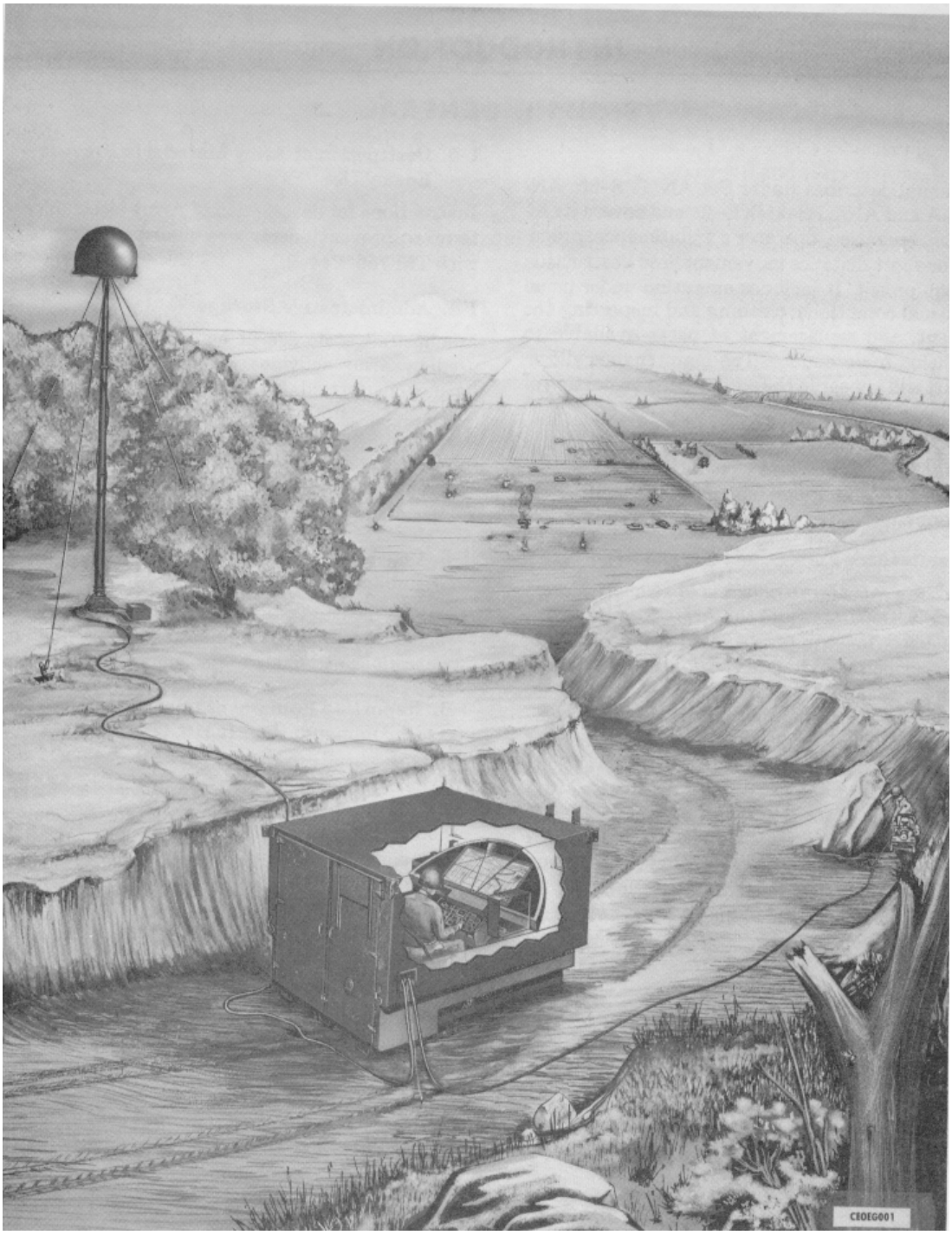


Figure 1-1. Radar Set AN/TPS-25 in Use.

Section II. DESCRIPTION AND DATA

1-7. Purpose and Use

Radar Set AN/TPS-25 (fig. 1-1, 1-2 and 1-3) is a transportable battlefield surveillance radar designed to detect the presence of moving targets and to supply information as to their location. With associated computing equipment, the radar set can detect the presence of a moving person at a range of 12,000 meters or a moving vehicle of the same relative size as a jeep at a range of 18,280 meters. The minimum range of the set is approximately 450 meters. Several modes of operation are provided which enable the radar set to first detect, then accurately locate, a target. The various capabilities of the radar set in this process are discussed below.

a. Search. The radar set is capable of searching for targets within a range of 450 to 18,280 meters, through 6,750 mils of azimuth, and at elevations from -265 to +265 mils. Searching in both azimuth and range can be manual or automatic.

(1) *Azimuth searching.* The full 6,750 mils of azimuth is possible only with manual control of the antenna. The azimuth search function is ordinarily used in a sector scan capacity wherein the radar is directed to the center of a sector of 180, 360, or 540 mils azimuth and scans it automatically. For sector scanning of a 180 mil area, the antenna is fixed in positions since the radiated beam width (10°) in a search condition is 180 mils. Azimuth searching is to determine the approximate location of the target in azimuth.

(2) *Range searching.* Ordinarily, the radar set searches a sector of terrain 900 meters forward from the point in range for which the range computer is set. When azimuth has been approximated, lateral rotation of the antenna is stopped but the radar continues to search in range. After the range of the target has been approximated, it can be narrowed by eliminating the automatic ranging feature and restricting the range surveillance to the 75-meter range gate width. In this condition, range sweep is controlled manually.

b. *Tracking.* The lateral width of the beam can be reduced from 10° to 20 for tracking purposes. The set is controlled manually in both the azimuth and range directions. 'Tacking is used to accurately locate the target in both range and azimuth. Ways are provided for peaking both the audio and the video return signals as a means of pinpointing the target.

c. *Artillery-Fire Surveillance.* Location of the terminal end of artillery and mortar fire is a secondary mission of the radar set. For such surveillance, the radar set is directed at the area to be observed and, with the antenna set at a low elevation, the area is either sector scanned or manually scanned. The operator can sometimes detect on the scope in the radar set control (or aurally by means of headset or loudspeaker) indications of shell burst on the ground in the area under surveillance. This operation may be used principally for night (or poor visibility) observation of shell hits in enemy held territory.

1-8. Technical Data

a. General

Type of radar system	X-band, noncoherent, doppler type.
Peak X and Y ground range coordinate errors.	57 meters at 900 meters; 72 mete at 4,500 meters; 94 meters at 9,000 meters; 140 meters at 18,280 meters.
Azimuth coverage:	
Limits	6,750 mils.
With plotting board	Any predetermined 3,200 mil sector.
Automatic search sector scan.	180, 360, or 540 mis.
Azimuth accuracy.	±2 1/2 mils in winds up to 256 mph.
Azimuth determination	Counter reading correlated with peak audio response as shown on oscilloscope or heard on loudspeaker and/or headset.
Maximum range	18,280 meters for moving vehicle (jeep size); 12,000 meters for moving person.
Minimum	450 meters.
Range determination	Counter reading correlated with first audio response heard either on loudspeaker and/or headset or as shown on the oscilloscope.
Range resolution	250 feet (all ranges).
Peak ground range errors.	42 meters at 900 meters; 49 meters at 4,500 meters; 58 meters at 9,000 meters; 75 meters at 18,280 meters.
Azimuth resolution	Resolves targets separated in imuth by 1 beam width.
Elevation coverage limits.	± 265 mile from horizontal.
Elevation determination	Counter reading correlated with peak audio response as shown on oscilloscope or heard on loudspeaker and/or headset.
Automatic azimuth tracking scan rate.	23 mils per second.
Range strobing rate	137 meters per second.
Antenna tower	Three mast sections, each approximately 6 1/2 ft long. (May or may not be used, depending on tactical situations.)
Shelter	Electrical Equipment Shelter S-124/G.
Assembly time	Refer to paragraph 2-6c.

b. Transmitting System.

Frequency	9.375 ± 30 mc.
Wavelength	3.02 cm.

Peak power output ..... 43 kw.
Average power output ..... 40 w.
Pulse repetition rate ..... 1,850 ppm.
Pulse width ..... 0.5 μ sec.
Pulse amplitude ..... 16,000 volts.
Duty cycle ..... 0.000925.
Source of RF power..... Fixed tuned magnetron oscillator (4J52A).
Modulation ..... pulse

c. RF System.
Transmission line..... Waveguide sections.
Radiating element ..... Modified perabolic reflector with dual feedhorn.
Horizontal beamwidth:
Search ..... 10° in positions 1, 2, and 3 of AUTOMAN selector switch.
Track..... 2° in positions 4 and 5 of AUTOMAN selector switch.
Vertical beamwidth ..... 4°
Attenuation of lobes:
Azimuth 10° search..... 25 db below main lobe. beamwidth.
Azimuth 2° search..... 20 db below main lobe. beamwidth.
Vertical beamwidth ..... 18 db below main lobe-at 0° antenna elevation.
Polarization:
10° beam ..... Vertical
2° beam ..... Horizontal.
VSWR at input to duplexer.
Duplexer ..... Short-slot hybrid on each side of dual integral cavity tr tube.

d Receiving System
Type..... Superheterodyne with reflex klystron local oscillator, and using 60-mc IF amplifier with cascode input. Local oscillator controlled by afc circuits.
Operating frequency ..... 9,3756 ± 30 mc.
Local oscillator tube ..... Klystron tube type, 6975. type.
Local oscillator ..... 9.435 ±30 mc. (60 mc above transmitter frequency.)
Intermediate frequency ..... 60 ± .3 mc.
IF amplifier bandwidth ..... 4 mc at 3 db.
Afc
Type..... transitron control of local oscillator.
IF ..... 60 mc.
Control voltage ..... -410 volts to - 470 volts dc. limits.
Iocal oscillator sweep frequency. 2 cycles per second.
Receiver sensitivity ..... -95 dbm minimum discernible
System sensitivity .....Detects walking man moving toward or away from radar position at a range of 12,000 meters or a jeep moving toward or away from radar position at a range of 18,280 meters.

e. Indicating System
Presentation:
Visual .....Counter indicators, plotting board and cathode-ray tube.
Aural ..... Headset and/or loudspeaker.
Cathode-ray tube.....3ACP1-A.
Sweep range .....900 meters.

f. Power Source.
Required for operation:

Voltage	115 ± 5% volts ac, 400 ±5% cycle, single phase.
Wattage less shelter).	1.17 KW; p.f. = .955.
Wattage (including shelter).	1.515 KW; p.f. = .955.
Average current less shelter).	10.2 amperes.
Average current (including shelter).	13.75 amperes.
Surge current (less shelter).	41.4 amperes.
Surge current (including shelter).	47.3 amperes.

g. Power Dissipation (Approximate).
receiver-transmitter .....300 w.
Modulator..... 200 w.
Coordinator..... 275 w.
Radar set control .....75 w.
Power supply.....125 w.
Shelter (including lights, fans, and heater). .....345 w.

1-9. Table of Components (fig. 1-2, 1-3, and 1-5)

a. Equipment Components. The components of Radar Set AN/TPS-25, less accessories, tools and running spares, are listed in the following chart. The chart also lists the weights and dimensions of the components. Accessories and tools are listed in *b* below. The running spares supplied with the equipment are listed in *c* below.

Component	Quantity	Height (in)	Depth (in)	Width (in)	Unit weight (lb)
Antenna AS-981/TPS25	1	44	48	48	153
Mast AB-568/TPS 25	3	82 1/2 ea	------	9 1/2 dia	34
Serve Data Coordinator SN-231/TPS25	1	16 1/4	22 1/2	21	88
Radar Modulator MD-344/TPS25	1	11 1/2	16 7/8	16	51
Tactical Display Plotting Board PT-441/TPS-25	1	51[b]	40	65 3/4	89
Power Supply PP-2166/TPS25	1	11 1/2	16 5/8	16	54
Radar Set Control C-2715/TPS-25	1	13	14 1/2	24 1/4	70
Radar Receiver- transmitter RT-500/TPS-25	1	22	27 1/2	24	124
Electrical Equipment Shelter S-124/G (transportable)	1	80	112	72	1,370 (empty)
Heater (p/o shelter)	1	7	12 1/2	11 1/2	
Accessories and tools (*b* below)					
Running spares (*c* below)					

[a] Spare supplied
[b] With legs folded, 11 5/8 inch

b. Accessories and Tools (fig. 1-16 through 1-18 and 2-43). The following accessories and tools stored in the shelter, are supplied with Radar Set AN/TPS-25. The accessories include the interconnecting cables for the equipment and miscellaneous items for the proper erection of the radar set.

Item	Quantity	Symbol No.	Additional data
Electrical Power Cable Assembly CX-4601/U (1 ft 6 in).	1	2603	Interconnects shelter wall connector J2607 with the heater.
Electrical Special Purpose Cable Assembly CX-4592/U (25 ft).	1	W2801	Interconnects antenna to receiver-transmitter.
Electrical Special Purpose Cable Assembly CX-4594/U (5 ft 6 in.).	1	W2802	Interconnects receiver/transmitter to modulator. Stowed in storage box
Electrical Special Purpose Cable Assembly CX-4593/U (2 ft).	I	W2803	Interconnects receiver/transmitter to modulator. Stowed in storage box
Electrical Special Purpose Cable Assembly CX-4595/U (25 ft).	1	W2804	One of the cables that interconnects receive transmitter to coordinator.
Electrical Special Purpose Cable Assembly CX-4596/U (100 ft).	1	W2805	One of the cables that interconnects receive-transmitter to coordinator.
Electrical Special Purpose Cable Assembly CX-4595/U (100 ft).	1	W2806	One of the cables that interconnects receive transmitter to coordinator.
Electrical Special Purpose Cable Assembly CX-4598/U (5 ft 6 in).	1	W2807	Interconnects coordinator to radar set control
Electrical Special Purpose Cable Assembly CX-4591/U (5 ft 6 in.).	I	W2808	Interconnects coordinator to radar set control
Electrical Special Purpose Cable Assembly CX-4596/U (5 ft 6 in.).	1	W2809	Interconnects coordinator to radar set control
Electrical Special Purpose Cable Assembly CX-45991U (3 ft).	1	W2810	Interconnects plotting board to radar set control
Radio Frequency Cable Assembly CG-1719/U (12 ft).	1	W2811	Interconnects coordinator to loudspeaker.
Electrical Special Purpose Cable Assembly CX-4597/U (4 ft).	1	W2812	Interconnects coordinator to power supply.
Electrical Power Cable Assembly CX-4600/U (100 ft).	1	W2813	One of the cables that interconnects engine generator to power supply.
Electrical Power Cable Assembly CX-4602/U (1 ft 6 in.).	1	W2814	Interconnects generator set to power supply. Connected to generator set when shipped from factory.
Cable reel assembly (30 in.)	1	.....	Reel for cable assemblies W2805 and W2813.
Cable reel assembly (30 in.)	1	.....	Reel for cable assemblies W2801 and W2806.
Cable reel assembly (23 in.)	1	.....	Reel for cable assembly W2804.
Permanent Magnet Loudspeaker LS451/G.	1	LS2801	Aural observation of target under normal conditions.
Electrical Headset H-171/G .	1	HT2801	Aural observation of target under noisy conditions or under certain tactical conditions.
30°° map hold down (mounted on plotting board fig. 1-7).	1	.....	Holds map in position on plotting board.

Item	Quantity	Symbol No.	Additional data
Storage box (fig. 1-5) (p/o shelter)	1		For stowing W2802, W2803, W2816, protective covers (2), headset, spare magnetron, and spare cathode-ray tube.
Accessories box (fig. 1-5) (p/o shelter)	1		For tools and antenna installation accessories.
Spare parts box	1		For spare parts.
Measuring rope	2		For installation of antenna
Base plate	1		Mounting plate for receiver-transmitter.
Base plate stake	3		Anchors base plate to ground.
Dacron guy rope	2		Guy rope for boom
Antenna guy-wire assembly	4		Antenna guy wires.
Winch hoist	4		Raising antenna and tension adjusting on antenna guy-wire assembly.
Winch-hoist handles	4		For operating winch hoist.
Guy-wire stake	5		Anchor posts for antenna guy wires.
Stake plate	5		Added to guy wire stake when soft or sandy soil is encountered.
Chain support	1		Used between first and fifth guy wire stakes (fig. 2-26).
Electrical ground stake assembly	1	E2801, W2815	Electrical ground to earth.
Protective cover	8		Protects mast sections, antenna, and receiver transmitter waveguide from dust and dirt.
Ac extension cable	1	W2816	Used for supplying ac power to maintenance equipment outside shelter.
Boom (2 sections)	1		Antenna installation tool
Reversible ratchet wrench	2		Installation tool.
Straight wall socket	2		Installation tool.
Reversible ratchet wrench extension bar.	2		Installation tool
Open-end box wrench	2		Installation tool
Shelter tiedown cable	4		Secures shelter to transporting vehicle.
Sledge hammer	2		Installation tool
Shelter lifting cable	1		Used to remove shelter from transporting vehicle.
Operator's folding chair	1		Operator's seat.
Shelter chock (mounted on outside of shelter (fig1-2)..	3		Shelter transportation accessories.
Gas can	2		Stores gasoline for shelter heater and engine generator.
Gas can feed line	1		Adapts gas can to supply gasoline for the shelter heater.
Fire extinguisher	1		Mounted in roadside rear of shelter (fig. 2-18).
Stimulator, Radar Target SM-201/TPS-25 (corner reflector, fig. 1-17)..	1		Supplied only with AN/TPS-25A. Used to stimulate a moving target when orienting the antenna.

c. Running Spares. The following running spares, stored in the spare parts box, are supplied with Radar Set AN/TPS-25. Spares are supplied for all normally expendable items, such as electron tubes, lamps, and fuses. The chart lists the quantity of running spares supplied.

Running spares - radar set

Description	*Quantity*
Lamp, glow (BU 10001) NE-51	2
Tube, electron (TU 1271)	1
Tube, klystron, 6975	1
Rectifier, JAN IN23WE	2
Tube, electron, 12AT7WA	2
Tube, electron 3ACP1A (in storage box)	1
Tube, electron, 3B24WA	1
Tube, electron, 4C35A	1
Tube, electron, 5651WA	1
Tube, electron, 5654/6AK5W	2
Tube, electron,5687	2
Tube, electron, 5726/6AL5W	4
Tube, electron, 5751	4
Tube, electron, 5814A	4
Tube, electron, 5842	1
Tube, electron, 5R4WGA	1
Tube, electron 6005/6AQ5W	1
Tube, electron, 6080WA	1
Tube, electron, 6627/OB2WA	1
Tube, electron, 6AG7Y	1
Tube, electron, 6AH6	1
Tube, electron, 6AU6WA	2
Tube, electron, OA2WA	1
Tube, electron, 5726/6AS6W	1

Running spares-radarset - Continued

Running spares - radar set - Continued	
Description	*Quantity*
Lamp, incandescent, MS25237-327	4
Lamp, incandescent, MS25231-313	3
Tube, magnetron, 4J52A (in storage box)	1
Rectifier, IN23C	1
Fuse, F02G1R50B	12
Fuse, F02G1ROOB	12
Fuse, F02G1R50A	12
Fuse, F02G2ROOA	36
Fuse, F02G3ROOA	12
Fuse F02GR500A	18
Fuse, F02GR125A	12
Fuse, F02GR2560A	12
Fuse, F02GR750A	36
Fuse, F03D20ROA	12
Fuse F03G5ROOA	6
Fuse, F03G8ROOA	12
Fuse, F03G10ROA	24
Fuse, F03G12ROA	12
Bulb, light, GE60A (shelter)	1

1-10. Common Names

A list of the nomenclature assignments for the components of Radar Set AN/TPS-25 is given below. A common usage name is indicated for each component.

NOTE

The common names given in the chart apply also to the corresponding nomenclatured units in Radar Set AN/TPS-25A.

Common name	*Nomenclature*
Antenna	Antenna AS-981/TPS-25.
Coordinator	Servo Date Coordinator SN-231/TPS-25.
Generator Set	Generator Set MEP 021A 3kW
Headset	Electrical Headset H-171/G.
Loudspeaker	Permanent Magnet Loudspeaker LS-451/G.
Mast	Mast AB-588/TPS 25.
Modulator	Radar Modulator MD-344/TPS-25.

Common name	*Nomenclature*
Receiver-transmitter	Radar Receiver-Transmitter RT-500/TPS-25.
Plotting board	Tactical Display Plotting Board PT-441/TPS-25.
Power supply	Power Supply PP-2166/TPS-25.
Radar set control	Radar Set Control C-2715/TPS-25.
Shelter	Electrical Equipment Shelter S-214/G.
Corner reflector	Simulator, Radar Target SM-201/TPS-25 (supplied only with AN/TPS-25A).

1-11. Description of Equipment

Radar Set AN/TPS-25 (fig. 1-2 and 1-3) is mounted in Electrical Equipment Shelter S-124/G. All components of the radar set are secured within the shelter (fig. 2-16) during transit to prevent damage. Quick release latches for rapidly removing the units of the radar set for remote operation outside the shelter are provided. Mounting brackets for the operation of the coordinator, plotting board, and associated components within the shelter are also provided. In operation the antenna, receiver-transmitter, modulator, antenna mast sections (if used), and interconnecting cables for the components are removed from the shelter and set up in the field. The generator set feeds power to the shelter power distribution box which distributes power to the shelter fans, lights, heater, and the various units of the radar set. The main power switch for the radar set is located on the power supply. All important operating controls are located on the radar set control.

NOTE

Generator set MEP 021A is not a component of the radar set, but is necessary for operation and is issued as a separate item.

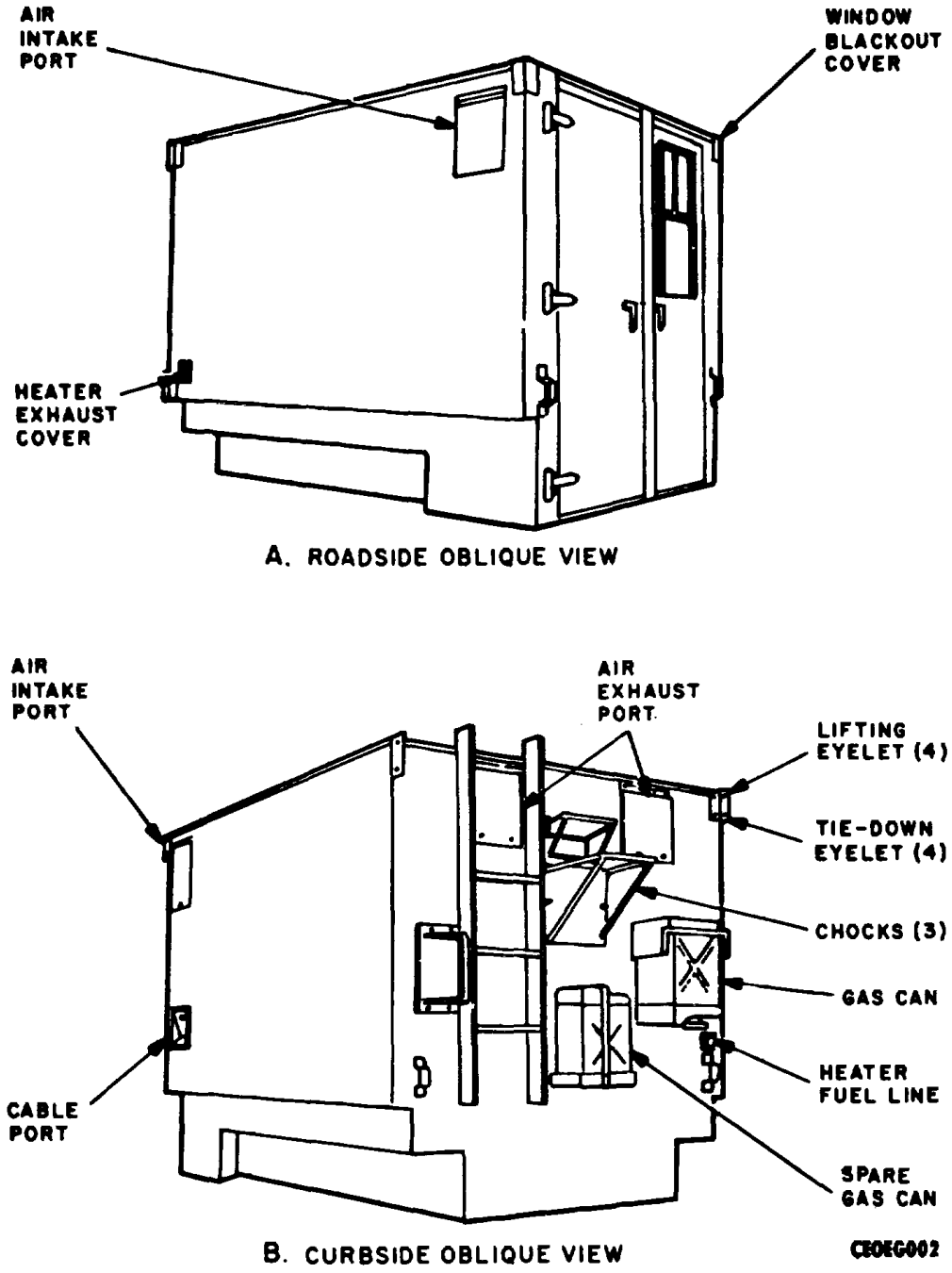


Figure 1-2. Electrical Equipment Shelter S-124/G.

1-12. Major Components (fig. 1-5 through 1-13)

Radar Set AN/TPS-25 consists of seven major components. The radar set control, power supply, plotting board, and coordinator. The modulator (fig. 1-10), receiver-transmitter (fig. 1-11), and antenna (fig. 1-13) are placed near each other and are connected by an interconnecting cable to the components inside the shelter.

a. **The receiver-transmitter and antenna may be located at any suitable position up to approximately 225 feet from the shelter**.

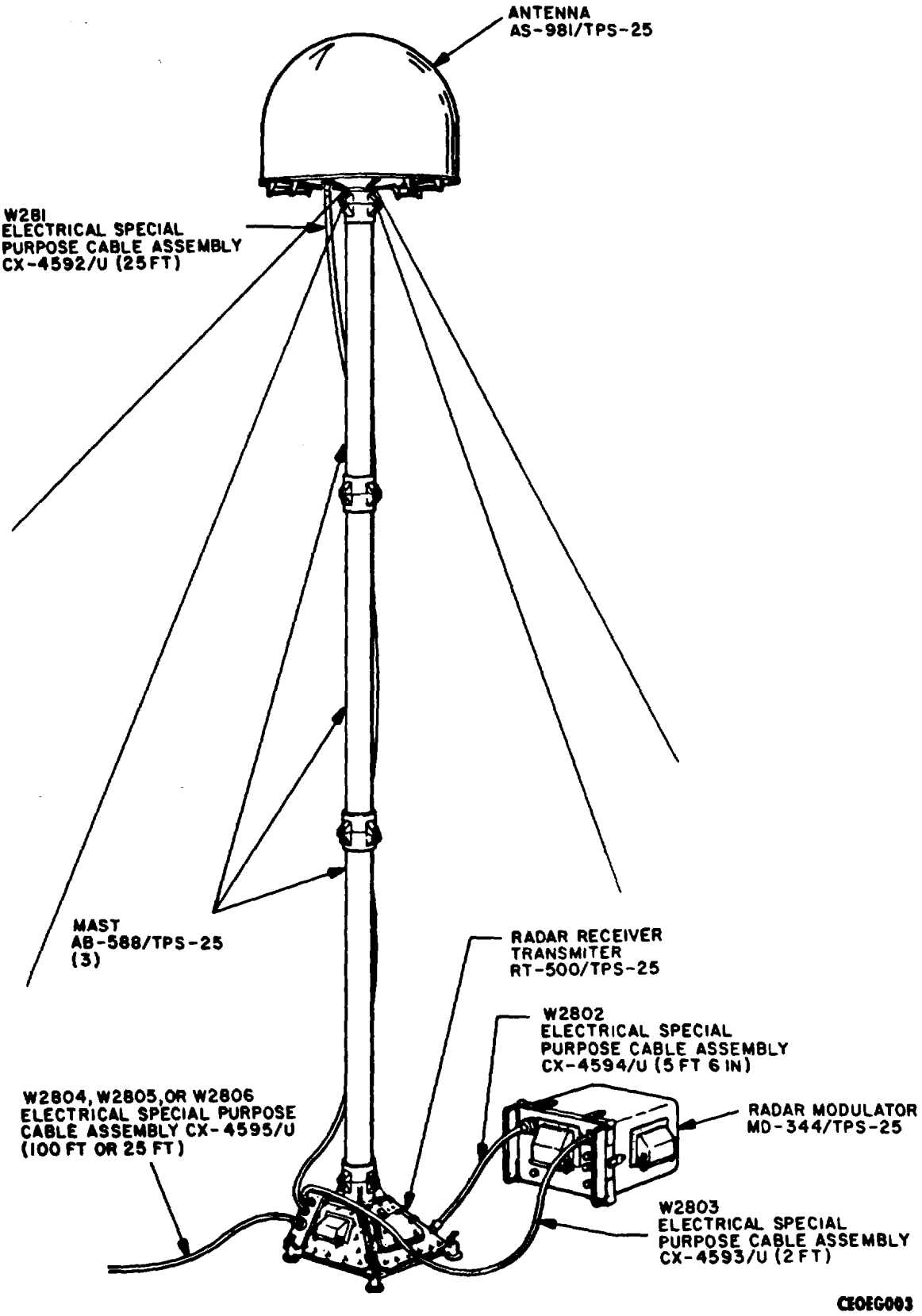


Figure 1-3. Antenna AS-981/TPS-25, Radar Modulator MD-344/TPS-25, and Radar Receiver-Transmitter RT-500/TPS-25.

b. The modulator is located at a distance of approximately 2 feet from the receiver/transmitter.

c. The engine generator may be located at any suitable position within approximately 100 feet of the shelter but should be at maximum cable distance to alleviate noise disturbance.

d. The major components ((1)-(4) below, are located inside the shelter (fig. 1-5).

(1) The coordinator (fig. 1-6) is mounted on the floor at the right front of the shelter under the plotting board.

(2) The plotting board (fig. 1-7) is mounted on the wall at the front of the shelter.

(3) The radar set control (fig. 1-8) is mounted on the front of the plotting board.

(4) The power supply (fig. 1-9) is mounted on the floor at the left front of the shelter under the plotting board.

1-13. Deleted

1-14. Description of Shelter (fig. 1-2)

a. Electrical Equipment Shelter S-1241G is approximately 80 inches high, 72 inches wide, and 112 inches long. It weighs approximately 2,960 pounds when the radar set is included. When being transported, the shelter contains all the radar set components (fig. 2-16) and the running spares, tools, cables, and fixtures necessary for installation. The shelter can be transported in a 2¼/2-ton cargo truck or in a 3/4-ton or 1 1/2-ton trailer (M-105 type).

b. Installation of a deep fording kit (not supplied with the shelter) permits the transported shelter to be towed at a rate of 5 miles per hour through a body of water 60 inches deep with no resulting water damage to the equipment. The method used for installing the deep fording kit is covered in paragraph 5-16.

c. Heating and ventilating equipment included in the shelter make it possible to operate within the shelter under extreme weather conditions.

1-15. Description of Coordinator (fig. 1-6)

The coordinator consists of a chassis and front panel assembly constructed of heavy gage aluminum which slides into an aluminum alloy case where it is secured by trunk latches. Fuses, an ac line voltmeter, a meter light switch, input and output connectors, and an air exhaust port mount through the front panel. The case has an air intake port on each side. The coordinator contains the servo amplifier circuits for the range, azimuth, elevation, and X and Y servos, as well as the circuits which sample, detect, and amplify the audio doppler return and those that produce the range gate. In addition, the coordinator contains the horizontal deflection circuit and high-voltage supply for the cathode-ray tube which is located in the radar set control.

1-16. Description of Plotting Board (fig. 1-7)

a. The plotting board when used in conjunction with the radar set control, provides a visual means of locating and tracking the movements of a target on a map of the area being covered by the radar. When a moving target is being tracked, an indicator light, focused from within the plotting board, supplies a visual indication of target location on the map. The indicator light is mounted on a carriage which moves back and forth on the plotting board arm as the target is tracked in range. The arm itself consists of two tubular stainless steel rails, pivoted at one end, which follows the movement of the antenna in azimuth. During automatic search, the light defines an arc at the minimum range of the area under surveillance.

b. The plotting board consists of a gear box and map table with a transparent Plexiglass top. Three U-shaped legs mounted under the plotting board are installed when the unit is used outside the shelter. In transport the legs are reversed and stowed under the board to reduce volume. In addition, provision has been made for mounting a 30° map holddown, as illustrated in figure 1-7.

Figure 1-4. Deleted

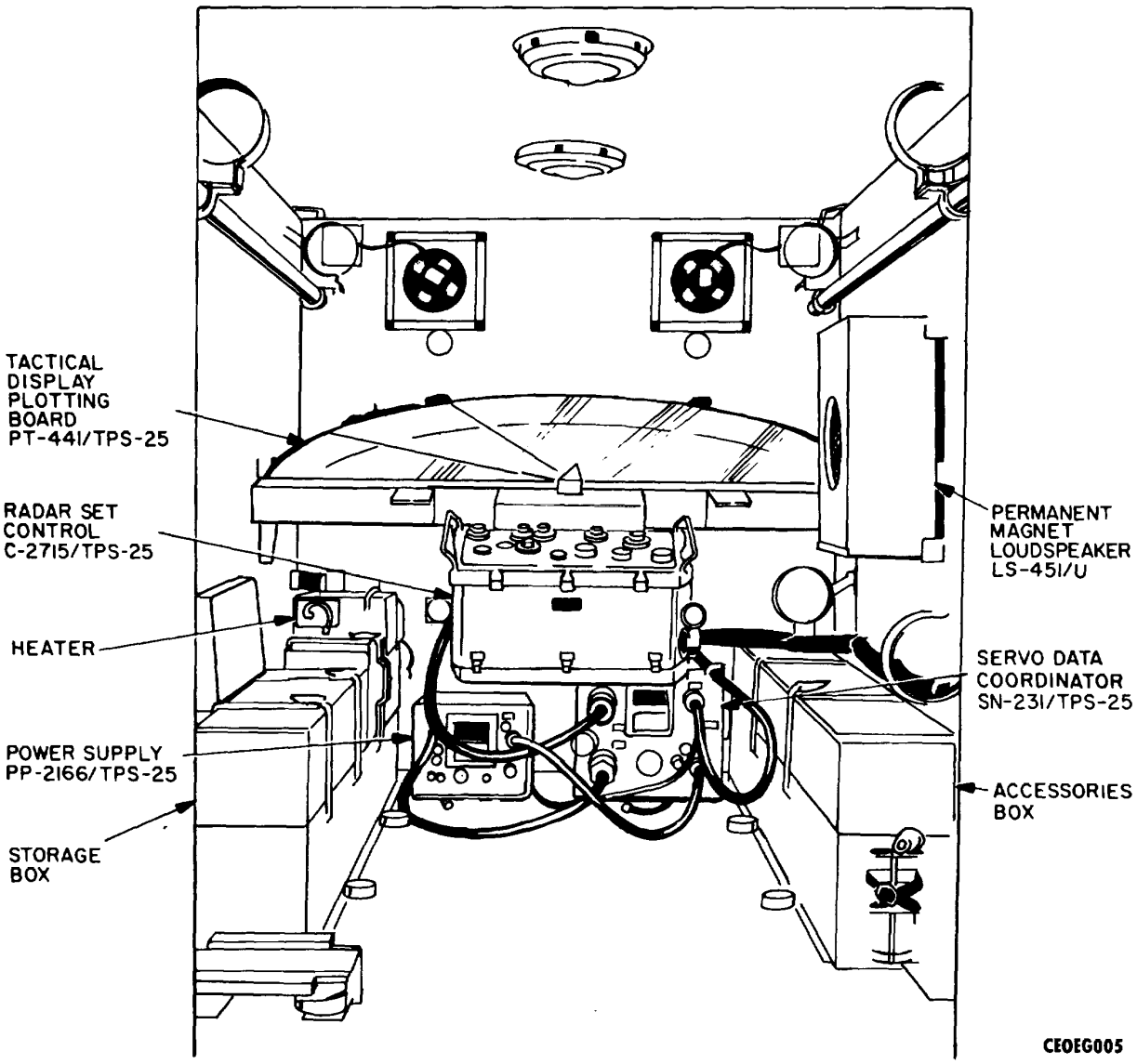


Figure 1-5. Electrical Equipment Shelter S-124/G, Operating Components.

1-17. Description of Radar Set Control (fig. 1-8)

a. The radar set control consists of a housing and front panel assembly constructed of aluminum alloy. The front cover must be removed for operation. The bottom cover is removed for maintenance only. The covers are secured to the housing by trunk latches. Counters, indicator lights, and controls (except RCVR GAIN and MAP ZERO switch) mount through the front panel. Input and output cable connectors and an air exhaust port are located on one side of the housing as well as the mechanical couplings which connect the range and azimuth mechanical subassemblies to the plotting board. Two phone jacks for headsets, the RCVR GAIN control, the MAP ZERO switch, an air intake port, and a fuse are located on the right side of the housing. This unit contains all the controls and some of the servo components necessary for the operation of the radar set, except for the main power switch which is located on the power supply. Controls are provided for adjusting range, azimuth, and elevation. The RADIATE switch provides a means for turning the transmitter on and off. A VOLUME control is provided to vary the audio output signal level.

b. Five direct-reading digital counters supply information pertaining to azimuth, elevation, range, and X and Y coordinates. In addition, the radar set control includes a 3-inch cathode-ray tube with controls to adjust vertical positioning, scope gain, intensity, and focus.

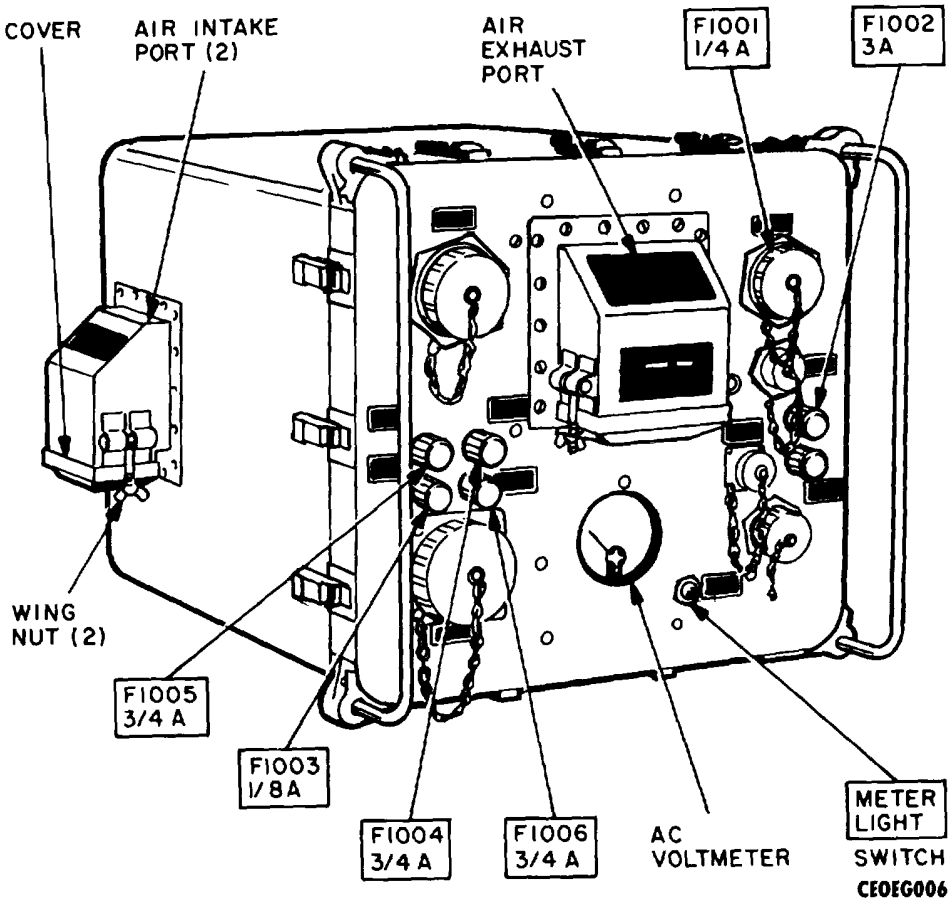


Figure 1-6. Servo Data Coordinator SN-231/TPS-25.

1-18. Description of Power Supply (fig. 1-9)

The power supply consists of a chassis and front panel assembly constructed of heavy gage aluminum which slides into an aluminum alloy case and is secured by trunk latches. An air intake port is located on one side of the case. The main power switch, a power-on indicator light, fuses, and input and output connectors, a 115-volt utility outlet, and air exhaust port mount through the front panel. The power supply furnishes the necessary direct current (dc) plate, heater, and bias voltages for operation of the range, audio, oscilloscope, and servo-amplifier circuits. Four of the supply voltages are regulated. The power supply also provides -27 volts dc for operation of relays, and 115 volts ac primary power (through interlocks) to the modulator, receiver-transmitter, antenna, coordinator, and radar set control.

1-19. Description of Modulator (fig. 1-10)

The modulator consists of a chassis and front panel assembly which is constructed of heavy gage aluminum alloy. The chassis and front panel assembly slides into an aluminum alloy case where it is secured in place with trunk latches. Fuses, input and output cable connectors, a pretrigger test jack, and an air exhaust port mount through the front panel. The case has an air intake port on one side. The modulator establishes the basic pulse repetition rate of the radar set. It supplies the magnetron pulse transformer in the receiver-transmitter with a .5-microsecond (mvusec) 4-kilovolt modulating pulse at a pulse repetition frequency (prf) of 1,850 pulses per second (pps). In addition, the modulator contains relay control circuits which provide a time delay to allow proper heating of the magnetron and thyratron filaments, reduc

tion of magnetron heater voltage during operation, protection against an open or shorted load, overvoltage protection, and automatic momentary turn-off of the transmitter during feedhorn switching.

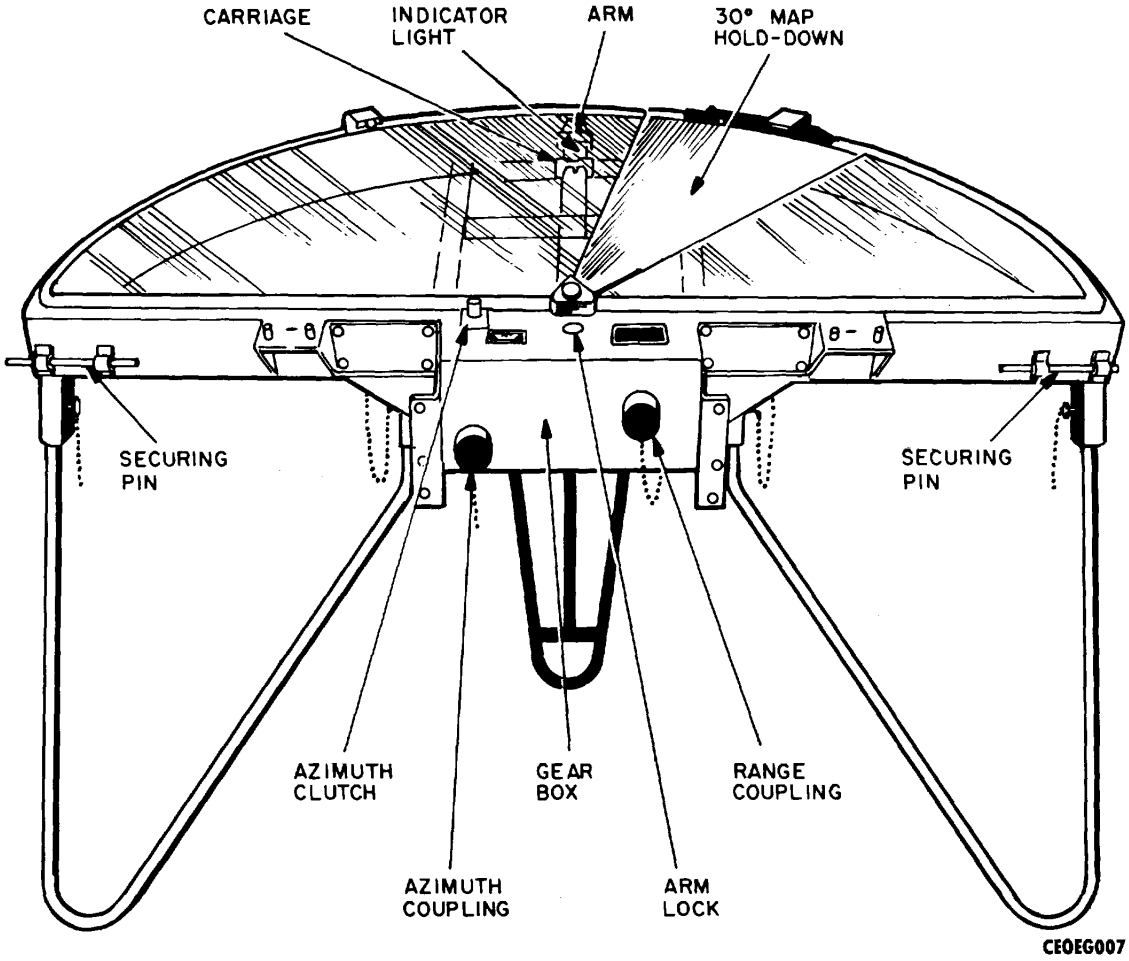


Figure 1-7. Tactical Display Plotting Board PT-441/TPS-25, Out of Shelter Erection.

1-20. Description of Receiver-Transmitter (fig. 1-11 and 1-12)

The receiver-transmitter serves as the base (mounting) for the antenna or antenna mast to which the antenna may be attached. The receiver-transmitter is housed in an aluminum alloy frame with removable side covers for access to the components within the unit. A 115-volt ac utility outlet is provided on the front cover of the unit housing. The transmitter is a pulsed magnetron oscillator operating at 9,375 megacycles (mc) at a prf of 1,850 pps. The nominal peak power output is 43 kilowatts (kw). The receiver is a superheterodyne type, using a reflex klystron as a local oscillator and a 60-megacycle, stagger-tuned intermediate-frequency (if) amplifier. A triple mixer is used to provide balanced mixing for the IF amplifier and single-ended mixing for use in the automatic frequency control (afc) IF amplifier. The afc circuit controls the frequency of the klystron local oscillator as a means of maintaining the 60-megacycle difference between the transmitter and the local oscillator.

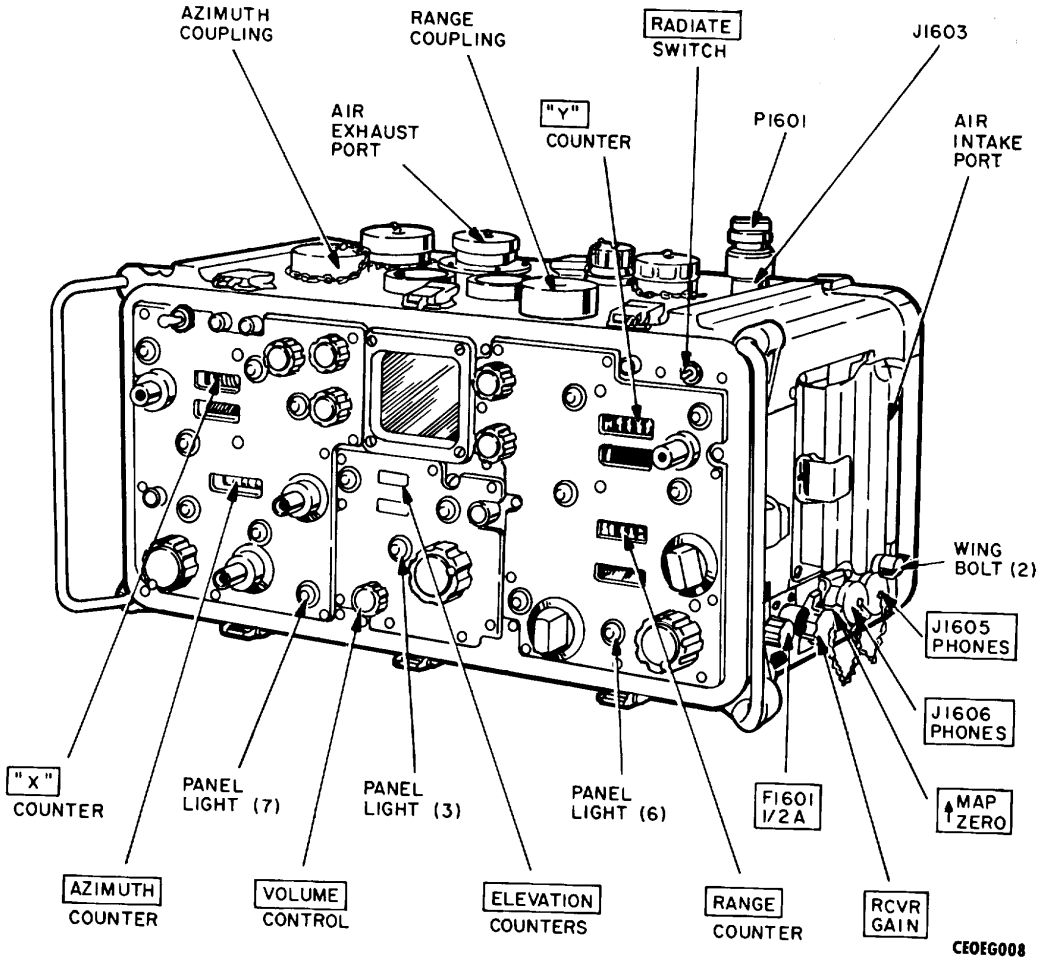


Figure 1-8. Radar Set Control C-2715/TPS-25, Cover Removed.

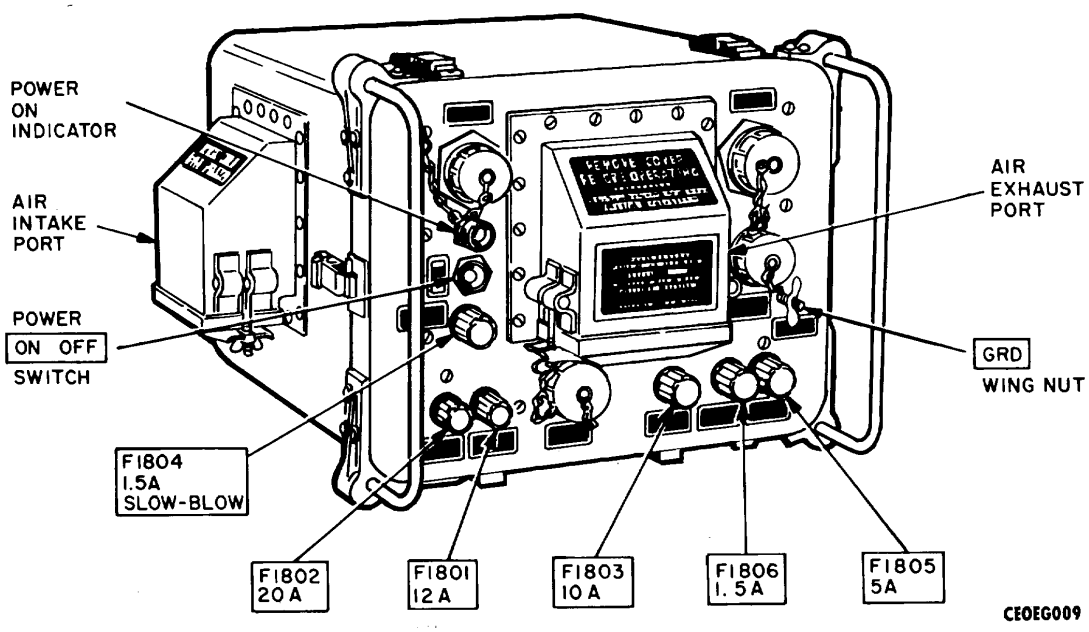


Figure 1-9. Power Supply PP-2166/TPS-25.

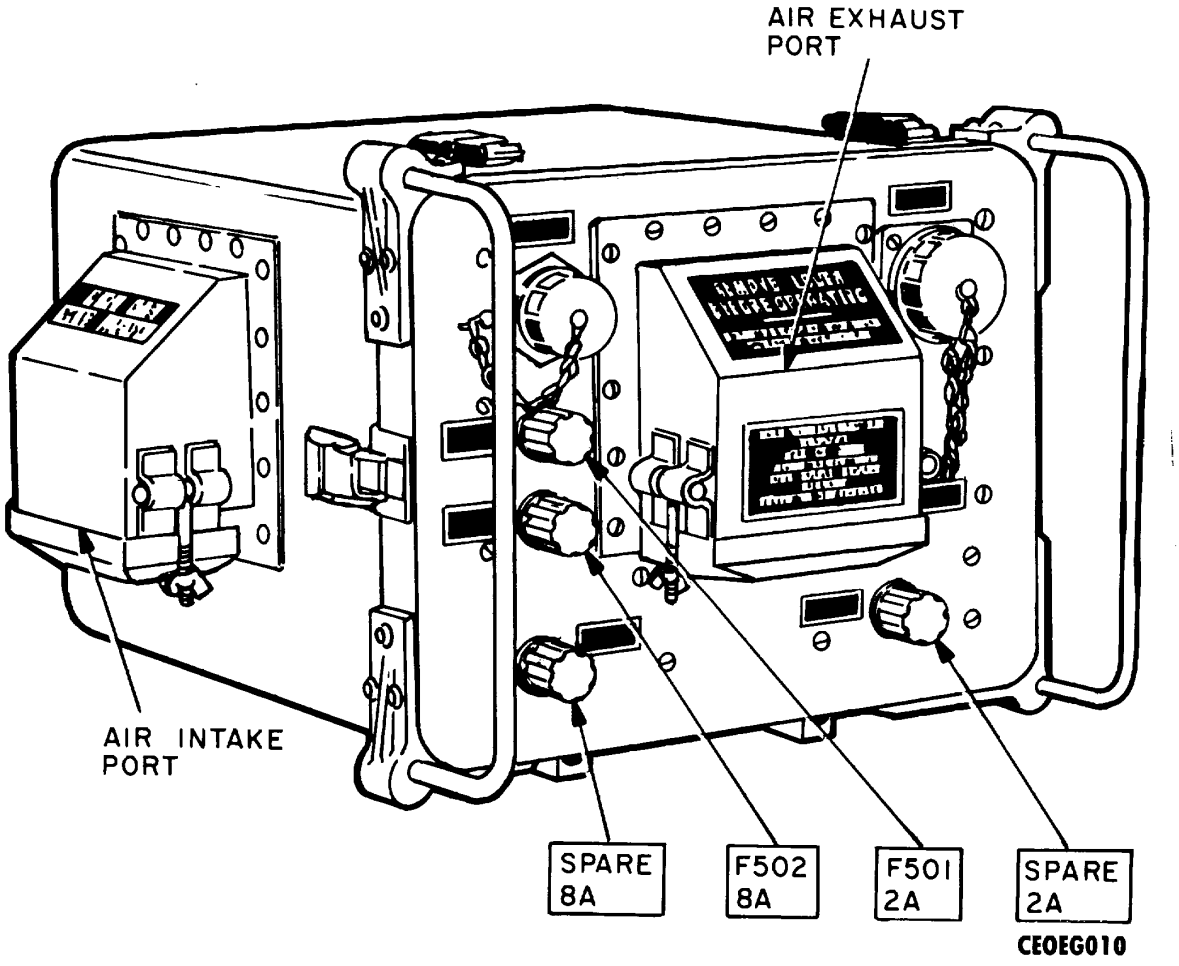


Figure 1-10. Radar Modulator MD-344/TPS-25.

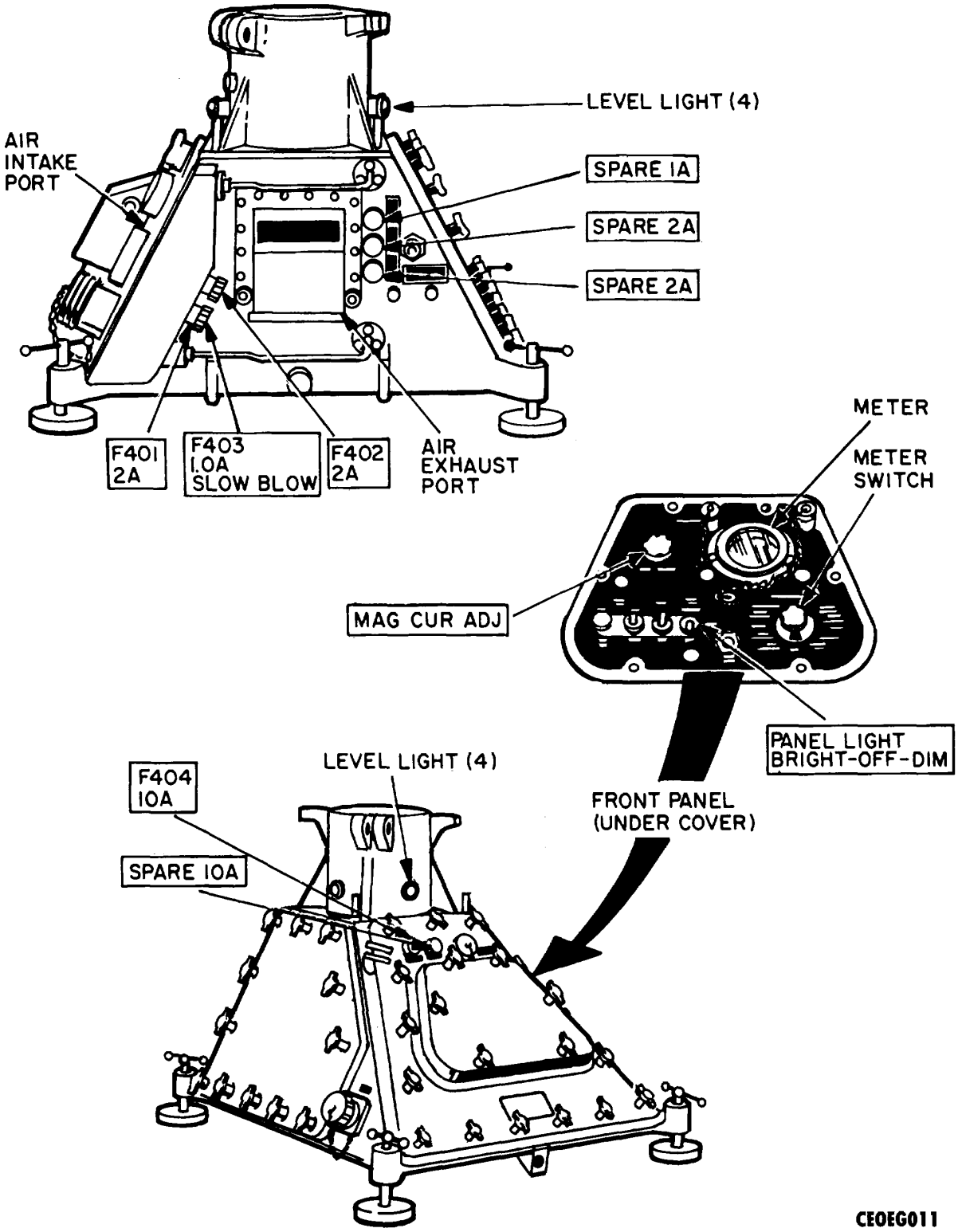


Figure 1-11. Radar Receiver-Transmitter RT-500/TPS-25.

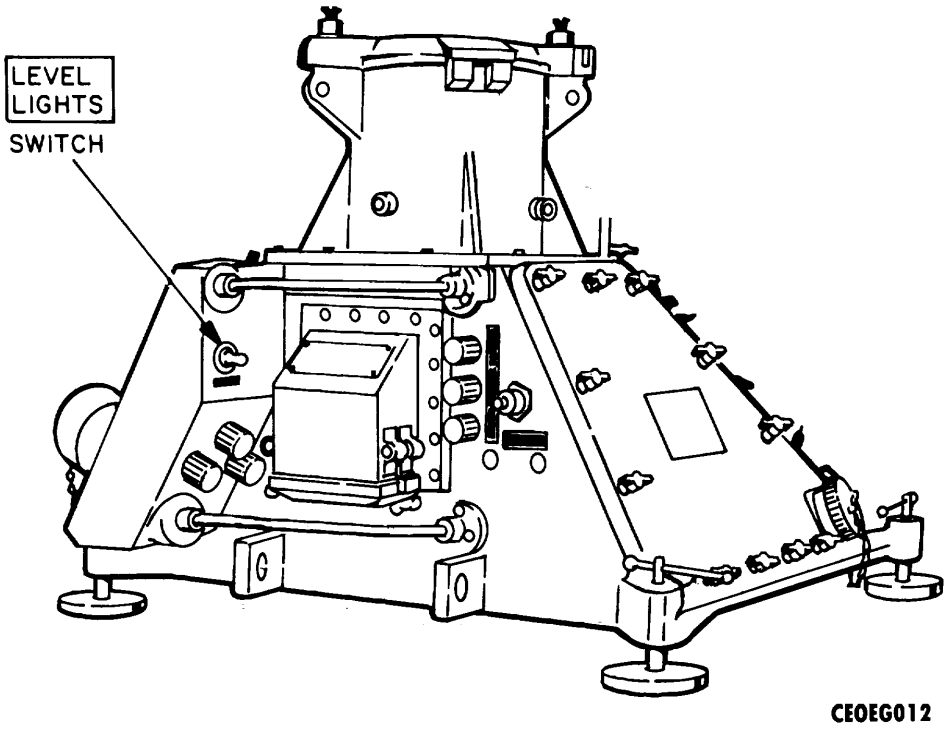


Figure 1-12. Receive-Transmitter, Radar RT-500A/TPS-25.

1-21. Description of Antenna (fig. 1-13)

a. The antenna consists of a fixed pedestal and a rotating parabolic reflector which is excited by a dual feedhorn assembly. The dual feedhorn assembly provides selection of a 2° or a 10° azimuth beam width. The antenna contains the drive motors, data transmission units, and leveling switches, as well as the radiator for the radar set.

b. The antenna may be rotated through 6,750 mils of azimuth by a drive motor positioned by synchros. Both the drive motor and the synchros are part of a servo system which transmits a command originating in the radar set control. Beam tilt may be varied ±265 mils from a level center by a servo system similar to that employed in azimuth positioning. Limit stops exist for both azimuth and elevation travel. Switches at the stops apply a reversing current to the appropriate drive motor to discourage possible overdriving of the antenna and turn on a warning lights on the radar set control panel.

c. The antenna proper is covered by a hemispherical radome which prevents wind loading on the reflector and also serves as protection against the weather. A connector on the underside of the antenna provides a means of connecting the antenna to the receiver-transmitter with a cable assembly.

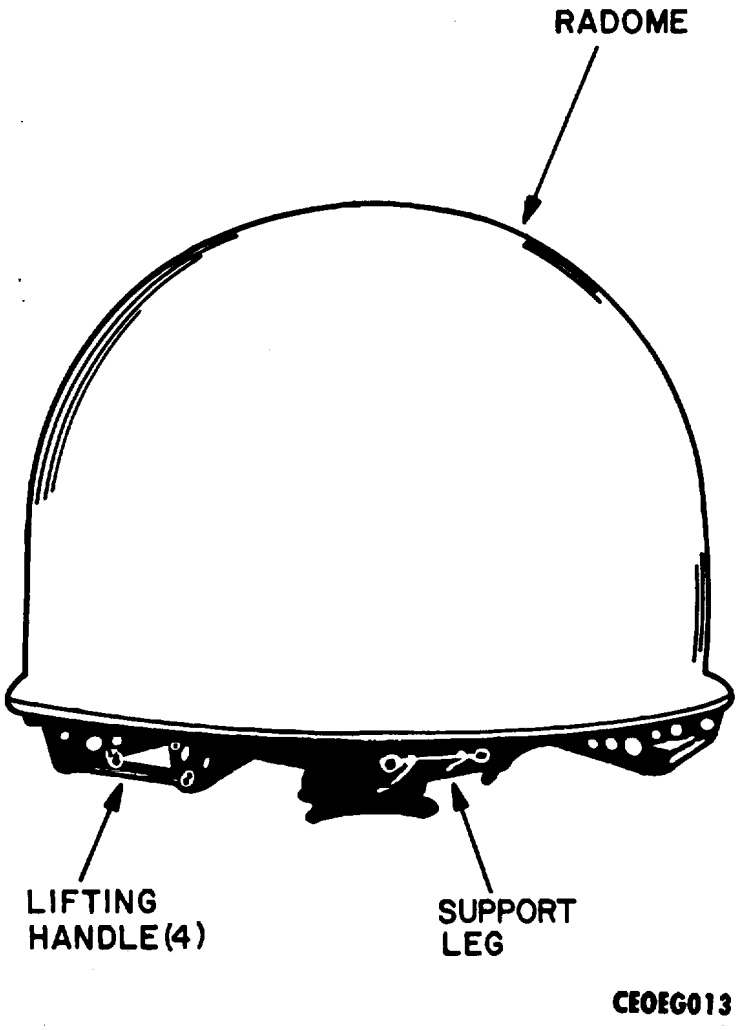


Figure 1-13. Antenna AS-81/TPS-25.

1-22. Description of Mast (fig. 1-14)

The mast assembly is made up of three mast sections each approximately 61/¼ feet long. Combined, they provide a maximum mast length of approximately 20 feet. Each mast section consists of a length of light-weight tubing with a length of waveguide mounted in the center. The ends of the sections are provided with dowel pins, thus insuring proper alinement of the waveguide flanges when they are placed against one another. Protective covers are provided for the section ends when the mast sections are not in use or when the equipment is in transport. The radar set can be operated with one, two, three, or no mast sections between the antenna and the receiver-transmitter.

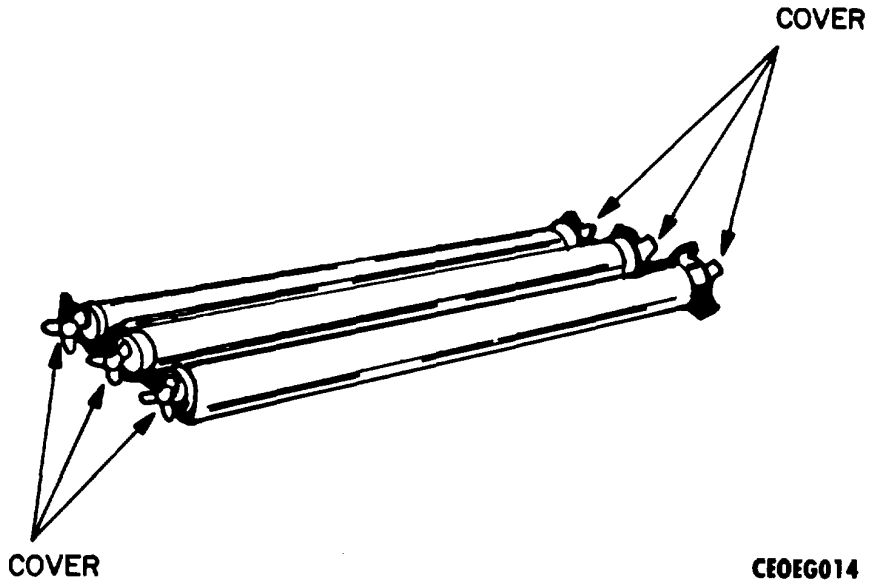


Figure 1-14. Mast AB-588/TPS-25.

1-23. Description of Heater (fig. 1-15)

The shelter heater is a gasoline-burning, thermostatically controlled unit which requires a 115-volt, 400 cycle, single-phase source of power for operation. All the operating controls are mounted on the front panel. Full details on the heater are found in the technical manual supplied with the unit. Refer to that manual for operational and repair information as required.

1-24. Description of Minor Components

Minor components supplied with the radar set are either mounted in or on the shelter or packed in the accessories box, storage box, or spare parts box. Figure 1-16 through 1-18 show the components furnished.

a. Shelter-Mounted Components. The shelter mounted components consist of a folding chair, boom, heater, heater fuel line, two gasoline cans, three cable reels (with cables) loudspeaker, spare parts box, a large chock and two small chocks, straight wall socket, ratchet wrench extension, reversible ratchet wrench, fire extinguisher, receiver-transmitter base plate corner reflector (AN/TPS-25A only) and five stake plates. The folding chair is used by the operator when operating the radar set. The boom (which is supplied in two sections) provides a fulcrum to raise the antenna into position when two or three mast sections are used. The heater fuel line (used in conjunction with one of the gasoline cans) supplies fuel to the heater in the shelter. The heater fuel line is shipped from the factory connected to the gasoline can. The second gasoline can is furnished as a spare gasoline container. The three cable reels hold the longer interconnecting cables. These cable reels are mounted on the walls inside the shelter. The cable reels are constructed of circular tubing with a bearing in the center. During transportation, each reel is locked into position by a clamp and wingnut. The loudspeaker monitors the aural output of the receiver and is connected by a cable to the coordinator. An attenuator is provided on the front of the loudspeaker to control the audio output level of the loudspeaker. The spare parts box contains the running spares for the radar set (para 1-9c). The chocks (one large and two small) are provided to keep the shelter in place when transported in a trailer so that the shelter cannot be displaced while the trailer is in motion. The reversible ratchet wrench, ratchet wrench extension, and straight-wall socket are supplied for use in removing the components of the radar set from the shelter. These tools are mounted in a bracket near the accessories box (fig. 2-22). A duplicate set of these tools (fig. 1-18) are in the accessories box. The five stake plates are used in conjunction with the guy-wire stakes (fig. 1-18) when the antenna assembly is guyed in soft or sandy ground. The fire extinguisher (located under the shelter power distribution box) contains $C0_2$ and can be used to extinguish electrical and petroleum type fires. The corner reflector, mounted on the shelter curbside door (fig. 2-17) during transport, is used to simulate a moving target when orienting the antenna. (The mounting of the components in the shelter is shown in figures 1-2, 2-16, and 2-21).

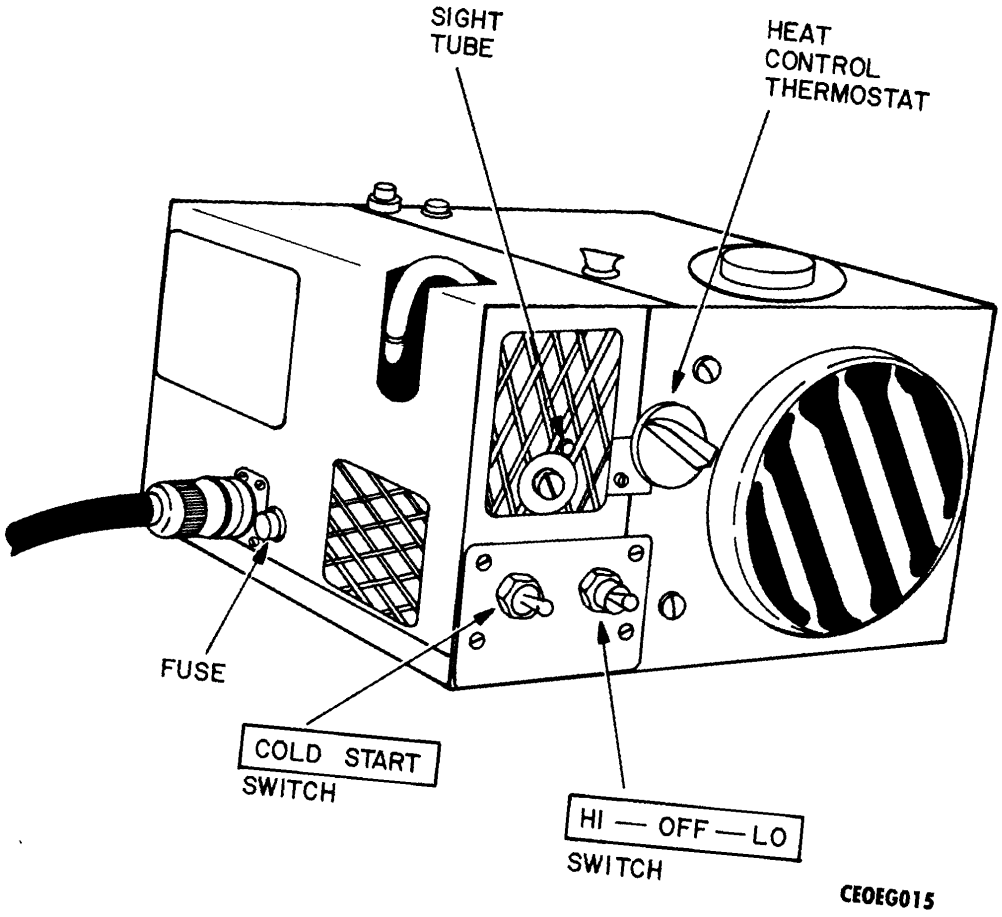


Figure 1-15. Heater.

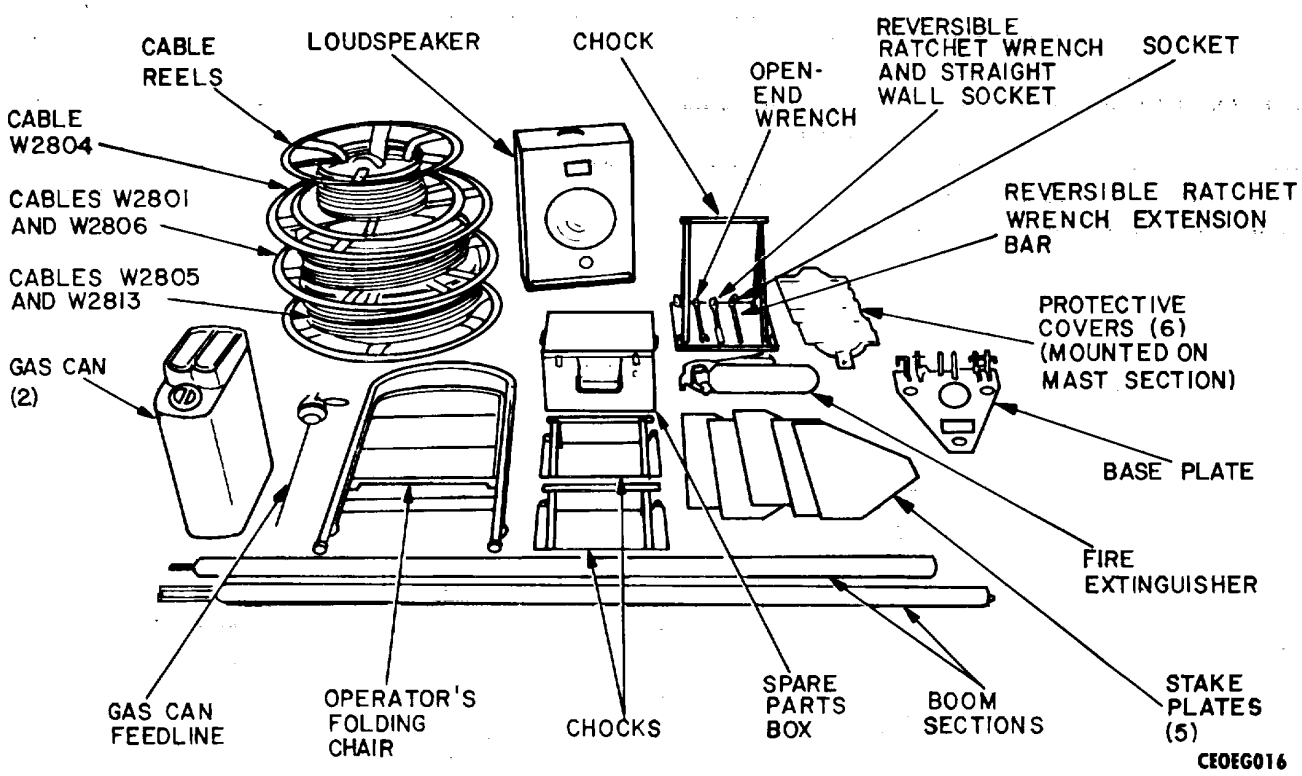


Figure 1-16. Shelter Mounted Minor components.

b. Accessories Box Components (fig. 1-18). The minor components shown in the figure are stored in the accessories box located on the curbside of the trailer (fig. 1-5). The accessories box components consist of five guy-wire stakes, two sledge hammers, three base-plate stakes, four guy wires, four winch hoists, four shelter-trailer tiedown cables, a shelter lifting cable an electrical ground stake, reversible ratchet wrench, straight-wall socket, ratchet wrench extension, two dacron guy ropes, two measuring ropes, and one chain support. The five guy-wire stakes are used in conjunction with the stake plates (fig. 1-16) when the ground is soft or sandy. Four of the stakes are used to anchor the guy wires for the antenna when the antenna is mounted on top of two or three mast sections. The fifth guy-wire stake is driven in the ground ahead of the guy-wire stake which is used in conjunction with a winch hoist and guy-wire cable to lift the antenna and mast sections into position. This fifth guy-wire stake (with chain support) is used as an added safety anchor when tension is applied on the hoisting winch. The sledge hammers are used to drive the stakes into the ground. The base plate (fig. 1-16) (used in conjunction with the base-plate stakes) is a rest for the receiver-transmitter and a pivot point for raising and lowering the masts and antenna when the antenna is placed on top of one, two, or three mast sections. The Figure 1-16. Shelter Mounted Minor Components. guy wires are used to steady the antenna when the antenna is mounted atop two or three mast sections. The guy wires run between the antenna and the winch hoists. The winch hoists are used in conjunction with the guy wires when two or three mast sections are used to raise the antenna into position and to hold the antenna in a level position. Four shelter-trailer tiedown cables are used to anchor the shelter to the trailer (B, 2-15) so that the shelter will remain in place during transport. The shelter lifting cable which consists of four separate cables linked together at the center, is used to remove the shelter from the transporting vehicle by means of a hoisting mechanism (A, fig. 2-15). The electrical ground stake assembly, consisting of ground wire W2815 and ground stake E2801, is a common ground for the radar set. When the equipment is operated from the shelter, the ground connection is made to the shelter. When the equipment is operated outside the shelter (shelter not used) the electrical ground is made to the power supply. The reversible ratchet wrench, in conjunction with the ratchet extension and straight-wall socket, is used to assemble the various components of the radar set. Two dacron guy ropes are supplied to act as a guy for the boom sections when the antenna is erected. The two measuring ropes are used only in laying out the installation of the radar set at the site selected. The chain support is connected between the

two guy-wire stakes (fig. 2-26 and 2-30 through 2-33) at the raising end of the antenna installation.

c. Storage Box Components (fig. 1-18). The storage box contains two interconnecting cables (lengths too short to be placed on a cable reel), a spare magnetron, a spare cathode-ray tube, an ac extension cable, two protective covers and a headset. The two interconnecting cables are used to interconnect the receiver-transmitter and modulator of the radar set. The headset is used when listening under high ambient noise levels or where the radar location might be disclosed by loudspeaker sounds. The two protective covers are used to cover and protect the antenna and receiver-transmitter waveguides from dust and dirt, when the antenna is separated from the receiver-transmitter prior to installation.

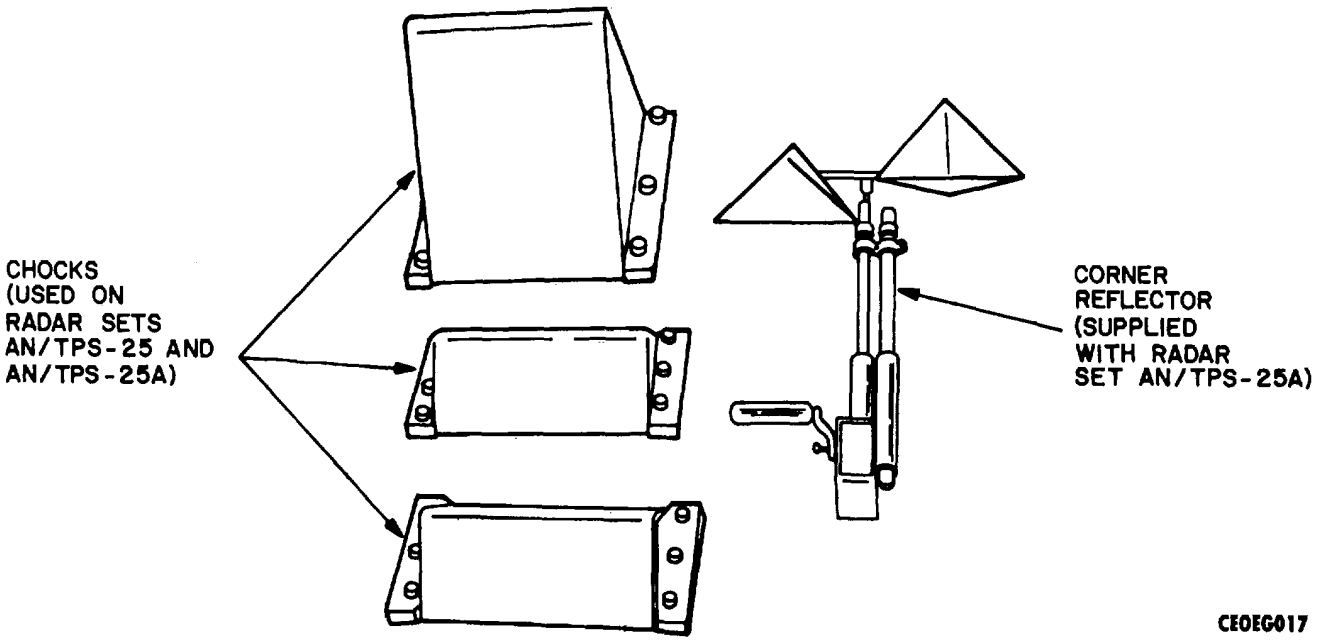


Figure 1-17. Additional Shelter Mounted Minor Components.

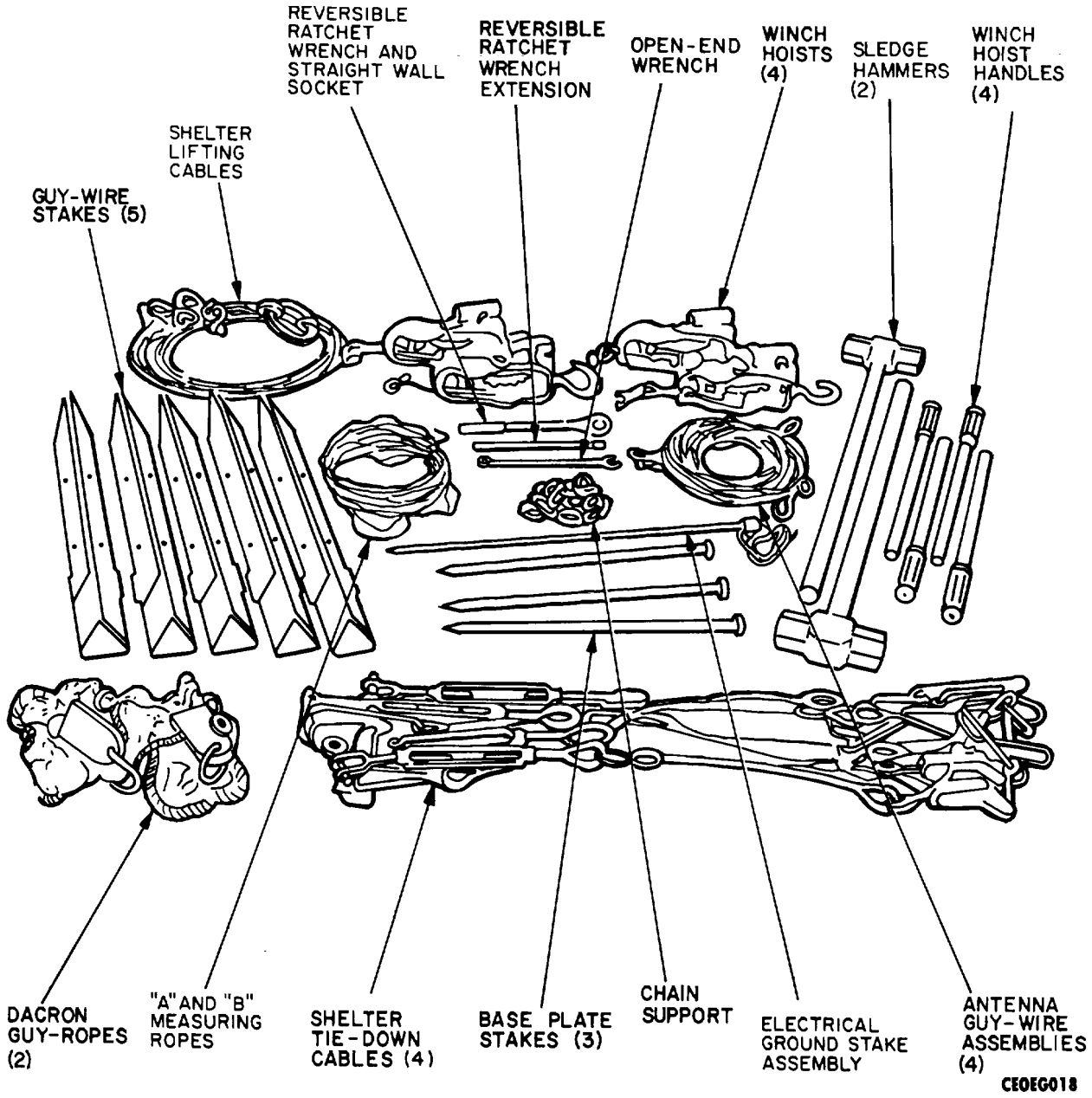


Figure 1-18. Minor Components Stored in Accessories Box.

1-25. Additional Equipment Required

a. Hoisting Gear. If the equipment is to be installed in a location without the transporting vehicle, some means should be provided to raise the shelter off the vehicle and set it in place. A hoisting mechanism capable of lifting 6,000 pounds is satisfactory. The hoisting mechanism is requisitioned separately. A lifting cable (fig. 1-18) is provided with the equipment. This lifting cable (four cable sections linked at the center) is connected to the lifting holes (upper-most holes) at the corners of the shelter (A, fig. 2-15).

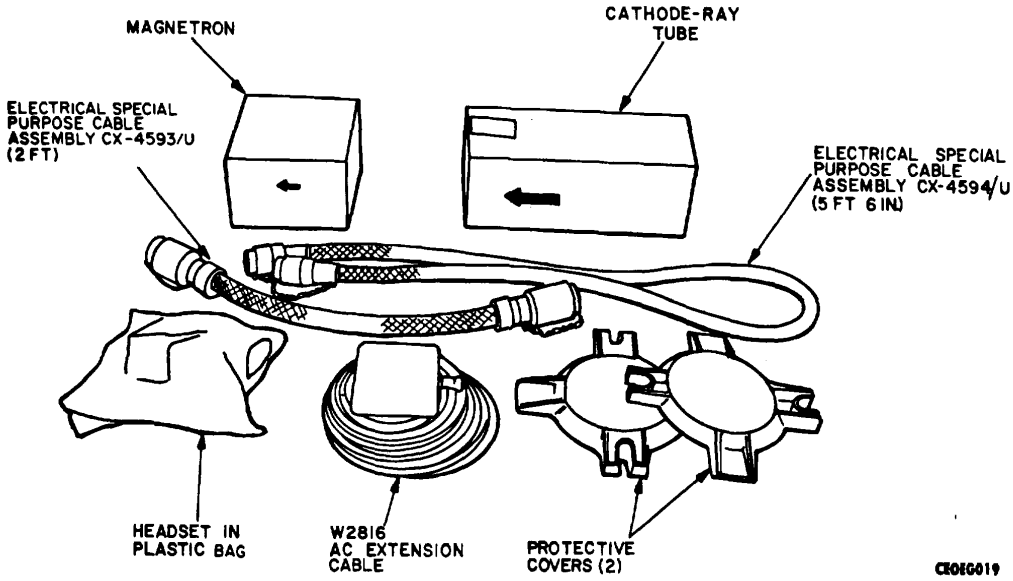


Figure 1-19. Minor Components Stored in Storage Box.

b. Hauling Gear. In the transport condition, the shelter houses the components of the radar set and some means must be provided for the transportation of the shelter to the operating site. The transporting vehicle can be a 2 1/2-ton cargo truck, a 3/4-ton, or 1 1/2-ton (M-106 type) trailer.

c. Covering. If the equipment is used outside the shelter some means should be provided for protecting the operator from the elements at the plotting board (if used) and the radar set control location. This covering may be a fly or tent enclosure and should be requisitioned.

d. Telephone. Telephone communication will be needed to help in maintenance adjustments since the antenna is located away from the operating shelter or operating position. Two field telephones such as Telephone Set TA-43/PT along with 225 feet of field wire should be requisitioned.

e. Fuel. Gasoline will be needed to run the generator for ac power and to run the heater to furnish heat within the shelter.

Section III. BASIC PRINCIPLES

1-26. Equipment Application

a. Equipment Function.

(1) Radar Set AN/TPS-26 radiates a beam of pulsed RF energy from its antenna. This beam of RF energy may be compared to a beam of' light. When the beam strikes an object, the object reflects some of the energy back toward the antenna. The reflecting object is called a target, and the reflected energy or signal is called an echo. The beam may be either 10 or 2° wide, depending on the feedhorn being used in the tactical operation. In search operation of the radar set, the first feedhorn illuminates only a portion of the reflector. This gives a beam width of 10° in a horizontal plane and 4° in the vertical plane. In tracking operation, the second feedhorn illuminates the entire reflector, resulting in a beam width of 20 in the horizontal plane and 4° in the vertical plane. The 4° vertical beam allows reasonable elevation accuracy and still gives good vertical coverage. An echo will be received by the radar set only when the antenna (and beam) is pointed directly at the target. The antenna, and hence the beam, may be rotated manually through 6,750 mils. In tactical use (with plotting board), the antenna may be rotated manu-

ally through an arc of only 3,200 mils or may be set to automatically scan an arc of either 180, 360, or 540 mils. Because the velocity of the radiated field of RF is so much greater than the antenna rotational speed, a radiated pulse can leave the antenna, reach a target, and return to the antenna before the antenna has rotated an appreciable amount. The direction the antenna is facing when an echo is received is considered the azimuth of the target. The RF beam may be tilted vertically to pinpoint the target. This vertical angle is read in mils (up to ± 265 mils) on a counter and this information is employed by the radar set to determine actual ground (map) range. The time required for the transmitted pulse to travel to the target and return is converted into distance (slant range, para 1-27a) to the target.

(2) Reflected signals are applied to the input of the receiver during the interval between the transmission of pulses. A duplexer, employing a transmit-receive (tr) tube, permits the use of the same antenna for transmission and reception.

(3) Each transmitted pulse beamed into the sector being scanned produces a complex radar return, called clutter, (fixed targets) (A, fig. 3-9), depending on the character of the terrain and the location of stationary objects. As viewed at the input terminals of the receiver, the net effect of the clutter produced at a particular range can be represented as the sum of the individual radar reflections (clutter components) coming from the terrain in that part of the sector (fig. 1-20). Since these individual reflections are from fixed objects, the phase and amplitude of the resulting clutter vector will be constant for each successive transmitted pulse.

(4) If a moving object is present at the range being considered, the signals reflected from it, as the result of successive transmitted pulses, will vary in phase in accordance with the object's speed and direction of motion. As shown in figure 1-20, the phase-changing reflected signal from the moving object can be represented as a rotating vector added to the fixed-phase clutter vector. The resultant is the net reflected signal from the vicinity of the moving object.

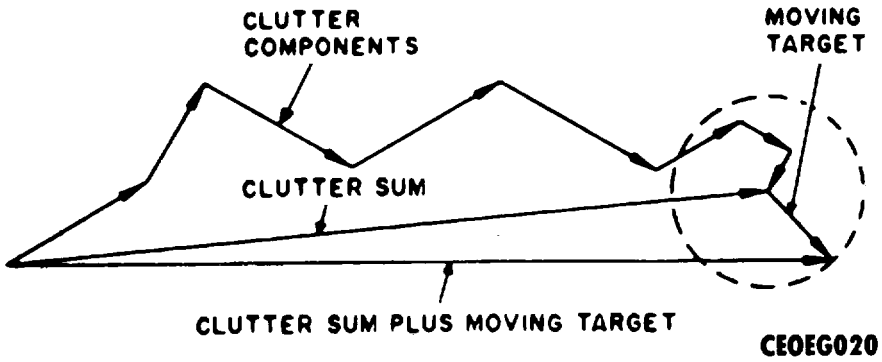


Figure 1-20. Vector Diagram Showing Formation of Doppler Audio.

(5) The amplitude of the net reflected signal changes as the moving target vector rotates. The frequency of this amplitude-variation is the doppler frequency from which the system derives its name. In Radar Set AN/TPS-25, the doppler frequency resulting from the types of moving targets for which the equipment is intended will be in the 20- to 1,000-cps audio range. This doppler signal can be heard in the headphones or loudspeaker. When the doppler signal is peaked (loudest) in the headphones or loudspeaker direct-reading digital counters then indicate target position in both polar and cartesian coordinates. Range and X and Y coordinates are corrected for elevation angle in the equipment and are thus actual map distances.

(6) Noncoherent applies to the use of clutter as a constant-phase reference signal. In coherent doppler radars, the reference signal is derived from an auxiliary oscillator which is locked in phase with the transmitted signal.

(7) The character of the clutter return from an area at any given range and azimuth remains essentially the same. That is, the size and shape of a particular signal return (fixed target) as presented on the A-scope (A, fig. 3-9) does not change. If a moving target (person or vehicle) enters the particular area, the size (height) of the fixed target return from that area begins to change rapidly in height. How rapidly it changes in height depends on the speed of the moving target toward or away from the radar set. Slow moving targets may cause the height of a target to vary at a rate as low as 20 cycles per second, while a fast moving target may cause a variation as high as 1,000 cycles a second. Generally, the larger the tar-

get, the greater will be the amount of change in the height of the target echo. The above audio frequencies (20 to 1,000 cycles per second) can be heard in the loudspeaker or headphones. Since fixed targets echoes do not vary in height, they cannot be heard in the headphones or loudspeaker. Only moving targets can be heard. Clear sounds heard in the headphones or loudspeaker, therefore, indicate the presence of a moving target at the range and azimuth of the area under consideration.

b. Application. Radar Set AN/TPS-25 is designed to locate and track moving military targets such as a moving person or vehicle. Data furnished by the radar set are of such form and accuracy as to permit the adjustment of artillery fire. The radar set is used in connection with forward observation operations to provide firing information for use by both direct support artillery and corps artillery. The technique of locating a target involves the following steps: the location of the target; tracking of the target; and the application of the information for the control of artillery fire.

(1) Target locating. An area of interest is selected and the radar set is set to automatically search the area. The operator observes the A-scope on the radar set control for a video response or listens to the loudspeaker and/or headset for an aural return indicating the presence of a target. The presence of a moving target is determined by sampling the reply signals at a particular range through the use of a detector. The audio output of the detector is amplified and supplied to a loudspeaker and/or headset. Various types of moving targets (personnel, motor vehicles, tanks, etc.) have characteristic sounds that enable the operator to distinguish between them.

(2) Target tracking. Once the presence of a moving target has been detected, the radar set is switched to manual control and by manipulating the azimuth, range, and elevation controls, the target is followed or tracked. Precise information regarding the target's location is indicated on direct-reading counters.

(3) Plot application. When the radar set is tracking a target and the plotting board is in use, an indicating light located on the plotting board under the map follows target movement as the controls on the radar set control are manipulated. This plot (on the map) is a function of range and is shown on counters located on the radar set control. In addition, the X and Y coordinates of the target are shown also on counters located on the front panel of the radar set control. Any or all of this information may be transmitted by voice to an artillery battery or combat information center for their use in zeroing in on the target with artillery fire.

c. Secondary Application In addition to its use for detecting moving personnel and vehicles, Radar Set AN/TPS-25 may be used also for observing an area to detect the concentration of artillery fire.

1-27. Range

a. Slant Range. The slant range of a target is the line-of-sight distance between the target and the radar set (fig. 1-21). Radar Set AN/TPS-25 measures the ground range in meters over a distance of 450 to 18,280 meters. Determination of slant range is based on the time required for the transmitted signal to leave the radar set, travel to the target, and return to the radar set as an echo. A radio wave takes approximately 6.7 microseconds (musec) to make the round trip between a radar set and a target 1,000 meters away. Thus, if the round trip is 67 microseconds, the slant range to the target is 10,000 meters. Actual calculations of the time required for a signal to make the round trip between radar and target are made within the radar set by range-measuring circuits.

b. Ground Range. The difference between slant range and ground range is shown in A, figure 1-21. In Radar Set AN/TPS-25, a computing system converts slant range from the range circuits and elevation angle from the antenna positioning system into ground range. Ground range is measured along a horizontal plane established at the level of the radar set antenna and is the horizontal distance between the antenna of the radar set and the target. In this radar set, the ground range measurement is taken in meters and can be read from a counter dial on the radar set control unit.

1-28. Azimuth and Elevation

a. Azimuth. The azimuth of a target (B, fig. 1-21) is its horizontal angular position, measured clockwise with respect to a specific direction or point. Usually, the radar set will be used to read azimuth with respect to true north. This necessitates an initial orientation of the antenna with respect to true north at the time of installation. Target azimuth is then read in mils relative to 0 mil true north reading, with 6,400 mils to a complete azimuth rotation.

b. Elevation. Elevation is the term used in expressing the vertical angle at which the radar beam of the antenna is tilted with respect to a horizontal plane. The elevation or elevation angle (A, fig. 1-20) of a target is the angle formed at the junction of a straight line drawn from the radar antenna to the target and a horizontal line drawn through the center of the antenna. In Radar Set AN/TPS-25, this angle is expressed in mils. The elevation angle is preceded by either a plus or minus sign to indicate whether a target is above or below the level of the radar antenna location.

1-29. Search

a. General The main purpose of the radar set is to locate moving military targets, such as a person or vehicle. The searching can be performed either automatically or manually.

b. Area Search.

(1) In this radar set, search requires that a finite listening time be allowed for any possible moving target in order that the operator be able to identify the tone. This operation consists of scanning the antenna back and forth through a desired sector at a constant rate and simultaneously searching range at a constant rate outward for a distance of 900 meters. The azimuth sector centers about a manually selected sector and may have a span of 180, 360, or 540 mils. The manner in which the beam scans an area is shown in A, figure 1-22. When moving in azimuth, the beam searches the area continuously at 23 mils per second.

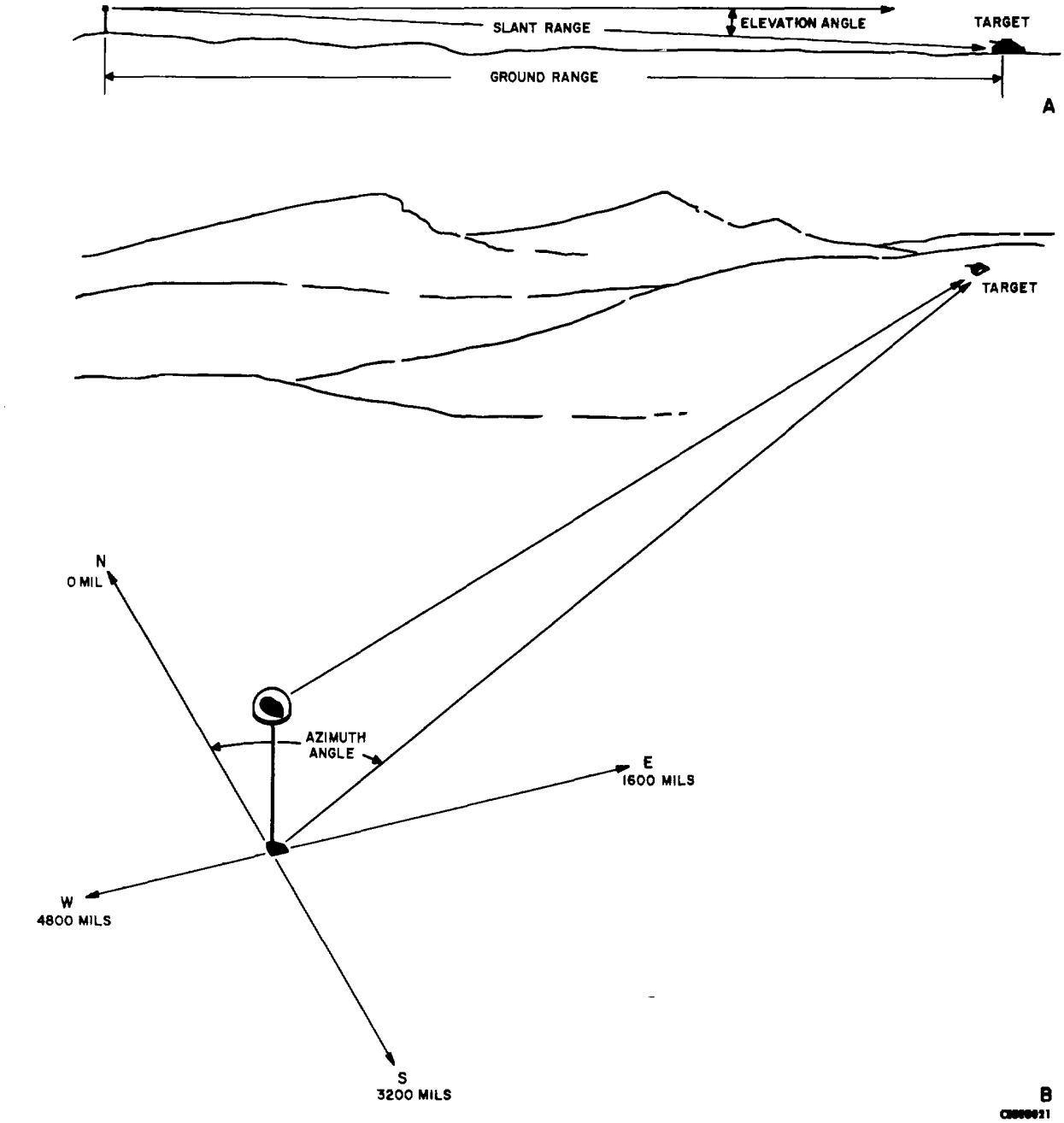


Figure 1-21. Basic Measurements.

(2) In addition to fully automatic scanning, search may be conducted on a semi-automatic basis where the beam ceases to scan in azimuth and is manually controlled while it continues to search in range automatically (B, fig. 1-22). Surveillance in this condition is restricted in azimuth to the 100 beam width (180 mils) but, by manual rotation, may be extended to 6,750 mils. In any mode of operation, the beam can be adjusted in elevation for ±265 mils from antenna level (C, fig. 1-22).

(3) In the final mode of searching, both azimuth and range are manually controlled. When automatic ranging ceases, a range gate width of 75 meters is used (B, fig. 1-22). This method of searching is ordinarily used after the presence of a target has been detected under one of the other methods of searching and constitutes the beginning of the tracking process.

1-30. Tracking

When a target has been located and the equipment is switched to tracking, the radiated beam width is changed from 100 to 20 while the range surveillance is maintained at the 75-meter range gate width (D, fig. 1-22). This is accomplished by a switching of feedhorns at the antenna which causes a larger portion of the parabolic reflector to be illuminated, narrowing the beam width. Reducing the area of surveillance in azimuth enables the target to be precisely located in terms of X and Y coordinates. Tracking is a manual operation. Two methods of optimizing the return signal for accurate tracking are provided.

a. In the first method, the audio signal resulting from the doppler signal is presented on the A-scope (range). The target is tracked by listening for the audio return and adjusting for azimuth and range until audio signal is at the maximum amplitude. The audio signal is seen as a series of horizontal lines on the oscilloscope presentation (B, fig. 1-23).

b. The second method presents the video signal on the range scope as it appears during searching, but with the 2° beam width employed. Used after the first method, it enables the target appearance to be made coincident with the trailing edge of the range gate (A, fig. 1-23), pinpointing the target.

1-31. Target Presentation

Information regarding the location of a target is presented on the counters and a plotting board (if one is used). Continuous target information is presented as long as the target is within the area being scanned.

a. A-Scope. The A-scope gives two kinds of presentations, depending on the position of the selector switch-

(1) In all positions of the AUTO MAN switch on the radar set control except MAN TRACK AUDIO (position 4), the A-scope gives a continuous presentation of targets appearing within an 1,100-meter span of the radar range (A, fig. 1-23). In addition, the 75-meter range gate appears on the display. Under the automatic ranging positions, the range gate moves out along a 900 meter span. Under the other two positions, the range gate stays stationary on the scope and the targets on the display are moved into the gate by manual control of the radar range. Azimuth changes are not shown on the A-scope except as they are evidenced by the emergence of different targets on the range sweep of the scope.

(2) In the MAN TRACK AUDIO position, the A-scope presents a display of the audio signal (B, fig. 1-23) generated as a result of a moving target being present within the range gate. This presentation makes possible the visual maximizing of the audio signal as the target is more precisely located in azimuth, range, and antenna elevation.

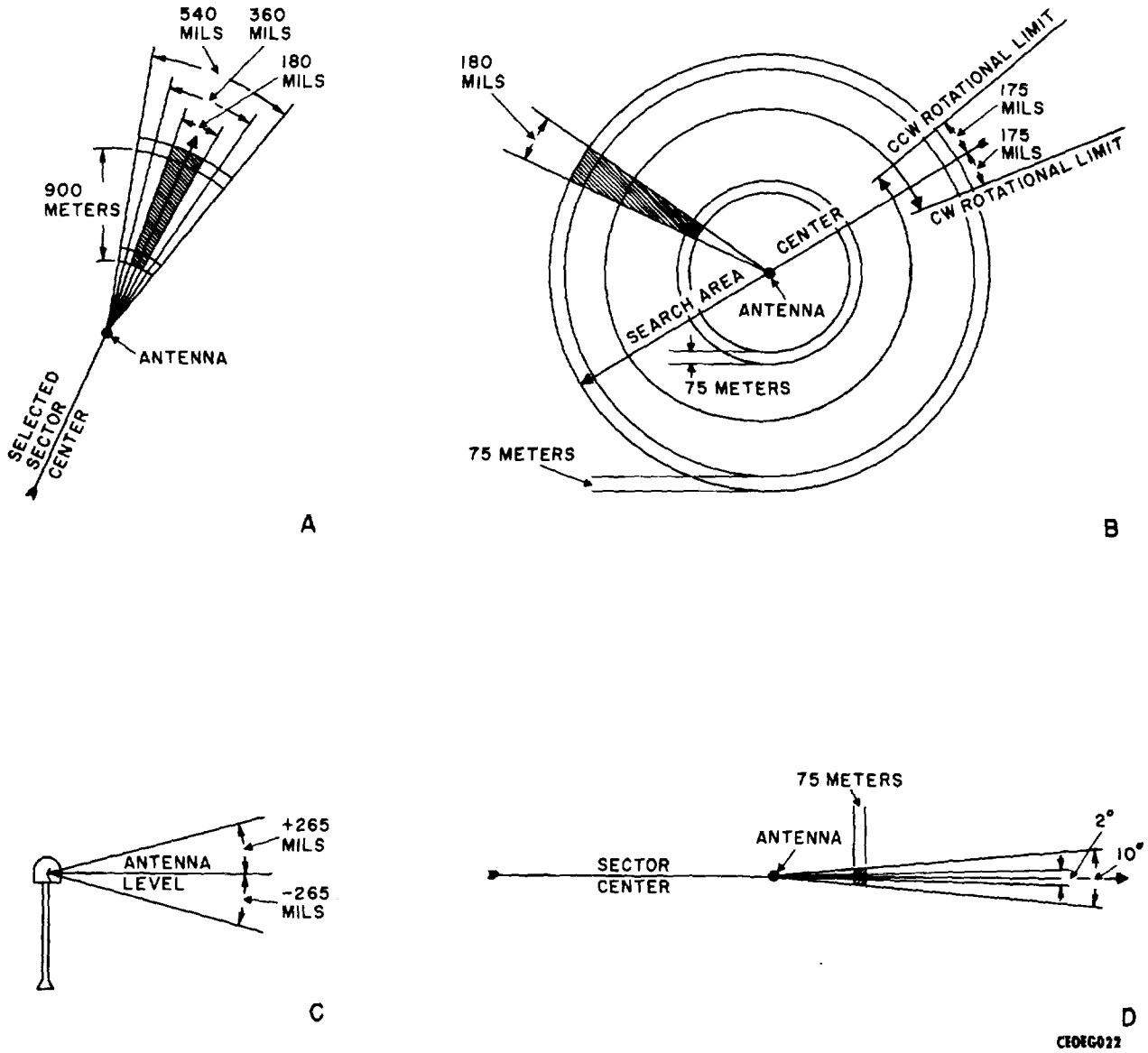


Figure 1-22. Search and Track Coverage.

b. Counters. Counters similar to that illustrated in C, figure 1-23 indicate changes in range (except during the 900 meter automatic search), azimuth, and elevation. In addition, two sets of counters are provided which give the position of the target as computed by the radar set into cartesian coordinates. The cartesian coordinate counters operate only during manual searching and tracking and give the map (ground) location of the target.

c. Loudspeaker and/or Headset. The audio evidence of a moving target within the range gate of the radar set is given by a loudspeaker or a headset, or both together. The signal changes in pitch as the speed of the target changes and in loudness as the target is centered in range and in azimuth. An audio presentation is made only when the target is within the range gate.

d. Plotting Board When the plotting board is used, a map representing the sector of interest is placed over it and positioned to correspond to the field of surveillance of the radar set. The radar set is restricted in this case to 3,200 mils of azimuth rotation. A moving indicator light in the plotting board follows the radar beam as it moves in range and azimuth. The motion of the indicator light in the range direction is supplied by the radar range and the elevation angle. The plotting board is especially useful in tracking a moving target, for it traces the direction of motion of the target and enables the observer to predict its point of probable intercept.

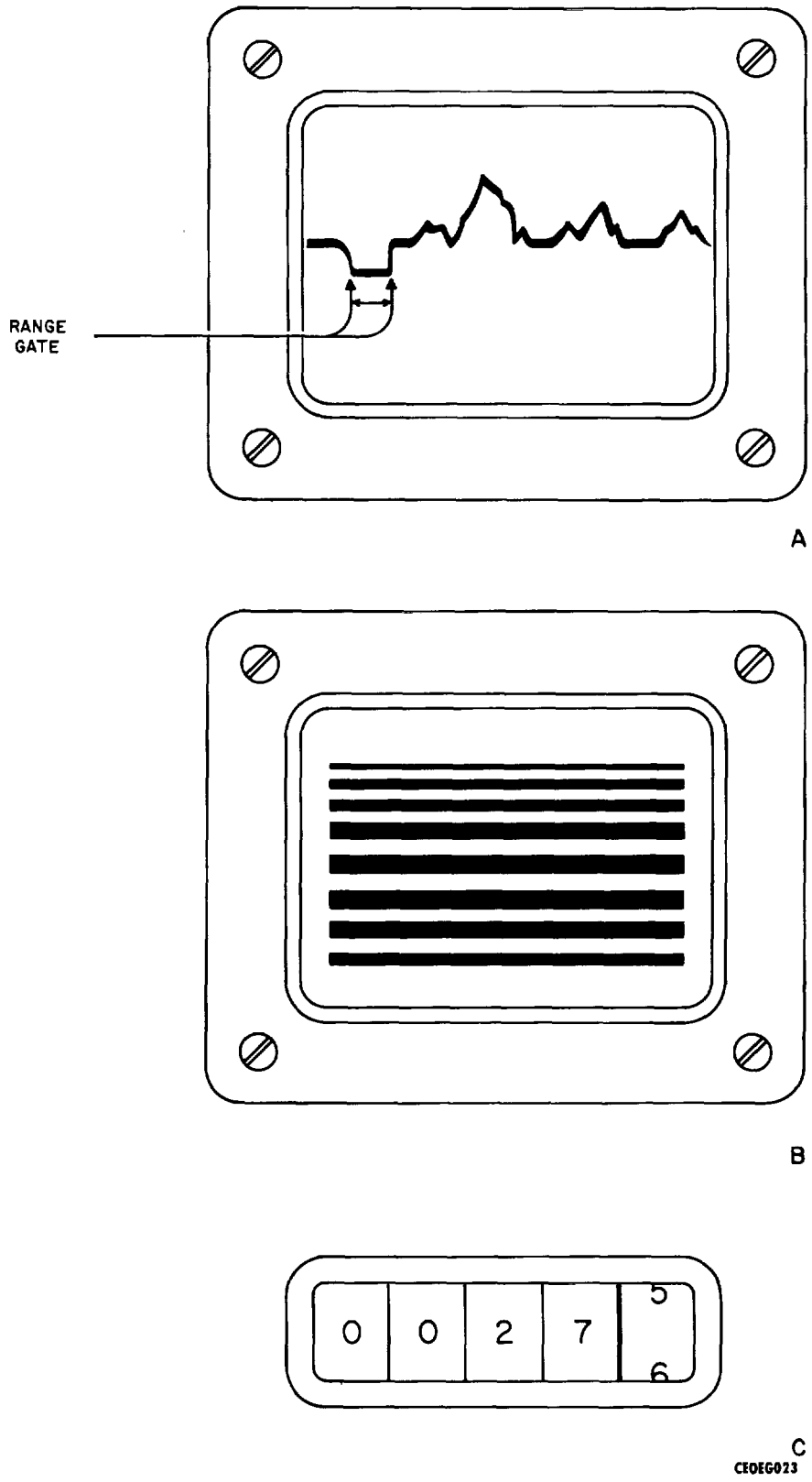


Figure 1-23. Target Presentation

1-32. Target Resolution

Resolution is the ability of the radar set to differentiate between two targets. When targets come within certain distances of one another, their signal returns tend to merge and appear as one echo.

a. Bearing Resolution. The ability of the radar set to separate two closely spaced targets at the same range depends largely on the horizontal width of the radar beam. Since Radar Set AN/TPS-25 may be used in search operation and in tracking operation, the beamwidths at the half-power points differ. In search operation, the beamwidth is 10°; in tracking operation, the beamwidth is 2°. Refer to A, figure 1-24, which shows two identical targets spaced 40 meters apart and at three different ranges from the radar set.

(1) Point 1 shows the two targets at 500 meters from the radar set. At this distance, the 20 beam covers only 17.5 meters. Since the two targets are separated by much more than the width of the beam, the target echoes will appear, disappear, then reappear on the scope as the beam sweeps over them.

(2) Point 2 shows the two targets at 1,000 meters from the radar set. At 1,000 meters, the beam covers approximately 35 meters. Since the separation of targets is only slightly larger than the beamwidth, the beam hits one target almost immediately after it leaves the other and the target responses will disappear only momentarily as the beam sweeps over them.

(3) Point 3 shows the two targets at 1,500 meters, still 40 meters apart. However, the span of the radar beam at 1,500 meters is about 52.5 meters, a distance greater than the separation between the targets. Therefore, in this case, both targets will be covered by the beam at the same time, and their resultant target indication will appear as a single target on the A-scope as the beam sweeps over them.

(4) The information given in (1), (2), and (3) above shows that the bearing resolution decreases as the range increases. The chart below gives the approximate span of the 20 beam and the 100 beam at various ranges from the radar set. Targets separated in azimuth by less than the indicated span will appear as a single target on the A-scope.

2° beam							
Range (meters)	500	1,000	2,000	4,000	8,000	16,000	18,280
Span (meters)	17.5	35	70	140	280	560	638
10° beam							
Range (meters)	500	1,000	2,000	4,000	8,000	16,000	18,280
Span (meters) 3,191	87	174.5	349	698	1,396	2,692	3.191

b. Range Resolution. Because of the constant 75-meter width of the range gate, target resolution on this radar set is the same for both long and short ranges. As shown in B, figure 1-24, the moving target visually can not be distinguished easily from clutter when it is out of the range gate. When the target is within the range gate, it disappears from A-scope and an audio presentation of the doppler signal generated by the moving target is given through the loudspeaker and/or headset. Therefore, if two targets have the same azimuth bearing and lie within 75 meters of each other, they can not be resolved by range alone.

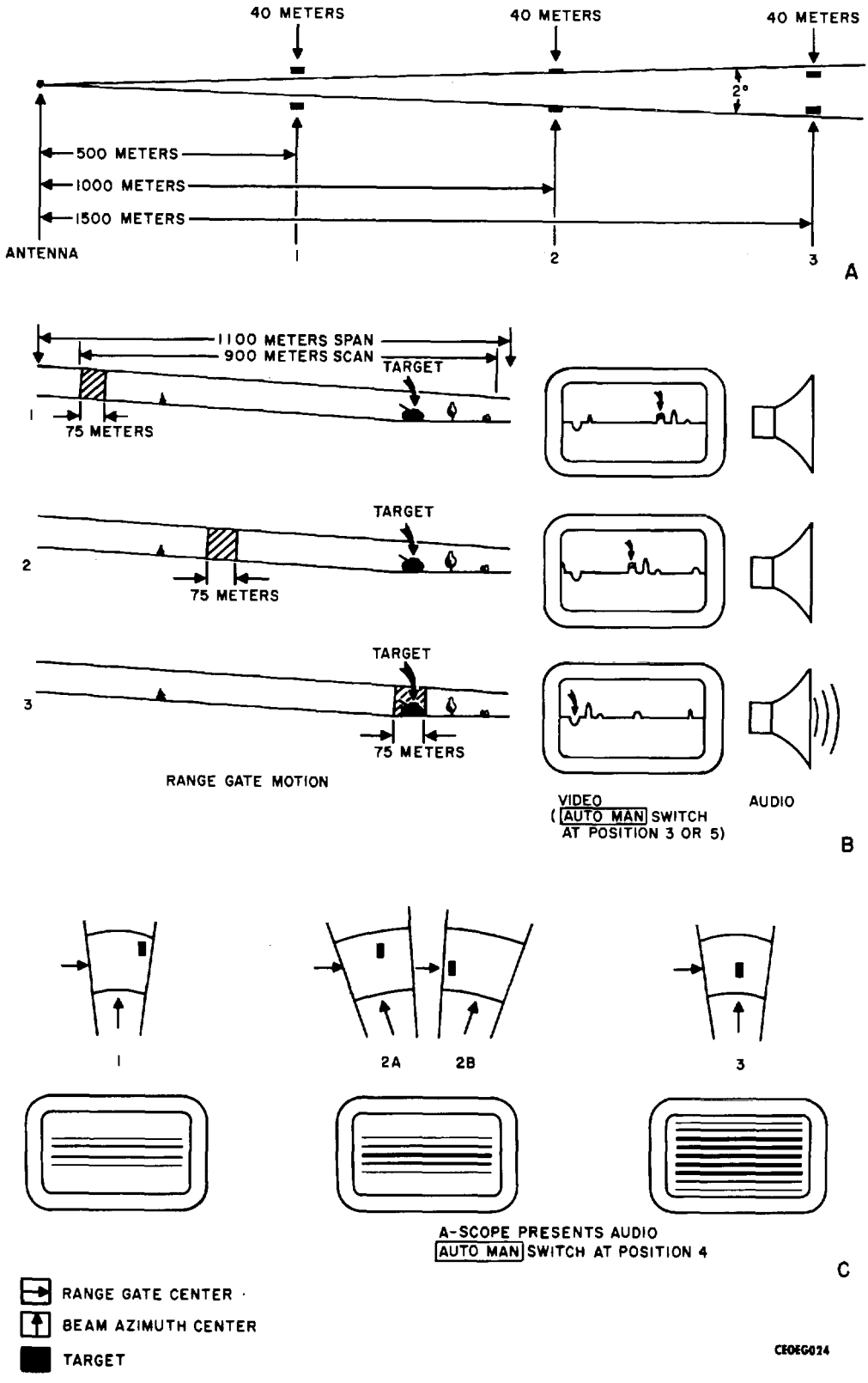


Figure 1-24. Target Resolution.

c. Aura/Resolution. The audio presentation of the doppler signal can be used to extend the resolution capabilities of the radar set in both the range and azimuth directions. As shown in C, figure 1-24, the aural return from a moving target will be strongest when the target is centered in both azimuth and range. Two targets present within the range and azimuth span of the radar beam can be detected by the presence of two audio peak levels of amplitude as the beam is critically centered. The MAN TRACK AUDIO position (position 4) of the AUTO MAN switch is particularly useful in such detection. To the trained ear, aural differences of tone also may uncover the existence of more than one target. If the targets are radically different in their characteristic motion or their speed, interpretation of the combined signal may permit detection. If the targets are of one class and moving at approximately the same speed, detection may still be possible through motions imparted to the target by the terrain it is moving over and through variation in the angle of intercept.

1-33. Differences in Models

a. Radar Set. AN/TPS-25A differs from Radar Set AN/TPS-25 and AN/TPS-25(XE-2) in that pressure relief valves (fig. 1-25) have been added in the coordinator, modulator, receiver-transmitter, power supply, radar set control, and antenna; an automatic leveling light turnoff circuit has been added to the receiver-transmitter (fig. 1-12); a corner reflector (fig. 1-17) is supplied with Radar Set AN/TPS-25A; and the shelter has provisions to mount the corner reflector on the inside of the curbside door, and linoleum has been laid on the shelter floor. Units that are identical in the two radar sets have the same nomenclature. Those that differ, even to a minor degree, contain an A in their nomenclature. The nomenclatures of these units are listed below. Corresponding units of both sets are operationally interchangeable.

(1) Antenna AS-981A/TPS-25.
(2) Control, Radar Set C-2715A/TPS/25.
(3) Coordinator, Servo Data SN-231A/TPS-5.
(4) Modulator, Radar MD-344A/TPS-25.
(5) Power Supply PP-2166A/TPS-25.
(6) Receiver-Transmitter, Radar RT-500A/TPS-25.
(7) Shelter, Electrical Equipment S- 124A/G.

b. The pressure relief valves in the major units of Radar Set AN/TPS-25A permit automatic equalization of air pressure between the inside and outside of the units, thus eliminating the need for opening the air intake ports on these units during high altitude transport.

c. The circuit added to the receiver-transmitter consists of a switch and a time-controlled relay circuit which turns off the leveling lights after 5 minutes of operation. When a switch at the back of the receiver-transmitter (fig. 1-12) is depressed, power is supplied to the leveling light circuit for 5 minutes (para 2-36(12)).

d. Radar Set AN/TPS-25(XE-2) differs from Radar Sets AN/TPS-25 and AN/TPS-25A in the nomenclature and component parts reference designation. The major units and cable assemblies of Radar Set AN/TPS-25 (XE-2) have nomenclature similar to those of Radar Set AN/TPS-25 with (XE-2) added. The differences between the component parts reference designations for the component parts in this manual are cross-referenced in the chart below:

AN/TPS-25(XE-21)	AN/TPS-25 and AN/TPS-25A
F1	F502
F2	F501
F101	F402
F102	F401
F103	F404
F104	F403
F501	F1002
F502	F1001
F701	F1006
F707	F1004
F708	F1005
F709	F1003
F901	F1801
F902	F1802
F903	F1803
F904	F1804
F905	F1806
F906	F1803
F1101	F1601
J1	J501
J2	J502
J209	J403
J210	J402
J211	J401
J212	J404
J501	J1005
J502	J1002
J503	J1001
J504	J1004
J505	J1006
J506	J2801
J507	J1003
J901	J1802
J902	J1801
J1101	J1604
J1102	J1601
J1103	J1603
J1105	J1605
J1109	J1602
J1201	J1901
J1301	J2401
J1401	J2601
J1402	J2602
P1	P2804
P2	P2806
P209	P2803
P210	P2805
P211	P2802
P212	P2807

AN/TPS-25(XE-21)	AN/TPS-25 and AN/TPS-25A
P213	P2808
P214	P2809
P215	P2810
P216	P2811
P217	P2812
P501	P2812
P502	P2818
P504	P2824
P505	P2822
P506	P2823
P507	P2813
P901	P2826
P902	P2825
P904	P2827
P905	P2828
P11O1	P2819
P1102	P2817
P1103	P2820
P1109	P2814
P1201	P2801
P1301	P2821
P1401	P2602
P1402	P2601
W205	W2801
W206	W2802
W207	W2803
W208	W2804
W209	W2805
W210	W2806
W501	W2809
W502	W2808
W503	W2812
W504	W2811
W505	W2807
W901	W2813
W902	W2814
W1401	W2602
W1402	W2601
W1404	W2603

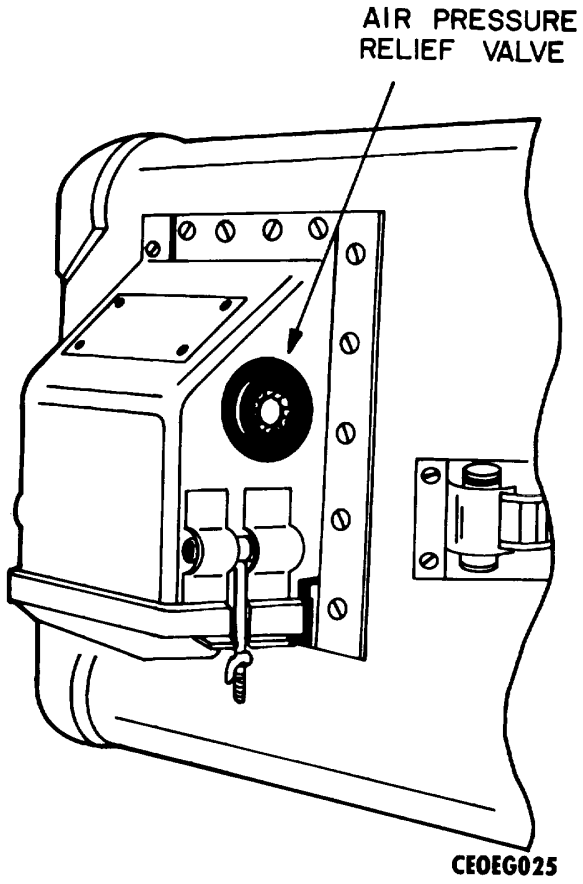


Figure 1-25. Typical Air Pressure Relief Valve.

CHAPTER 2

INSTALLATION

Section I. SERVICE UPON RECEIPT OF RADAR SET AN/TPS-25

2-1. Unpacking

a. Packaging Data. When packed for shipment, the components of Radar Set AN/TPS-25 are placed in the shelter which is then enclosed in a wooden crate. Figure 2-1 illustrates the method of crating the radar set when it is shipped from the factory. The table below lists the overall dimensions, volume, weight, and contents of the shipping crate.

	Over-all dimensions (inches)					Contents of box	
Shipping box No.	Height	Weight	Depth	Unit volume (cu ft)	Unit weight (lb)	Quantity	Name
1	80	80	125	463	3,900	1	Electrical Equipment Shelter S-124/G with all operating components of Radar Set AN/TPS-25

b. Removing Contents. Perform all the steps outlined below when removing the equipment packaged in the wooden crate (fig. 2-1).

(1) Remove the nails from the top and sides of the crate with a nail puller. Remove the top and sides. Do not attempt to pry off the top and sides since this may damage the shelter.

(2) Cut and remove the four metal straps that are used to secure the shelter to the skid.

(3) Remove the shelter from the skid.

(4) When the shelter is opened for inspection (para 2-2) remove any desiccants that have been placed inside the unit.

2-2. Checking Unpacked Equipment

NOTE

In order to inspect the individual units of Radar Set AN/TPS-25, the remote operating components must be removed from the shelter according to the procedure outlined in paragraph 2-12 After the remote operating components have been removed from the shelter, open the accessories box (fig. 43) and remove the shelter tiedown cables and shelter lifting cable (fig. 1-18). Place these cables aside for later use when the shelter is mounted and tied down on its transporting vehicle. The remote operating components should be put back into the shelter only after the shelter is placed on the vehicle. The shelter lifting cable can then be replaced in the accessories box.

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on SF 364 (Report of Discrepancy). Proceed as follows:

(1) After the removal of the remote operating components (para 2-12), inspect each unit of the radar set stored in the shelter during shipment. Make sure none of the shelter operating components have been loosened or detached from their respective moorings on the shelter floor or walls. Remove the front cover or canvas cover from any loosened or detached units.

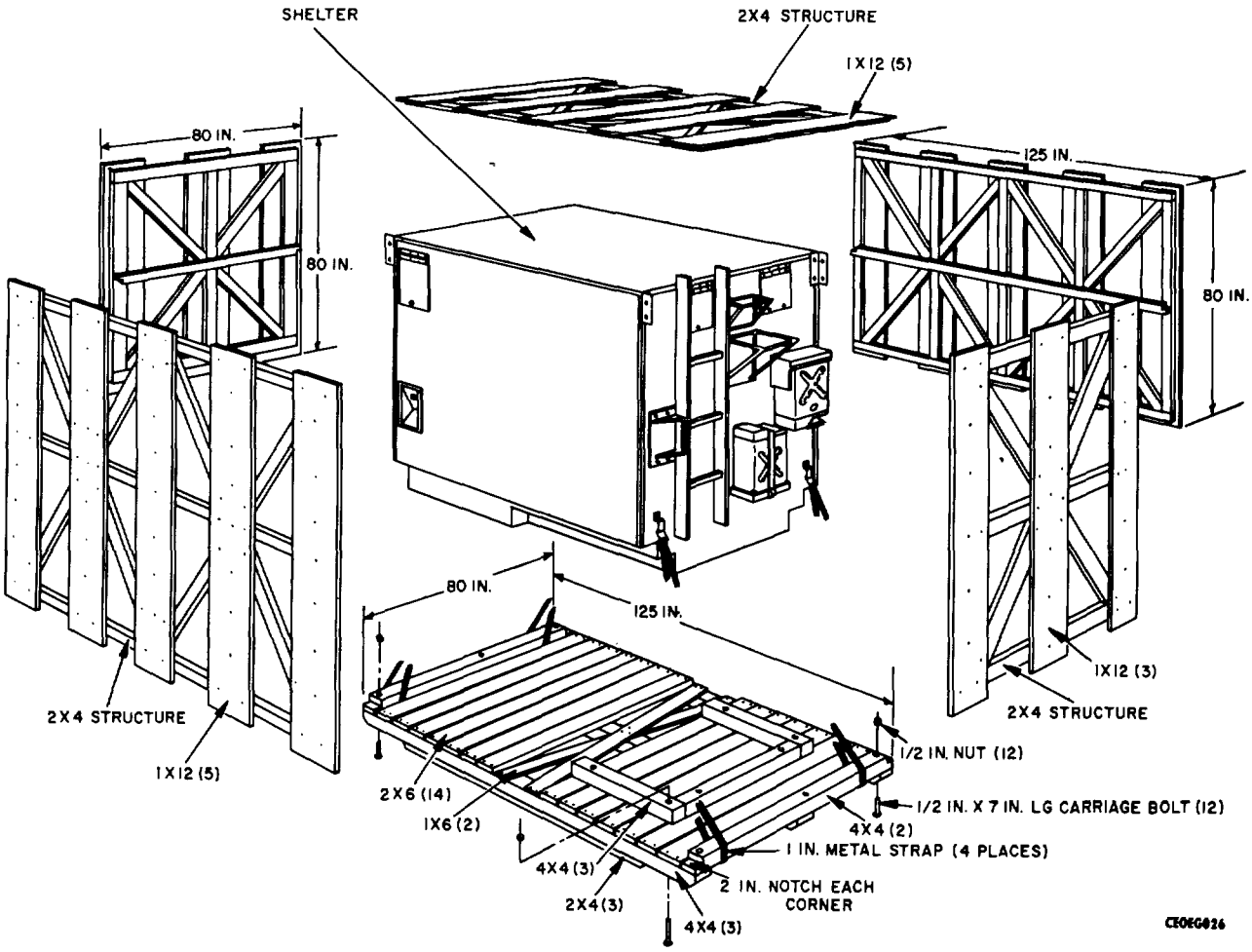


Figure 2-1. Packaging of Radar Set AN/TPS-25.

(2) Loosen the trunk latches that secure the panel chassis assemblies to the unit cases and slide or lift the unit or assembly out of its case as far as possible.

(3) Inspect each unit for the following:

(a) Loose or broken tubes.

(b) Loose tube shields.

(c) Loose tube exterior lead connections, including the filament connections on the magnetron.

(d) Broken insulators.

(e) Broken connectors.

(f) Loose knobs.

(4) Be careful when inspecting the radar set control which is mounted on the plotting board. Make sure the coupling connections for range and azimuth control to the plotting board are tight and intact and are not damaged or bent in any way.

b. Check the equipment against the packing list and the table of components (para 1-9).

c. If the equipment has been used or reconditioned, check whether it has been changed by a modification work order (MWO). If modified, the MWO number will appear on the front panel near the nomenclature plate. Check to see that the literature has been corrected to reflect the MWO.

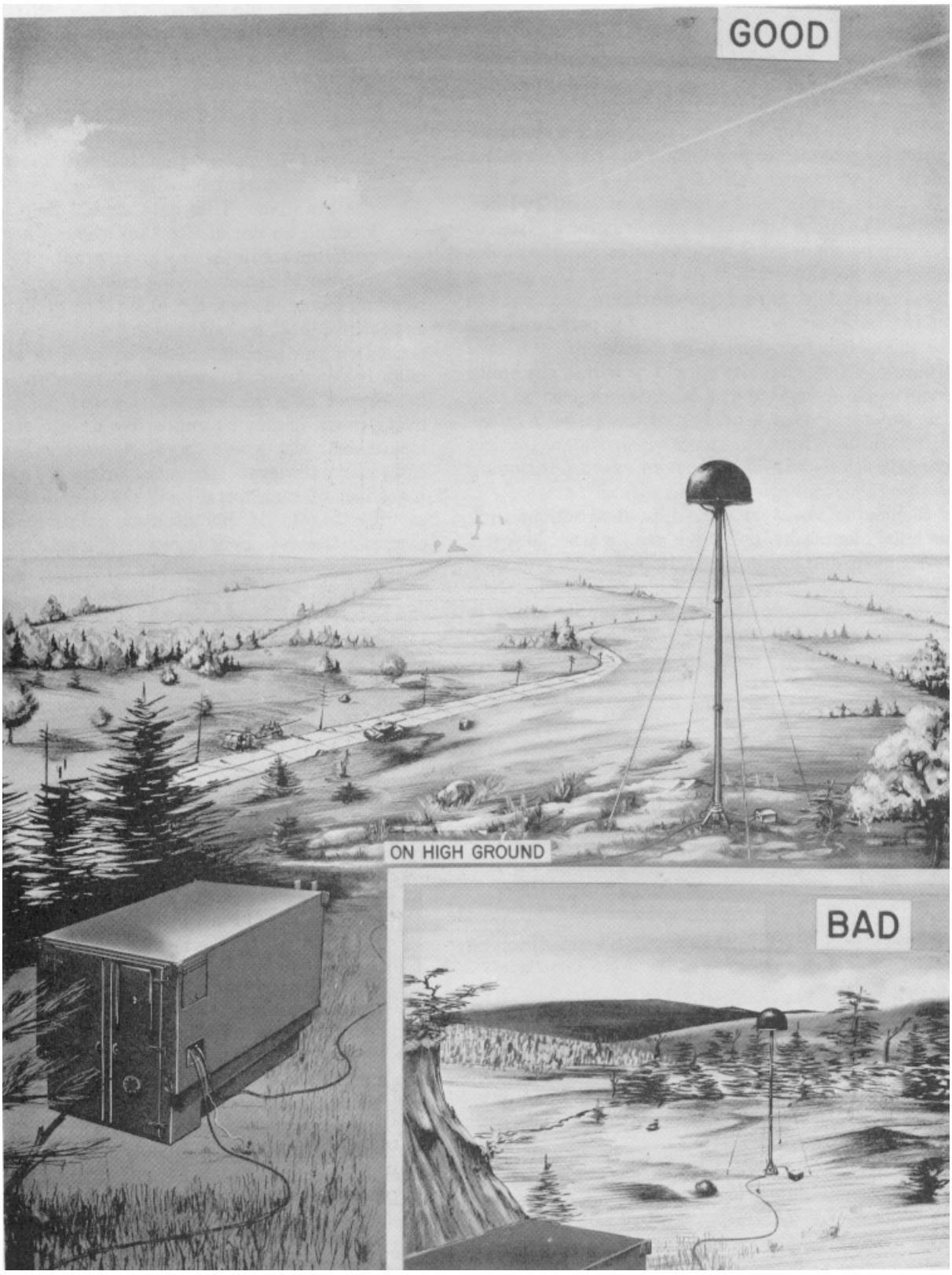


Figure 2-2. Siting Radar Set AN/TPS-25

2-3. Siting

a. An ideal operating site provides maximum range-detection capabilities in all directions of interest with a minimum of fixed targets that could obscure moving targets. A certain amount of fixed targets are necessary however, to provide a reference point for moving targets within the fixed target or clutter area (doppler effect, para 1-26). Figure 2-2 illustrates terrain characteristics of good and bad siting. The radar set is used primarily for location of moving personnel or moving vehicles, and the choice of a site depends to a large extent on the general location of these targets. The maximum usable range of the radar set is 12,000 meters for personnel and 18,280 meters for vehicles the relative size of a jeep. Therefore, the radar site should be within the limits mentioned for the type of detection desired so that the greatest possible portion of the target's movement will be within the range of the radar. Tactical considerations will dictate more exact positioning within these limitations.

b. Shadow areas are caused by obstructions such as hills, mountains, buildings, etc., which block the radar beam and prevent detection of moving targets located on the far side (fig. 2-3). These targets are said to be in shadow so far as radar detection is concerned. Careful consideration is necessary to locate a site that will give best results. If the chosen site does not provide satisfactory detection capabilities and/or large areas of fixed targets interfere with the tracking of moving targets, the radar set should be moved to a new location, determined by an evaluation of results obtained at the initial site.

NOTE

In the information that follows, known factors that control selection of a radar site are given. This data should help in locating an initial site that gives a near optimum result for any given area.

e. In order to detect moving military objects, particularly foot-soldiers and vehicles at as great a range as possible, the line-of-sight path from the radar to all points on the horizon should be level or slanting lightly downward. In general the radar site should be located at a moderately elevated position. In many cases, it may be impossible or impractical to locate the radar where there are no terrain projections above the level of the radar antenna. The shielding effect of such terrain will prevent detection of moving targets. If this situation exists in an area over which surveillance is required, locate the radar antenna as near as possible to a position where such obstructions lie in directions where a loss of detection can be tolerated. The higher and closer a hill or mountain is to the radar site, the more extensive will be the loss of radar coverage.

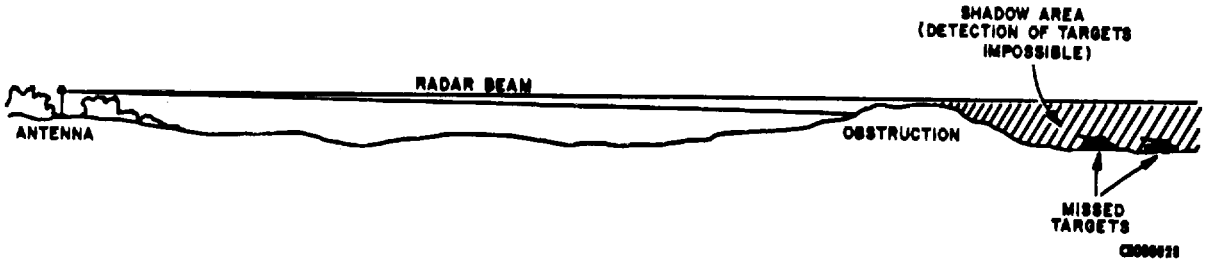


Figure 2-3. Shadow Area.

d. Radar Set AN/TPS-25 is normally operated from within the shelter. When so operated, all units of the radar set except the remote operating components and their interconnecting cables are located within the shelter as shown in figure 1-5.

e. Since an aural indication is utilized for the detection of targets, the operating position should be made as free of noise as possible. The engine generator, therefore, should be located as far as possible from the shelter, and the shelter doors should be kept shut during operation to minimize any external noise.

f. If required by local considerations, tactical or otherwise, the receiver-transmitter, antenna, and modulator may be installed on the roof of the shelter and operated from that position.

g. When tactical considerations warrant, or weather conditions and outside noise conditions permit, the radar set may be operated outside the shelter. In this case, all the components of the radar set normally used in shelter operation can be removed from the shelter and set up in a fixed station (bunker, building, or enclosure of some type) or in the field. Three interchangeable cables are supplied for connecting the receiver-transmitter to the coordinator. These cables have a total combined length of 225 feet and are used singly, or in a series combination, in locating the antenna, modulator, and receiver-

transmitter away from the enclosure or operating location (fig. 1-1).

h. Three interchangeable mast sections (fig. 1-14) are supplied to provide a maximum antenna height of approximately 25 feet. The equipment may be operated with one, two, or three mast sections, or without the mast since the receiver-transmitter design permits direct mounting of either the mast or the antenna. Normally, the antenna should be as high as possible to avoid local obstructions. However, this will depend upon tactical considerations.

I. If the antenna is to be installed at a distance of less than 126 feet from the shelter, the relative positions of the antenna and shelter should be chosen so that the beam of the antenna will not be directed toward the shelter in normal operation. A hazard from RF burns exists up to a distance of 126 feet.

2-4. Preinstallation Survey

After selecting an operating site, a survey should be made to obtain the information listed in *a* through *d* below. This information is essential if full advantage is to be taken of the accuracy of the radar set. Orientation procedures for attaining accurate reference to North are given in paragraph 2-38. Under certain conditions, it may be necessary to accept less accurate orientation with reference to North. This may be due to the location of the particular area or sector under surveillance by the radar. Procedures will also be discussed for orienting the antenna for these conditions.

a. The exact location of the proposed antenna site, located with a stake and shown on the applicable sector map.

b. The exact location of a second stake, shown on the sector map and placed approximately 450 meters from the antenna stake in the opposite direction of the sector of interest.

c. The azimuth angle, in mils, of the line between the two stakes and true or map North.

d. The condition of the ground at the antenna site. If the ground is hard, do not mount the stake plates (fig. 1-16) on the guy-wire stakes. If the ground is soft or sandy, mount the stake plates on the guy-wire stakes.

2-5. Out of Shelter Operation Requirements

Radar Set AN/TPS-25 is designed primarily for shelter operation. The equipment may be conveniently set up for fixed station operation, however, by the removal of all operating components located in the shelter. The interconnecting cables supplied with the equipment have sufficient length to permit a good arrangement of the units in an operating room or area (such as a bunker). The suggestions which follow will aid in taking advantage of the inherent flexibility afforded by the equipment design, without making up special cables.

a. When installing the radar set in a fixed station location, cables W2601 and W2602 (para 2-28a) located in the shelter and connecting the receiver-transmitter to the coordinator and the engine generator to the power supply will not be used since these cables are part of the shelter.

b. Arrangement of the units in the fixed station location can be the same as when they were in the shelter. The coordinator and power supply can be placed on the floor under the plotting board. The radar set control will be fastened to the plotting board as in the shelter. Here, the plotting board is normally used unless otherwise warranted by tactical considerations. The loudspeaker may be placed conveniently within the limits of the length of connecting cable W2811 (para 2-28*c*).

c. The modulator, receiver-transmitter, and the antenna (with mast sections, if used), can be grouped in a location at a maximum distance of up to approximately 225 feet away from the fixed station. Three cables are supplied for interconnecting the receiver-transmitter with the coordinator, and any convenient number of cables may be used.

d. Make certain than the floor or any benches in the fixed station location on which the equipment units are to be installed are strong enough to support the weight of the units. Unit weight of the equipment is given in the components chart (para 1-9*a*).

e. A minimum of approximately 48 square feet of floor space is required to install the various units in another shelter with sufficient space allowed around the units for operating and servicing. Allow at least 6 inches between the walls of the station and the rear of the units for running cables and for servicing. The overall dimensions of each unit (fig. 2-4, 2-6 through 2-14) will be helpful when planning a fixed station installation.

f. The generator should be placed as far away as possible from the station so that its noise does not interfere with the operation of the equipment, since moving targets are indicated aurally and any additional noise would tend to obscure the target indication.

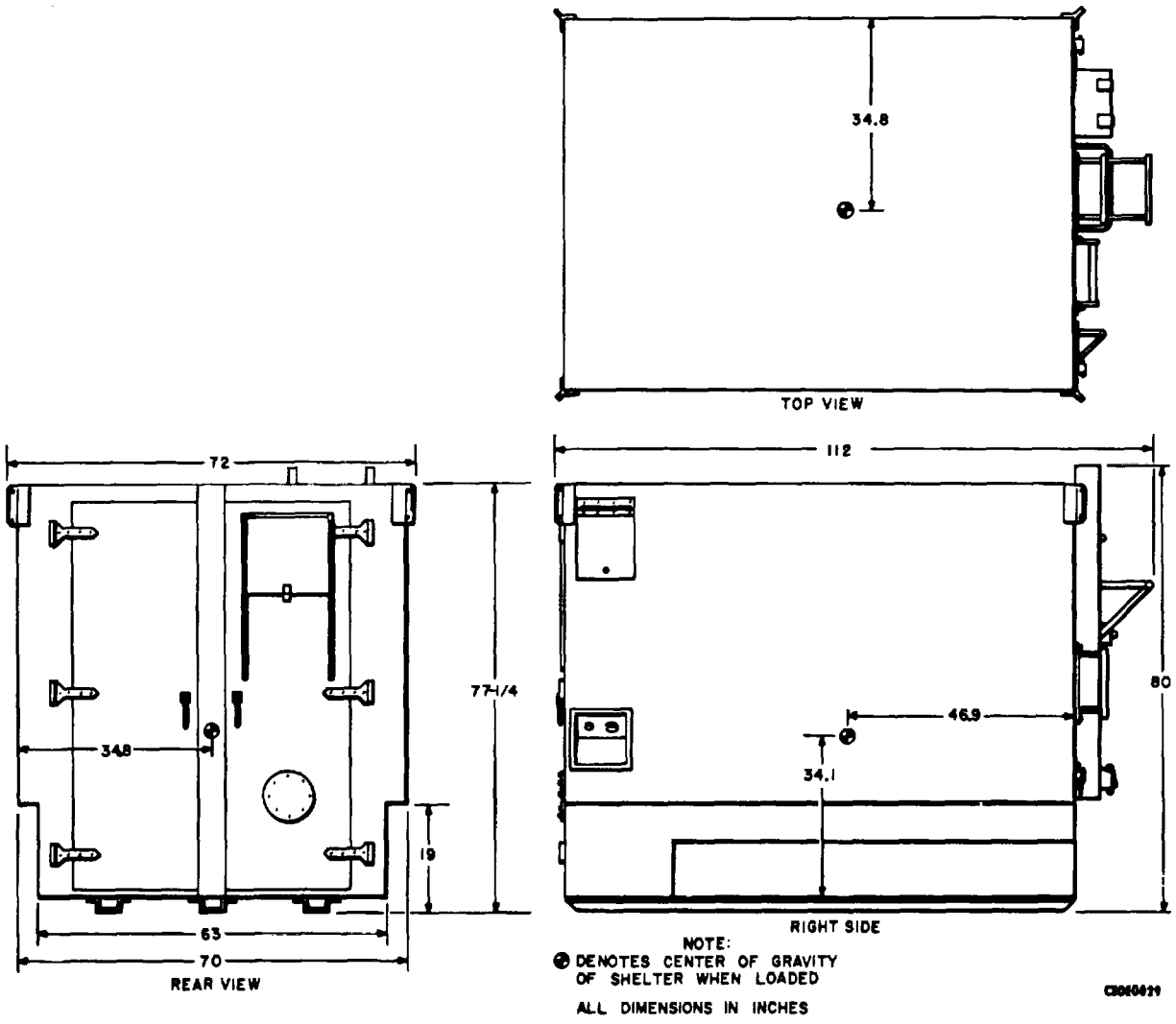


Figure 2-4. Electrical Equipment Shelter S-124/G, Dimensional Drawing.

Figure 2-5. Deleted

All data on page 2-7, including Figure 2-5, deleted.

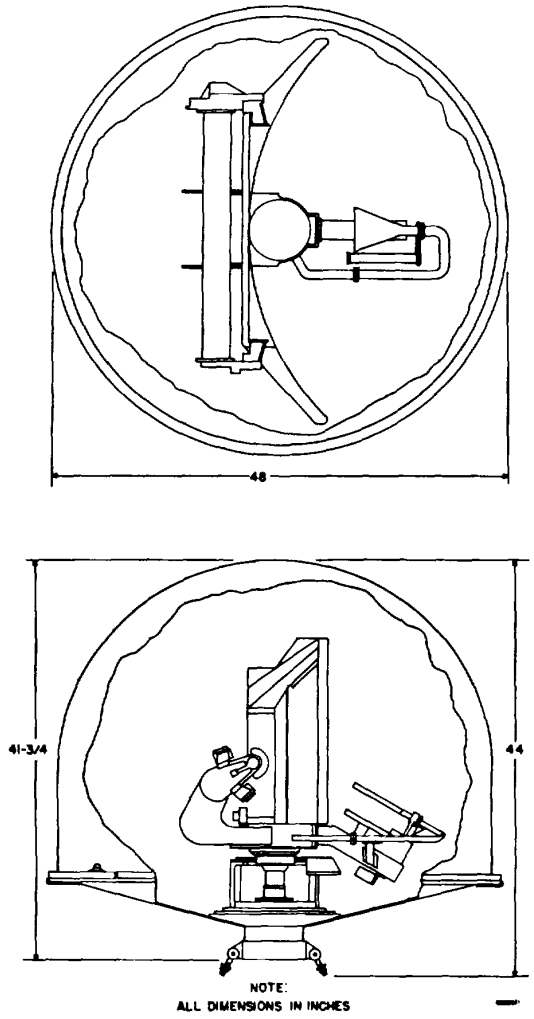


Figure 2-6. Antenna AS-981/TPS-25, Dimensional Drawing

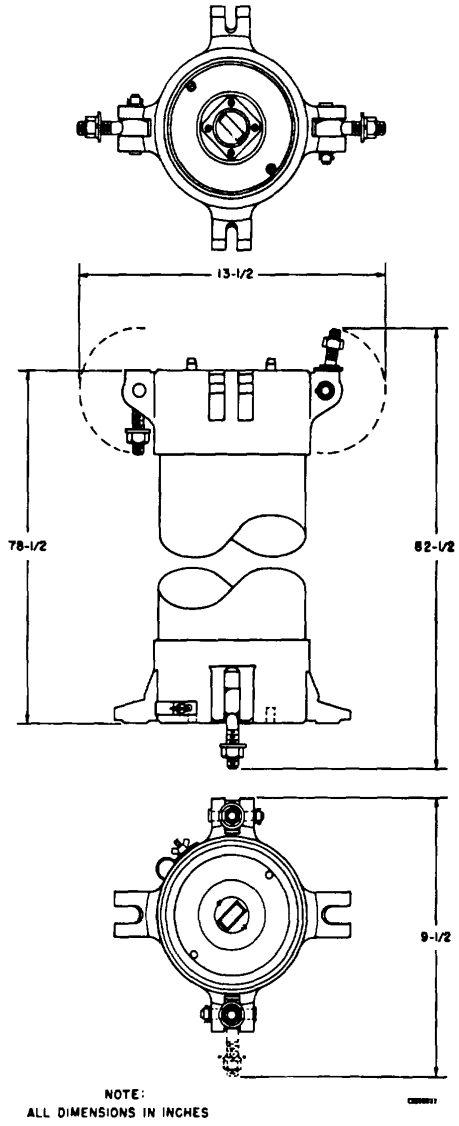


Figure 2-7. Mast AB-588/TPS-25, Dimensional Drawing.

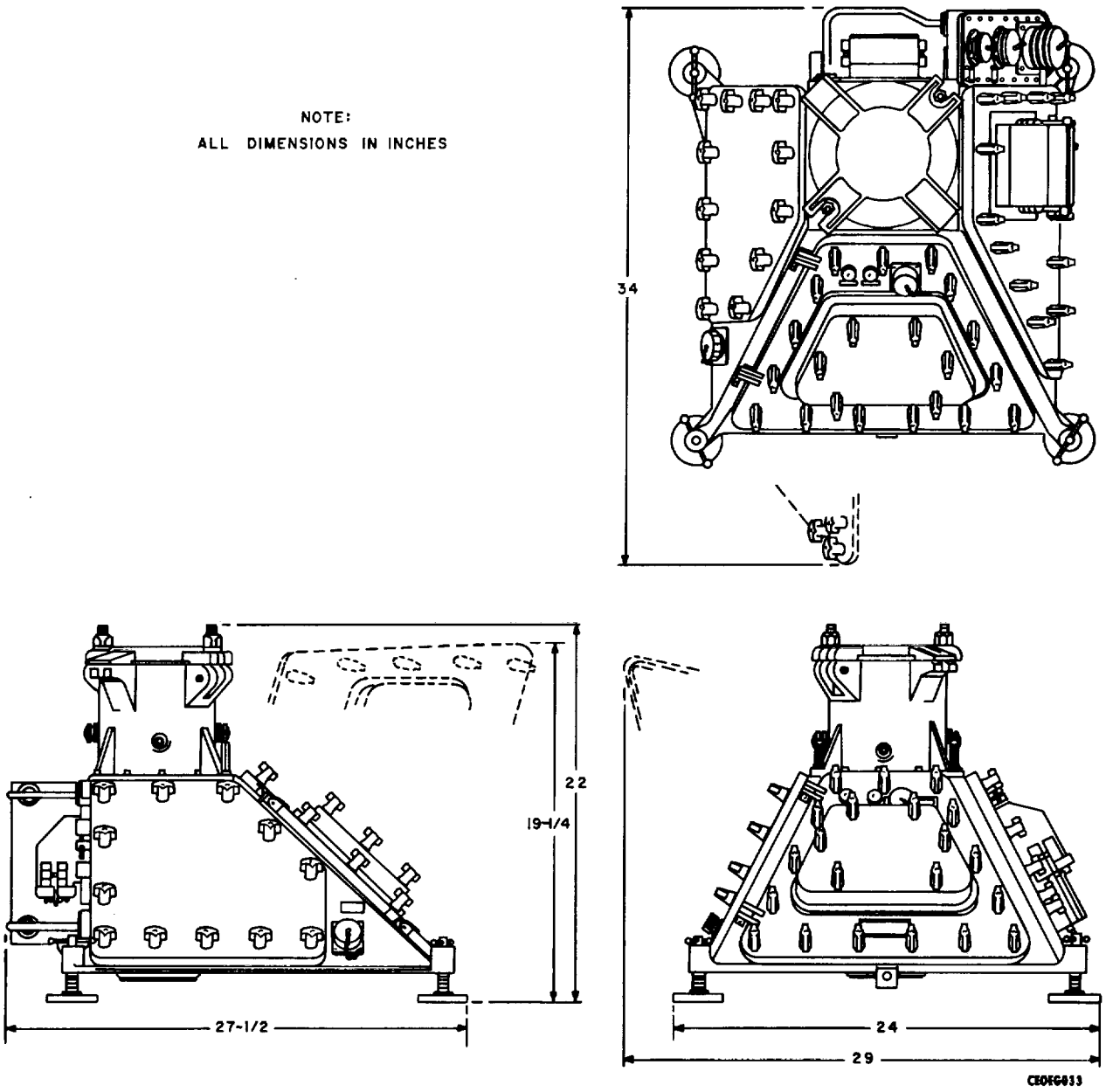


Figure 2-8. Radar Receiver-Transmitter RT-500/TPS-25, Dimensional Drawing.

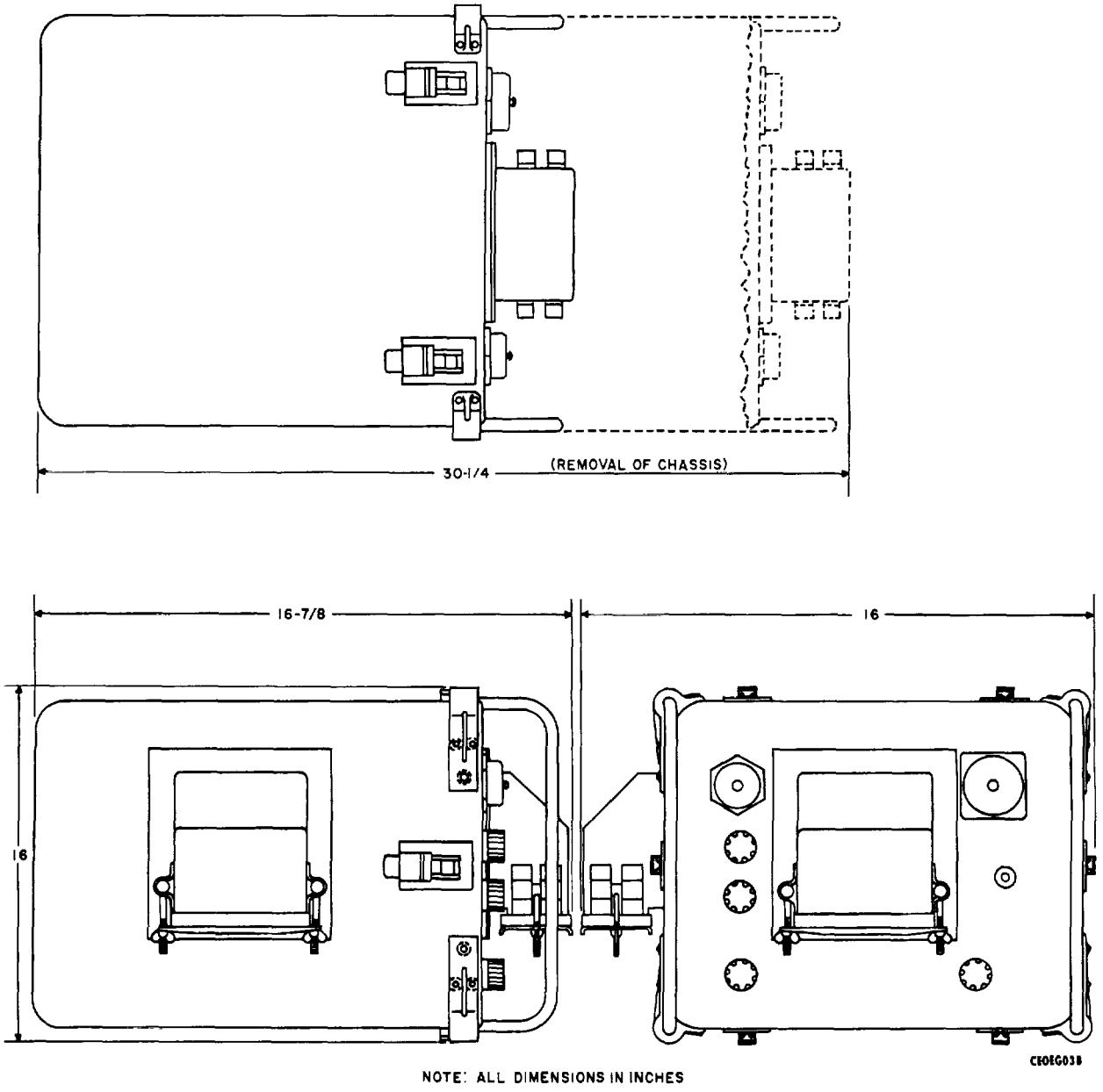


Figure 2-13. Radar Modulator MD-344/TPS-25, Dimensional Drawing.

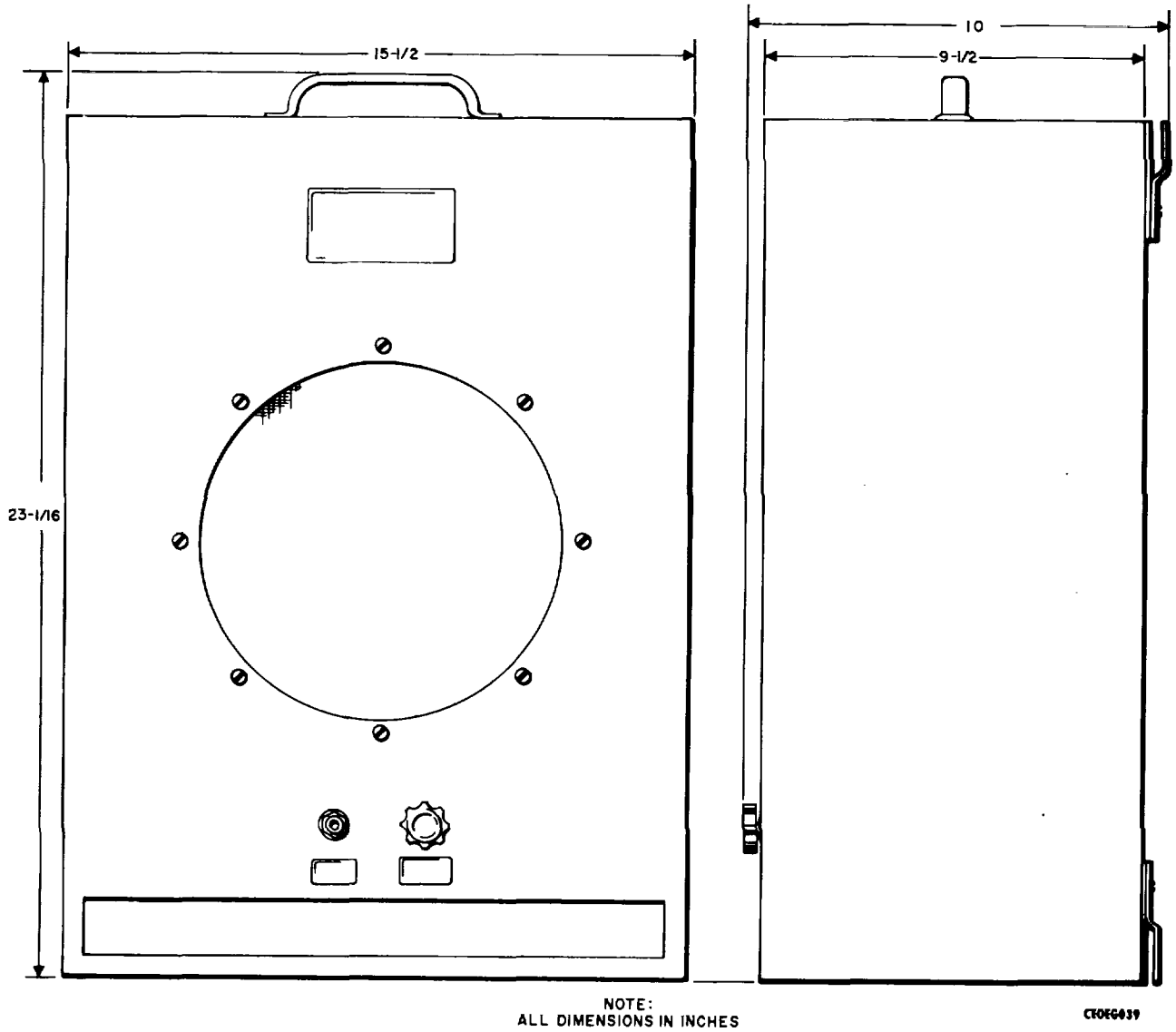


Figure 2-14. Permanent Magnet Loudspeaker LS-451/G, Dimensional Drawing.

Section II. INSTALLATION PROCEDURES

WARNING

Overexposure to radio frequency energy is injurious to personnel. Avoid direct exposure in the radiated beam when the antenna is stationary. Exposure in the stationary radiated beam at a distance of 40 feet from the antenna should be limited to 10 minutes. Exposure at shorter distances should be limited accordingly and avoided entirely, if possible. At a distance of 126 feet or more from the antenna, the radiation level within the antenna beam is not -20 injurious to personnel. Limit direct exposure in the stationary beam at distances between 40 and 126 feet on the basis of a maximum of 10 minutes permissible exposure at 40 feet. The antenna should not be installed within 126 feet of a fixed working area without proper authority.

2-6. General

a. After the operating site has been selected, the radar may be set up for operation from the shelter or for operation with the shelter components of the ra-

dar set installed in a bunker, tent, or building. Paragraphs 2-12 through 2-9 cover operation from the shelter. Paragraph 2-23 covers the removal of the components from the shelter for operation outside the shelter. When tactical considerations warrant the removal of the shelter from the transporting vehicle, lifting equipment is required to raise the shelter off the transporting vehicle (truck or trailer), or a skid should be provided to slide the shelter from its transporting vehicle when the shelter has reached the proposed operating site. If the equipment is to be used outside the shelter but there is no bunker, building, or enclosure of any type available, the operating components may be set up in the field. When a field installation is being made however, the radar set control and the plotting board should have a protective covering, such as a tent or fly. The plotting board and radar set control (with front cover removed) are not immersionproof and should be protected from rain and moisture. If the radar set control is used without the plotting board, and in an exposed condition, the air exhaust port and the air intake port, on the top and side of the radar set control respectively, must be shielded so that water cannot flow into them. Also, dummy plug P1601 (fig. 1-8), on the radar set control, must be connected to J1603 on the radar set control. This dummy plug contains a short between two pins, which completes the 115-volt ac distribution circuit. Power cannot be applied to the radar set control when the plotting board is not used without connecting this dummy plug (P1601).

b. If the equipment is to be housed in a bunker, building, or enclosure of some type, all the pieces of equipment normally used in shelter operation can be moved inside the enclosure, if there is an adequate area within the enclosure for easily operating and maintaining the equipment. If the radar set control is used without the plotting board, the procedure for connecting the dummy plug will be the same as in a above.

c. When operation from the shelter is desired but the shelter must be removed from the transporting vehicle, a method for lifting the shelter off the transporting vehicle must be provided. A lifting eyelet is available on a bracket at each upper corner of the shelter (fig. 1-2) for securing the shelter lifting cable (supplied with the equipment). Be careful when lifting the shelter from the transporting vehicle.

d. If a lifting mechanism is not available, a skid can be used to slide the shelter off the transporting vehicle. The skid should be braced against the rear of the transporting vehicle so that the angle of incline of the skid from the vehicle to the ground is not too steep. Methods of removing the shelter from the transporting vehicle are covered in detail in paragraphs 2-9 through 2-11.

e. At least four people are required to install Radar Set AN/TPS-25 for normal operation from the shelter. The average time for installation and disassembly, using four- and six-person teams, is given below:

Mast sections used	Number of people	Time for assembly (min)	Time for disassembly (min)
3	6	27	23
3	4	34	25
2	6	24	18
2	4	29	22
1	4	21	16
No mast	4	13	14

NOTE

Time shown does not include the time required to remove the shelter from the transporting vehicle.

f. Select the equipment site and determine the azimuth orientation reference point as outlined in paragraph 2-4.

g. Install the radar set in the following sequence:

(1) Remove the remote operating components (para 2-12).

(2) Remove the shelter from the transporting vehicle, if desired (para 2-9).

(3) Install the receiver-transmitter baseplate and antenna guywire stakes (para 2-13).

(4) Install the receiver-transmitter (para 2-14).

(5) Connect the mast sections (if used) to the antenna and receiver-transmitter (para 2-165).

(6) Erect the mast and antenna (para 2-16).

(7) Install the modulator and generator (para 2-17).

(8) Prepare the shelter components for operation (para 2-18).

(9) Make the interunit cabling connections (para 2-20).

(10) Perform the alinement and adjustment procedures (para 2-36-2-41).

NOTE

Omit steps (3), (5), and (6) above, if the radar set is to be operated without the mast sections.

h. The hardware required to assemble and connect the components of the radar set is found fastened to the units, or stored in the curbside accessories box or the roadside storage box (fig. 2-22).

i. All of the interconnecting cables have a female connector at one end and a male connector at the opposite end. When interconnecting the various units of the radar set, be sure that a male connector is inserted into a female connector, and vice versa. Careless forcing of a male connector into a female connector may seriously damage the connector pins or jacks. All cables and connectors on the various units are supplied with caps. Each pair of corresponding cover caps is threaded to match. After inserting a connector into a receptacle and tightening it into place, screw the two cover caps together to prevent accumulation of dirt and corrosion of the threaded parts.

2-7. Reinstallation of Equipment After Short Distance Travel

Paragraph 5-1 specifies the procedures involved for dismantling the equipment for travel over short distances. For reinstallation of the radar set and preparation for operating after short distance travel, select and survey the new site and then proceed with reinstallation according to paragraphs 2-9 through 2-22.

2-8. Special Tools and Test Equipment Required for Installation

No special tools or test equipment are required for installing Radar Set AN/TPS-25. All parts or articles necessary for installation are supplied with the equipment. The operating components of the radar set should be in good operating condition when they arrive after shipment. If no damage has been incurred during shipment, the components of the radar set, after installation, should perform their respective functions with the normal adjustments and alinements as stated in paragraphs 2-29 through 2-41.

2-9. Removal of Shelter from Transporting Vehicle

If the shelter is to be removed from the transporting vehicle, a means for lifting or sliding the shelter off the vehicle must be provided. The shelter transporting vehicle can be either a 3/4-tone trailer, a 1 1/2-ton trailer (M-105 type), or a 2 1/2-ton cargo truck. Two methods for removing the shelter from the vehicle will be covered in paragraphs 2-10 through 2-11. In most instances the two methods will be the same for both the M-105 type trailer (if used) and the 2 1/2-ton cargo truck (if used).

2-10. Removal of Shelter Using Hoisting Mechanism (fig. 2-15)

If a hoisting mechanism is available (such as a crane 2-22 attached to a truck), the removal of the shelter from the transporting vehicle can be facilitated by following the procedure outlined below. The hoisting mechanism must be capable of lifting at least 6,000 pounds.

a. If the shelter is mounted on an M-105 type trailer, lower the retractable wheel at the front of the trailer and lock it in the down position.

b. Decouple the trailer from the prime mover.

c. Move the trailer to the desired location at the site and use at least three people. Note that, if possible, the prime mover should move the trailer as close as practicable to the desired operating location. Shelter-mounted components of the radar set can be located at a maximum distance of approximately 225 feet from the antenna site. The location should be fairly level and permit ready access to the shelter.

d. Apply the trailer handbrake and chock the wheels to prevent the trailer from moving. (If the transporting vehicle is a 21A-ton cargo truck, this procedure step also applies).

e. Unlock and lower the rear leg prop assembly attached to the rear underside of the trailer and lock it in the lowered position. The rear leg prop assembly prevents the trailer from tipping backwards.

f. Remove the shelter from the transporting vehicle (trailer or cargo truck) as follows:

(1) Loosen the tension on the four shelter tiedown cables (fig. 1-18) that are hooked to the bottom hole on the bracket at each upper corner of the shelter by releasing each locking lever of each cable. Loosen the turnbuckle and unhook the cables first from the transporting vehicle and then from the shelter.

(2) Recoil the cables and place them to one side.

(3) Remove the remote operating components of the radar set as stated in paragraph 2-12.

NOTE

The removal of all other units of the radar set from the shelter (para 2-23) is not required before shelter removal, but it is advisable to take out all the shelter operating components, both to lessen the weight of the shelter, and to avoid damage to the equipment in case of a faulty hoisting mechanism. Should the shelter be chocked in place on the transporting vehicle by three chocks (two small and one large, supplied with the equipment) bolted to the sides and front of the shelter, they do not have to be removed.

(4) Remove the shelter lifting cable (fig. 1-18) from the accessories box located at the curbside wall of the shelter. Attach the shackle on each of the four ends of the cable to the top hole in the bracket (fig. 1-2) at each upper corner of the shelter.

(5) The hook on the end of the hoisting mechanism is then placed through the ring attached to the common end (lifting ring) of the shelter lifting cable.

(6) Lift the shelter from the transporting vehicle (remove transporting vehicle if necessary) and place the shelter into position.

(7) After the shelter has been placed in the desired location, replace the shelter operating components in the shelter (if they had been removed previously) according to the procedure for repacking the equipment (para 5-10).

NOTE

The shelter can also be removed from the transporting vehicle by means of a helicopter equipped with a heavy duty winch hoist.

2-11. Removal of Shelter Using Skid (fig. 2-15)

a. If a hoisting mechanism is not available, a skid may be used to remove the shelter from the transporting vehicle. The preparation for removal is the same as in paragraph 2-10a through f(3). After these preparatory steps have been completed, perform the following steps:

b. The skid can be shored up by using blocks of wood or a wooden horse. Driving stakes into the ground directly at the bottom of the skid will prevent the skid from sliding off the rear of the vehicle as the shelter is being pushed onto it. If the transporting vehicle can be backed up to an abutment or a rise in the ground that does not exceed the chassis height of the vehicle, it will facilitate the removal of the shelter from the vehicle by the above method.

c. Whenever the shelter is to be removed from the transporting vehicle, the shelter should be moved to the exact operating site by the vehicle, if possible. This will make any movement of the shelter unnecessary once it is taken off. If the radar is to be set up in a particular installation for any length of time, the chocks may be removed from their shelter transport location and bolted in their storage place on the front of the shelter (fig. 1-2).

2-12. Removal of Remote Operating Components

Radar Set AN/TPS-25 is designed primarily for operation apart from the transporting vehicle. When tactical considerations are such that the removal of the shelter from the vehicle proves to be a disadvantage (both to personnel and the equipment), the radar set can be operated from the transporting vehicle. In all cases, however, remove the remote operating components from the shelter, and proceed as follows:

a. Unlock and open both doors at the rear of the shelter.

b. Loosen the wingnut locks (fig. 2-16) at the top and bottom of the center post between the doors. Swing out the bottom of the post and pull it down; disengaging the pin at the top of the post from the shelter. Remove the center post from the shelter.

c. Deleted.

d. Remove the reversible ratchet wrench from its bracket at the end of the accessories box toward the rear curbside corner of the shelter.

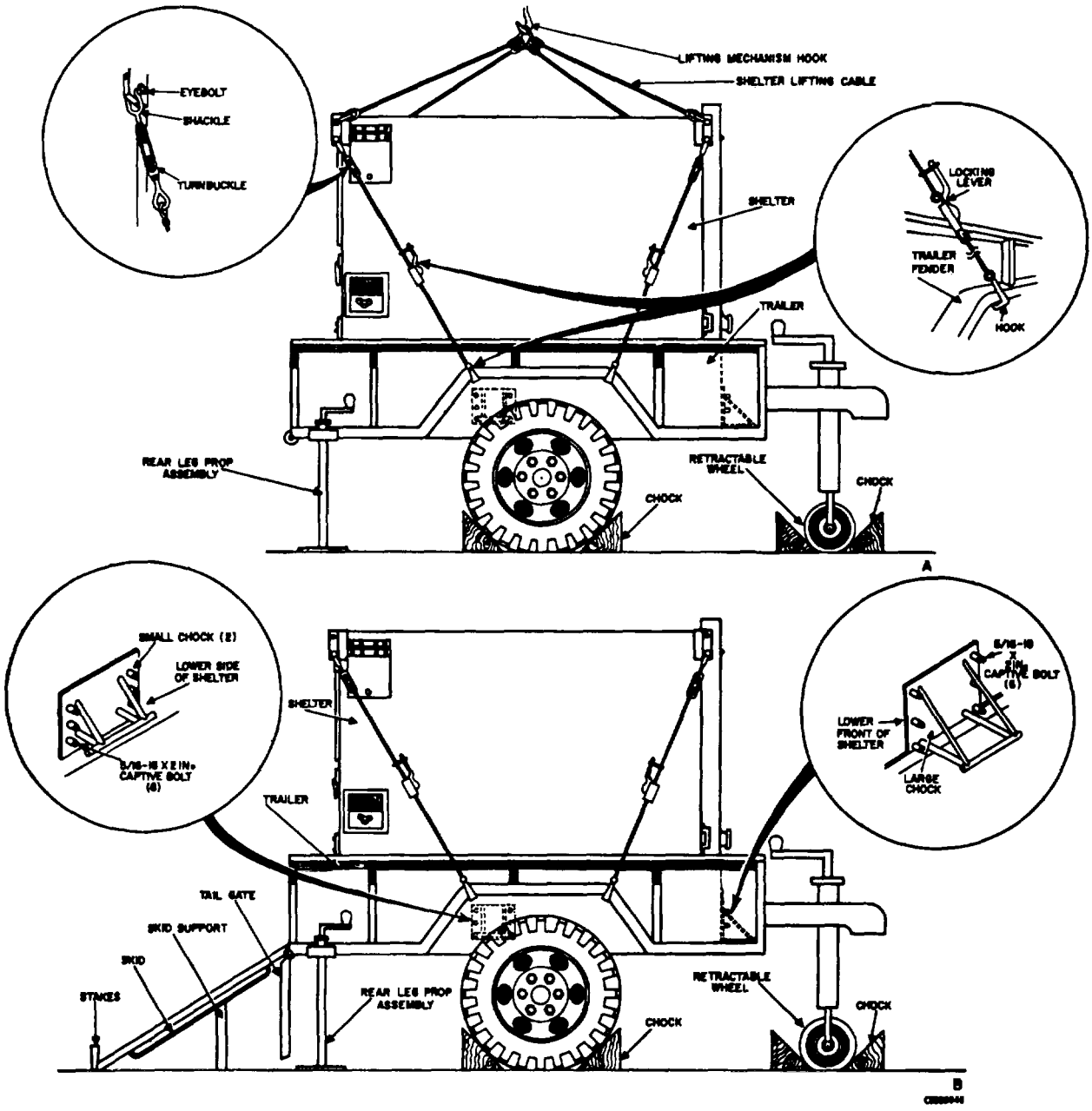


Figure 2-15 Removal of Shelter from Transporting Vehicle.

e. Deleted

f. Deleted

NOTE

If the installation of the radar set is being made in darkness, the generator may be installed and connected immediately to the shelter (after the removal of the remote operating components) to provide illumination inside the shelter. Install and connect the generator according to the procedure outlined in paragraphs 2-17*b* and 2-20*c* and *d.*

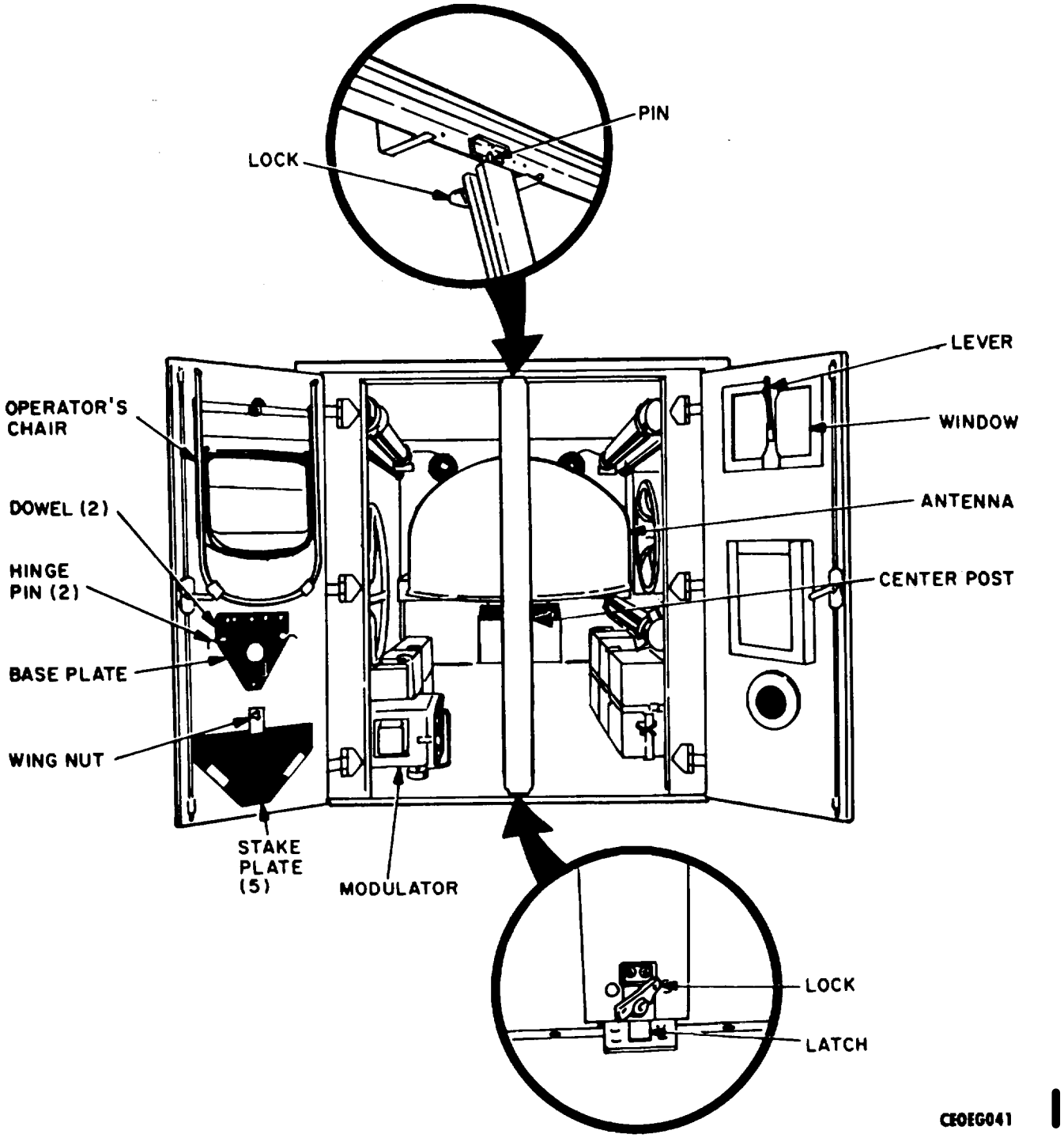


Figure 2-16. Removal of Center Post From Shelter Doorway.

g. Loosen the two wingnuts (fig. 2-19) that secure the modulator to its shock mount at the rear roadside corner of the shelter. Pull the pressure clamps out and swing them down and away from the modulator. Lift the modulator out of the shelter by its carrying handles. The modulator must be carried to a position close to the antenna site, since the interconnecting cables used between the modulator and receiver-transmitter are relatively short.

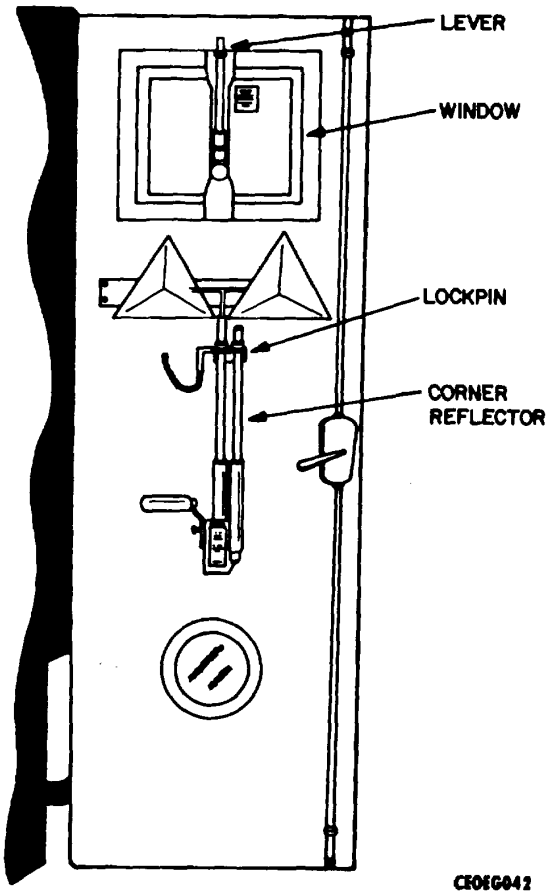


Figure 2-17. Shelter Mounting of Simulator, Radar Target SM-201I/TPS-25 (Corner Reflector) on Door of Radar Set AN/TPS-25A.

h. With the straight-wall socket and ratchet wrench, loosen the four spring-loaded captive mounting bolts (fig. 2-20) that hold the receiver-transmitter shock mount to the shelter floor. Lower the receiver-transmitter shock mount casters by turning the caster cranks counterclockwise. This raises the shock mount off the floor. Grasp the pull-handle on the forward part of the receiver-transmitter shock mount, lift it up, and pull it forward until the mount almost clears the shelter. With two people inside the shelter behind the receiver-transmitter shock mount and two people in front, lift the receiver-transmitter, antenna, and shock mount from the shelter. (The shock mount remains outside the shelter until ready to repack the equipment.). Loosen the jamnuts on the four turnbuckle assemblies that secure the antenna and receiver-transmitter to the shock mount. Rotate the turns buckles until the assemblies are slack. Unfasten the shackles from the eyes on the antenna mast coupling. Unscrew the top portion of the turnbuckle located at the rear of the receiver-transmitter so that it will clear the receiver-transmitter handle. Replace the top portion of the turnbuckle.

■ *Figure 2-18. Deleted*

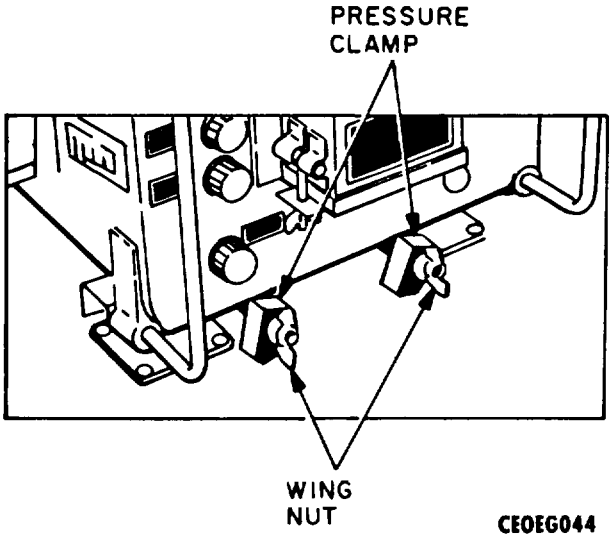


Figure 2-19. Modulator, Power Supply, and Coordinator Securing Clamps.

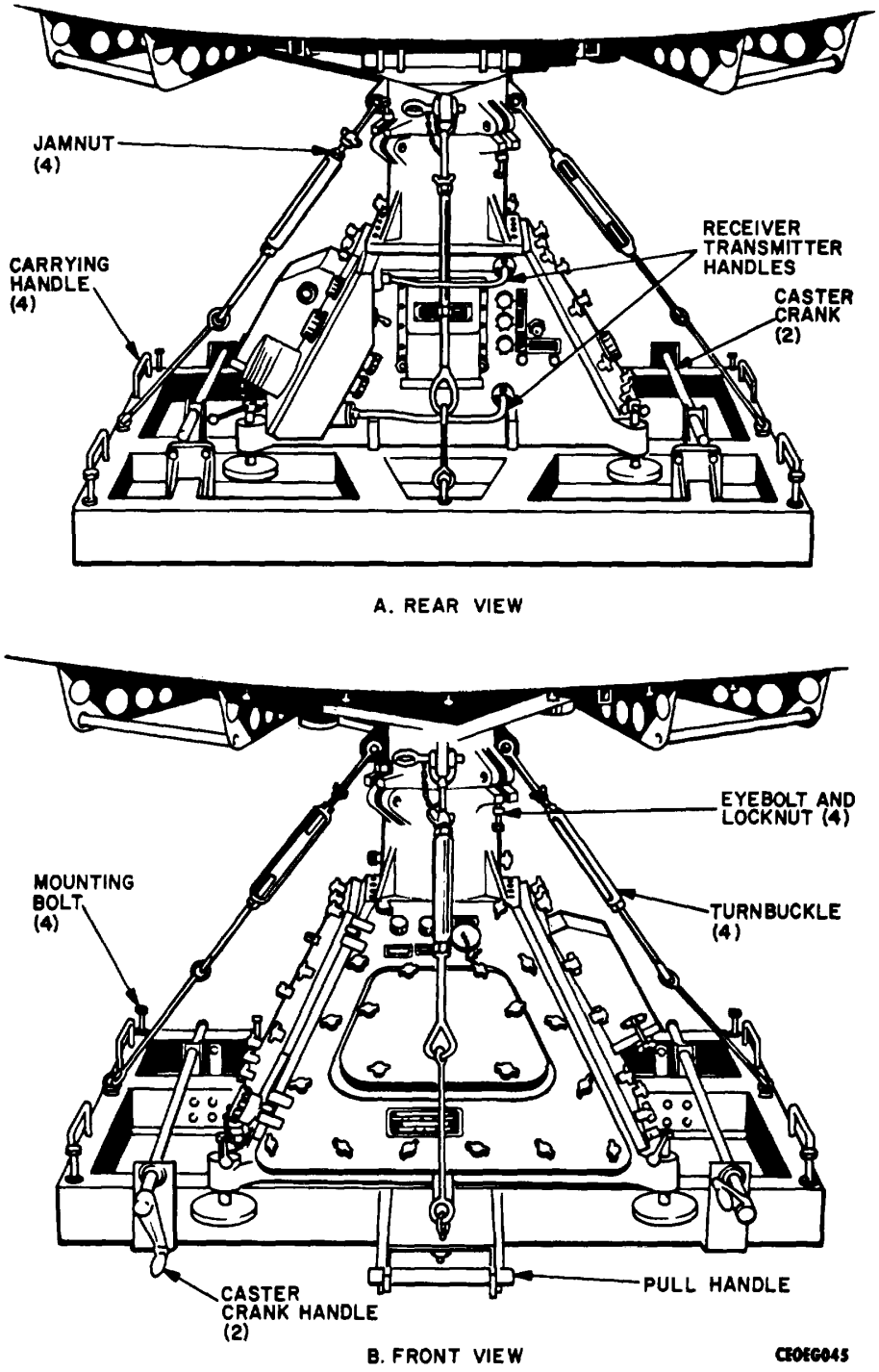


Figure 2-20. Removal of Receiver-Transmitter from Shelter.

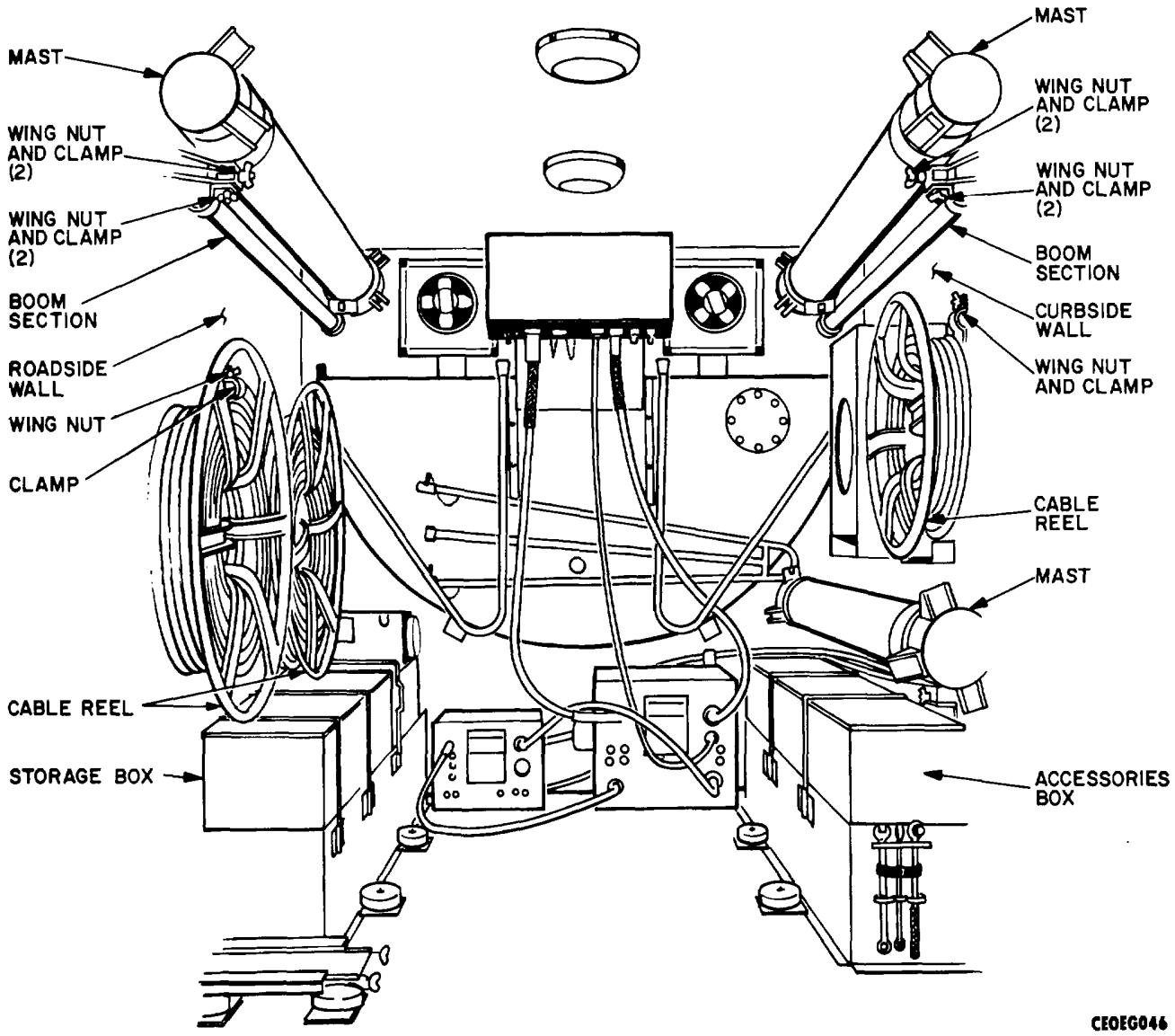


Figure 2-21. Removal of Cable Reels, Mast and Boom Sections.

l. Loosen the wingnuts that secure the clamps over the top inside rung of the roadside cable reels inside the shelter (fig. 2-21). Swing the clamps free from the reels and, using two people, lift the reels, one at a time, from their wall mounting brackets and take them from the shelter. In the same manner, remove the small reel from the curbside wall of the shelter.

NOTE

Omit the procedures given in *j* and *i* below, if the antenna is to be installed without the use of mast sections.

j. If the antenna is to be erected with two or three mast sections, first remove the bottom mast section from the curbside wall of the shelter by loosening the wingnuts securing the mast clamps. Remove the mast section from the shelter. Remove the two boom sections and remaining mast sections in the above manner and carry the boom sections and mast sections to the antenna site.

NOTE

The bottom mast section on the curbside wall must be removed in any case to facilitate the removal of articles from the accessories box.

k. Open the snap latches on the curbside accessories box (fig. 2-22), and swing the retaining bars toward the shelter wall. Remove the following articles (fig. 1-18):

(1) Two sledge hammers.
(2) Three round base-plate stakes.
(3) Four guy-wire stakes (five, if needed).
(4) Four winch hoists and handles.
(5) Four antenna guy wires.
(6) A and B measuring ropes.
(7) Two dacron guy ropes.

l. Remove the receiver-transmitter baseplate (fig. 2-16) from the inside of the roadside door by pulling out the hinge pins from the two dowels seated through the parallel holes in the baseplate and slipping the baseplate off the dowels (fig. 2-16).

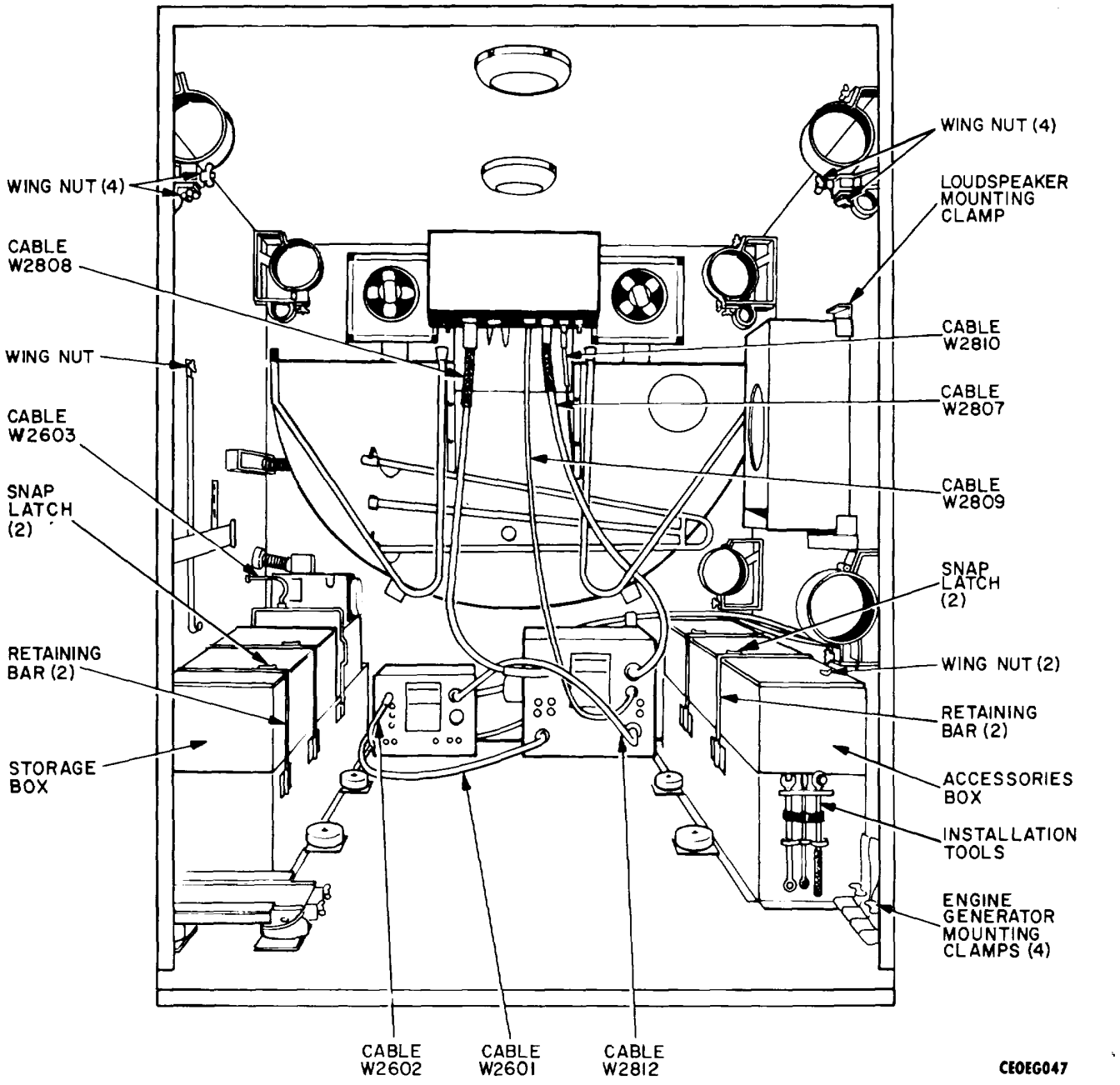


Figure 2-22. Interior of Shelter, Remote Operating Components Removed.

NOTE

If the ground at the surveyed antenna site is soft or sandy, remove the stake plates (clamped in their brackets at the bottom inside of the roadside door) and bolt the plates to the guy-wire stakes. The bolts are mounted on the stakes.

m. Store the shelter tiedown cables and shelter lifting cable in the accessories box and replace the center post in the doorway of the shelter.

2-13. Installation of Receiver-Transmitter Baseplate and Antenna Guy-Wire Stakes (figs. 2-24 through 2-26)

The baseplate, guy wires, and guy-wire stakes are used only when mast sections are to be used with the antenna. Two measuring ropes in the accessories box are used to determine the antenna guy-wire stake positions in preparation for the antenna installation. To lay out the guy-wire stake positions, remove the antenna survey stake (para 2-4b) from the ground and proceed as follows:

a. Orient the baseplate so that the hinge is 180° from the sector of interest and the socket is directly over the location of the survey stake just removed. Be sure that the ground under the baseplate is firm, level, and free from stones. Fasten the baseplate in position by using two of the round baseplate stakes in the two holes marking a line parallel with the hinge. Drive these stakes into the ground (A, fig. 2-24). Be careful not to strike the baseplate with the sledge hammer.

b. Stretch the A measuring rope (A, fig. 2-23) out full length so that center link Al fits over the socket on the base plate, the 20-foot section is toward the sector of interest, and the 26-foot segment is in a straight line 1800 away.

c. Pass a round base plate stake through eyelet A_2 on the end of the 26-foot section of rope and through the eyelet of one end of the B measuring rope and drive the base-plate stake into the ground (fig. 2-25). Be sure that the 26-foot section of the A measuring rope is extended full length.

d. Pull the 20-foot section of the A measuring rope out full length in a straight line with the 26-foot segment. Drive the first guy-wire stake into the ground directly below eyelet A3 at the end of the 20-foot section at an angle approximately of 600 with the ground and pointing directly away from the surveyed antenna site. The stake section containing the three holes must be toward the antenna site.

NOTE

If the ground is soft or sandy, two stakes with stake plates attached must be driven into the ground, one behind the other, at the first guy-wire stake position. To do this, proceed as follows:

(1) Select a guy-wire stake and screw the chain support (fig. 1-18) to it. Drive the stake part way into the ground at a 600 angle at the location determined for the first guy-wire stake. The stake should be driven only far enough into the ground to allow it to stand firmly without being held. The stake must be oriented as described above, with the side to which the chain is attached facing directly away from the surveyed antenna site (link Al in the A measuring rope).

(2) Use the notch hooks at the other end of the chain and attach the chain to the middle hole in one of the remaining guy-wire stakes.

(3) With the chain pulled tightly, drive this stake into the ground directly behind the first stake at a corresponding 60° angle with the first stake until the chain is parallel with the ground.

(4) Alternately drive both stakes into the ground, keeping the chain as nearly parallel with the ground as possible, until the middle hole in the first guy-wire stake is at ground level.

(5) Continue to drive the other stake into the ground until the chain becomes taut.

e. Holding the free end of the A measuring rope to that of the B measuring rope, fix the location of the second guy-wire stake (B, fig. 2-23) by extending to full length the B measuring rope and the 20-foot section of the A measuring rope. Drive the second guy-wire stake into the ground at this location at a 600 angle with the ground: point the stake directly away from the surveyed antenna site. The section of the stake containing the three holes must be toward the antenna site. Two holes in stake must remain above ground.

f. Joining the eyelets of the A and B measuring ropes as described in e above, cross directly over to the opposite side of the surveyed stake position and fix the location of the third guy-wire stake (C, fig. 2-23). Drive the third guy-wire stake into the ground.

g. Remove the round base-plate stake that secures the A and B measuring ropes to the ground and drive this stake into the ground through the remaining hole in the base plate (B, fig. 2-24).

CAUTION

Do not strike the baseplate with the sledge hammer.

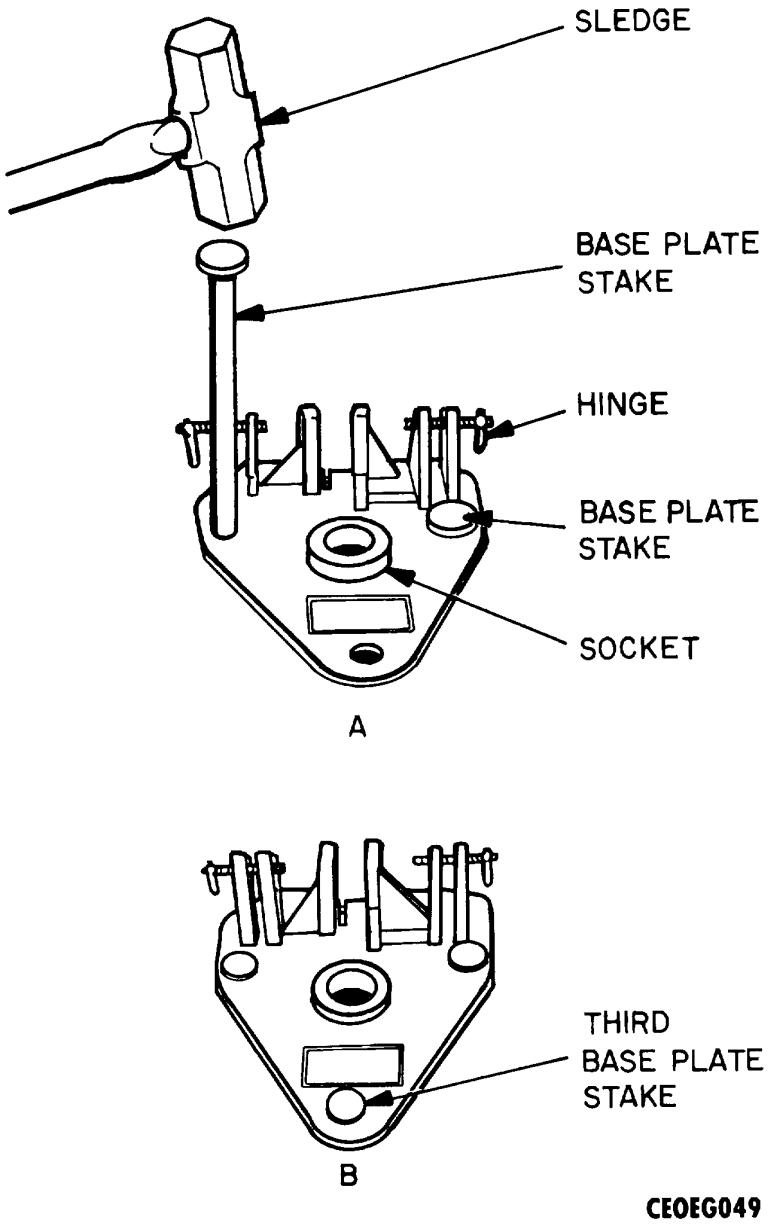


Figure 2-24. Anchoring Base Plate.

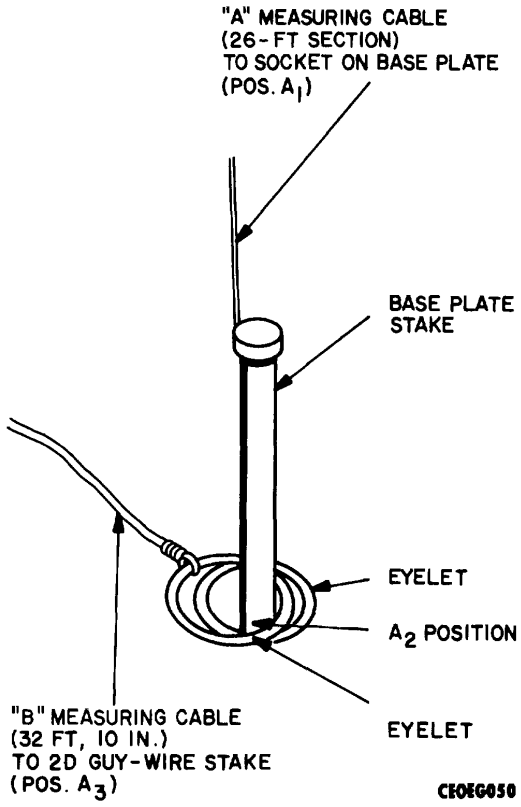


Figure 2-25. Securing A and B Measuring Ropes.

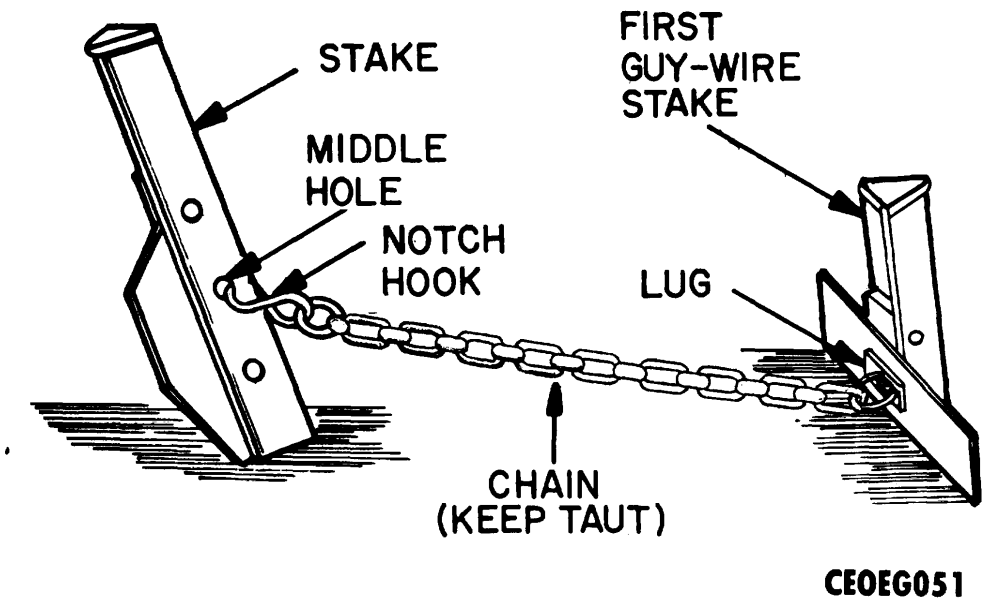


Figure 2-26. Installing Guy-Wire Stakes with Chain Support Attached.

h. Drive the fourth guy-wire stake at a 60° angle (*e* above) in the hole vacated by the round base plate stake (D, fig. 2-23).

i Coil the A and B measuring ropes and store them in the curbside accessories box.

2-14. Installation of Receiver-Transmitter (fig. 2-27)

After the positioning of the guy-wire stakes has been completed, proceed with the placement of the receiver-transmitter. If one, two, or three mast sections are to be used, install the receiver-transmitter on the base plate as explained in a below. If no mast sections are to be used, the receiver-transmitter is installed without the use of the base plate as explained in *b* below.

a. Installation of Receiver-Transmitter on Base Plate.

(1) Disconnect the antenna from the receiver-transmitter by using the open end wrench to loosen the four hex locknuts from the eyebolts (fig. 2-20). Swing the eyebolts free of the clamps and lift the antenna from the receiver-transmitter. Remove the two protective covers (fig. 1-19) from the roadside storage box (fig. 2-22), and fasten protective covers over the antenna mast coupling and the receiver-transmitter mast coupling.

(2) Place the receiver-transmitter onto the base plate and insert the hinge pins. Make sure that the ball attached to the receiver-transmitter fits snugly between the guide block assembly on the base plate.

CAUTION

When the mast is to be used, the four leveling jacks must be raised fully so that the unit will be supported by the ball socket at the bottom of the receiver-transmitter housing. Failure to raise the leveling jacks fully, will result in broken leveling jacks on the receiver-transmitter. The leveling jacks are not to be lowered after the antenna has been erected.

b. Installation of Receiver-Transmitter When no Mast Sections are Used.

CAUTION

The following installation should be attempted only on firm hard ground. Accurate leveling of the antenna cannot be attained if the ground is soft or sandy.

(1) Check that the support leg (fig. 1-23) on the underside of the antenna is above the rear of the transmitter. If the support leg is toward the front (longest sloping face) of the transmitter, disconnect the antenna from the receiver-transmitter (*a*(1) above) and reconnect the antenna to the receiver-transmitter so that the antenna support leg is above the rear of the receiver-transmitter.

(2) Carry the assembled antenna and receiver-transmitter to the survey stake (para 2-9b) marking the site for the antenna. Remove the survey stake.

(3) Set the assembled antenna and receiver-transmitter directly over the spot from which the survey stake was removed with the longest sloping face (front) of the receiver-transmitter toward the sector of interest.

(4) Adjust the leveling jacks until the antenna appears to be level. (Accurate leveling of the antenna will be accomplished when performing the level light adjustment (para 2-36) during the installation alinement and adjustment procedures.)

2-15. Connecting Mast to Antenna and Receiver-Transmitter (fig. 2-29)

a. Remove the covers from the mast sections by loosening the hexagonal locknuts, and swing out the eyebolts. Mate the guide pins and holes (A, fig. 2-29) in the end of the mast sections and connect the mast sections together (C, fig. 2-29) with the captive eyebolts and locknuts.

CAUTION

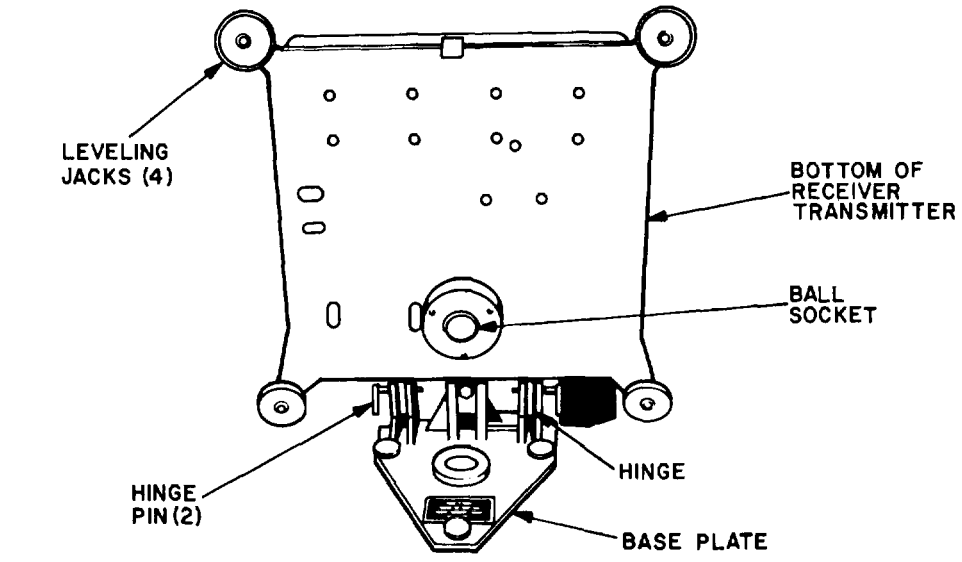
With the covers off the mast sections, make sure no dirt or foreign matter gets into the waveguide sections of the masts.

b. Place the V-shaped support leg under the antenna base in the out position. To do this, unfasten the Dzus fastener (B, fig. 2-28) which locks the leg in the in position, and securely lock the leg in the out position by the two slide locking devices on the leg. Tip the antenna up on edge so that it rests on the V-shaped support leg; remove the covers from the antenna mast coupling and connect one end of the mast to the antenna (A, fig. 2-29).

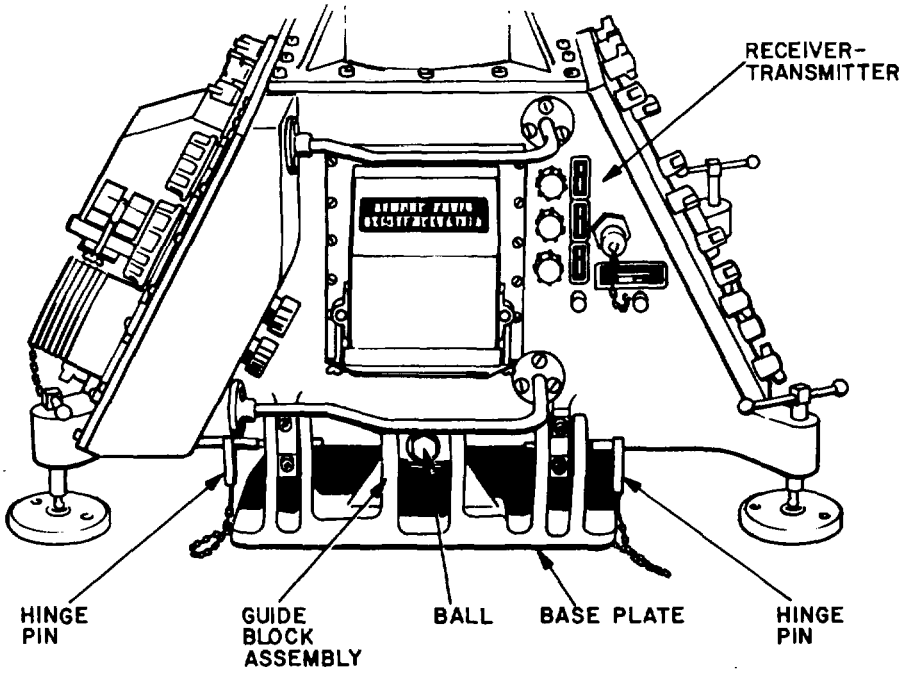
NOTE

Resting the antenna on the support leg protects the radome from damage and insures that when the antenna and mast are raised, the 6,750 mil antenna rotation stops will face away from the area of interest.

c. Tip the receiver-transmitter back off the base plate and connect the other end of the mast to the top of the receiver-transmitter (B, fig. 2-29). Store the covers in the roadside storage box inside the shelter.

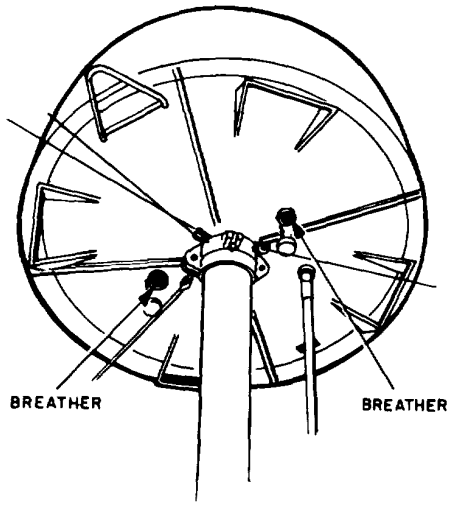


A. RECEIVER-TRANSMITTER SWUNG INTO POSITION FOR MAST MOUNTING

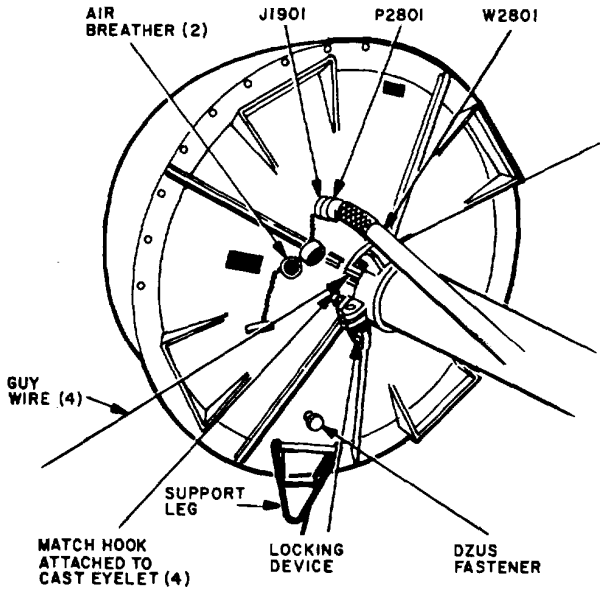


B. RECEIVER-TRANSMITTER ON BASE PLATE CEOEG052

Figure 2-27. Installation of Receiver-Transmitter on Base Plate.



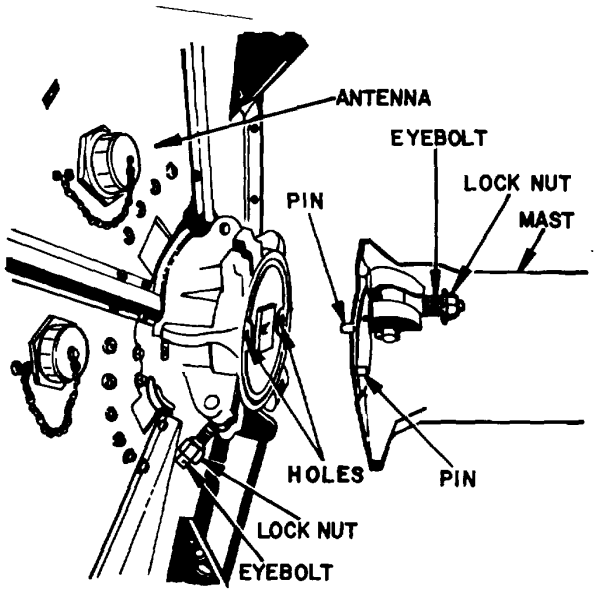
A. ANTENNA IN ERECTED POSITION



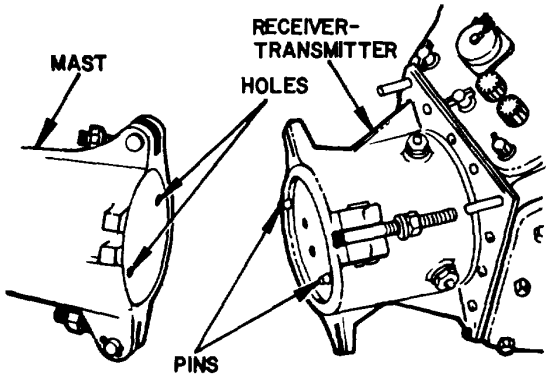
B. ANTENNA ON GROUND READY TO BE RAISED

CEOEG053

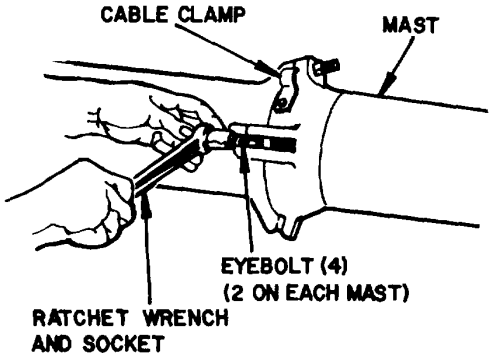
Figure 2-28. Bottom View of Antenna



A. COUPLING ANTENNA TO MAST



B. COUPLING RECEIVER-TRANSMITTER TO MAST



C. COUPLING MAST SECTIONS

CEOEG054

Figure 2-29. Mating Mast Sections, Antenna, and Receiver-Transmitter.

d. Unreel cable W2801 from one of the 30-inch reels, and connect P2801 of W2801 to antenna connector J1901 (B, fig. 2-28). Secure the cable to the mast using the cable clamps (C, fig. 2-29) provided on each mast section. Do not connect the cable to the receiver-transmitter until after the mast and antenna have been erected. Open the two breather caps (A, fig. 2-28) on the underside of the antenna.

e. Note that a match hook is attached to one end of each guy wire supplied. If two or three mast sections are used, utilize the hook and connect a guy wire to each of the four cast eyelets (B, fig. 2-28) on the antenna mast coupling.

f. Connect the winch hoists (A, fig. 2-30) as follows:

(1) Attach the hook on each winch hoist through the hole nearest the ground (center hole) in the guy-wire stake.

(2) At a position behind the stake and facing the antenna location, declutch the raising pawl on the winch hoist by snapping down the operating control level on the right rear side of the winch hoist.

(3) Press the lowering pawl (left front side of the hoist) until it disengages from the ratchet drum.

(4) With one person holding the lowering pawl in this position, grab the end of the winch-hoist cable and pull the desired length of cable from the winch hoist.

2-16. Erecting Mast and Antenna (figs. 2-30 through 2-35)

a. When three mast sections are used, the shackle on the end of the winch-hoist cable should be connected to the link at the extreme end of the guy wire. If two mast sections are used, connect the shackle to the guy-wire link that is about 5 feet from the end.

NOTE

If only one mast section is used, the guy wires are not required. The winch-hoist cable itself is used to support the antenna and mast. Connect the shackles on the ends of the winch-hoist cables directly to the four cast eyelets on the antenna mast coupling. The boom is not used. The erection of the antenna using one mast section is covered in g below.

b. If two or three mast sections are used, assemble the boom (fig. 1-16). Place the tapered end of one section of the boom into the socket on the other section of the boom. Lay the boom across the receiver-transmitter with the long pin on the end pointing toward the first guy-wire stake position. Attach the snap hook on the end of each dacron guy rope to the shackle to which the guy-wire and winch-hoist cable are connected (B, fig. 2-30). Grasp the guy-rope lock on one of the dacron guy ropes, and walk toward the second guy-wire stake, letting out the guy rope. Pass the hook on the guy-rope lock through the top hole in the second guy-wire stake (A, fig. 2-30). Repeat the above procedure with the other dacron guy rope, attaching the hook on the guy-rope lock through the top hole in the third guy-wire stake.

c. Insert the end of the boom containing the long pin through the shackle (B, fig. 2-30) to which the guy wire, the winch hoist cable, and the two dacron guy ropes are attached. Raise the boom, placing its lower end into the socket on the receiver-transmitter. Adjust the lengths of the dacron guy ropes by grasping the free end of the guy rope at the guy-rope lock and pulling the rope until it is taut. Make sure the boom is vertical (fig. 2-34).

d. Take up the slack on the two side guy wires. Retract the winch-hoist cable at the fourth guy-wire stake until the link on the end of the fourth guy wire is a few inches from the winch hoist. Carefully raise the antenna, using the winch hoist at the first guy-wire stake. See h below for winch hoist operating instructions. Continually check the two side guy wires and the two dacron guy ropes during the erection procedure; take up slack when necessary to keep the antenna and the mast rising in a vertical plane with respect to the ground. The dacron guy ropes must also be checked to be sure that the boom is kept perpendicular to the receiver-transmitter and the antenna and mast sections.

e. Continue raising the antenna until the fourth guy wire is taut. As the antenna is being raised further, the winch-hoist cable connected to the fourth guy wire should be let out carefully so that no slack is present at any time (fig. 2-35. This will prevent the antenna from tipping forward after it has reached an upright position. When the antenna is almost upright, the long pin on the end of the boom will become disengaged from the shackle on the end of the first guy wire, and the boom will fall to the ground. Check to see that the ball on the receiver-transmitter fits snugly between the guide block assembly on the base plate (B, fig. 2-27).

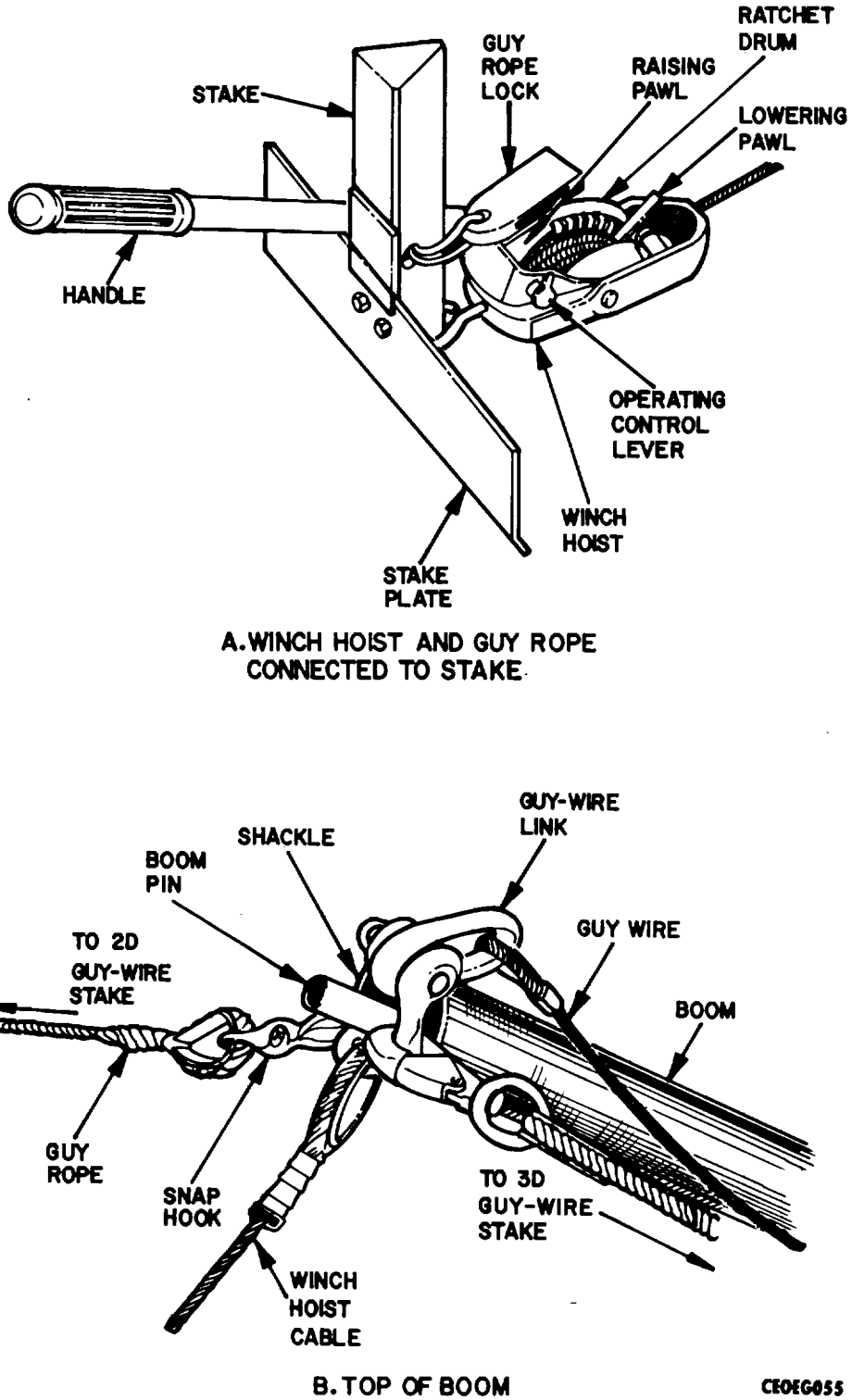


Figure 2-30. Shackle Connections, Winch Hoist, and Guy Ropes.

f. When the mast is upright, take up any slack in the guy wires with the winch hoists until the mast and antenna are steady. Disassemble the boom. Unhook the guy-rope locks from the second and third guy-wire stakes and the snap hooks from the shackle connecting the winch-hoist and guy-wire cables. Coil the dacron guy ropes and store them in the accessories box at the curbside wall of the shelter. Replace the boom sections in their storage clamps on the curbside and roadside walls of the shelter. The procedure for accurate leveling of the antenna, prior to operation, is given in paragraph 2-36.

g. The following general erection procedure should be followed when only one mast section is used (3, fig. 2-31 through 2-33).

(1) As previously explained (para 2-16*a*), the guy wires are not used. The winch-hoist cables themselves are used to support the mast. The boom is not used.

(2) Once the antenna and mast section has been assembled to the receiver-transmitter, they can be *walked up* by two people. A third person should steady the receiver-transmitter while the assembly is being raised. When the assembly is upright, the third person should take up the slack in all four winch-hoist cables.

h. The winch-hoist (A, fig. 2-30) is automatic and is operated in the following manner:

(1) Insert the handle into the handle cylinder on the left side of the winch hoist so that the locating stud on the handle will slip into the cutout on the handle cylinder. The handle will be held in place by the plunger lock assembly on the cylinder which fits into the hole on the handle. Both ends of the cylinder will accept the handle.

(2) Snap up the operating control level on the right rear side of the winch hoist. Work the handle to operate the winch. Remember that the handle is reversible with respect to the cylinder. This feature will permit constant pulling against the load and will facilitate working in close places. The handle can be reversed in a few seconds. To release tension on the cable, snap the operating control lever down and operate the handle to the extreme end of its stroke until the load is lifted from the lowering pawl; then back the handle off until the load is again held by the lowering pawl. To continue releasing tension, repeat this operation. The winch hoist may be operated quite fast, if desired, by making short rapid strokes. The releasing feature is very simple if the operator will be sure to pull the handle to its extreme limit after placing the control lever in the down position.

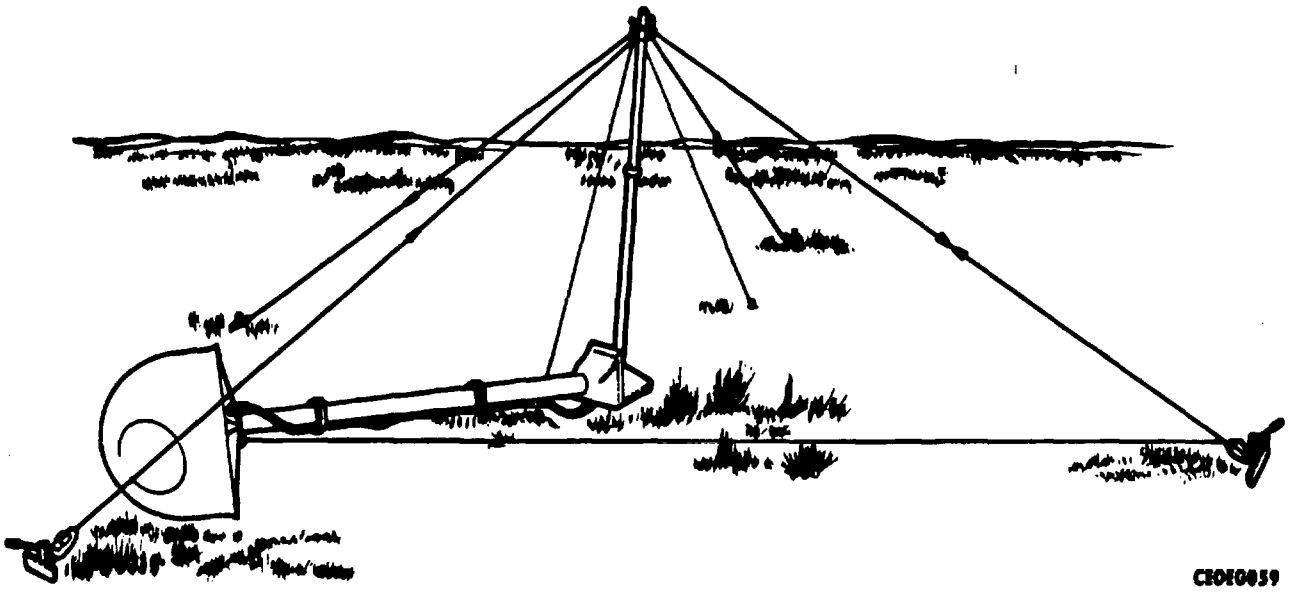


Figure 2-34. Antenna Ready to be Erected.

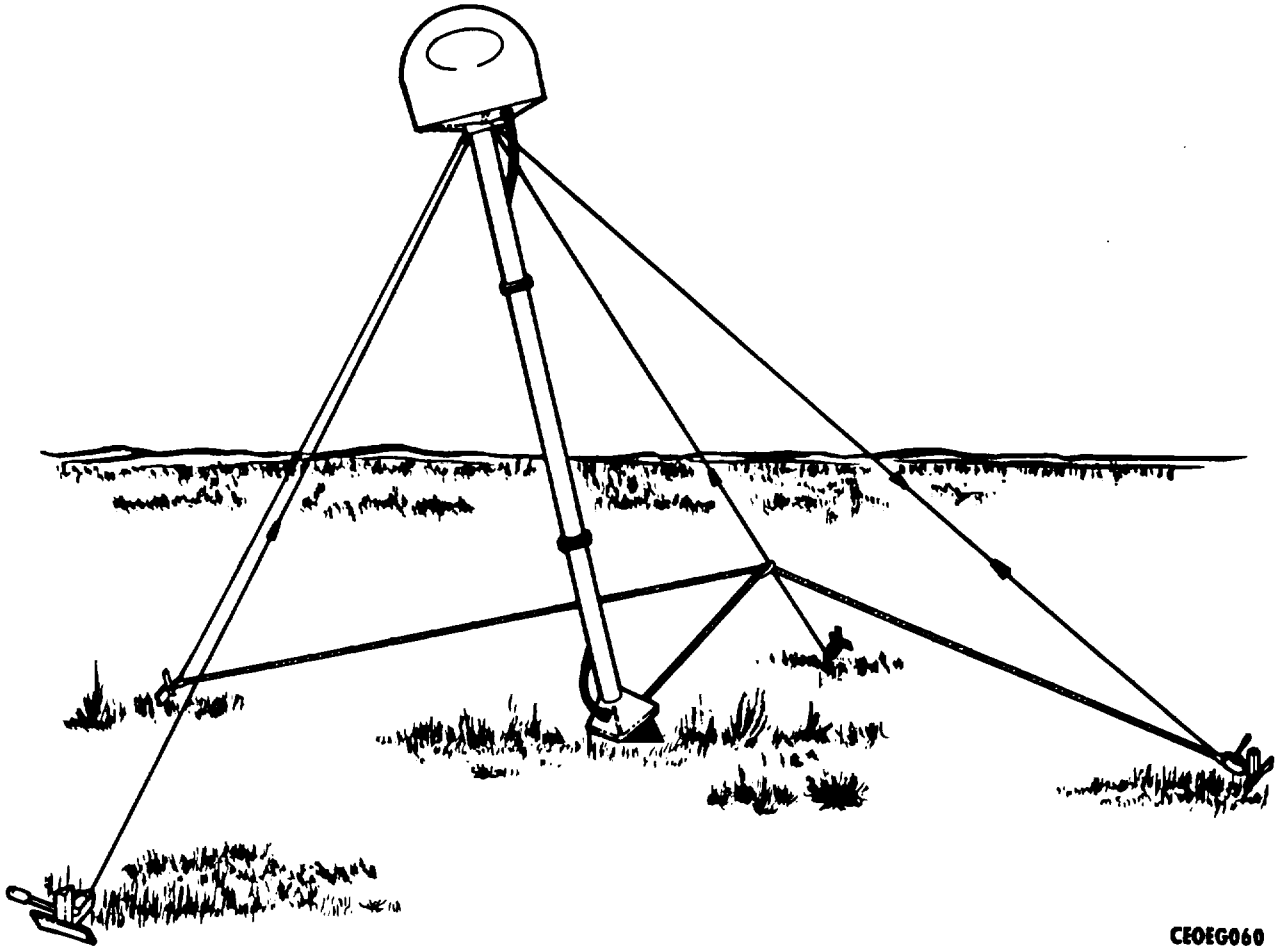


Figure 2-35. Antenna Erected to Almost Vertical.

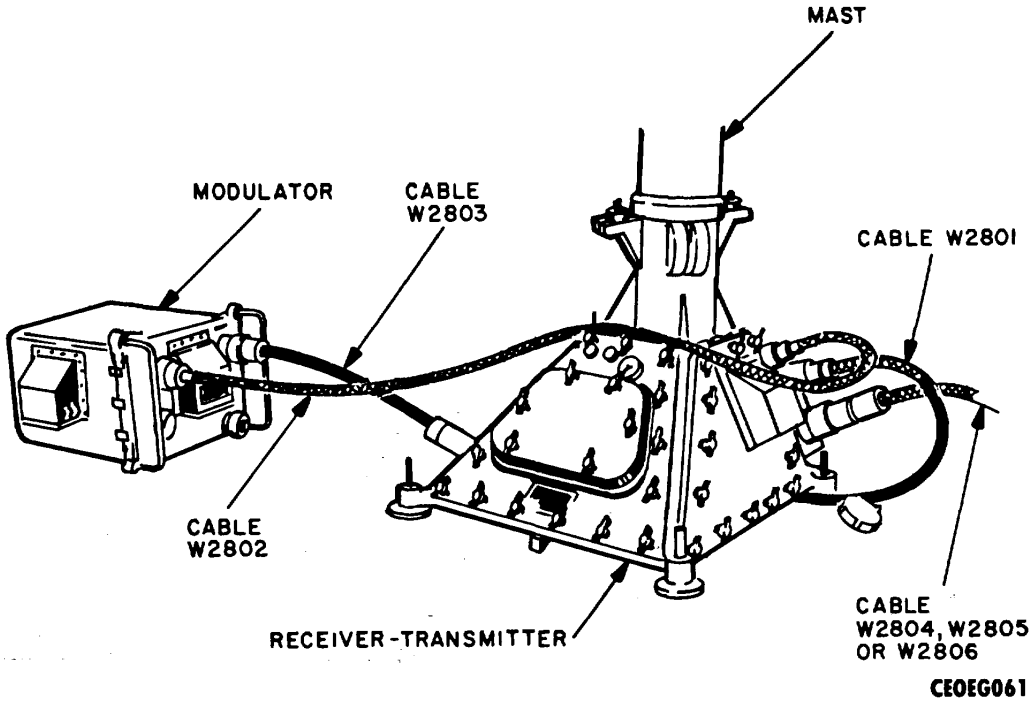


Figure 2-36. Installation of Modulator.

2-17. Installation of Modulator and Generator MEP 021A

a. After the antenna and mast have been raised and firmly secured, lift the modulator by its carrying handles and carry it to the antenna location, setting it down close to the receiver-transmitter. The interconnecting cables from the receiver-transmitter to the modulator are fairly short and will dictate the exact placement distance of the modulator from the receiver-transmitter (fig. 2-36).

b. Using four people, lift the generator set by its frame and carry to a location as far from the shelter as the interconnecting cable (W2813) will allow so noise interference from the generator, which could obscure the aural indication of targets (para 2-3e), will be kept at a minimum. The maximum distance the generator can be removed from the shelter is approximately 100 feet.

2-18. Preparation of Shelter Components for Operation

a. The plotting board with the radar set control attached and the space heater are the only shelter operating components requiring preparation prior to operation. All the other shelter operating components should be in immediate operating condition except for opening the seven air intake and exhaust ports; three on the coordinator (fig. 1-6); two on the radar set control (fig. 1-8); and two on the power supply (fig. 1-9). Also open the four ventilating ports on the remote operating components-two each on the receiver-transmitter (fig. 1-11) and the modulator (fig. 1-10).

b. The air intake and exhaust ports on all the components except the radar set control are opened in the following manner:

(1) Loosen the two wingnuts (fig. 1-6) securing the cover over the ventilating port.

(2) Disengage the bolts from the notches in the cover by swinging the bolts away from the cover.

(3) The cover will fall away from the vent opening and will be suspended by the captive wingnut and bolt on the hood.

c. The air intake and exhaust ports on the radar set control (fig. 1-8) are opened in the following manner:

(1) Loosen the two captive wingbolts securing the cover over the air intake port located on the side of the radar set control.

(2) Swing the cover out and toward the front panel of the radar set control.

(3) Manipulate the cover until it sits in the notches which allow it to remain open at an angle of approximately 45°.

(4) Unscrew the cover cap which protects the air exhaust port on the top of the radar set control.

d. The plotting board, with the radar set control attached, is secured to the front interior wall of the shelter during shipment (fig. 2-37).

WARNING

Two people will be required to lower the plotting board and the radar set control because of the weight of these units.

(1) Using the ratchet wrench, remove the four captive bolts (two above and two below) that secure the plotting board to the front interior wall of the shelter.

(2) Pull the plotting board (fig. 2-38) straight out on its tracks (located at the curbside and roadside walls of the shelter) and swing the plotting board down into operating position. Lock the unit into position by inserting the plotting board securing pins into the securing-pin holes in the walls of the shelter. (There are three securing-pin holes (fig. 2-38) for the plotting board on side walls of the shelter. The angle of the plotting board can be varied (if desired) by inserting the securing pins on each side of the plotting board into one of three corresponding holes in each wall of the shelter.)

(3) Remove the canvas cover from the plotting board. Release the two locks for the plotting board arm by turning them counterclockwise (one lock is located on the bottom side of the plotting board (fig. 2-37) the other arm lock on top (fig. 1-7)). Make sure the two ventilating ports (c, above) are opened on the radar set control.

(4) If the plotting board is not to be used during shelter operation, disengage azimuth coupling to the plotting board by loosening the locknut in the center of the azimuth clutch control knob (fig. 3-6). The plotting board arm will then be free of the azimuth coupling to the radar set control.

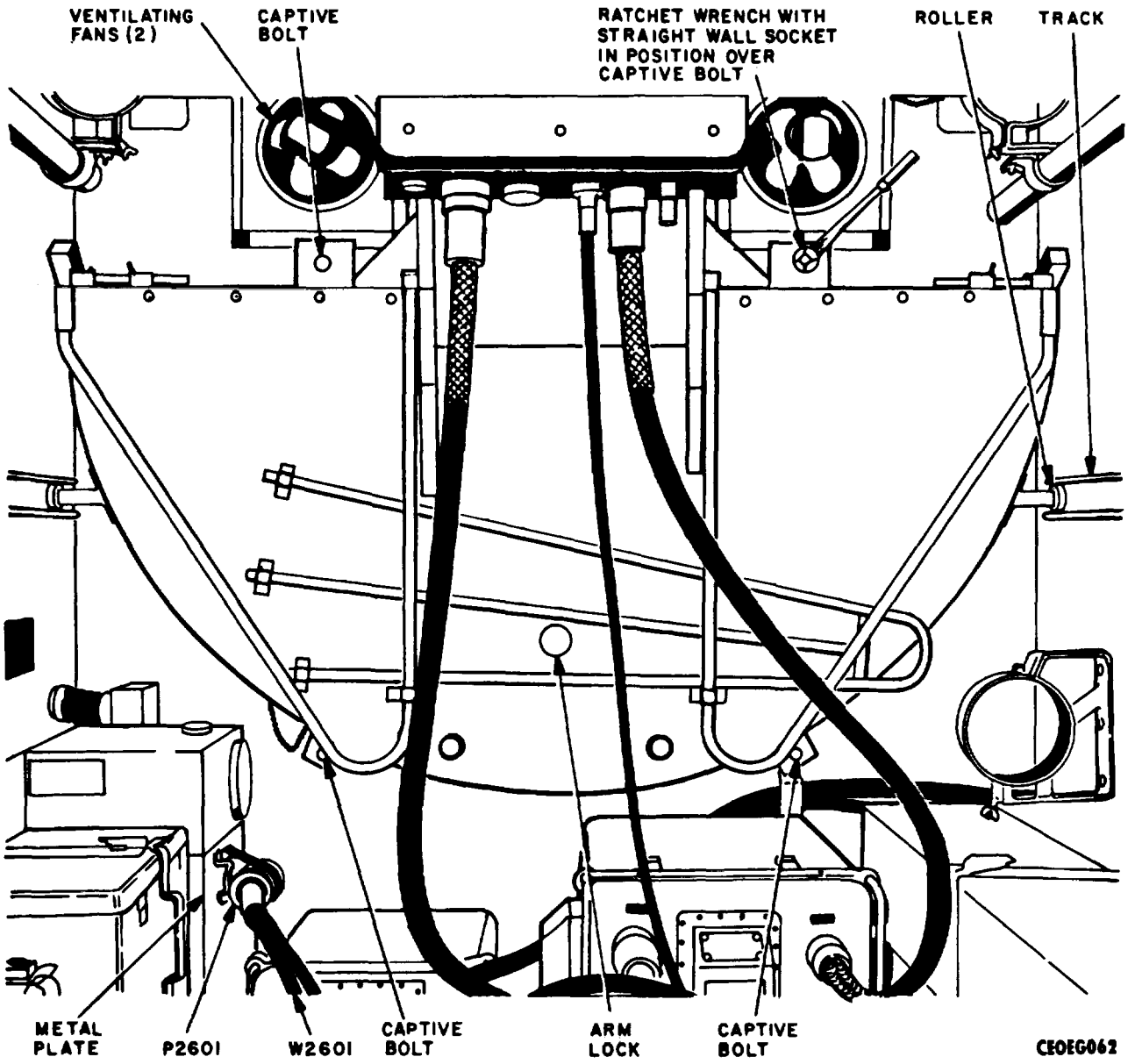


Figure 2-37. Lowering the Plotting Board.

e. Prepare the space heater as follows (fig. 2-39):

(1) If the heater fuel tank is empty (no fuel in sediment bowl), use the following procedure:

(a) On the front wall outside the shelter, disconnect the fuel line from the sediment bowl by pulling back the connector shell (B, fig. 2-39).

(b) Loosen the two wingbolts above the gas can and flip up the hinged retaining plate (C, fig. 2-39). Swing the gas can down, and remove it from the bracket on the shelter wall (B, fig. 2-39) and set it right side up on the ground.

(c) Pull up the locking lever (C, fig. 2-39) on the gas can cap and remove the cap. Refuel the gas can (any type gasoline).

WARNING

Do not refuel the gas can while the radar set is transmitting. Voltages induced in a metal object near an operating radar set may create small sparks if another metal object is brought into contact with it. When handling gasoline near a radar set,

observe the following precautions unless otherwise ordered by the officer or non-commissioned officer in charge during extreme emergency.

1. Turn off the radar transmitter before filling the gas cans.

2. Do not handle the open gasoline cans in a way that will bring them into contact with other metal objects without first turning off the radar transmitter.

3. Do not use plastic containers for refueling purposes because static electricity may cause an igniting spark. *Use the container supplied with the equipment.*

(2) Reverse the above procedure to reconnect the gas can and fuel line.

(a) Connect the fuel line to the sediment bowl by pulling back the connector shell, and slip the connector over the nipple connected to the sediment bowl. Release the connector shell. The sediment bowl will be seen to fill with gas.

(b) Check the fuel line and connections for leaks. Make sure the exhaust port (B, fig. 2-39) for the heater is open. It is located on the front exterior roadside wall of the shelter.

(c) Inside the shelter, make sure that the heat control thermostat on the heater calls for heat (heat control thermostat clockwise (fig. 1-15)).

f. Remove the electrical ground stake assembly (fig. 1-18) from the accessories box. Unwind the ground wire, and using a sledge hammer, drive the ground stake into the ground on the curbside of the shelter (fig. 2-40). Drive the stake close enough to the cable port leading to the shelter power distribution box, so that the ground wire will reach the ground terminal lug (E2601) located in the cable port. Slip the end of the ground wire under the ground terminal wingnut and firmly tighten the wingnut.

g. Loosen the straps that secure the operator's chair (fig. 2-16) to the interior of the roadside door of the shelter, and set up the chair in front of the radar set control.

2-19. General Instructions for Installing Cables

a. All the interconnecting cables necessary for proper operation of the radar set are furnished. All cables are supplied with connectors and the cables are of sufficient length to place units properly in relation to each other. Figure 2-41 illustrates a typical cable installation.

b. The following are points to be observed when planning cable runs:

(1) Avoid sharp bends.

(2) Protect cables from damage if they run across roadways or locations having heavy traffic.

2-20. Cabling for Interunit Connections (fig. 2-41)

The cables necessary for interconnecting the shelter operating components are connected to the units when the equipment leaves the factory and are left connected during transit, except for P2601 of cable W2601 which interconnects the coordinator to the receiver-transmitter via the shelter power distribution box. During transit, this connector is strapped against a small metal plate located below the shelter heater (fig. 2-37). The headset (earphones) (fig. 1-18) and the cables (W2802 and W2803) for interconnecting the receiver-transmitter and modulator are all stored in the storage box (fig. 2-22) on the roadside wall of the shelter. The cables (W2801, W2804, W2805, W2806, and W2813) used to connect the remote operating components of the shelter are wound on the cable reels (fig. 1-16). To interconnect the units of the radar set, proceed as follows:

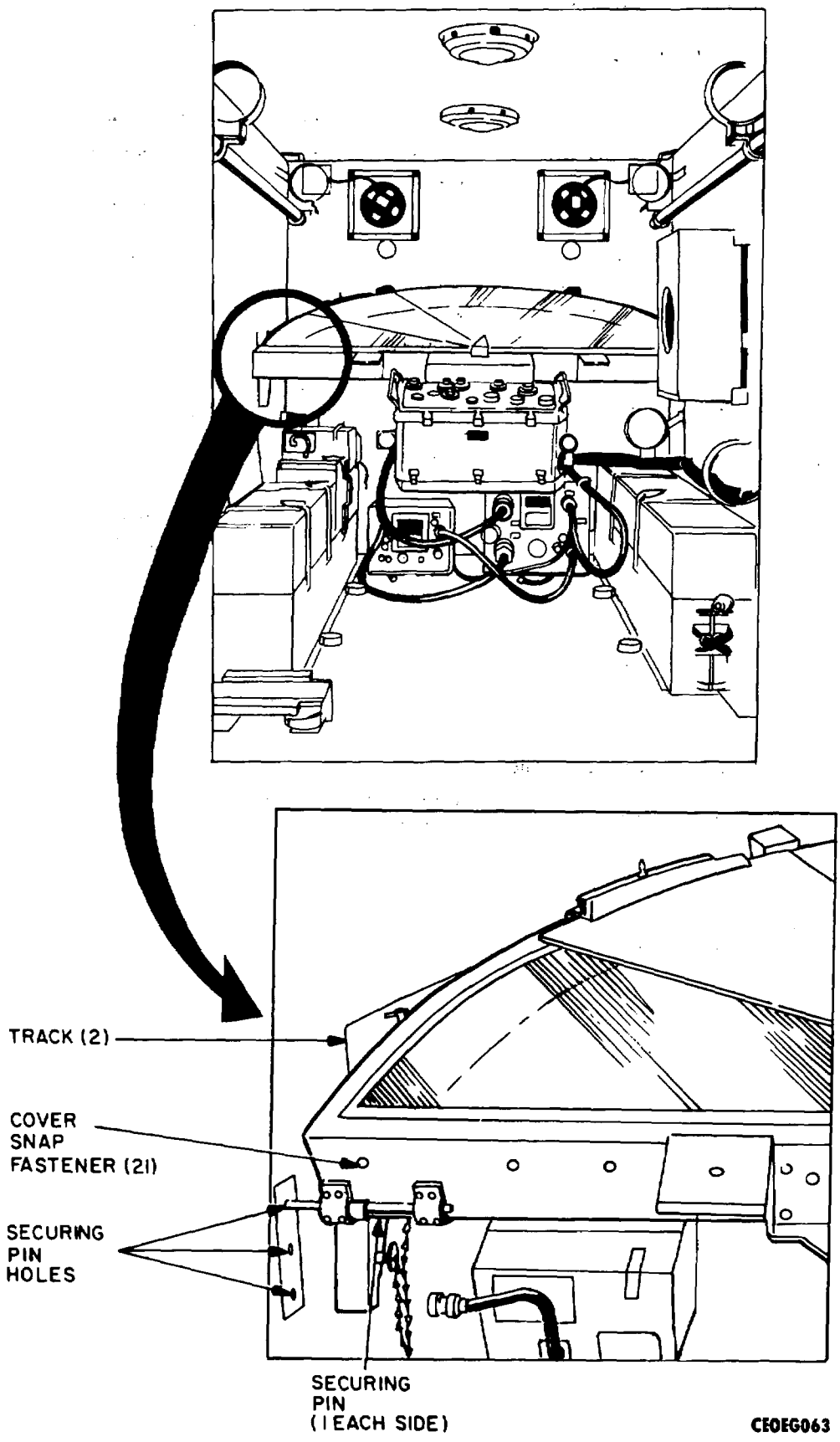


Figure 2-38. Securing Plotting Board Into Position in the Shelter.

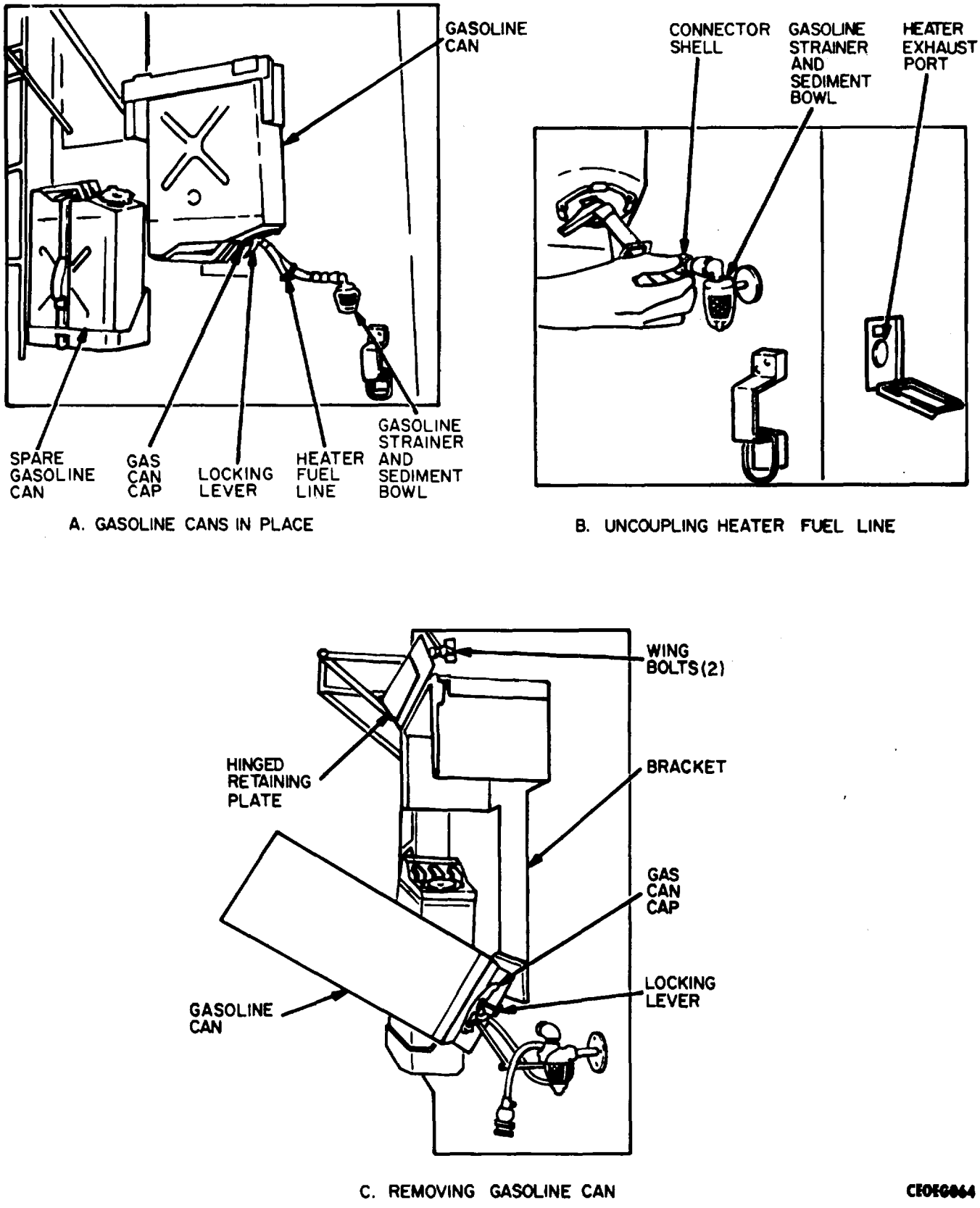


Figure 2-39. Heater Fuel Line and Gasoline Can.

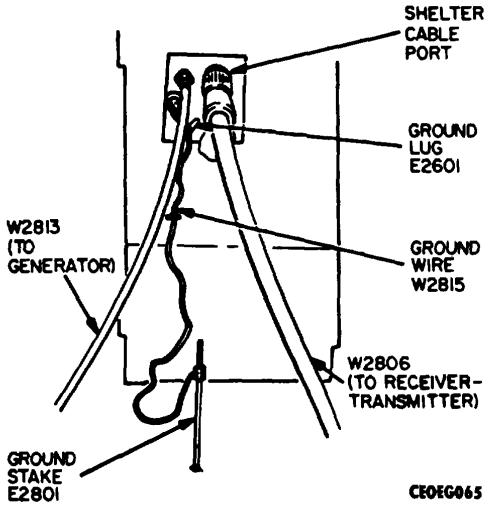


Figure 2-40. Shelter Cable Port

a. Inside the shelter, unstrap the connector (P2601 of cable W2601) from the plate below the heater, and connect it to J1001 on the coordinator.

b. If the headset is to be used, remove it from the plastic bag stored in the roadside storage box and connect the headset plug to J1605 or J1606 on the radar set control.

c. Check to see that P2602 of cable W2602 is connected to J1802 on the power supply. (The other - end of cable W2602 is permanently connected to the shelter power distribution box.) Unreel power cable W2813 which is wound on one of the large reels (fig. 1-16) that were removed previously from the roadside wall of the shelter. This cable is approximately 100 feet long and is used in conjunction with cable W2814 m which is connected to the generator when the equipment is shipped.

d. Couple P2827 of cable W2813 to P2828 of cable W2814. Screw the two protective cover caps together. Connect P2826 of cable W2813 to J2601 in the shelter cable port. Screw the protective cover caps together.

e. Cables W2802 and W2803 (fig. 1-18), used to interconnect the receiver-transmitter and modulator, are stored in the roadside storage box.

(1) Connect P2804 of cable W2802 to J501 on the modulator. Connect P2803 of cable W2802 to J403 on the receiver-transmitter.

(2) Connect P2806 of cable W2803 to J502 on the modulator. Connect P2805 of cable W2803 to J402 on the receiver-transmitter. Screw all protective cover caps together.

f. Unwind cables W2804, W2805, and W2806 (if all of them are to be used) from the cable reels. Connect P2802 of antenna cable W2801 to J401 on the receiver-transmitter. Connect the main cables W2804, W2805, and W2806 (if all are used) which interconnect the receiver-transmitter and J2602 in the shelter cable port as follows:

(1) Couple P2808 of cable W2804 to P2809 of cable W2805. Couple P2810 of cable W2805 to P2811 of cable W2806.

(2) Connect P2807 of cable W2804 to J404 on the receiver-transmitter. Connect P2812 of cable W2806 to J2602 in the shelter cable port.

(3) Screw all protective cover caps together. Cables W2804, W2805, and W2806 are interchangeable so that one, two, or three cables sections can be used to interconnect the receiver-transmitter with the shelter if a maximum cable run is necessary.

2-21. Cabling Check

After installation and prior to applying power to the equipment, refer to figure 2-41 and check to see that the radar set has been properly cabled as follows:

a. Check to see that the cables are installed and connected to the proper jacks on the units or make entrance to the unit through the appropriate cable entrance according to the pictorial cabling diagram.

b. Check to see that all cables are securely connected to the appropriate termination and are securely fastened to the shelter cable port leading to the power distribution box.

c. At each unit, check to see that all jacks, plugs, and connectors are firmly secured.

d. Check to see that all cable runs are free from sharp bends and that the cables connecting the generator to the shelter and the receiver-transmitter to the shelter, are protected from vehicular or pedestrian traffic.

e. Check to see that all cables are correctly placed so as to protect them from possible contact with grease and oil.

f. Make sure that all cables are properly tightened to prevent water leakage. Special attention should be given to the junctions of W2804, W2805, and W2806, which may lie in puddles of water. Relieve any unnecessary strain between cables and their terminations.

2-22. Installation of Tubes, Crystals, and Fuses

Radar Set AN/TPS-25 is shipped from the factory with tubes, crystals, and fuses installed. It will be necessary only to see that tubes are properly seated

in their sockets, and that the proper value fuses have been inserted in the fuseholders. The following table lists all of the fuses used in the equipment, provides the rating of each fuse, and locates the fuse by figure reference.

Ref symbol	Fuse rating		Location		Figure No.
	Volts	Amp	Component	Circuit	
F401	250	2.0	Receiver-transmitter	Ac primary of power supply	11
F402	250	2.0	Receiver-transmitter	Antenna synchro and motors	11
F403 (slow blow)	250	1	Receiver-transmitter	Antenna azimuth and elevation brakes	11
F404	250	10	Receiver-transmitter	Convenience outlet J406	11
F501	250	2	Modulator	Filament and blower	10
F502	250	8	Modulator	Hv primary	10
F1001	250	1/4	Coordinator	Hv transformer	6
F1002	250	3	Coordinator	Filament transformer and blower	6
F1003	250	1/8	Coordinator	Ac to computing transformer	6
F1004	250	3/4	Coordinator	Ac to computing system	6
F1005	250	3/4	Coordinator	Ac primary	6
F1006	250	3/4	Coordinator	Ac primary	6
F1601	260	1/2	Radar set control	Ac to motors	8
F1801	250	12	Power Supply	Power to remote units	9
F1802	125	20	Power supply	Power to shelter units	9
F1803	250	10	Power supply	Convenience outlet	9
F1804 (Slow blow)	125	1.5	Power supply	Hv transformer	9
F1805	250	5	Power supply	Lv transformer and blower	9
F1806	250	1.5	Power supply	28 vdc rectifier	9

NOTE

Spare fuses for shelter-operated components are located inside the top cover of the radar set control; all other spares are located in holder mounted on the units (fig. 10 and 11).

2-23. Removal of Units from Shelter (Out-of-Shelter Operation)

The radar set is normally operated from the shelter. In this mode of operation, the plotting board, radar set control coordinator, and power supply remain within the shelter. The radar set may, if necessary, be operated completely outside the shelter in a bunker, building, or enclosure of some type, or in the field (para 2-5). In this type of installation, all units of Radar Set ANI/TPS-25 are removed from the shelter. Follow the procedure below to remove the units from the shelter.

a. Remove the remote operating components from the shelter as described in paragraph 2-12.

b. Disconnect all interunit cabling (fig. 2-41) within the shelter and replace the protective cover caps on all connectors and jacks. Remove all the interunit cables (except W2601, W2602, and W2603 (fig. 2-22)) from the shelter.

c. Loosen the wingnuts (fig. 2-19) that secure the power supply (fig. 1-5) to its shock mount. Pull the pressure clamps out and swing them down and away from the power supply. Lift the power supply out of the shelter by its carrying handles.

d. Loosen the wingnuts that secure the coordinator to its shock mount. Pull the pressure clamps out and swing them down and away from the coordinator. Using two people, lift the coordinator out of the shelter by its carrying handles.

CAUTION

Two people are required for the procedure in e through l because of the weight of the radar set control (fig. 2-37).

e. Loosen the four captive bolts (two above and two below) that secure the plotting board and radar set control to the front interior wall of the shelter.

f. Lower the plotting board into the normal operating position (fig. 2-38), utilize the rollers in the tracks (fig. 2-37) at the curbside and roadside walls of the shelter.

g. Lock the unit into position by inserting the plotting board securing pins into the securing-pin holes in the walls of the shelter (fig. 2-38). Remove the canvas cover from the plotting board.

h. Using two people to support the radar set control to prevent a sudden fall when disconnecting it, loosen the four Allen-head wingbolts (C, fig. 2-45) which fasten the radar set control to the front of the plotting board; use the large Allen wrench stored underneath the right hand flange at the front of the plotting board (B, fig. 2-45).

l. Lift the radar set control straight out and away from the plotting board, being careful not to damage the mechanical couplings.

j. Replace dust covers on the azimuth and range couplings (C, fig. 2-45) on the radar set control and the plotting board.

k. Remove the radar set control from the shelter.

l. Remove the securing pins (fig. 2-38) from the holes in the shelter walls and pull the plotting board straight out. Lift up until the plotting board rollers clear the tracks.

m. Using three people, carry the plotting board from the shelter.

NOTE

The plotting board may or may not be used. If the plotting board is not used, it may be left in the shelter. Make sure that the coupling dust caps have been put on the azimuth and range couplings on the plotting board. Cable W2810 (fig. 2-22) which connects the radar set control to the plotting board will not be used. Temporarily store this cable in the roadside storage box, make sure the connector dust caps are secure.

n. The loudspeaker is seated in place by means of a wall mounting bracket on the curbside wall of the shelter (fig. 2-22). A slide clamp at the top of the loudspeaker, mounted over a bolt on the shelter wall and held in place by a wingnut, keeps the loudspeaker seated in the wall bracket. Loosen the wingnut and slide up the clamp. Remove the loudspeaker from the wall bracket and take it from the shelter.

2-24. Out-of-Shelter Installation

a. When out-of-shelter operation of the radar set is desired, the installation of the operating components of the radar set is similar to, and in most cases, the same as, the installation for shelter operation.

b. The remote operating components (receiver-transmitter, modulator, antenna, and generator) are installed in the same manner as when the shelter is used (para 2-12 through 2-17).

c. If the shelter operating components of the radar set are to be operated from a bunker, building, or enclosure of some type (fixed station), make sure there is ample room inside the station for easily operating and maintaining the equipment (para 2-5). The equipment dimensional drawings (figs. 2-4, 2-6 through 2-14) will be helpful when making an out-of-shelter installation.

2-25. Installation of Operating Components

The following procedure should be followed when installing the operating components of the radar set for fixed station operation:

a. Lay out the guy-wire stake positions at the surveyed antenna site (para 2-20). Be sure that the surveyed antenna site is not located too far from the fixed station location, the exact distance being governed by the length of cables W2804, W2805, and W2806 (in series) connecting the receiver-transmitter to the coordinator. The maximum length of these cables in series is 225 feet.

b. The installation of the receiver-transmitter, antenna and mast sections, the erection of the antenna, and the installation of the modulator and generator will be the same as in paragraphs 2-14 through 2-17.

2-26. Installation of Plotting Board and Radar Set Control (fig. 2-4)

a. Remove the plotting board legs from the stowed position by removing the six plotting board leg securing pins and two leg straps. Reverse the two U-shaped side legs so that they are in a position opposite that of the stowed positions. Lock them in position with the securing pins. Remove the tripod shaped rear leg from its stowed position and insert the two outside rungs in receptacles provided at the rear of the plotting board. Lock the middle rung in position by sliding it underneath the wingbolt and clamp underneath the plotting board. Tighten the wingbolt.

b. Remove the protective dust covers from the azimuth and range couplings on the plotting board and radar set control. Release the two locks for the plotting board arm by turning them counterclockwise. (One plotting board arm lock is located on the bottom side of the plotting board (A, fig. 2-45) and the other (C, fig. 2-45) on the top.)

c. Examine the azimuth and range couplings (C, fig. 2-45) on both the plotting board and radar set control and note that the couplings on the radar set control contain notches and those on the plotting board contain pins. When the radar set control is attached to the plotting board, the pins on the plotting board couplings fit into the notches in the corresponding couplings on the radar set control. To aline the couplings on the radar set control with those on the plotting board, proceed as follows:

(1) Rotate the range coupling on the plotting board until the indicating light (fig. 3-6) and its carriage are all the way down to the base of the arm. Then back off onto the coupling until the pin in the range coupling is toward the top of the plotting board.

(2) Rotate the azimuth coupling until the pin in the coupling is toward the top of the plotting board.

(3) Rotate the range coupler on the radar set control until the range counter (fig. 3-1) reads zero. Then back off onto the coupling until the notch in the coupling is toward the top of the radar set control.

(4) Rotate the azimuth coupler on the radar set control until the notch in the coupling is toward the top of the radar set control.

CAUTION

Be extremely careful when mounting the radar set control on the plotting board to see that the range and azimuth couplings are accurately alined for proper mating. The coupling may be bent or broken if misalined when the two units are joined.

d. Use two people and support the radar set control so that the locating pins (C, fig. 2-45) on the plotting board are alined with the corresponding holes in the radar set control. Carefully begin to join the two units; make sure the azimuth and range couplings on the units are accurately alined. The units should join with reasonable ease.

CAUTION

Do not force or bang the units together. If they do not join with reasonable ease, the couplings are probably misalined. Forcing the units together will bend or break the couplings. Readjust the couplings to insure correct alinement.

e. After joining the radar set control to the plotting board, tighten the four Allen-head wingbolts (C, fig. 2-45) located next to the locating pins. Secure the wingbolts by using the Allen-head wrench (B, Fig. 2-45) that is fastened underneath the right hand flange at the front of the plotting board.

NOTE

The radar set control may be used without the plotting board if so desired. In this type of installation the plotting board can be left in the shelter, and the radar set control may be set down on a bench or any convenient location in the fixed station. Make sure, however, that any benches or tables used in the fixed station are capable of withstanding the weight of the unit (para 2-5e). Make sure also, that the dummy plug P1601 on the top of the radar set control, is connected to J1603 and that the radar set control is protected from the weather (para 2-6a).

2-27. Installation of Power Supply, Coordinator and Loudspeaker

a. The power supply and coordinator can be placed under the plotting board in the same manner as in the shelter. Remember that the distance separating these two units is dependent upon the length of the cables interconnecting them.

b. The loudspeaker may be placed at a convenient location, being limited by the 12-foot cable (W2811) connecting it to the coordinator.

2-28. Interunit Cabling for Out-of-Shelter Installation (fig. 2-42)

a. Cabling of the units in a fixed station installation is almost identical with cabling for shelter operation, except for cables W2601 and W2602 (fig. 2-22) which connect to the power distribution box in the shelter. These cables are permanently attached to the shelter power distribution box, and so must be left in the shelter. When positioning the units for operation, keep in mind the siting considerations discussed in paragraph 2-3. A prime factor to take into account in locating the various units of the radar set is the lengths of the interconnecting cables to be used between the units. Maximum separation between the units is governed by the maximum lengths of these cables. However, it may be desirable in many situations to locate the units in close proximity to each other, due to considerations of topography, tactics, concealment, camouflage, and convenience.

b. To interconnect the coordinator, radar set control, and the plotting board, proceed as follows:

(1) Remove the protective cover caps from cable W2807 and connect P2813 to J1003 on the coordinator. Connect P2814 to J1602 on the radar set control.

(2) Remove the protective cover caps from cable W2808 and connect P2816 to J1002 on the coordinator. Connect P2817 to J1601 on the radar set control.

(3) Remove the protective cover caps from cable W2809 and connect P2818 to J1005 on the coordinator. Connect P2819 to J1604 on the radar set control.

(4) Remove the protective cover caps from cable W2810 and connect P2820 to J1603 on the radar set control and connect P2821 to J2401 on the plotting board.

NOTE

If the plotting board is not used, it may be left in the shelter. Cable W2810 will not be used. Make sure, however, that P1601 on the radar set control is connected to J1603 (para 2-6a).

c. To interconnect the coordinator, power supply, and loudspeaker (if used), make the following connections:

(1) Remove the protective cover caps from cable W2812 and connect P2824 to J1004 on the coordinator. Connect P2825 to J1801 on the power supply.

(2) Using cable W2811, connect P2822 of cable W2811 to J1006 on the coordinator. Connect P2823 to J2801 on the loudspeaker.

(3) If the headset (earphones) is to be used, remove the headset from the plastic bag stored in the roadside storage box (fig. 2-22) and connect it to J1605 or J1606 on the radar set control.

d. To connect the remote operating components of the radar set, remove cables W2802 and W2803 (fig. 1-19) from the roadside storage box and make the following connections:

(1) Connect P2804 of cable W2802 to J501 on the modulator. Connect P2803 of cable W2802 to J403 on the receiver-transmitter. Connect P2806 of cable W2803 to J502 on the modulator. Connect P2805 of cable W2803 to J402 on the receiver-transmitter.

All data on pages 2-68 through 2-70, including Figures 2-43 and 2-44, deleted.

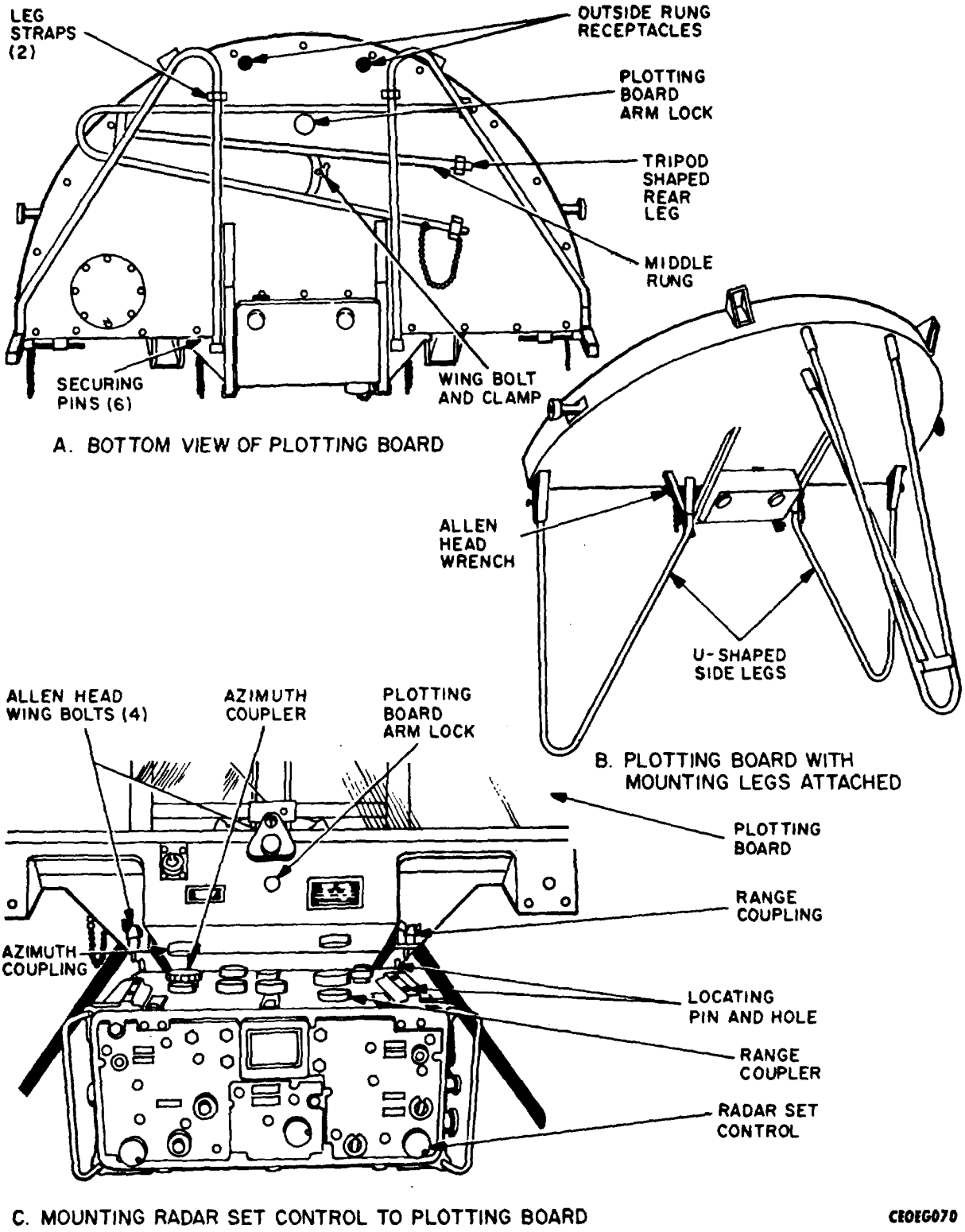


Figure 2-45. Connecting Radar Set Control to Plotting Board and Mounting Legs on Plotting Board.

(2) Unwind cables W2804, W2805, and W2806 (if all three cables are to be used) from the cable reels (fig. 1-16). Make sure that P2802 of antenna cable W2801 is connected to J401 on the receiver-transmitter. Couple P2808 of cable W2804 to P2809 of cable W2805. Couple P2810 of cable W2805 to P2811 of cable W2806. Connect P2807 of cable W2804 to J404 on the receiver-transmitter. Connect P2812 of cable W2806 directly to J1001 on the coordinator.

(3) Unwind cable W2813 from the large cable reel and remove the protective cover caps. Couple P2827 of cable W2813 to P2828 of cable W2814. Connect P2826 of cable W2813 to J1802 on the power supply.

(4) Make sure that all protective covers on the cables are screwed to the protective covers for the unit jacks. Make sure that the protective covers at cabling couplings are also mated together.

e. Perform the cabling check (para 2-21). Refer to figure 2-41 when making the check.

f. Check that all fuses are installed and are of correct value (para 2-22).

Section III. INSTALLATION ALINEMENT AND ADJUSTMENT PROCEDURE

2-29. General

a. This section covers the operational checks, and alinement, and adjustment procedures that must be performed on Radar Set AN/TPS-25 after installation and prior to the operation of the equipment.

b. Before proceeding, carefully read all the alinement steps outlined in this section and define clearly the responsibilities of the installation people. Haphazard sequence in performing the alinement and adjustment procedures may result in serious damage to the radar set. Therefore, perform the procedures in the order in which they are presented. Be sure to make all the initial checks before applying power to the radar set.

WARNING

Do not refuel the engine generator while the radar set is transmitting. Voltages induced in a metal object near an operating radar set may create small sparks when another metal object is brought into contact with it. When handling gasoline near a radar set, observe the following precautions unless otherwise ordered in an extreme emergency by the officer or noncommissioned office in charge.

(1) Turn off the radar transmitter before refueling the engine generator.

(2) Do not handle open gasoline cans in a way that will bring them into contact with other metal objects without first turning off the radar transmitter.

(3) Do not use plastic containers for refueling purposes because static electricity may cause an igniting spark. Use the container supplied with the equipment

2-30. Tools and Test Equipment Required

a. No tools or test equipment is required to perform the normal alinement and adjustment of Radar Set AN/TPS-25 after installation and prior to operation. The alinement and adjustment as outlined in paragraphs 2-38 through 2-41 can be carried out by the manual setting of controls and switches on the radar set control, the plotting board, and the receiver-transmitter.

b. Radar Set AN/TPS-25 should operate satisfactorily upon receipt without having to perform alinement and adjustment requiring the use of test equipment. However, from time to time during the course of operation, certain performance checks employing test equipment may be made on the radar set to evaluate its performance characteristics. These checks are carried out by higher echelon maintenance personnel, and are not covered in this manual.

2-31. Initial Checks

a. Check the connections of all the cables to the units for tightness. Check all connections (para 2-21) for proper terminations; refer to the interconnection cabling diagrams for shelter or out-of-shelter operation (fig. 2-41 or 2-42) for cable termination designations.

CAUTION

Be sure to check all cable connections care fully against the proper interconnection cabling diagram to prevent damage to the equipment when the circuits are energized.

b. Check for adequate tension of the guy wires between the antenna and the guy-wire stakes.

c. Check to see that all ventilating ports on the

components are open (para 2-18) so that proper operation of the ventilating system is assured.

d. Check to see that the electrical ground stake, E2801 (located near the shelter cable port during shelter operation) and ground wire W2815 are securely fastened together.

e. On the generator, check to see that one lead of cable W2814 is connected to terminal L_1 and the second lead is connected to terminal L_2 of the control box.

2-32. Standby Power Checks

a. Radar Set AN/TPS-25 has been tested and checked for proper operation at the factory before being crated and shipped. However, because of the possibility of damage incurred during transit, and because certain preoperational checks cannot be made on the equipment until it is installed, the equipment must be carefully turned on in stages and various checks made, and if any faults occur, they should be corrected before continuing with the checks.

CAUTION

Failure to take necessary precautions, or failure to perform the required check may result in damage to the equipment, severe enough to require depot maintenance.

b. The standby power checks for Radar Set AN/TPS-25 are presented step-by-step in the sequence in which they must be performed, starting with paragraph 2-33 and continuing through paragraph 2-36. Correct any malfunctions before proceeding to the next check (para 4-6).

2-33. Line Voltage Checks

a. Set all controls to their preliminary start positions as directed in paragraph 3-11.

b. Start the generator. The voltmeter on the generator should read 115 ±5 volts. If the indicated voltage is incorrect, adjust the voltage as outlined in TM 5-6115-271-14.

CAUTION

Do not place any of the circuit breakers on the shelter power distribution box or the ON-OFF switch on the power supply of the radar set to ON until specifically instructed to do so.

2-34. Shelter Power Check (fig. 38)

NOTE

Make sure the power switch on the radar power supply is in the OFF position.

a. Place the MAIN circuit breaker (located in the center of the shelter power distribution box mounted on the interior wall of the shelter by the curbside door) controlling the shelter power, to the ON position. This places available power to the SHELTER and RADAR circuit breakers.

b. Place the SHELTER circuit breaker to ON. This places available power to the shelter utility switches (FANS, LIGHTS, and HEATER switches on the power distribution box), and to the four ac outlets located above the distribution box.

c. Open the two air intake ports (fig. 1-2) on the rear curbside and roadside walls on the outside of the shelter, and the two air exhaust ports on the front outside wall of the shelter. Place the LEFT and RIGHT shelter FAN switches on the distribution box to ON. The ventilating motors in the exhaust ports (located on the front wall of the shelter) will be heard to come up to speed. If ventilation is required, leave the FAN switches in the ON position.

d. Place the shelter LIGHTS switch on the shelter power distribution box to ON. Make sure the shelter doors are closed. The shelter lights on the ceiling should come on at this time. Leave the shelter lights on if needed. Remember that the shelter doors activate two interlock switches in the shelter lights circuit. The lights will not come on unless both shelter doors are closed. Open and close the shelter doors and check to see that the lights go off and on.

e. Make sure that the HI-OFF-LO switch (fig. 3-7) on the heater is in the OFF position (center). Turn the HEATER switch on the shelter power distribution box to ON. This makes power available to the heater HI-OFF-LO control switch.

f. Place the RADAR circuit breaker on the shelter power distribution box to ON. This makes power available to the power supply ON-OFF switch.

2-35. Heater Check (figs. 1-15 and 3-7)

Outside the shelter, make sure the exhaust port for the heater (B, fig. 2-39) is open, and that the fuel line (A, fig. 2-39) is secure.

a. Make sure the heat control thermostat on the heater calls for heat (clockwise).

b. Turn the HI-OFF-LO switch to the HI position. Combustion should take place within 45 seconds. Combustion may be observed by peering into the sight tube through the grating on the front of the heater.

c. If there is no combustion after 45 seconds, with the HI-OFF-LO switch still in the HI position, depress the COLD START switch until combustion takes place. If too much heat is being generated, turn the HI-OFF-LO switch to LO.

d. If the heater is not to be used, turn the heat control thermostat fully counterclockwise and let the heater run for 30 seconds. Snap the HI-OFF-LO

switch to OFF. The heater blower will continue to run until the heater system is purged.

2-36. Static Checks (fig. 3-1)

The checks below are carried out while the radar set is in the standby condition (before the RADIATE switch is thrown, and after power has been applied). The checks are designed to ascertain whether or not the various controls, switches, and counters are functioning normally. Proceed with the static checks as follows:

a. Turn the ON-OFF switch on the power supply (fig. 3-3) to the ON position. The indicator lamp above the ON-OFF switch should light.

b. Check the ac voltmeter on the front panel of the coordinator unit (fig. 3-2). The meter should read a nominal line voltage of 115 ±5 volts ac. Should the meter reading be incorrect, adjust the generator voltage output. Illuminate the ac voltmeter face on the coordinator by throwing the METER LIGHT switch (located below and to the right of the voltmeter) to the on (up) position. Throw the METER LIGHT switch off (down position). Meter illuminating light should go on and off.

c. Blower motors should be heard operating in the power supply, coordinator (if the temperature is above 5° F. (-15° C.)), radar set control, modulator, and receiver-transmitter units. Check to see that the air intake and exhaust ports on each unit are open, and that air is circulating properly. Verify antenna leveling as follows:

NOTE

In some radar sets the blowers will be heard operating if the temperature is above -13° F (-25°C).

(1) Open the lens shutters on each of the four LEVELING LIGHTS, by turning the lens counter-clockwise. Depress the LEVELING LIGHT switch (AN/TPS-25A ONLY). If any of the leveling lights are on, the antenna must be leveled.

(2) Leveling light ON indicates high side. When no mast sections are used, use leveling jacks (mounted on the receiver-transmitter) to raise the side opposite leveling light, or lower the side indicated by the leveling light until the light goes off. Antenna is level when no leveling lights are on. Close leveling light shutters by turning lens clockwise.

(3) When mast sections are used, tighten the guy wire indicated by the leveling light, and loosen the opposite guy wire until the leveling light goes off. Ensure that all guy wire are tight and leveling shutters are closed before leaving antenna site.

NOTE

On the AN/TPS-25A, the leveling lights will stay on for 5 minutes from the time the leveling light switch is depressed. If additional time is required to level the antenna, depress the leveling light switch again.

d. After the power switch on the power supply has been turned ON, a minimum delay of 3 minutes will elapse before the transmitter can be energized (RADIATE ON). The delay is supplied automatically and, during the waiting period, the RADIATE switch (fig. 3-1) on the radar set control will have no effect. If the ambient temperature drops, the warmup period is extended until at -400 F (the lowest temperature for which the radar set has been designed to operate), a time delay of 5 minutes is experienced. The following checks are made during this warmup period.

(1) Rotate the PANEL control on the radar set control clockwise and counterclockwise. The plotting board indicator light and the edge lights on the front panel of the radar set control will brighten and dim. Return the PANEL control to approximately mid-range setting.

(2) Turn the AZIMUTH crank first, then the RANGE crank, each a single turn. Make sure the AZIMUTH counter does not read 0, 1600, 3200, or 4800 mils, when the RANGE crank is turned. In each case, check to see that the X and Y counters move, that the indicator light on the plotting board arm moves in range, and that the plotting arm moves in azimuth. Make sure both cranks turn easily. Rotate the AZIMUTH crank sufficiently to see that the X and Y counters go through their zero points with proper transfer from PLUS to MINUS and vice versa.

(3) Declutch the plotting board arm by loosening the locknut in the center of the azimuth clutch control knob (fig. 3-6). The plotting board arm is now free from its mechanical coupling to the radar set control in azimuth. Rotate the AZIMUTH crank until the AZIMUTH WARNING lamp lights on the radar set control. While watching the AZIMUTH counter, rotate the AZIMUTH crank in the opposite direction until the AZIMUTH WARNING lamp lights again. The AZIMUTH counter should have turned through 6,750 mils (minimum) between the two limits. In both cases, the AZIMUTH WARNING lamp should blink on and off at a slow rate.

NOTE

If the AZIMUTH crank is turned too fast while performing the above check, the AZIMUTH WARNING lamp may flash prematurely.

(4) Rotate the ELEVATION handcrank through its limits (+ 270 and -270 mils). Check that the crank moves easily and that the ELEVATION WARNING lamp does not light between +265 and - 265 mils. Set ELEVATION counter to 0 mil.

(5) Set the MAP SCALE switch (located at the right-hand side of the radar set control) to the 1:25K position. Turn the RANGE crank so that the RANGE counter reads 18,000 meters. Set the MAP SCALE switch to the 1:50K position. Check the RANGE counter to see that the shutter closes over the 1:25K counter and opens over the 1:50 K counter, and that the 1:50K counter reads 18,000 meters within ± 75 meters. Return the MAP SCALE switch to the 1:25K position and check again for proper switching of the counters.

(6) The procedures described in (*a*) through (*f*) below must be accomplished in sequence. The X and Y counters must be oriented to indicate the grid coordinates of the target located. The grid reference of the antenna must be known to the nearest meter.

(a) Set the ELEVATION counter to 0; set the RANGE counter at minimum.

(b) Turn the X and Y counters clockwise until both the PLUS and MINUS windows open. Adjust the PLUS counters to read all zeros and the MINUS counters to read all nines. When these conditions have been verified, cover the MINUS windows with masking tape.

(c) Set the RANGE counter at 18,000 meters and the AZIMUTH counter at either 0 or 3200 mils.

(d) Set the PLUS X counter by reducing the counter reading if the easting radar coordinate is over 50,000 and increasing the counter reading if the easting coordinate is under 50,000 meters.

(e) Set the AZIMUTH counter at 1600 or 4800.

(f) Set the radar northing coordinate into the PLUS Y counter by reducing the counter reading if the northing coordinate is over 50,000 and by increasing the counter reading if the coordinate is under 50,000.

(7) Check calibration of the X and Y counters as follows:

(a) Set the ELEVATION counter to 0 mil, the RANGE counter to 18,000 meters, and the AZIMUTH counter to either 1,600 or 4,800 mils.

(b) The PLUS X counter should indicate 18,000 meters more than the radar antenna easting grid if the AZIMUTH counter was set to 1,600 mils or less than the radar easting grid if the AZIMUTH counter was set to 4,800 mils. (The tolerance is ± 140 meters.)

(c) Set the AZIMUTH counter to either 0 or 3,200 mils. Do not change the ELEVATION and RANGE counter readings ((a) above).

(d) The PLUS Y counter should indicate 18,000 meters more than the radar antenna northing grid if the AZIMUTH counter was set to 0 mil or 18,000 meters less than the radar antenna northing grid if the AZIMUTH counter was set to 3,200 mils. (The tolerance is t 140 meters.)

(e) Set sector center know and center the plotting board arm; then reengage plotting board arm.

2-37. Dynamic Checks

a. On the radar set control, press the RADIATE switch to ON. Check the ac voltmeter on the coordinator. Voltage should be 115 ±5 volts (para 2-36b). At the receiver-transmitter, check the magnetron current reading on the meter. Magnetron current should read .70 (14 ma); if it does not, adjust current by adjusting MAG CUR ADJ control (fig. 3-5) until 14 ma is obtained. Make the following check by rotating the meter switch. Also make the following check by rotating the meter switch on the receiver-transmitter unit:

Position	Needle Condition	Normal Reading
-750 V (800 VFS)	Steady	79 to 1
-300 V (400 VFS)	Steady	63 to .86
AFC AM	Fluctuating	35 to .85
+150 V (200 VFS)	Steady	62 to .86
-6.3 V (10 VFS)	Steady	53 to .73
MAG CUR (20 AM FS)	Steady	zero
AFC MXR XTAL (2 MA FS)	Fluctuating	0 to .75
MXTR XTAL 1 (2 MA FS)	Fluctuating	0 to .75
MXTR XTAL 1 (2 MA FS)	Fluctuating	0 to .75
-27 V (40 VFS)	Steady	57 to .78

b. Return the meter switch to the MAG CUR position.

c. On the radar set control check to see that the range gate is sweeping when the AUTO MAN switch is in position 1 or 2. Adjust the scope controls for focus, intensity, centering, and scope grain. With the AUTO MAN switch in position 1 (AUTO SEARCH) obtain a typical video presentation (fig. 3-9) by adjusting the RANGE and ELEVATION cranks as well as the RCVR GAIN control (fig. 3-1) located on the right side of the radar set control. Check to see that the video presentation changes as the antenna scans in azimuth. Note the audio indication from the loudspeaker or headset.

d. Set the AUTO MAN switch to AUTO RANGE (position 2). Check to see that the range gate still sweeps but the video presentation remains station-

ary, since the antenna is no longer scanning in azimuth.

e. Set the AUTO MAN switch to MAN SEARCH (position 3). Check to see that the range gate is stationary on the left hand side of the scope and that the video presentation is still indicated. Move the RANGE counter through its entire range. Notice that the range gate remains stationary on the left hand side of the scope except for a small jump at a low range.

f. Check to see that the video presentation moves with a change in the RANGE counter reading. Check to see that the video presentation amplitude decreases when a large target return is located in the range gate.

g. Turn the AUTO MAN switch to MAN TRACK AUDIO (position 4). Notice that the scope trace is momentarily interrupted because of the switching of the antenna feedhorns. Observe that there is an audio presentation on the scope (fig. 3-9), the amplitude being dependent on whether or not there is a moving target present within the stationary range gate (not present on the scope).

h. Set the AUTO MAN switch to MAN TRACK VIDEO (position 5). Check to see that the video presentation is again seen on the scope.

I. Reset the AUTO MAN switch to MAN SEARCH (position 3).

j. Turn RADIATE to OFF.

2-38. Antenna Orientation Using Surveyed Points

After the dynamic checks have been made on Radar Set AN/TPS-25, the antenna must be oriented with respect to either true or map North, and the radar set control AZIMUTH counter (fig. 1-8) set to the corresponding azimuth angle. Rotate the antenna until the AZIMUTH WARNING lamp illuminates and note the direction of rotation (counterclockwise or clockwise). Loosen the locknut on the SECTOR CENTER knob and rotate the line on the flange in the same direction that the antenna was rotated until the line reaches the limit stop approximately 175 mils beyond the reference line on the panel. Lock the knob with the locknut. The line of the flange will then indicate the direction that the antenna is pointing with respect to the limit stop. Turn the AZIMUTH handwheel in the direction opposite that in which the antenna was turned until the line on the flange is alined with the reference line on the control panel. The antenna will then be pointed toward the rear guy wire stake. Estimate the angle between the rear guy wire stake and the orienting point. With the AZIMUTH handwheel, apply this (±) to the reading on the AZIMUTH counter, and the antenna will be pointed approximately at the orienting point. In addition, the exact location of the antenna is usually known, as well as the exact location of a survey stake located about 450 meters from the antenna and in the opposite direction of the sector of interest. (See preinstallation survey, paragraph 2-9). When orienting the antenna for Radar Set AN/TPS-25, follow the procedure in a below. When orienting the antenna for Radar Set AN/TPS-25A, follow the procedure in a(1) below.

a. Send a person out to the survey stake and have them operate the corner reflector (fig. 2-46). Turn RADIATE to ON. This provides a moving target upon which the antenna may be oriented. The corner reflector is operated as follows:

(1) With the corner reflector removed from the shelter curbside door, grasp the tip of the leg firmly and pull out until all four sections are extended and locked.

NOTE

The corner reflector can be used under various tactical conditions. The operator can use it in a prone, sitting, or standing position. AU four sections of the telescoping leg extend to a total length of 52 inches. If it is desirable to use only one section of the leg, extend the leg to its full length and stand the corner reflector up. Depress the latches on both sides of the bottom leg section and push down on the corner reflector. The bottom leg section will telescope into the section above it. Repeat this process for each leg section (if necessary) until the corner reflector is the desired height.

(2) Hold the handgrip of the corner reflector in the left hand; place the tip of the leg on the ground next to the survey stake and face in the direction of the antenna installation.

(3) Turn the knurled crank lock clockwise until it snaps out, releasing the crank. Turn the crank clockwise to operate the corner reflector at approximately 1 revolution per second.

(4) After orientation of the antenna, return the corner reflector to storage as follows: Aline the crank lock with the hole in the gearcase. Press the crank lock in and rotate 90°. This holds the crank handle in a fixed position. To telescope the leg sections, depress the latches on both sides of the top section and push down on the extended leg sections until they are completely telescoped into place.

b. The operator should become familiar at this point with the operation section (para 3-13) since a standard search procedure must be used to locate the simulated target at the second survey stake. It is suggested that a search procedure be used as outlined below.

(1) Turn on the radar set (paras 3-11 and 3-12).

(2) Declutch the plotting board arm by loosening the locknut (fig. 3-6) in the center of the knob. The plotting arm is now free from its mechanical coupling to the radar set control permitting a 6,400 rmil search, if necessary, to locate the person at the second survey stake.

(3) Set the RANGE counter (fig. 3-1 on the radar set control to 250 meters. Set the AUTO MAN switch to AUTO RANGE (position 2). The automatic range gate will search a 900 meter interval from 250 o 1,150 meters.

(4) It is now possible to search the area around he antenna site for a full 6,400 mils by slowly turning the AZIMUTH crank. Alternately, it is possible set up automatic search (position 1 of the AUTO AN switch).

(5) Follow the procedure in paragraph 3-14 and ate the target at the second survey stake.

(6) Once the target has been accurately located, press the RADIATE switch to the OFF position.

c. Declutch the ORIENTATION control (fig. 3-1) he following manner:

(1) Tighten the large diameter locknut on the AZIMUTH ORIENTATION control by turning the clockwise.

(2) Loosen the AZIMUTH ORIENTATION control knob by turning it in a counterclockwise direction. It is now possible to set the AZIMUTH counter without moving the antenna from its on target position.

d. Set the AZIMUTH counter with the AZIMUTH crank to the known azimuth angle of the second survey stake as determined in the preinstallation survey (para 2-9).

NOTE

In situations where rapid antenna orientation is of greater importance than extreme accuracy, alternate methods of orientation are possible. For example; an arbitrary grid system could be set up in which he radar would be given a back azimuth a known point (assuming the radar site ere visible from the known point), and with the range to the known point available from the radar, the radar position should be determined. Triangulation by either optical or radar means, encompassing o or more prominent terrain features, is other feasible method of orientation. A third possible method of orientation exists where a recognizable video landmark (such as a water tank) is available, and where the azimuth of this landmark is known with respect to the radar. In such a case, orientation is Possible by means of video peaking, with the

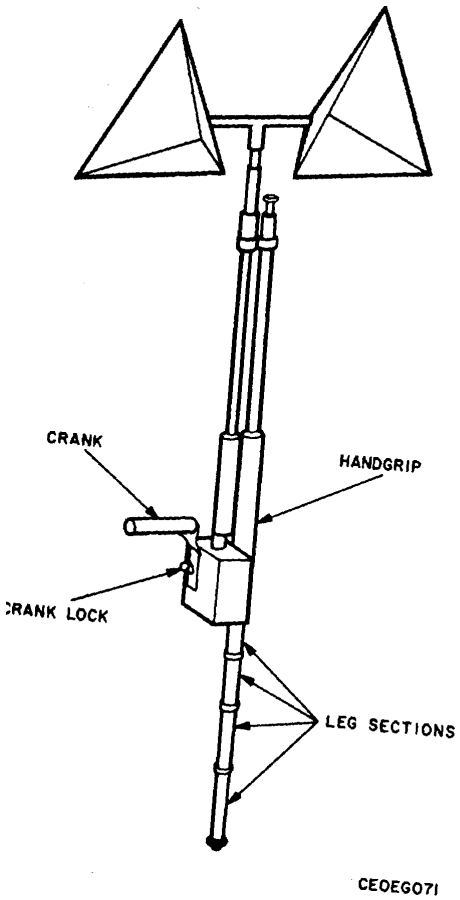


Figure 2-46. Simulator, Radar Target SM-201/TPS-25 (Corner Reflector.)

AUTO MAN switch on the radar set control set to MAN TRACK VIDEO (position 5).

e. Tighten the ORIENTATION control knob by turning it clockwise. Loosen the locknut by turning it counterclockwise. The antenna and AZIMUTH counter are now synchronized, and have been oriented with respect to true or map North.

f. Check to see that the target location indicated by the AZIMUTH counter readings is correct by pressing the RADIATE switch to ON and peaking the aural target indication by manipulation of the AZIMUTH crank. When maximum volume is heard on the loudspeaker and/or headset, the AZIMUTH counter should read the azimuth of the target, the target location is correct. Press the RADIATE switch to OFF.

2-39. Orienting Map on Plotting Board (fig. 2-47)

When the radar site was chosen and surveyed, the location of both the antenna site and the second survey stake (450 meters away from the antenna site) was marked on the applicable map depicting the area of surveillance (para 2-4). The azimuth angle in mils, of the line between the antenna site and the second stake, and true or map North was also determined. In the information that follows a map marked with the appropriate locations of the antenna and second survey stake will be placed on the plotting board and the plotting arm will be synchronized with the antenna and AZIMUTH counter of the radar set control. The AZIMUTH counter and the antenna are already synchronized because of the antenna orientation procedure above (para 2-38). Orient the map on the plotting board as described in a through *k* below.

NOTE

Do not disturb the setting of the ORIENTATION control on the radar set control This control has been set to orient the AZIMUTH counter correctly (para 2-38).

a. Loosen the locknut in the center of the azimuth clutch control knob (fig. 3-6) by turning it counter-clockwise. The plotting board arm is now free from its azimuth coupling to the radar set control and can be positioned independently by means of the knob.

b. Turn the RANGE crank (fig. 3-1) on the radar set control fully counterclockwise (minimum range).

c. Place the MAP ZERO switch, located on the right side of the radar set control (fig. 2-47) to the map zero position (toward top of radar set control).

CAUTION

When moving the range counter to zero with the range coupling, turn the coupling slowly when approaching zero to avoid damage to the subassembly stop.

d. Manually move the range coupling (fig. 2-47) until the RANGE counter reads zero meters. This places the plotting board indicator light at the origin of the plotting board.

e. Place the map on the plotting board with the marked antenna site location (para 2-4) exactly over the plotting board arm indicator light spot. Orient the map so that the sector of interest is roughly in the center of the plotting board. Exact placement of the sector of interest is not critical but the antenna site location must be placed exactly over the indicator light. Fasten the map in position with tape centered over the sector of interest. Any portion of the map overhanging the radar set control may be cut off or rolled up tightly and taped.

f. Place the MAP ZERO switch in the operate position (toward bottom of radar set control) and crank until the indicator lamp on the plotting board arm is at the outer edge of the map.

CAUTION

Do not lean on, or place heavy objects on the plotting board plexiglass cover.

g. Draw a line through the antenna site location parallel to one of the X or Y coordinate grid lines (A, fig. 2-47). Position the plotting board arm by means of the azimuth clutch control knob (fig. 3-6) until the indicator light on the plotting board arm is directly under the line previously drawn (B, fig. 2-47). Determine the direction of this X or Y reference grid line (East, West, North, or South) and select the corresponding angle in mils from the table below.

Cardinal compass points converted to mils	
North	0 mil
East	1,600 mils
South	3,200 mils
West	4,800 mils

h. Set the AZIMUTH counter on the radar set control for the selected azimuth angle (g. above) by means of the AZIMUTH crank (fig. 3-1).

1. Grasp the plotting board azimuth clutch control knob (fig. 3-6) firmly to prevent movement, and tighten the locknut by turning it clockwise. The antenna, AZIMUTH counter (on radar set control), and plotting board arm are now synchronized with respect to the same azimuth angle on the sector map.

j. Set the MAP SCALE switch on the radar set control to the appropriate scale for the map being used (1:25K or 1:50K).

NOTE

When the plotting board is not used with the radar set, the 1:25K MAP SCALE setting should be used.

k. Should the area of interest shift off the plotting board map, the procedures given above can be repeated for orienting the map for a new area of interest.

2-40. Setting Sector Centerline (fig. 3-1)

a. Determine the particular sector to be scanned within the area of interest and set the SECTOR WIDTH switch on the radar set control for either 360 or 540 mils width. If only a 180-mil sector of interest is desired, start the search operation in the AUTO RANGE position of the AUTO MAN switch (position 2), since the antenna beam width is 180 mils for this position. If only the 180-mil sector is desired, ignore *b* through *e* below.

b. Set the AUTO MAN switch on the radar set

control to MAN SEARCH (position 3). Rotate the AZIMUTH crank until indicating light on the plotting board is in the center of the particular sector to be scanned. If the plotting board is not used, set the AZIMUTH counter to the desired azimuth angle instead.

c. Declutch the SECTOR CENTER control on the radar set control by loosening the locknut on the forward part of the knob. Rotate the SECTOR CENTER control until the reference marks on the SECTOR CENTER knob and the radar set control front panel are alined.

d. Retighten the locknut on the SECTOR CENTER control knob. Set the AUTO MAN switch to AUTO SEARCH (position 1).

e. If the sector to be scanned goes beyond the plotting board limits, the limit switches in the plotting board will shut off the automatic scan. If this happens, set the AUTO MAN switch to MAN SEARCH (position 3) and reset the sector center reference line sufficiently to avoid this condition.

2-41 Offsetting the X and Y Counters (fig. 3-1)

a. The X and Y counters have already been oriented (zero set) with respect to the AZIMUTH counter and will correctly define target position with respect to the antenna site (para 2-36d(6)). The X and Y counters may be set to give the correct coordinate information for locating a target with respect to a point other than the antenna site (such as a single remote artillery battery) by the following procedure. (Another such point might be the nearest intersection of grid lines, so as to allow addition or subtraction of an integral number of thousands of meters for special applications.)

(1) Determine the X and Y coordinates of the antenna site with respect to the alternate site.

(2) Set the RANGE counter to its counterclockwise limit.

(3) Set the AZIMUTH counter for zero mil.

(4) Declutch the X counter by loosening the lock-nut in the center of the control knob.

(5) Set the X counter to read the X coordinate of the alternate point. Tighten the locknut in the center of the control knob.

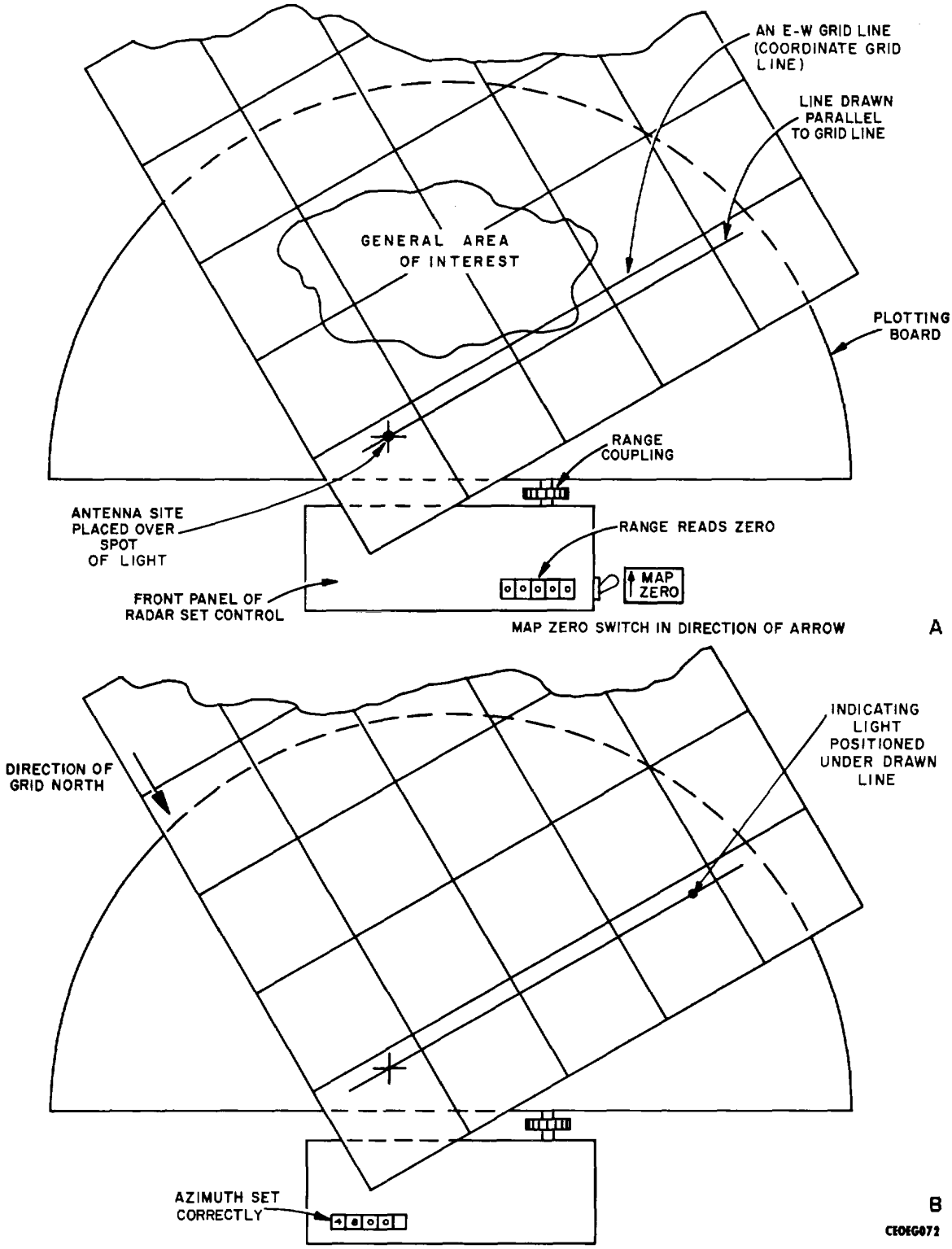


Figure 2-47. Map Zero Alinement.

CAUTION

Never offset either of the X and Y counters by more than 60,000 meters because of the counter window mechanism.

(6) Set the AZIMUTH counter to 1,600 mils.

(7) Declutch the Y counter by loosening the locknut in the center of the control knob.

(8) Set the Y counter to read the Y coordinate of the alternate point. Retighten the locknut in the center of the control knob.

b. The X and Y counters now supply the operator with target coordinates which are direct reading from the alternate point to the target.

c. If the X and Y coordinates have been set for reading from an alternate point and it is desired to return them to read the X and Y coordinates with respect to the antenna site, they may be reset very simply by performing the procedure outlined in paragraph 2-36*d*(6).

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. OPERATOR'S CONTROLS AND INSTRUMENTS

NOTE

This section covers only items used by the operator; items used by maintenance personnel are covered in instructions for the appropriate maintenance echelon.

3-1. Operator's Controls and Indicators

a. Careless operation or improper setting can cause damage to the radar set and needlessly make the radar set inoperative when enemy personnel or vehicles are in the surveillance area. It is important to know the function of every operational control of the radar set. The functions of all operator's controls and instruments (with the exception of the generator) are discussed in paragraphs 3-2 through 3-9.

b. During operation of Radar Set AN/TPS-25, observe the following precautions and instructions:

(1) Do not disturb the controls having shaft locks. These locks should be kept secured This applies to the panel controls (when the front panel cover is removed) located on the receiver-transmitter.

(2) If the reading of the meter on the front panel of the receiver-transmitter exceeds 14 ma (when the meter switch is set at MAG CUR (20 MA FS)) at any time during operation and cannot be adjusted to the required 14 ma, the magnetron may be damaged. Stop the equipment and have the second echelon mechanic check for the cause.

3-2. Radar Set Control C-2715/TPS-25 Controls and Instruments (fig. -1)

a. The following chart lists the controls of the radar set control and their functions.

Controls/indicators	Function
SECTOR WIDTH	Selects either 360 or 540 mil sector scan.
PANEL lights	Adjusts panel lights and plotting board indicator light for proper illumination.
VERTICAL	Vertical position of scope trace.
SCOPE GAIN	Increases or decreases vertical height of signals on scope trace.
X (counter) control	Provides a means of declutching X counter from zero system and manually setting to zero or to a desired offset.
AZIMUTH crank	Crank controls antenna rotation with AUTO MAN switch in all positions, except AUTO SEARCH (position 1).
ORIENTATION	Control which provides means of disengaging AZIMUTH counter from servo system and manually setting counter to a predetermined azimuth when orienting antenna
SECTOR CENTER	Control provides a means of selecting center of sector to be searched
ELEVATION crank	Crank controls elevation angle of antenna beam.
VOLUME	Controls audio output level to loudspeaker orland headset.
INTENSITY	Controls brightness of scope trace.
FOCUS	Controls focus of scope trace.
RADIATE switch	In ON position the transmitter is energized and RF energy is radiated from antenna. In OFF position the transmitter is turned off and no RF energy is radiated from antenna
Y counter control	Provides a means of disengaging Y counter from sevo system and manually setting counter to zero or a desired offset.
MAP SCALE	Selects map scale of 1:26K or 1:50K to correspond to scale of map used Also directs proper RANGE counter.
RANGE crank	Crank positions the range gate. Used to set starting range for the automatic range sweep in positions 1 and 2 of AUTO MAN switch. Use to manually search or track targets in range in positions S. 4. and 6 of the AUTO MAN switch.
AUTO MAN	Selector selects method of operation of the equipment in following positions: *Position* — *Action* AUTO SEARCH — Automatic search in both azimuth and range. AUTO RANGE — Azimuth manually controlled, range search automatic. MAN SEARCH — Range and azimuth manually controlled. MAN TRACK AUDIO — Range and azimuth manually controlled beamwidth reduced to 2 degrees. Audio signal presentation on scope. MAN TRACK VIDEO — Range and azimuth manually controlled with beamwidth reduced to 2 degrees and video signal presentation on scope
RCVR GAIN	Sets diagonal noise level of receiver with VOLUME control in midposition.
MAP ZERO	Allows range to be set to zero for orientation of map on plotting board.

b. Radar Set Control C-2715/TPS-25 instruments and indicators are listed in the following chart:

Controls/indicators	Function
CCW light	Lights when antenna is rotating counterclockwise during sector Scan Stays lit in AUTO RANGE position indicating the direction in which the antenna was last turning.
CW light	Lights when antenna is rotating clockwise during sector scan. Stays lit in AUTO RANGE position indicating the direction in which antenna was last turning.
X counter	Indicates X coordinate of target when equipment is operated in either MANUAL TRACK or MANUAL SEARCH.
AZIMUTH WARNING light	Lights when antenna reaches rotation limits in azimuth, or when AZIMUTH crank is rotated too fast
ELEVATION counter	Indicates elevation of antenna beam. One window (PLUS) shows beam angle above the horizontal; other window (MINUS) shows beam angle below the horizontal
ELEVATION WARNING light	Lights when antenna reaches elevation limits.
Y counter	Supplies Y coordinate of target in meters when AUTO MAN switch is in position 3, 4 or 5.
RADIATE lamp	Lights when RADIATE switch is in ON position and radar set is transmitting.
RANGE counter	Indicates engine metes with map scales of either 1:25K or 1:50K. Counter not used is covered by a shutter.
AZIMUTH counter	Indicates azimuth angle of antenna beam in mils.

3-3. Servo Data Coordinator SN-231/TPS-25 Controls and Instruments (fig. 3-2)

a. Control The panel of the coordinator has one control: The METER LIGHT switch may be used to illuminate the dial face of the ac voltmeter located at the bottom center of the coordinator.

b. Instruments. The coordinator front panel has one meter which indicates the line voltage supplied to the radar set when the power ON-OFF switch located on the power supply is turned to ON.

3-4. Power Supply PP-2166/TPS-25 Controls and Indicators (fig. 3-3)

a. The panel of the power supply has one control: ON-OFF power switch. ON and OFF positions of this switch are used to turn the radar set power on and off.

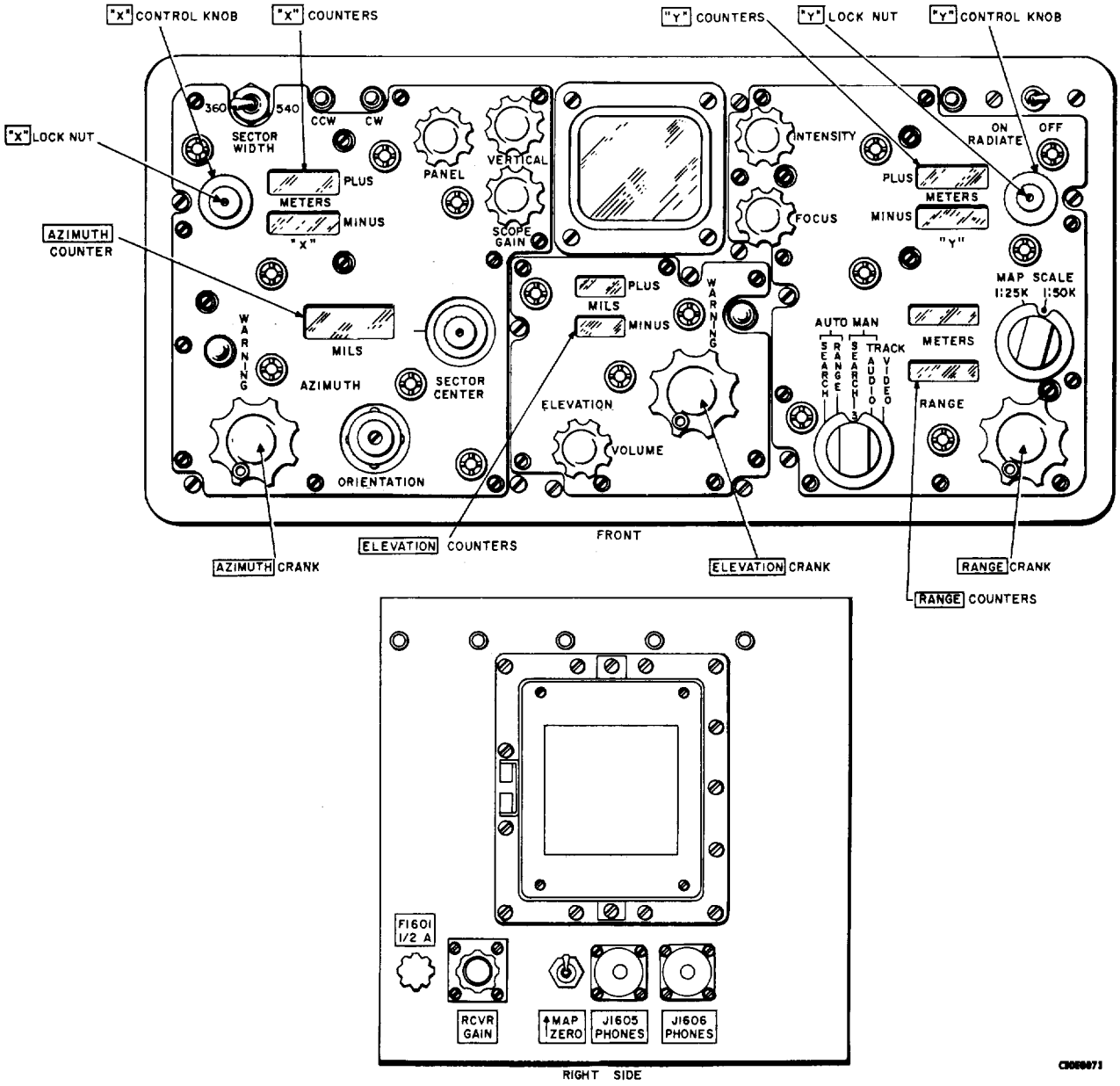


Figure 3-1. Radar Set Control Front Panel and Right Side.

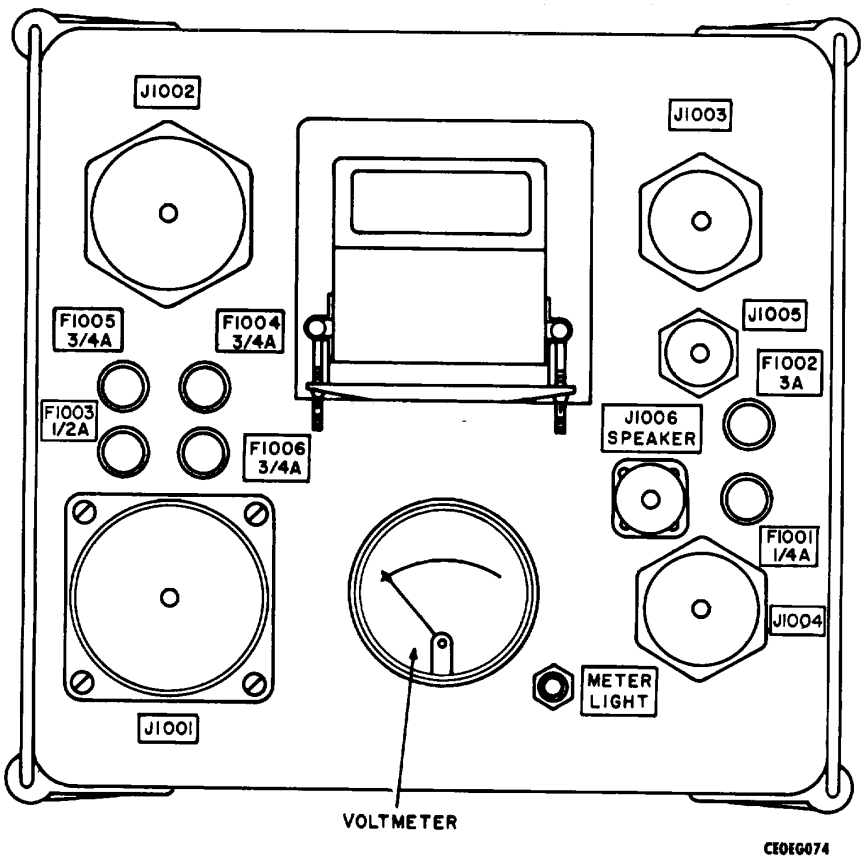


Figure 3-2. Coordinator, Front Panel.

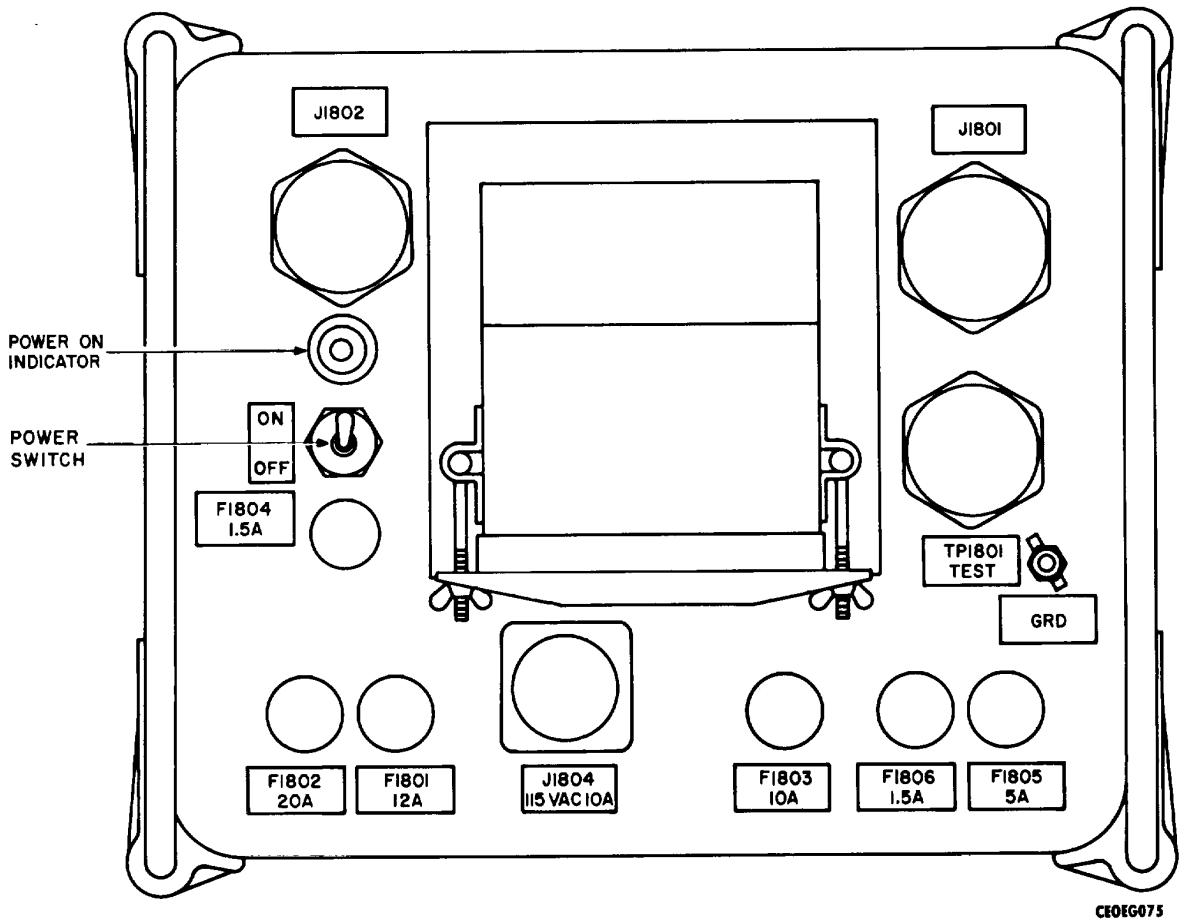


Figure 3-3. Power Supply, Front Panel

b. Indicators. The panel of the power supply has one indicator which indicates when power is on or off. This is a pilot light located above the power switch which lights when the switch is placed in the ON position.

3-5. Permanent Magnet Loudspeaker LS-451/G Control (fig. 3-4).

The loudspeaker has one control located on the front of the case. The SPEAKER VOLUME may be manipulated by the operator to set the level of the audio output from the loudspeaker.

3-6. Radar Receiver-Transmitter RT-500/TPS-25 Controls and Instruments (fig. 3-5)

a. Controls. The following chart lists the controls of the receiver-transmitter and their functions. The Figure 3-3. Power Supply, Front Panel operator should not use any of the controls on the panel that are not listed here. The other controls are for use by maintenance personnel.

Control	Function
Meter switch	The switch selects circuits to be measured and has 11 positions plus an OFF position.
PANEL LIGHT	Turns panel illumination to BRIGHT, DIM or OFF as required.
MAG CUR ADJ	Adjusts magnetron current for proper operation of magnetron.
LEVEL LIGHTS switch (fig. 1-12)	Used on Radar Set AN/TPS-25A only. Actuates the leveling light circuit for periods of 5 minutes when leveling the antenna.

b. Instruments. The receiver-transmitter instruments are listed in the following chart.

Instrument	Function
Meter	Provides readings from zero to 1 for each position of the meter switch. Readings are used to check various radar set circuits for normal operation.
Level Lights (fig. 1 - 11)	Indicates antenna is level when none of the lights are lit.

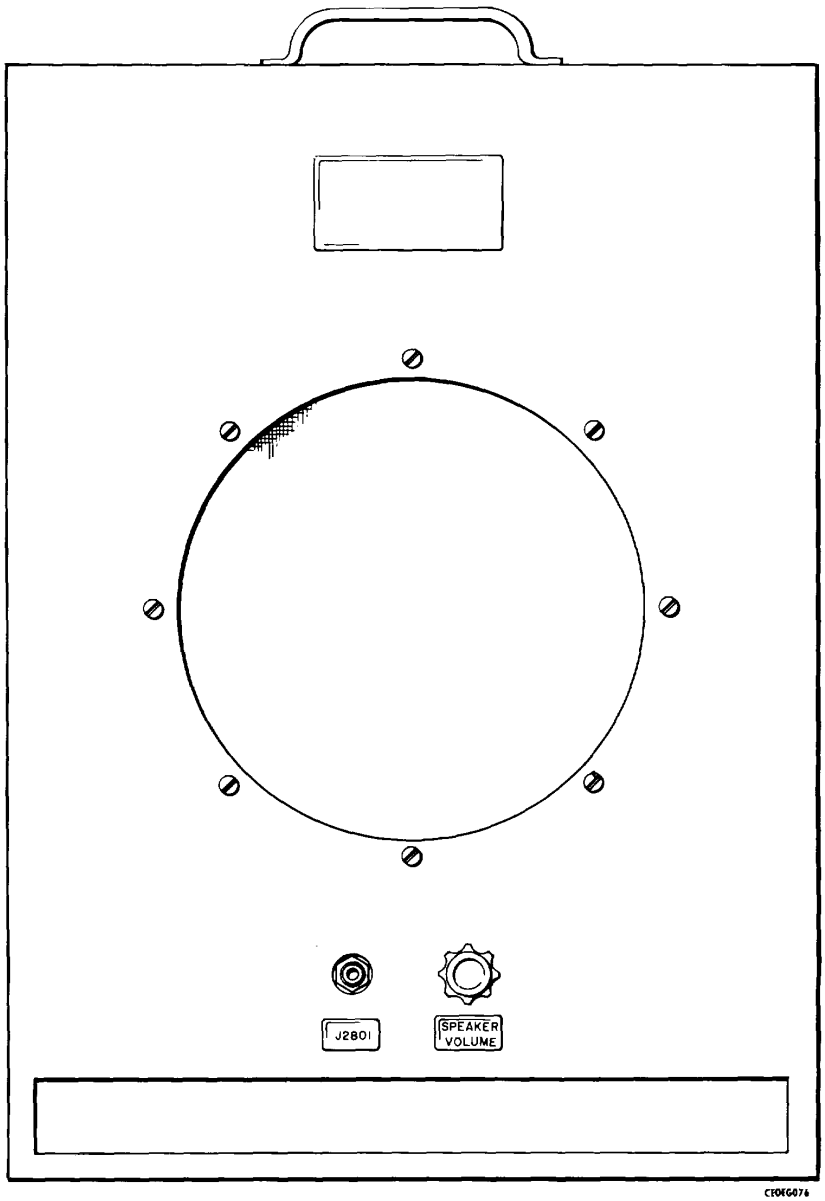


Figure 3-4. Loudspeaker, Front of Cabinet.

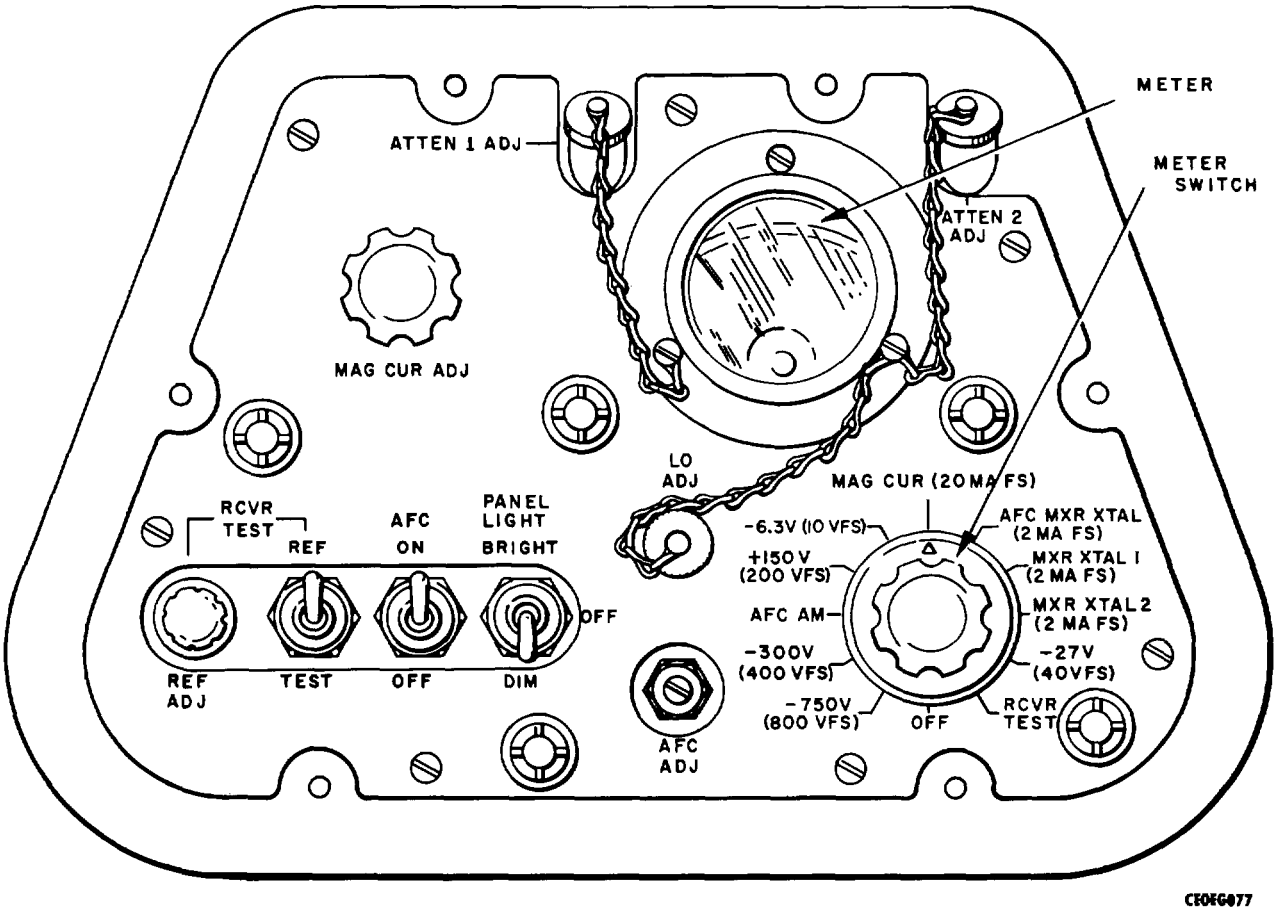


Figure 3-5. Receiver-Transmitter, Front Panel

3-7. Tactical Display Plotting Board PT-441/ TPS-25 Controls and Instruments (fig. 3-6)

a. Control The plotting board has an azimuth clutch control that may be used to engage or disengage the plotting board arm from the radar set control in azimuth.

b. Instruments. The plotting board has an indicating light that moves in azimuth and range, thereby indicating the position of the target being tracked.

3-8. Heater Controls and Indicator (fig. 3-7)

a. Controls. The front panel of the heater has three controls as follows:

Control	Function
HI-OFF-LO	Controls primary power to heater as well as controlling the blower motor speed.
COLD START	Facilitates starting of heater when normal starting procedure fails be cause of extremely low temperature.
INCREASE control	Controls the temperature at which the heater will operate and shut down.

b. Indicator. An indicator sight tube, located inside the grille above the switch plate, is visible to the operator and indicates to the operator when heater combustion takes place by the flame glow seen in it.

3-9. Shelter Power Distribution Box (fig. 3-8)

The following chart lists the controls of the shelter power distribution box and their functions.

Control	Function
MAIN circuit breaker	Controls power fed to all components of the radar set and to the shelter.
SHELTER circuit breaker	Controls power to shelter internal wiring.
RADAR circuit breaker	Controls power to radar set via the power supply power switch.
FANS:	
LEFT switch	Controls power to left shelter ventilating fan.
RIGHT switch	Controls power to right shelter ventilating fan.
HEATER switch	Controls power to heater HI-OFF-LO switch on the heater.
LIGHTS switch	Turns shelter ceiling lights on and off when shelter doors are closed.

3-10. Air Filter Intake and Exhaust Ports

Blowers and air filters are located in the coordinator, power supply, modulator, receiver-transmitter, radar set control, and shelter. The blowers are used to circulate clean cool air through the interior of the units. The intake ports are equipped with removable air filters. The exhaust ports contain the blower motors. Intake and exhaust ports have covers (except for the radar set control exhaust port) that are held in place by means of thumbscrews. The chart below lists the locations of all the ports:

NOTE

The exhaust port cover of the radar set control is a threaded cap screwed to a threaded flange.

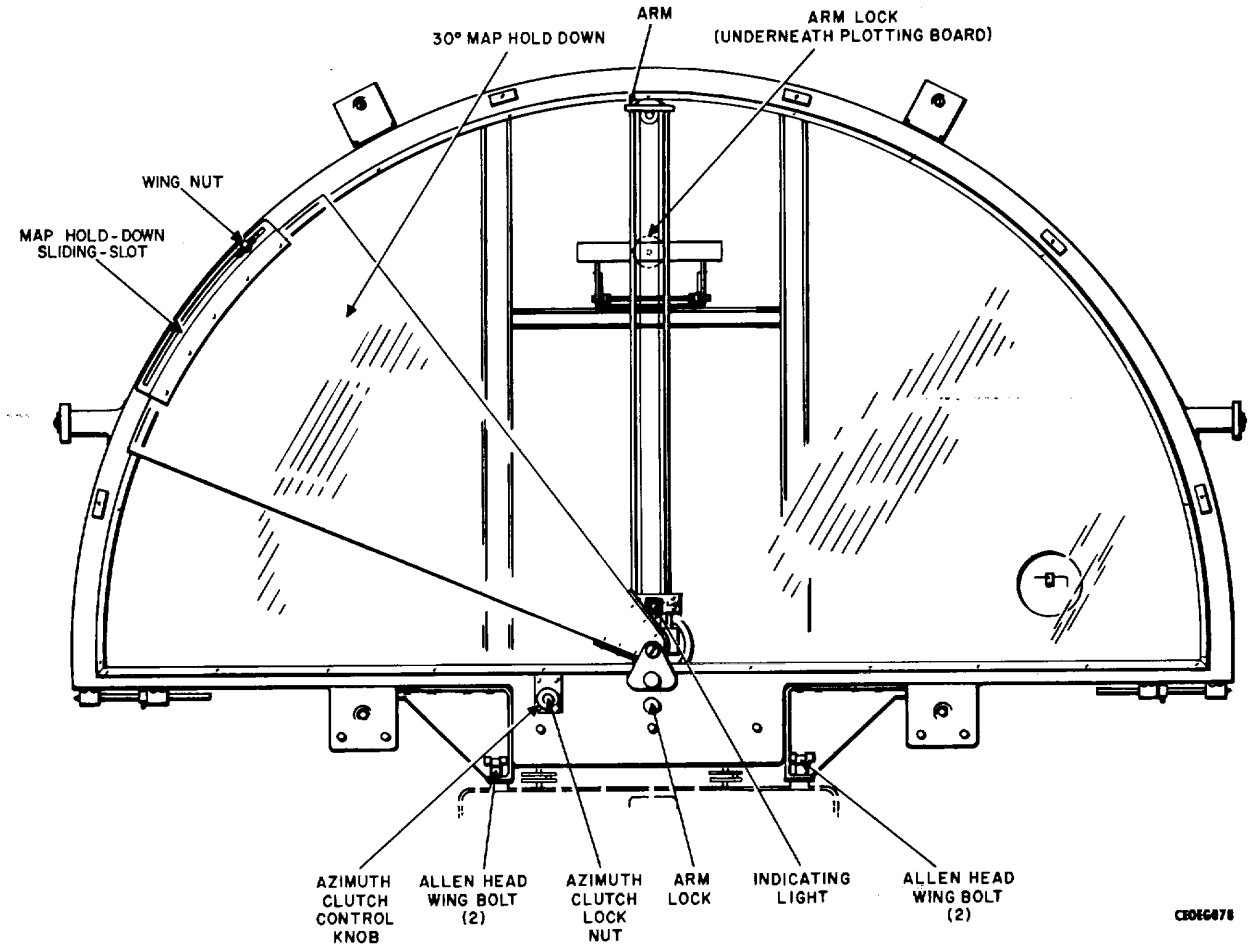


Figure 3-6. Plotting Board, Controls.

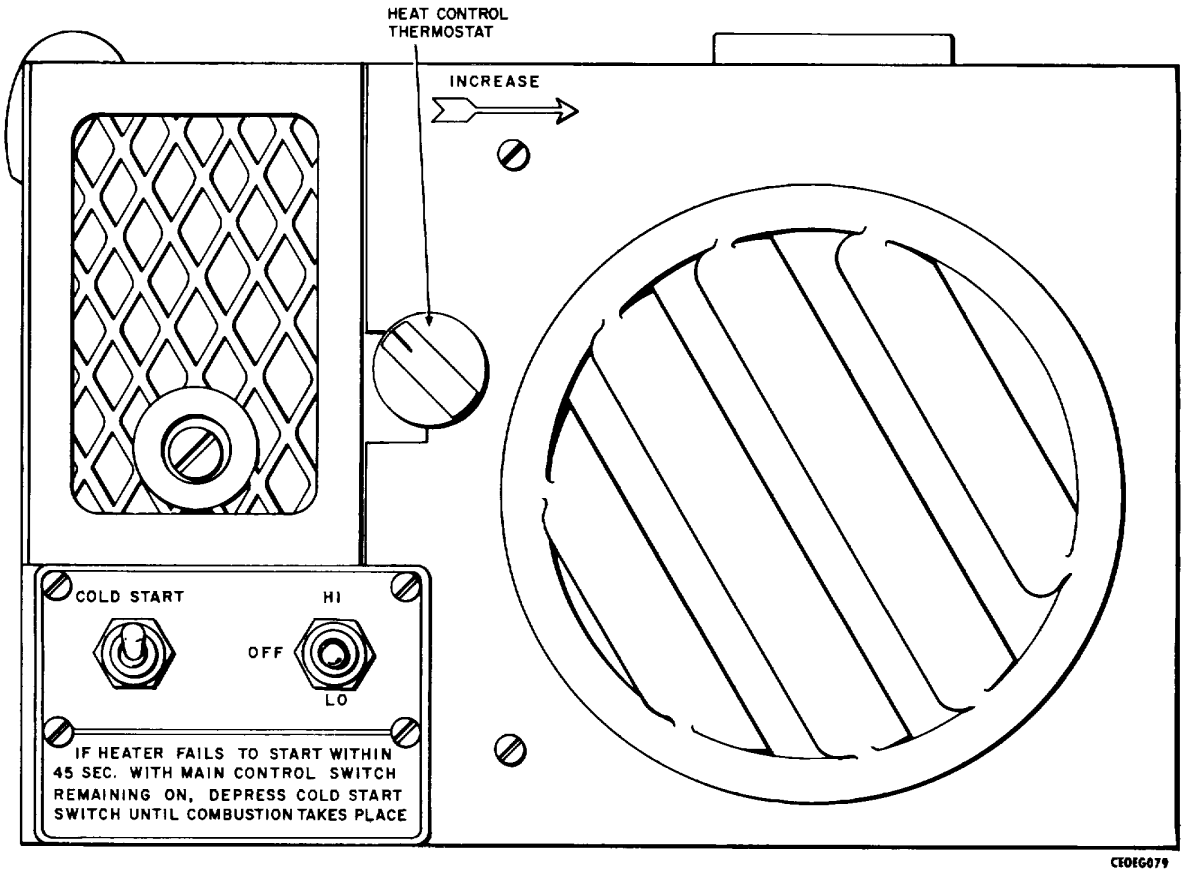


Figure 3-7. Heater, Controls.

Component	Intake ports			Exhaust ports		
	Quantity	Location	Figure	Quantity	Location	Figure
Coordinator	2	Right and Left side	6	1	Front	6
Power supply	1	Left side	9	1	Front	9
Modulator	1	Left side	10	1	Front	10
Receiver-transmitter	1	Right side	11	1	Rear	11
Radar set control	1	Right side	8	1	Top (cable entrance side)	8
Shelter	2	Each wall near doors	2	2	Front of shelter	2

NOTE

The antenna has two air circulation ports (breather ports) located on the bottom side of the antenna (fig. 2-28).

Section II. OPERATION UNDER USUAL CONDITIONS

3-11. Preliminary Control Settings

Radar Set AN/TPS-25 may be operated to search for and track moving targets. The preliminary control settings and the starting procedure are the same for all types of operation. Before starting the equipment (para 3-12) check the settings of the operating controls and reset the controls as necessary.

a. At the radar set control (fig. 3-1), set the controls as follows:

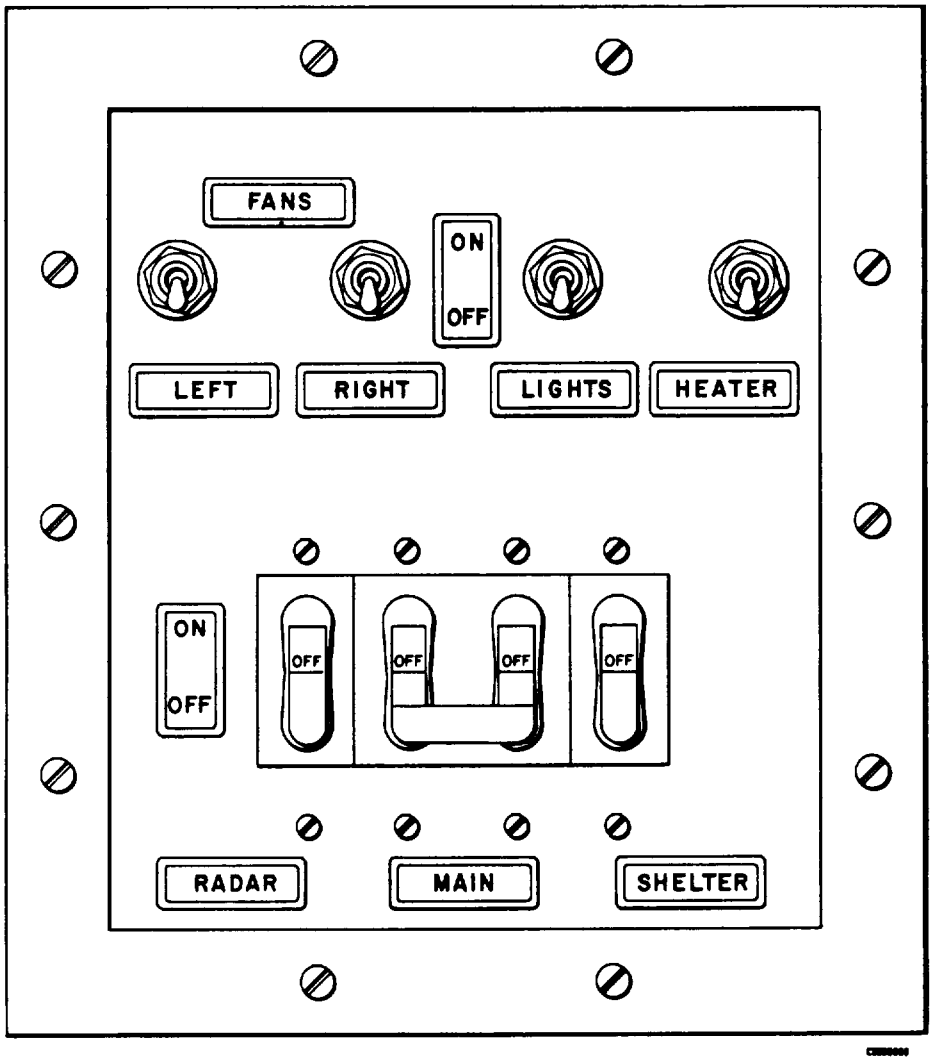


Figure 3-8. Shelter Power Distribution Box, Panel View.

Control	Position
INTENSITY*	Midrange
FOCUS*	Midrange
VERTICAL*	Midrange
SCOPE GAIN*	Midrange
VOLUME*	Midrange
PANEL lights	Midrange
RCVR GAIN*	Clockwise
MAP SCALE	1:25K or 1:50K depending on map used.
AUTO MAN selector	MAIN SEARCH (pos. 3)
SECTOR WIDTH	360
RANGE crank	Arbitrary
MAP ZERO	Operate position (toward bottom of radar set control)

*If controls have been previously set for normal operation, they do not have to be repositioned before turning on the radar set.

b. At the power supply, set the power supply power switch (fig. 3-3) to the OFF position.

c. At the shelter power distribution box (fig. 3-8) which is located on the curbside wall of the shelter, check that the MAIN, RADAR, and SHELTER circuit breakers are set at OFF and that the FANS, LIGHTS, and HEATER switches are set to OFF.

NOTE

If the equipment is operated outside the shelter, the distribution box is not used. Make sure the power supply switch is set at OFF.

d. At the receiver-transmitter front panel (fig. 3-5), set the meter switch to MAG CUR (20 MA FS) and PANEL LIGHT at OFF. Close the shutter dim-

mer on each of the four level lights (fig. 1-11) (turn clockwise).

e. At the generator set MEP 021A, ensure voltage selector switch is at 120 volts single phase.

CAUTION

When the generator is shipped from the factory, a cotter pin has been inserted through the safety holes on the VOLTS and PHASE switches so that they cannot be moved from these positions. The equipment may be seriously damaged if either of these switches is accidentally thrown to the alternate position during starting or operation.

f. Check that the air filter intake and exhaust ports (para 3-10) on the coordinator, power supply, modulator, receiver-transmitter, and radar set control are open (para 2-18).

3-12. Starting Procedure

NOTE

If an abnormal result is obtained during the starting procedure, refer to the operational checklist (para 4-6). Refer to the preliminary control settings (para 3-11) before using the starting procedure.

a. Start the generator set; follow the instructions given in TM 5-6115-271-14. Adjust the generator set voltage so the voltage reading on the single-phase line is 115 ±5 volts.

WARNING

When handling gasoline near the radar set, observe the following precautions unless otherwise ordered by the officer or noncommissioned officer in charge during extreme emergency. Never refuel the generator or handle open gasoline cans in a way that will bring them into contact with other metal objects while the radar set is transmitting. Voltages produced in metal objects near an operating radar set may create small sparks if another metal object is brought into contact with them. If the radar set is transmitting, press the RADIATE switch on the radar set control (fig. 3-1) to OFF before refueling the engine generator. Do not use plastic containers for refueling purposes because static electricity may cause an igniting spark.

b. After a suitable warmup period, check the no-load reading of the voltmeter on the generator. The voltmeter should read 115 ±5 volts.

CAUTION

To prevent possible damage to the power supply when the RADAR switch on the shelter power distribution box is turned to ON, check to see that the radar set power switch (located on the power supply (fig. 3-3)) is at OFF.

c. At the shelter power distribution box (fig. 3-8) set the MAIN power switch to ON (up position). Place the SHELTER switch to ON. If shelter lights are required throw the LIGHTS switch to ON. Shelter lights should light if the shelter doors are closed, (The shelter lights will not light if the doors are open because of the interlocks being open). If ventilation is required place FANS switch LEFT and RIGHT to ON positions. As each switch is thrown to ON, the appropriate fan on the front wall of the shelter should be heard to come up to speed. Throw the RADAR circuit breaker to ON.

WARNING

When starting the radar set in a tactical situation or during dusk or darkness, check that the PANEL LIGHT switch (located on the front panel of the receiver-transmitter (fig. 3-5) is set at OFF and the pilot light dimmers on the antenna leveling lights located on the receiver-transmitter (fig. 1-11) are turned fully clockwise before operating the power supply power switch to ON. On Radar Set AN/TPS-25A, the leveling lights will remain off unless activated by the LEVEL LIGHTS switch on the receiver-transmitter.

d. Set the power switch on the power supply to ON (fig. 3-3). The power-on indicator above the power switch should light. The voltmeter (fig. 3-2) located on the coordinator should indicate 115 ±5 volts. (To illuminate the voltmeter scale, set the METER LIGHT switch to the on (up) position.) Blower motors should be heard operating in the power supply, coordinator (if the temperature is above +5° E (- 15 C.)) radar set control, modulator, and receiver-transmitter.

NOTE

In some radar sets, the blower motors may be heard to operate if the temperature is above -13° F. (-25° C.).

e. After 3 minutes push the RADIATE switch (fig. 3-1) on the radar set control momentarily to ON (left). The indicator light (to the left of the switch) will light, indicating that the radar set is radiating.

NOTE

RADIATE switch is inoperative from 3 to 5 minutes after the power switch on the power supply is set to ON (para 2-36d).

f. IF the noise level in the shelter is high, the headset supplied with the radar set may be used. Remove the headset from its plastic bag (located in storage box, fig. 2-22) and plug the headset into either PHONES jack (J1605 and J1606) at the right side of the radar set control (fig. 3-1).

g. With the VOLUME control (fig. 3-1) set to midrange, adjust the RCVR GAIN control on the radar set control until the noise output from the head-phones is clearly audible. If the loudspeaker is used, set the SPEAKER VOLUME (fig. 3-4) to midrange and adjust RCVR GAIN as above.

h. At the receiver-transmitter (fig. 3-5) check the readings as presented on the meter switch against the readings given in the table below:

Position	Meter pointer condition	Reading
MAG CUR	Steady	7
AFC MXR XTAL	Steady	337 to .412
MXR XTAL 1	Steady	337 to .412
MXR XTAL 2	Steady	337 to .412

NOTE

If magnetron does not read .7 (14 ma), adjust MAG CUR ADJ until meter reads .7 (14 ma).

I. Adjust RANGE, ELEVATION controls and SCOPE GAIN control on the radar set control (fig. 3-1) until a presentation is obtained on the A-scope. The presentation on the A-scope (A, fig. 3-9) should include a base line, range gate, and targets (if any). If necessary increase the intensity of the presentation by means of the INTENSITY control. Perform the following adjustments:

(1) Adjust the INTENSITY control until the trace is just visible.

(2) Adjust the FOCUS control for a sharply defined trace.

(3) Adjust the VERTICAL control until the presentation is centered vertically on the A-scope.

(4) Advance the SCOPE GAIN until echo signals reach a maximum amplitude of approximately 1 inch on the A-scope.

j. Place the RADIATE switch at OFF (standby condition). Refer to paragraphs 3-13 and 3-14 for search and tracking operation of the radar set.

3-13. Ground Surveillance and Target Detection

a. General When the radar set is first put into operation at a new location, the operator should be come familiar with normal radar indications and ranges of fixed targets as seen on the A-scope. This will provide a standard for a daily check of the radar set operation.

b. Operating Hints.

(1) The operator should become familiar with aural response of moving targets as heard in the loudspeaker or headset during normal radar operation. As the operator becomes experienced with set operation, identification of dissimilar targets will become possible.

(2) The blind areas of a particular location should be known to the operator, as well as the range at which a moving target will disappear into the horizon shadow.

(3) The operator should be aware of areas that produce blocks of heavily saturated signals because in these areas moving targets may be temporarily lost.

(4) As soon as a target is detected, note its direction and visualize where its target might later be picked up should it pass from view or be lost momentarily because of a blind spot. Blind spots can also be caused by moving targets moving radially toward the antenna at certain speeds called blind speeds. Ordinarily, in this radar set, the chance for a blind spot because of target speed is very small due to motion other than radial movement of the target. Some targets, especially those at greater range, are more likely to disappear from view because of depressions in the terrain which would obscure the target.

(5) The disappearance of a target signal may indicate that the target has stopped its motion or is moving in a perfect circle with respect to the antenna site, or, as pointed out in (4) above, the target has disappeared from view because of an obstruction between target and antenna. Therefore, it is important for the operator to know the terrain within the range of the radar set.

c. Set Operation

(1) If a map other than the one used for the installation of the radar set is to be used, orient the new map as outlined in paragraph 2-39.

(2) Determine from the officer or noncommissioned officer in charge of the area of interest to be scanned. Set the SECTOR CENTER control as given in paragraph 2-40.

(3) Set evaluation angle of antenna by means of the ELEVATION control. If the antenna site and/or target is located on other than essentially level terrain, the following procedure may be used to preset the sector elevation angle.

(a) Estimate the elevation angle from range and elevation data on the sector map. (One mil corresponds to approximately one meter elevation per thousand meters of range.)

(b) Set the elevation angle (in mils) on the ELEVATION counter (fig. 3-1) with the ELEVATION crank. Turn the ELEVATION crank clockwise for

elevation angle above horizontal (PLUS), and counterclockwise for angles below horizontal (MINUS). The ELEVATION WARNING indicator will light if the antenna reaches either PLUS or MINUS limits. These limits are ±270 mils. Once the radar set is radiating, the elevation angle is readily set by maximizing the video ground return.

(4) Start the radar set as outlined in paragraph 3-12.

(5) Set the AUTO MAN switch (fig. 3-1) to AUTO SEARCH (position 1). The antenna is now scanning the desired sector of interest but the transmitter is not radiating. The AZIMUTH counter on the radar set control indicates the center of the RF beam. The CW and CCW indicator lights on the radar set control indicate the direction of antenna rotation.

(6) Set the RANGE counter to the minimum range to be scanned with the RANGE crank. (In AUTO SEARCH (position 1) and AUTO RANGE (position 2) of the AUTO MAN switch, the area automatically scanned in range begins at the range indicated on the RANGE counter and extends outward 900 meters. For example, if the RANGE counter is set at 10,000 meters, the range gate will sweep from 10,000 to 10,900 meters.)

(7) Push the RADIATE switch to ON. The RADIATE light will light indicating that the transmitter is radiating.

(8) Set the VOLUME control at midrange. Adjust the RCVR GAIN control until the noise output of the receiver in the headset is clearly audible. If the loudspeaker is used, its volume can be adjusted by means of the SPEAKER VOLUME control on the loudspeaker cabinet. The radar set is now in a condition whereby targets may be searched for and tracked.

314. Target Locating Operation

a. Two methods are provided for locating a moving target.

(1) If the RF beam from the antenna sweeps across a moving target, an audio return will be heard in the headphones and/or speaker. The fundamental audio signal will be in the 20- to 1,000-cps range depending on the speed and direction of movement of the target.

(2) If the target is large enough, a visual indication (appearing as a pulse varying in amplitude) of its presence will be obtained on the A-scope video display of the radar return from the 900-meter portion of the sector being scanned (para 3-13c(6)). (The video display (A, fig. 3-9) is presented on the scope, located on the front panel of the radar set control, when the AUTO MAN switch (fig. 3-1) is in positions AUTO SEARCH, AUTO RANGE, MAN SEARCH, and MAN TRACK VIDEO. The video display is replaced by a display of the audio doppler return (B, 3-14 fig. 3-9) when the AUTO MAN switch is in AUTO TRACK AUDIO position.)

b. Upon receipt of an audio return, indicating a target within the scanned sector, set AUTO MAN switch to AUTO RANGE (position 2). The antenna stops automatic scanning; azimuth scan is obtained manually by use of the AZIMUTH crank. The range search continues automatically over the 900-meter portion of the sector being searched. The target has now been located within the 900-meter portion of the sector covered by the 180-mil beamwidth of the antenna.

NOTE

If the audio signal (indicating the moving target) is not heard upon switching to AUTO RANGE (position 2) of the AUTO MAN switch, check the CW and CCW indicators to determine in which direction the antenna was moving when the AUTO MAN switch was placed in AUTO RANGE position. It is possible that the antenna radio frequency (RF) beam has swept beyond the target, and the AZIMUTH crank must be turned in the reverse direction to relocate the target.

c. After target azimuth has been located manually, observe the approximate position of the range gate on the scope as it passes through the target (sound will be heard as the range gate passes the target). Switch AUTO MAN control to MAN SEARCH (position 3).

NOTE

In the MAN SEARCH position of the AUTO MAN switch, the range gate search stops and the target must be relocated in range by means of the RANGE crank.

d. Turn the RANGE crank manually to the point on the video display where the target was observed. This is accomplished by turning the RANGE crank counterclockwise until the point where the target was observed is moved into the gate on the left side of the video display (A, fig. 3-9).

NOTE

In the MAN SEARCH position of the AUTO MAN switch, the CW and CCW indicator lights are inoperative (not lighted). However, a relay retains the direction of rotation information so that when or if automatic azimuth search is resumed the antenna rotation will be the same as it was when the AUTO MAN switch was set at AUTO SEARCH.

e. Peak the target audio return (heard in the headphones or loudspeaker) by manipulating the RANGE, AZIMUTH and ELEVATION cranks.

f. After having located the target in range and in azimuth, place the AUTO MAN switch in MAN TRACK AUDIO (position 4). In this position the beamwidth of the antenna is changed from 180 to 36 mils, and the video target display on the A-scope is replaced by a display of the audio return (B, fig. 3-9).

g. Azimuth and elevation of the target are now accurately determined by adjusting the AZIMUTH crank, and the ELEVATION crank manually for maximum amplitude of the audio display on the A-scope.

h. The range of the target is determined by manually adjusting the RANGE crank. The RANGE crank should be turned counterclockwise until the range gate is off the target; then it should be moved clockwise until the audio response first becomes audible. The target will now be pinpointed in range at this position.

NOTE

Use of the A-scope at this time is desirable for pinpointing the target, since the audio response can often be seen before it can be detected by ear.

I. Accurate target information in range, azimuth, elevation (if needed), and X and Y coordinates can now be taken from the direct reading counters on the front panel of the radar set control. As the target moves, it must be tracked manually by continued adjustment of the AZIMUTH and RANGE cranks, and to a lesser extent, by the ELEVATION crank. (Proper use of the RANGE crank during tracking consists of *bumping* the target with the trailing edge of the range gate as the target moves.) X, Y, and range readings are all automatically corrected for elevation angle and the readings shown on the counters are measurements in a horizontal plane.

NOTE

Occasionally, the audio indication of the moving target will disappear from the A-scope when the antenna beamwidth is narrowed (AUTO MAN switch turned from MAN SEARCH (position 3) to MAN TRACK AUDIO (position 4)). This may occur when the target has not been centered properly in the 180-mil beamwidth of the antenna. Normally, however, the greater concentration of power produced by the narrower beam of the antenna provides enough clutter from even the poorest reflecting surfaces to permit the formation of a doppler return.

j. At any time during operation, the AUTO MAN switch may be returned to AUTO SEARCH (position 1) and the radar set will resume automatic search in the azimuth sector originally chosen. The starting point for the 900-meters range sweep will have to be chosen again by adjusting the RANGE crank until the RANGE counter reads the desired range.

Figure 3-8.1. Predicted Target Location.

k. After tracking a target for 30 seconds, the radar operator can determine the speed of the target, predict the time that the target will arrive at a given point (e.g., a road junction or a suspected rendezvous area) and request artillery fire on that point. The operator determines the speed of the target by measuring on the map the distance the target traveled during a specific period of time and then computes the time that the target will arrive at the selected point.

Example: Assume that the operator is tracking a target traveling on Battle Creek Road towards RJ 1620 (fig. 3-8.1.). After the operator has peaked the target return in mode 4 or 5 and is tracking the target

satisfactorily, the operator makes a pencil mark at the leading edge of the indicator light at point A. With a stop watch or a clock, the operator times the movement of the target for 30 seconds and marks the leading edge of the indicator light at point B. By measuring the distance the target traveled from point A or B and the distance the target will travel from point B to RJ 1620 the predetermined point, with a plotting scale, the operator predicts the time the target will arrive at RJ 1620 by the formula-

$$\frac{\text{Distance from A to B}}{\text{Travel time from A to B (always 30 seconds)}} = \frac{\text{Distance from B to selected point}}{\text{X (predicted time)}}$$

Given:
Distance from point A to point B = 400.
Distance from point B to RJ 1620 = 2000.
Solution:

$$\frac{400}{30} = \frac{2000}{X} = \frac{60{,}000}{400X} = \frac{150}{}$$

Therefore, X = 150 seconds, or 2.5 minutes.

l. It may be necessary to record the speed of targets in miles per hour. A simple conversion can be applied to the measurement in meters to determine the approximate speed in miles per hour. The distance that the target travels in 30 seconds is measured in meters. A target traveling at a speed of 5 miles per hour covers 65 meters in 30 seconds. Therefore, if a vehicle travels 130 meters in 30 seconds, it is traveling 10 miles per hour. The speed in miles per hour is equal to the number of meters traveled in 30 seconds divided by 13.

3-15. Heater Operation

WARNING

Never, under any circumstances, operate the heater in the shelter without providing proper ventilation to the heater and shelter. Open the protective cover on the heater exhaust on the outside of the shelter (fig. 2-39). Provide ventilation to the shelter by opening either the shelter air intake ports (fig. 1-2) or by opening the window on the door of the shelter.

a. Turning on Heater. Make sure the HEATER switch on the shelter power distribution box (fig. 3-8) is at ON. At the heater (fig. 3-7) proceed as follows:

(1) Make sure the heat control (INCREASE) thermostat on the heater calls for heat (turn clockwise).

(2) Turn the HI-OFF-LO switch to the HI position. Combustion should take place within 45 seconds. Combustion may be observed by peering into the sight tube (fig. 1-15) through the grating on the front of the heater.

(3) If combustion does not take place within 45 seconds with the HI-OFF-LO switch still set at HI, depress the COLD START switch until combustion takes place. If too much heat is being generated for shelter heating, turn the HI-OFF-LO switch to LO or regulate the INCREASE control for proper shelter temperature.

b. Turning off Heater.

(1) Place the HI-OFF-LO switch to the OFF position.

NOTE

In an emergency, the heater may be shut off by placing the HEATER switch on the shelter power distribution box to OFF

(2) The heater blower will continue to run until the heater system has purged itself.

CAUTION

If the radar set is to undergo deep fording during transit, make certain that the heater exhaust port has been closed. Refer to paragraph 2-18 for application of the deep fording kit.

3-16. Normal Stopping

a. Turn the power switch to the OFF position. Power on indicator lamp goes out.

b. Turn the MAIN circuit breaker on the shelter power distribution box to OFF.

c. Shut down the generator.

d. Place the radar set control top cover over the front panel of the unit to protect the panel. Lock the cover in place with two of the trunk latches. If the radar set control is detached from the plotting board, all trunk latches on the radar set control should be latched. If the radar set control is operated outside the shelter and is not protected against rain, close both of the ventilating ports.

3-17. Emergency Stopping

a. In an emergency, it may be necessary to turn off

the radar set in the shortest possible time. To do this, at the MAIN circuit breaker (fig. 3-8) on the shelter power distribution box control panel to OFF Before starting the equipment again, check to see that the controls are set as described in paragraph 3-11.

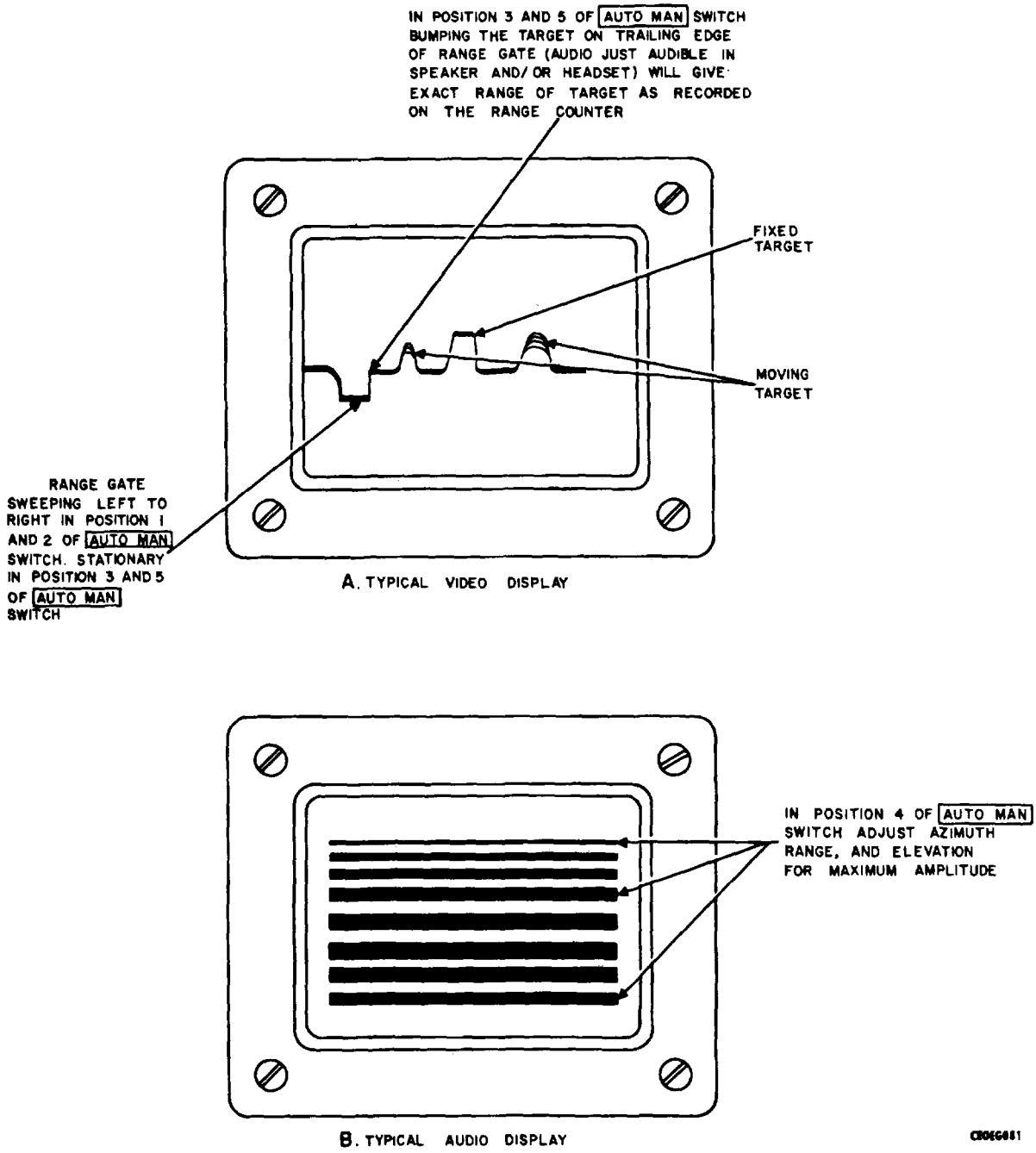


Figure 3-9. Scope display.

b. It is also possible to turn off the radar set by either throwing the power (ON-OFF) switch on the power supply (fig. 3-3) to OFF or to shut down the generator.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

3-18. Deep Fording Kit

The deep fording kit (not supplied with the equipment) is used to provide a waterproof covering for the lower part of the shelter. The kit consists of two neoprene gaskets and a roll of waterproof adhesive tape. (The tape is expendable after once being used.) The deep fording kit is installed on the shelter so that the shelter can be forded through water 3 feet deep, without danger of damage that can result from exposing the components not waterproofed. The procedure for preparing the shelter for deep fording is given in paragraph 5-16.

3-19. Ventilating Shelter

The shelter may be ventilated by opening the window or by using the ventilating fans when the window must remain closed.

a. Window Ventilation.

(1) Lower the blackout cover (fig. 1-2) on the outside of the window (curbside door of the shelter) by pulling out the latch spring on the lower end of the cover and sliding the cover down.

(2) Inside the shelter, unhook the lever (fig. 2-16) attached to the window. Swing the level down and push the window open. Notches cut in the lever allow adjustment of the window opening.

b. Fan Ventilation

(1) Loosen the thumbscrews in the covers over the two shelter air intake ports (roadside and curb side of shelter near doors) and two exhaust fan ports on the outside of the shelter (fig. 1-2) and lift the covers up until the support arms latch into place.

(2) With the doors and the window on the door closed, and with the MAIN and SHELTER switches (fig. 3-8) of the shelter power distribution box at ON, set the LEFT and RIGHT FANS switches to ON.

CAUTION

The exhaust port on each exhaust fan assembly must be in the open position before the FANS switches are turned ON.

3-20. Operation in Arctic Climates

Subzero temperatures below -40° F (-40° C.) and climatic conditions associated with cold weather affect the efficient use of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Keep the equipment as warm and dry as possible. This is possible with the shelter-mounted units by making use of the built-in heater of the shelter. Units used outside the shelter should be protected from icy drafts and snow flurries. When the equipment is not in use, the power should be left on but the RADIATE switch on the radar set control should be set at OFF to help offset the extreme cold encountered in arctic climates.

NOTE

If the temperature inside the coordinator is below -13° F (- 25° C.), the ventilating motor on the coordinator will shut off. (The ventilating motor may shut off below +5° F. (-15° C.) in some radar sets.)

b. Under extremes of ice and snow, the exposed units (outside shelter) should be inspected and any accumulation of ice or snow on the units should be removed.

c. When the equipment is first started in a cold condition and after the power has been turned on (RADIATE switch on the radar set control set at OFF), wait 5 minutes, depending on the temperature of the outside air, before placing the RADIATE switch to ON. Tubes in the modulator and the receiver-transmitter require approximately 3 minutes to warm up under normal conditions but considerably longer under conditions of extreme cold. The necessary delay is provided automatically by a time delay relay in the modulator.

d. All ventilating ports on the equipment used outside the shelter and the ventilating ports on the shelter itself should be checked periodically and cleared of ice and snow.

3-21. Operation in Tropical Climates

All components of the radar set except the radar set control and the plotting board are waterproof when in the operating condition. Since moisture and humidity conditions are more severe in the tropics, it is recommended that drainage be provided around the units used outside the shelter and the ventilating ports checked and all foreign matter removed when it is required. The plotting board and radar set control (if used outside the shelter) should be protected with some sort of covering so that no water will fall on the operating surfaces of these items. Since condensation of moisture occurs frequently on the equipment it is suggested that the equipment be wiped dry occasionally. This applies especially to the radar set control and the plotting board.

3-22. Operation in Desert Climates

Since sand and heat conditions are encountered when operating in desert climates, a greater amount of attention must be given to the condition of the equipment when operated in desert areas.

a. Check the air filters frequently and brush away any accumulation of sand at the air filter locations.

b. Do not open the equipment unnecessarily. It is recommended that the shelter doors be closed and the ventilating system be used for operator comfort. If the doors of the shelter have to be opened during sand storm conditions, the radar set control cover should be placed over the radar set control and the plotting board be covered temporarily to reduce the possibility of sand penetration into these units.

c. If the radar set control and plotting board are used outside the shelter, a cover should be constructed (such as a tent) to house the radar set control and plotting board. The housing should be as dustproof as possible.

d. Be careful when handling the units if they have been exposed to the sun for long periods of time. The exterior surfaces of the units are metal and metal surfaces may reach a temperature of 150° F. The temperature inside the units may be even higher. Always wear gloves and a jacket or shirt that covers the entire body and arms when handling the equipment under such conditions.

Section IV. COUNTER-COUNTERMEASURE OPERATION

3-23. Electronic Countermeasures

Electronic countermeasures as applied to radar include measures, tactics, and techniques used by the enemy to reduce or nullify the effectiveness of our radar equipment. Such activities can be subdivided into two principal categories, *passive countermeasures* and *active countermeasures*.

a. Passive Countermeasures. Passive countermeasures comprise the means and methods used by the enemy to determine the technical and operational characteristics of opposing radars. By means of monitoring equipment the enemy can intercept and analyze radar signals to determine transmission frequency, pulse repetition frequency, power output, and other such technical characteristics of a radar set. From this information, the enemy can make a reasonable determination of the types and probable uses of opposing radars. The information gained from passive countermeasures activity also is used by the enemy in planning his active countermeasure operations. Passive countermeasures, however, do not affect a radar set directly and, consequently, are not a principal concern of the radar operator.

b. Active Countermeasures. These countermeasures are the immediate concern of the radar operator in that their application is intended to affect the operational effectiveness of the radar set directly. These countermeasures are dividing into two classes, *Jamming and Deception*. Within the two classes there is a further division into two types, *Transmission* and *Reflection*. Detailed information on the methods of producing these countermeasures is given FM 32-30, Radar Antijamming for the Operator (U).

(1) *Transmission jamming*. This type of jamming is produced by an active transmitter operating at or close to the radar frequency. The jamming signal may be a straight, continuous wave (cw) signal or it may be a cw signal, frequency modulated (FM) and/or amplitude modulated (AM) by a variety of different waveforms. The jamming also may be produced in barrage form, where a number of jammers tuned to adjacent frequencies jam a large segment of the frequency band or in swept frequency form, where the frequency of the jamming transmission is swept or varied over a portion of the radar frequency band. The purpose of all jamming is to JAM into the radar receiver signals of sufficient strength to obliterate the return echoes from targets in the area of surveillance of the radar set. To be successful, the jammer must produce signals that will be accepted by the radar receiver, and produce these signals in a strength that will be greater than the target return signals. The relative power of the jammer and the radar transmitter and the distance between these two transmitters are important factors in counter-measures operations.

(2) *Reflection jamming*. This type of jamming is produced by large numbers of reflecting items that efficiently return echoes of the transmitted radar signal back to the radar set. Like transmission jamming, reflection jamming is intended to flood the radar receiver with strong signals that will overshadow real target echoes.

(3) *Transmission deception.* Deception. differs from jamming in that the deception signals are intended to confuse the radar operator by presenting false targets rather than to overshadow real target echoes. Transmission deception signals, for the most part, are produced by transmitting devices known as repeaters. These repeaters are triggered by the radar transmitter signal and respond with one or more pulses of energy at the radar frequency. The repeater pulses appear to the radar set as return echoes of its own transmitted pulse. This type of countermeasure is often referred to as spoofing.

(4) *Reflection deception.* Reflection deception signals, like those of transmission deception, are intended also to appear as real target echoes. These signals are produced, in most instances, by small,

rotating or mobilized corner reflectors that reflect back to the source any radar signals they intercept.

3-24. Counter-Countermeasures

Tactics, techniques, and procedures designed and carried out to reduce the effectiveness of enemy countermeasures are called counter-counter-measures. Usually, counter-countermeasures applications, whether used against jamming or deception, are called Antijamming or AJ procedures or operation. The responsibility for AJ operation lies almost entirely with the radar operator. It is of the greatest tactical importance that the radar operator be able to detect and minimize the effectiveness of enemy countermeasures. Whether or not enemy countermeasures are effective will depend, to a great extent, upon the positive AJ action taken at all echelons by commanders and staff officers, signal and communications officers, technical supervisors, and radar operators. AJ measures must be included in all planning and AJ activities must be controlled and coordinated. The radar operator must be thoroughly and continually trained to expect countermeasures, to recognize the difference between countermeasures effects and equipment malfunction or other interference, to be able to identify various types of countermeasures, to make adequate countermeasures reports, and to 'continue operation while under countermeasure attack.

3-25. Countermeasure Identification

Noise or unusual disturbance is not always an indication of countermeasures activity. It may be natural interference resulting from atmospheric disturbances, unintentional interference by friendly equipment, or the equipment may be operating improperly.

a. Need for Identification. After an interfering signal is recognized as a countermeasure signal, it is essential that the signal characteristics be accurately identified. It is important that identification be made before AJ action is taken, for the following reasons.

(1) AJ techniques are based upon both the types of countermeasures received and the countermeasures signal characteristics. Application of the recommended AJ procedure against a specific type of countermeasure signal is most likely to enable the radar operator to operate through the countermeasures signals.

(2) Systematic identification of the countermeasures signal characteristics, followed by prescribed use of AJ devices and equipment controls saves time. The radar operator avoids haphazard knob-twisting.

(3) Accurate identification, including location information, probably will be useful to higher headquarters in determining countermeasures signal sources and enemy countermeasures potential.

b. National and Unintentional Interference. Unintentional interference from friendly radio sets, radar sets, or other electronic equipment is sometimes received. Harmonic interference occurs when a signal from an external source, a multiple or submultiple of the radar operating frequently, also is accepted by the radar receiver. When the harmonic interference contains readable intelligence, the origin of the signal can usually be determined. Natural interference can result from electrical disturbances in the atmosphere. As a general rule, natural and unintentional interference will not be as persistent as intentional interference and will not have the regularity of pattern or the directional characteristics usually evident in intentional interference or countermeasures signals.

c. Deception. Because deception signals are generated to give the appearance of real target echoes, skillfully applied deception usually is very difficult to recognize and identify.

(1) *Transmission deception*. The most common type of transmission deception used against surveillance radars is spoofing (para 3-23b(3)). The deception signals, usually produced by a repeater type transmitter, produce radar indications that appear as a series or line of targets. In some cases, the pattern of the deception signals may be identified by its comparative perfection; that is, the uniformity of signal intensity and signal spacing. If the radar operator has been thoroughly trained so that he readily recognizes the indications of the various targets normally encountered (personnel, tanks, trucks, etc.), he may be able to identify the aural indications of the deception signals as being different from any of the normal target indications. The movement, if any, of the deception indications also should differ greatly from that of real targets. Thorough familiarity with both aural and visual indications of all the various types of real targets is the greatest aid to the radar operator in recognizing transmission deception.

(2) *Reflection deception.* This deception usually will be attempted by the use of a number of reflecting devices called angels. The most common type angel is a small but highly efficient corner reflector. A good deception device will produce a radar indication very similar to that of a real target. As in the case of transmission deception, thorough familiarity with the indications, both aural and visual, of all types of targets is the radar operator's greatest aid in recognizing and identifying reflection deception signals.

(3) *Transmission jamming*. If the jamming signal is produced at the radar set frequency, to affect only that frequency, the result is called spot jam-

ming. This type jamming, that permits the jammer to concentrate all its power at one frequency or in a very narrow frequency band, is difficult to work through. The jamming may produce a crackling and rushing noise in the earphones and will cause the radar scope to blossom brightly with noise indications. These jamming indications will be much the same whether cw or modulated jamming signals are used. The amount of noise present, both aural and visual, will vary as the strength of the jamming signal varies. The effects of barrage jamming are similar to those of spot jamming. If swept jamming (or swept frequency jamming) is encountered, it will produce sounds resembling a rushing wind coming and going and will cause a recurring brightening of the scope. Each time the jamming frequency, in its sweep, coincides with the radar frequency, the jamming indications will be evident. All types of jamming will have directional characteristics. That is, the jamming will be evident only, or most strongly, when the radar antenna is facing the direction of the jammer location. This directional characteristic, with proper operation of the radar controls, will permit identification of interference as jamming rather than natural or unintentional interference which normally do not possess directional characteristics.

(4) Reflection jamming. This type of jamming usually is produced by large numbers or quantities of small pieces of reflecting material that produce radar indications similar to large blocks of target returns.

3-26. Counter-Countermeasure (Antijamming) Operation

Since success of military operations may depend upon information obtained from radar equipment, radar operators are called on to maintain operations during enemy countermeasure attacks. While not all AJ measures are the responsibility of the radar operator, they must be responsible for doing everything within their capability to accomplish their mission. Countermeasures against the AN/TPS-25 may be used while the radar is either searching for a target or tracking a target. The procedures given below may be used by the AN/TPS-25 operator to reduce the effects of countermeasures that might be encountered.

a. Search Mode AJ Operations. The following AJ measures should be employed when the radar set is under countermeasure attack in the search mode.

(1) Against jamming.

(a) Select a narrower sector to scan.

(b) Adjust the receiver gain control (RCVR GAIN) to minimize the effects of the jamming. Also establish, by use of this control, the direction from which the jamming is received.

(c) Operate the set manually (MAN-TRACK VIDEO operation) and by observing where the jamming signal is strongest, locate the probable azimuth and elevation of the jamming source. Then return to search operation and try to locate targets on the edges of the jammed area as well as within the jammed area.

(d) As soon as practicable (but not while the countermeasure attack is in progress), select a different radar site; preferably one which will afford a screening crest between the radar and the source of the jamming.

(e) Keep the radar set on the air. No matter how severe the jamming is, there is always a chance of locating targets in breaks in the jamming pattern.

(2) Against deception

(a) Observe both the visual and aural indications of all targets carefully. The regular strength and uniform spacing of the deception signals on the scope and the aural indications which should differ from those of known types of targets will help to identify the false targets.

(b) Observe the indications of target move ment. Familiarity with the motion of real targets of all types should permit identification of real targets as opposed to false targets.

b. tracking Mode AJ Operation. When subjected to countermeasures while operating in the tracking mode, use the following AJ procedures.

(1) Against jamming.

(a) Operating the set manually (MANTRACK AUDIO operation), adjust the AZIMUTH and ELEVATION cranks to keep the amplitude of the audio display maximized. Gently rocking these controls should aid in seeing the target through the jamming.

(b) Adjust the RANGE crank for maximum audio amplitude on the scope display.

(c) If the target becomes lost in the jamming, continue adjusting the AZIMUTH, ELEVATION, and RANGE cranks to continue tracking at the same rate and in the same direction the target was moving prior to the interference. This may permit acquisition of the target when it moves out of the jamming cover.

(d) Observing the target path on the plotting board also may aid in tracking through jamming since, for example, a vehicle traveling on a road may tend to remain on this road.

(e) Keep trying to track and DO NOT turn off the radar. A shutdown will inform the jammer crew that they are being effective.

(f) When practicable, site the radar so that a screening crest will protect the radar from jamming that may originate in areas that are not of primary interest.

(2) Against deception.

(a) Observe the appearance of target indica-

tions carefully. A transmission deception signal will tend to maintain a constant strength, while real target indications tend to vary in strength with the movement of the target.

(b) In most cases, real target movement will be definite and purposeful where the indications of reflection deception devices probably will remain stationary or evidence erratic or random changes of range and azimuth.

3-27. Reporting and Recording

The existence of unidentifiable interfering signals should be reported immediately. This enables higher headquarters, through correlation of information from other units operating on various frequencies within a particular portion of the frequency spectrum, to determine whether or not countermeasures are actually being encountered. Prompt, accurate, and complete reporting of countermeasures reception is important. Properly correlated countermeasures information can give warning of impending enemy action in a sector or on a broad front, and may provide intelligence on the extent and importance of such action.

a. Initial Report. As soon as countermeasures signals are encountered, a report must be made immediately to higher echelon through the radar operator's immediate communication supervisor. Attempted, as well as successful countermeasures activity also should be reported. The operator must determine as quickly as possible and report the following.

(1) The frequency being affected and the width of the frequency coverage of the countermeasure signal, if it can be established.

(2) The type of countermeasure signal (transmission or reflection, jamming or deception) and the type of modulation, if any, when the signal is jamming.

(3) The time and duration of the interference, including repetition, if any.

(4) Signal strength and effect on radar operation, including effect on other radars in the area if such sets can be contacted. Signal strength may be classified as strong, medium, or weak.

(5) As close as possible, the direction both in azimuth and elevation of the countermeasure signal origin.

(6) Unit, and name and grade of the operator making the report.

NOTE

The report items above are suggested. Local standing operating procedures should detail the items to be covered in the report and their order of priority.

b. Detailed Report. A detailed report of the reception of countermeasures is to be made to the Commanding Officer by the person in charge of the radar station immediately after the countermeasure attack occurs. The Commanding Officer will have the report processed through channels as determined by the tactical situation.

c. Recording. During operation, while under countermeasure attack, the radar operator should keep a running record of events. The material for the record may be in the form of notes made by the operator or it may be a verbal account, given by the operator to another crew member who, in turn, will make notes for the record. To be recorded are such things as: time of the initial reception of the interference; visual and aural indications of the countermeasure signals; means or operation used to determine type, strength, direction of origin, and effectiveness of the counter-measures signals, progressive steps taken to combat the countermeasures; and the results and effectiveness of each AJ measure as it is applied. Such information may be required in detailed reports, and will be valuable for future use by both operational and higher echelon personnel.

CHAPTER 4

OPERATOR'S MAINTENANCE

NOTE

Preventive maintenance for commanders is contained in DA Pam 750-1.

4-1. Scope of Maintenance

The maintenance duties of the operator are to perform a prescribed sequence of preventive maintenance checks and services. The preventive maintenance procedures are the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble and to reduce downtime by detecting and correcting the onset of trouble. These checks and services are to maintain Army electronic equipment in a combat serviceable and mission ready condition.

a. Routine services (para 4-3).

b. Preventive maintenance checks and services (PMCS) (para 4-5).

c. Operator's weekly checks (para 4-6).

d. Cleaning (para 4-7).

e. Troubleshooting (para 4-8).

4-2. Tools, Materials, and Equipment Required for Maintenance

No tools or equipment are required for operator's maintenance. The following cleaning materials will be useful to the operator.

a. Lint-free cloths.

b. Dishwashing compound or detergent.

c. Cleaning compound.

4-3. Routine Services

Routine services are a collection of checks and observations performed by the operator at all times. Routine services are not listed in the preventive maintenance checks and services (table 1-4), in order to separate the nonoperational from the operational services.

a. Routines. The operator should perform the following routines as necessary:

(1) Check for completeness of equipment.
(2) Cleaning.
(3) Dusting.
(4) Check for cut or frayed cables.
(5) Check for dented, bent, or broken components.
(6) Check that items not in use (installation tools and equipment) are properly stowed.
(7) Check security of guy wires and guy wire stakes.
(8) Check for rusting.
(9) Check controls for smooth operation.
(10) Cover unused receptacles.
(11) Check for loose nuts, bolts, and connectors.
(12) Check that all nameplates are clean and legible.
(13) Check security of base plate stakes.
(14) Check security of safety chain on guy wire stakes, and steady.
(15) Check security of antenna mast sections.
(16) Check security of shelter tie-down cables.

b. Items Requiring Routine Services.

(1) Heater.
(2) Heater fuel line.
(3) Heater fuel cans.
(4) Shelter air intake and heater exhaust ports.
(5) Electrical ground stakes.
(6) Shelter external surfaces.
(7) Shelter internal surfaces.
(8) Guy wires and guy wire staking.
(9) Receiver-transmitter.
(10) Headphone and loudspeaker.
(11) Modulator.
(12) Power supply.
(13) Radar set control.
(14) Plotting board.
(15) Shelter power distribution box.

4-4. Preventive Maintenance Checks and Services Periods

Complete preventive maintenance is the performance of routine services (para 4-3) and preventive maintenance checks and services (PMCS) (Para 4-5) to insure that the equipment is available and ready for a mission. The equipment should be checked and serviced just before going on a mission and as soon as possible after completion of the mission.

4-5. Preventive Maintenance Checks and Services (PMCS)

a. PMCS procedures, covering operational services of the radar set, are given in table 1. The PMCS are normally performed by the operator/crew.

b. Before starting PMCS, check that the operating components are not damaged, all cables and accessories are in usable condition, and major assemblies fit properly.

c. A test moving target (Radar Target Simulator SM-201/TPS-25 (corner reflector)) or a person

swinging a canteen may be used and should be located at a known azimuth and range from the radar set within the sector of interest.

d. If a PMCS procedure does not meet the readiness/availability requirements, refer to the operator's troubleshooting chart (para 4-9). The troubleshooting chart lists the conditions given in the right-hand column of the PMCS table and is keyed to the PMCS Item No. and Procedures column.

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services

NOTES

Within the designated interval, these checks are to be performed in the order listed. The designated intervals are as follows: Official nomenclature that includes (*) is used to designate all models of the equipment.

B—Before D—During W—Weekly

Item No.	Interval B	Interval D	Interval W	Item to be inspected	Procedure	Equipment will be reported not ready (Red) if:
1	●			Radar Set AN/TPS-25(*) (radar set)	*a* Installation.	Operable equipment items damaged or missing (appx B).
					b. System alinement (para 2-29 through 2-41).	System alinement cannot be completed.
					NOTE When operation is continuous after a and b, above proceed to chapter 3. Proceed with *c* or item 3 below when operation begins from a shutdown condition. When radar set not shelterized proceed to item 3 below.	
					c. Place all radar switches and controls in preliminary setting positions (para 3-11).	Any switch or control broken or missing.
2	●			Shelter equipment	*a.* Verify 115 ± 5.0 volts 400 Hz power applied to shelter power distribution box.	Power absent or incorrect.
					b. Place MAIN circuit breaker to ON.	MAIN circuit breaker trips.
					c. Place SHELTER circuit breaker to ON.	SHELTER circuit breaker trips.
					NOTE Insure intake and exhaust ports are open.	
					d. Place LEFT and RIGHT FAN switches ON. Fans operate.	Fan motors do not operate.
					e. With shelter doors closed, place LIGHTS switch to ON. (Shelter lights will not light with a shelter door open)	Shelter lights do not light. (Both shelter doors are closed and blackout switches are actuated.)
					f Perform heater check (para 2-35).	Shelter heat not available and required.
					g. Place RADAR circuit breaker to ON.	RADAR circuit breaker trips.
3	●			Power Supply PP- 2166(*)/TPS-25	*a.* Place POWER switch to ON. Rotate POWER indicator lens cw. POWER indicator lighted.	POWER indicator does not light.
					b. Blower motor operates. (Ambient temperature above -13° F (-25° C), 5° F (-15° C), (some sets)).	Blower motor does not operate.
					c. Ac voltmeter on coordinator indicates 115 ±5.0 volts (METER LIGHT switch in ON position). Return METER LIGHT switch to OFF	Voltmeter does not indicate 115 ±5.0 volts.
					d SN-231(*)/TPS-25 blower motor operates (ambient temperature -13° F (-25° C), or 5° F (-15° C), (on some sets)).	
					e. Radar set control blower motor operates.	Blower motor does not operate.

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services-Continued

NOTES

Within the designated interval, these checks are to be performed in the order listed. The designated intervals are as follows: Official nomenclature that includes (e) is used to designate all models of the equipment.

B—Before D—During W—Weekly

Item No.	Interval B	Interval D	Interval W	Item to be inspected	Procedure	Equipment will be reported not ready (Red) if:
					f. Receiver-transmitter blower motor operates.	Blower motor does not operate.
					g. Modulator blower motor operates.	Blower motor does not operate.
4	●			Radar Set Control C-2715(*/TPS-25 (radar set control)	PANEL control turned cw and ccw. Edge lights on radar et control and edge lights on plotting board vary in intensity. trolled.	All edge lights on radar at control and plotting board are not lighted or light intensity cannot be c
5	●			Radar set control	*a.* Rotate AZIMUTH crank to an azimuth which is the approximate center of the area of interest. Rotate the AZIMUTH and RANGE cranks together about one turn each. X, Y, RANGE and AZIMUTH counters operate. Plotting board indicator lamp moves in azimuth and range.	Any one or more counters do not op erate or plotting board indicator does not move.
					b. Turn the AZIMUTH and RANGE cranks to place plotting board indicator light at about the center of its operating range. Note the point on the plotting board and reading on RANGE and AZIMUTH counters. Disengage plotting board arm. Slowly turn AZIMUTH crank cw then ccw through 6,760 mile. AZIMUTH WARNING light flashes at the extreme cw and ccw limits.	AZIMUTH WARNING light does not flash at extreme cw and ccw limits.
					c. Rotate ELEVATION crank cw and ccw to the ELEVATION counter limits (+270 and -270 miles. Reset ELEVATION crank to zero mile. ELEVATION, RANGE, X and Y counters move with ELEVATION crank rotation and ELEVATION WARNING light lights at more than +265 and -265 mils.	One or more of the ELEVATION RANGE, X or Y counters do not move or ELEVATION WARNING light remain on continuously or does not light at extreme limits of ELEVATION crank.
					d. Rotate RANGE crank to indicate 18000 on RANGE METERS counter. Place MAP SCALE switch to 1:50K position then return to 1:25K position. RANGE METERS counter switch counters and in each MAP SCALE switch position and the RANGE METERS counter indicates 18000 ±75 meters.	RANGE METERS counters do not switch between counters or 18000 ±75 meters is not indicated in one or both counters.
					e.. Rotate AZIMUTH crank for AZIMUTH MILS counter indication of zero, RANGE crank maximum ccw and ELEVATION crank for zero indication on EL, EVATION MILS counter. Disengage X and Y counters. Set X counter for zero then engage X counter. Rotate AZIMUTH crank cw for 1600 indication on AZIMUTH MILS counter. Set Y counter for zero then engage Y counter. X counter registers + 18000 meters.	X counter does not indicate + 18000 ±140 meters.

Table 4-1. Operator/crew Preventive Maintenance Checks and Services-Continued

NOTES

Within the designated interval, these checks are to be performed in the order listed. The designated intervals are as follows: Official nomenclature that includes (*) is used to designate all models of the equipment.

B—Before D—During W—Weekly

Item No.	Interval B	Interval D	Interval W	Item to be inspected	Procedure	Equipment will be reported not ready (Red) if:
					f. Rotate AZIMUTH crank to indicate 3200 in AZIMUTH MILS counter. X counter indicates zero ±140 meters Y counter indicates -18000 ±140 meters.	X counter does not indicate zero :t±140 meters or Y counter does not indicate -18000 ±140 me ters.
					g. Rotate AZIMUTH crank to indicate 4800 on AZIMUTH MILS indicator. X counter indicates - 18000 ±140 meters. Y counter indicates zero ±140 meters.	X counter does not indicate -18000 ±140 meters or Y indicator does not indicate zero ±140 meters.
					h. Rotate AZIMUTH crank to indicate 6400 on AZIMUTH MILS indicator. X counter indicates zero ±140 meters. Y counter indicates +18000 ±140 meters.	X counter does not indicate zero ±140 meters or Y counter does not indicate +18000 ±140 me. ters.
					i Rotate AZIMUTH crank to indicate 800 on AZIMUTH MILS indicator. Rotate ELEVATION crank to indicate 178 on ELEVATION PLUS MILS indicator. RANGE METER counter indicates 17726 ±75 meters. X and Y indicators indicate PLUS 12532 ±140 meters.	RANGE METERS counter does not indicate 17723 ±75 meters or X or Y PLUS indicators do not indicate 12532 ±140 meters.
					j. Rotate ELEVATION crank to indicate zero on ELEVATION counter. Rotate AZIMUTH and RANGE cranks to range and azimuth positions noted in *b* above. Engage plotting board arm and insure indicator light is at correct azimuth and range. Tighten azimuth clutch control knob.	Unable to adjust AZIMUTH and RANGE cranks to proper indicator indications with plotting board indicator light position.
					k. Place AUTO MAN switch to AUTO SEARCH 1 position. AZIMUTH MILS counter indicates azimuth scan of 360 +36 -4 mil. Plotting board indicator light moves through azimuth scan. CW and CCW lights indicate direction of scan. Return AUTO MAN switch to MAN SEARCH 3 position.	AZIMUTH MILS counter does not indicate scan of 360 +36 -4 mils, plotting board indicator does not scan in azimuth or either CW or CCW indicators do not light.
					l. Place SECTOR WIDTH switch to 540 position. Place AUTO MAN switch to AUTO SEARCH 1 position. AZIMUTH MILS counter indicates azimuth scan of 540 +43 -7 mils. Plotting board indicator light moves through azimuth scan. CW and CCW indicator lights indicate direction of scan. Return AUTO MAN switch to MAN SEARCH 3 position.	AZIMUTH MILS counter does not scan 540 +43 -7 mils, plotting board indicator does not scan in azimuth or either CW or CCW indicators do not light.
6	●			Radar Receive Transmitter RT-500(*)/ TPS 25 (Receiver-transmitter)	Rotate lens ccw (open) on four level lights. On RT-500A/TPS 25 only, press LEVEL LIGHTS switch to ON. Observe that the four level lights are not lighted.	One or more level lights light.
					b. Remove front panel cover. Place PANEL LIGHT switch to BRIGHT and DIM positions. Panel lights glow bright and dim.	Panel lights do not light or glow bright and dim in response to PANEL LIGHT switch positions.
					c. Place meter switch to the *position* indicated below for the respective meter *indication.*	One or more of the meter switch positions does not give proper meter indication.

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services-Continued

NOTES

Within the designated interval, these checks are to be performed in the order listed. The designated intervals are as follows: Official nomenclature that includes (*) is used to designate all models of the equipment.

B—Before D—During W—Weekly

Item No.	Interval B	Interval D	Interval W	Item to be inspected	Procedure	Equipment will be reported not ready (Red) if:
y					Position — Indication 750V (800VFS) — 79 to 1 -35V (400VFS) — 63 to .86 AFC AM — 35 to .85 fluctuating - 150V (200VFS) — 62 to .86 -6.3V (100VFS) — 53 to .7 MAG CUR — zero AFC MTR — 0 to.75 XTL (2MA FS) — fluctuating MXR XTAL 1 (2MA FS) — same MXR XTAL 2 (2MA FS) — same -27V (40VFS) — 57 to .78 OFF — zero **WARNING** Before performing d and e below, to minimize microwave radiation exposure, on radar set control rotate ELEVATION crank cw to indicate 265 on ELEVATION MILS PLUS counter. d. On radar set control place RADIATE switch to ON position. RADIATE indicator lights. Place meter switch to MAG CUR position. Adjust MAG CUR ADJ control for meter reading of .7 (14 ma) steady magnetron current. c. Place meter switch to the position indicated below for the respective meter *indication.* Position — Indication AFC MXR XTAL — 337 to .412 MXR XTAL 1 (2 MA FS) — same MXR XTAL 2 (2 MA FS) — same Place meter switch to OFF position. Replace front panel cover.	No magnetron current or unable to adjust for proper level or RADIATE indicator does not light.
7		●	●	Radar set control	a. Rotate ELEVATION crank to indicate about zero in ELEVATION MILS indicators. Adjust scope controls (SCOPE GAIN, VERTICAL, INTENSITY and FOCUS) for proper cathode ray tube (crt) presentation. b. Adjust RCVR GAIN control cw for indication of receiver noise and target video. Peak target video with cw and ccw rotation of ELEVATION crank. Rotate RANGE crank and observe that range gate moves in range in response to rotation of RANGE crank.	Absence of crt sweep or unable to adjust scope controls for proper crt sweep presentation. Absence of target video, absence of range gate or range gate does not move in response to rotation of RANGE crank.

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services-Continued

NOTES

Within the designated interval, these checks are to be performed in the order listed. The designated intervals are as follows: Official nomenclature that includes (*) is used to designate all models of the equipment.

B—Before D—During W—Weekly

Item No.	Interval B	Interval D	Interval W	Item to be inspected	Procedure	Equipment will be reported not ready (Red) if:
					c. Place AUTO MAN switch to AUTO SEARCH 1 position. Range gate sweeps from left to right and video varies in response to automatic range and azimuth scans.	Range gate does not move left to right or video does not vary in response to automatic azimuth scan.
					d. Place AUTO MAN switch to AUTO RANGE 2 position. Range gate sweeps left to right. Video remains nearly stationary in response to the absence of azimuth scan.	Range gate does not sweep left to right in response to automatic range scan.
					e. Obtain a moving target at a known location within the sector of interest. Employ the radar target simulator corner reflector when tactically possible. Place AUTO MAN switch to MAN TRACK AUDIO 4 position. Operate AZIMUTH, RANGE and ELEVATION cranks to obtain maximum crt audio presentation (B, fig. 3-9). Adjust VOLUME control for adequate audio in headset and loudspeaker. Verify that the coordinates of the moving target are correct.	Unable to obtain proper crt presentation, headset and loudspeaker audio or coordinates of moving target are incorrect.
					f. Engage plotting board azimuth clutch with clutch control knob, Operate AZIMUTH, RANGE and ELEVATION cranks for maximum moving target (*e* above) audio display on crt (B, fig. 3-9). Plotting board indicating lamp should be at approximate map location of moving target.	Indicating lamp on plotting board does not show approximate location of moving target.
					g. Place AUTO MAN switch to MAN TRACK VIDEO 5 position. Operate AZIMUTH, RANGE and ELEVATION cranks for maximum moving target video. Adjust RANGE crank to place the range gate leading edge bumping the moving target video. Note that operation of the cranks provide increased moving target range and azimuth resolution.	Absence of crt video display or target azimuth and range resolution does not improve. (Compare with e above.)
8		●	●	Power supply	*a* Place POWER switch to OFF position. Note that POWER indicator lamp goes out and power supply blower motor stops.	POWER indicator lamp remains on and blower motor continues to run.
					b. Note that ac voltmeter on coordinator reads zero and blower motor stops.	Coordinator voltmeter does not read zero or blower motor continues to run.
					c. Note that blower motor in radar set control stops.	Radar set control blower motor continues to run.
					d. Note that blower motor in receiver-transmitter stops.	Receiver-transmitter blower motor continues to run.
					e. Note that blower motor in modulator stops.	Modulator blower motor continues to run.

4-6. Operator's Weekly Checks

Check for completeness of the radar set. Refer to appendix B, components and end items list.

4-7. Cleaning

The exterior surfaces of the components of the radar set and the internal and external shelter surfaces should be kept clean and free of dirt, grease, and fungus. When necessary, clean the surfaces as follows:

a. Dust and Loose Dirt. Remove dust and loose dirt by wiping with a clean, soft cloth.

b. Grease, Fungus, and Ground-In-Dirt. Remove grease, fungus, and ground-in-dirt, as follows:

WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

(1) Dampen (do not soak) cloth with trichlorotrifluoroethane.

(2) Wipe off grease, fungus, or ground-in-dirt with a cloth.

(3) Wipe the component dry with a clean cloth.

c. Plugs and Jacks. Remove dirt from plugs and jacks with a brush.

d. Meters, Counters, Switches, Control Knobs and Cranks. Clean switches, hold down control knobs, cranks and glass windows of meters and counters and the plotting board 30° map hold down as follows:

CAUTION

Do not press on glass windows of meters and counters.

(1) Dampen a cloth with water. (Use dishwashing compound or detergent or mild soap, if available).

(2) Gently wipe dirt off all windows, switches, control knobs and cranks with a damp cloth.

(3) Dry with a clean cloth.

4-8. Operator's Troubleshooting Chart

The operator's troubleshooting chart given below corresponds to the item numbers and procedures given in Table 4-1, Operator/Crew Preventive Maintenance Checks and Services.

Item No.	Trouble symptom	Probable trouble	Corrective measure
1*a*	Unable to complete system installation.	Missing or damaged component or installation equipment.	Higher level of maintenance required.
1*b*	Unable to complete system alinement.	Faulty operating component.	Higher level of maintenance required.
1*c*	Inoperable or broken switch or control listed in paragraph 3-11.	Damaged control.	Higher level of maintenance required.
2*a*	Primary ac power (115 +5.0 volts 400 Hz) not available from shelter power distribution box.	Faulty cable or cable connector.	(1) Verify power unit provides proper ac power. (2) Check cables W2814, W2813 connectors to insure proper mating. (3) Higher level of maintenance required.
2*b*	MAIN circuit breaker on power distribution box trips to OFF	Faulty MAIN circuit breaker or power distribution box.	Higher level of maintenance required.
2*c*	SHELTER circuit breaker on power distribution box trips to OFF.	Faulty SHELTER circuit breaker or power distribution box.	Higher level of maintenance required.
2*d*	Left or right shelter exhaust fans fail to operate when respective LEFT or RIGHT FAN switch is placed to ON position.	Faulty switch, cables, junction box or fan motor.	Higher level of maintenance required.
2*e*	Shelter lights fail to light with LIGHTS switch in ON position.	Faulty switch or open interlock on either door.	(1) Verify both doors are closed to close interlocks. (2) Higher level of maintenance required.
2*f*	Inoperable heater.	Absence of fuel, ac power or faulty heater.	(1) Check heater fuel line and fuel can. (2) Check connector of power cable W2603. (3) Higher level of maintenance required.
2*g*	RADAR circuit breaker or power distribution box trips to OFF (2) Higher level of maintenance required.	Faulty cabling or faulty power distribution box.	(1) Check cabling from power distribution box.

Item No.	Trouble symptom	Probable trouble	Corrective measure
3*a*	POWER indicator on power supply does not glow with POWER switch ON.	Faulty cable W2602 or connector.	(1) Check connector P2602 to J2602. (2) Higher level of maintenance required.
3*b*	Blower motor in power supply does not operate (ambient temperature above -13° F (-25° C)).	Faulty cable or open interlock switch in power supply, coordinator or radar set control.	(1) Verify interlocks are not open on power supply (chassis fully in case) coordinator (chassis case) and radar set control (rear cover). (2) Check connectors on cables W2812 (power supply to coordinator) and W2807 coordinator to radar set control. (3) Higher level of maintenance required.
3*c*	Acc voltmeter on coordinator does not indicate 115 ± 5.0 volts.	Faulty ac voltmeter or improper ac power applied from primary source.	Higher level of maintenance required.
3*d*	Blower motor in coordinator does not operate (ambient temperature above -13°° F(-25°° C)).	Blown fuse.	Higher level of maintenance required.
3*e*	Blower motor in radar set control does not operate (ambient temperature above -13°° F (-25° C)).	(1) Faulty cable W2807 or connector.	Check cable W2807 connector on coordinator at J1003 and connector or radar set control at J1602.
		(2) Blown fuse.	Higher level of maintenance required.
		(3) Faulty motor.	Higher level of maintenance required.
3*f*	Blower motor in receiver-transmitter does not operate.	(1) Faulty cable W2804, W2805, W2601 or W2806 or connector.	Check cable W2804 connect on receiver-transmitter at J404, W2804 or W2805 connector, W2805 to W2806 connector, W2806 connector to power distribution box or J1001 on coordinator and W2601 connector to J1001 on coordinator.
		(2) Blown fuse.	Higher level of maintenance required.
		(3) Faulty motor.	Higher level of maintenance required.
3*g*.	Blower motor in modulator does not operate .	(1) Faulty cable W2802 or connector.	Check W2802 connector at J501 on modulator and J403 on receiver-transmitter
		(2) Blown fuse.	Higher level of maintenance required.
		(3) Faulty motor.	Higher level of maintenance required.
4	Edge lights on radar set control and/or plotting board do not light or cannot be controlled.	(1) Faulty cable W2807 or connector for radar set control and plotting board or cable W2810 for plotting board.	Check W2807 connector at J1003 on coordinator and connector at J1602 on radar set control.
		(2) Blown fuse.	Higher level of maintenance required.
5*a*	X, Y, RANGE or AZIMUTH counters do not operate or plotting board indicator does not move.	Faulty radar set control.	Higher level of maintenance required.
5*b*	AZIMUTH WARNING lights do not flash at extreme limits of AZIMUTH crank.	Faulty radar set control.	Higher level of maintenance required.
5*c*	ELEVATION, RANGE, X or Y counters do not move or ELEVATION WARNING light remains on or does not light at extreme limits of ELEVATION crank.	Faulty radar set control.	Higher level of maintenance required.
5*d*	RANGE METERS counters do not switch between counters or 18000 ±75 meters is not indicated in appropriate counter.	Faulty radar set control.	Higher level of maintenance required
5*e*	X counter does not indicate + 18000 ±140 meters.	Faulty radar set control.	Higher level of maintenance required.
5f	X counter does not indicate zero + ±140 meters or Y counter does not indicate 18000 + ±140 meters.	Faulty radar set control.	Higher level of maintenance required.
5*g*	X counter does not indicate - 18000 ±140 meters or Y counter does not indicate zero ±140 meters.	Faulty radar set control.	Higher level of maintenance required.
5*h*	X counter does not indicate zero + ±140 meters or Y counter does not indicate +18000 ±140 meters.	Faulty radar set control.	Higher level of maintenance required.

Item No.	Trouble symptom	Probable trouble	Corrective measure
5*i*	RANGE METERS counter does not indicate 17723 ±75 meters or X or Y PLUS indicators do not indicate 12532 ±140 meters.	Faulty radar set control.	Higher level of maintenance required.
5*j*	Unable to adjust AZIMUTH RANGE cranks to proper indicator indications with plotting board indicator light position.	and Azimuth or range coupling between radar set control and plotting board not properly connected. higher level of maintenance required	Verify azimuth-and range couplings are properly connected (para 2-26b through e). If both couplings are satisfactory,
5*k*	AZIMUTH MILS counter does not scan 360 + 36 -4 mils, plotting board does not scan in azimuth or cr or ccw indicators do not light.	(1) Antenna not scanning a 360 mil sector.	e- Verify antenna sector scan by listening to characteristic sound at base of antenna mast. (*a*) If antenna scanning sound is present, check cables W2804, W2805, W2806, W2807 and W2809 connectors, at receiver-transmitter, coordinator and radar set control If satisfactory, higher level of maintenance required *(b)* If antenna scanning sound is not present, check cabling (a) above. If satisfactory, higher level of maintenance required.
		(2) Faulty radar set control	Higher level of maintenance required.
		(3) Faulty coordinator.	Higher level of maintenance required.
		(4) Faulty receiver-transmitter.	Higher level of maintenance required.
5*l*	AZIMUTH MILS counter does not scan 540 + 43 -7 mils, plotting board indicator does not scan in azimuth or cw or ccw indicators do not light.	If 5k above probable trouble not present, faulty radar set control.	Higher level of maintenance required.
6*a*	One or more level lights light.	Antenna is not level.	Level antenna by adjusting guy wires or receiver-transmitter leveling jacks (para 2-36).
6*b*	Panel lights do not light or do not respond to PANEL LIGHT switch position (bright or dim).	Faulty receiver-transmitter.	Higher level of maintenance required.
6*c*	One or more of meter switch positions does not give proper meter indication.	Faulty receiver-transmitter.	Higher level of maintenance required.
6*d*	RADIATE indicator does not light or no magnetron or unable to adjust for proper level.	(1) Faulty radar set control.	Verify MAG CUR position of meter switch (on receiver-transmitter) indicates .7 (14MA). If correct indication is present, higher level of maintenance required.
		(2) Faulty receiver-transmitter	Verify that RADIATE indicator lights and MAG CUR cannot be adjusted for .7 (14 MA). Higher level of maintenance required.
6*e*	One or more crystal currents absent or incorrect.	Faulty receiver-transmitter.	Higher level of maintenance required.
7*a*	Absence of crt sweep or unable to adjust scope controls for proper crt sweep presentation.	(1) Radar transmitter not radiating (RADIATE switch in ON position).	Verify RADIATE indicator is lighted. If RADIATE indicator is not lighted, higher level of maintenance required.
		(2) Faulty radar set control	Higher level of maintenance required.
		(3) Faulty coordinator.	Higher level of maintenance required.
		(4) Faulty receiver-transmitter.	
7*b*	Absence of target video, absence of range gate or range gate does not move in response to RANGE crank.	Same as 7a (2), (3), and (4) above.	Higher level of maintenance required.
7*c*	Range gate does not move, video does not vary in response to automatic azimuth scan.	(1) Faulty coordinator. (2) Faulty radar set control	Higher level of maintenance required. Higher level of maintenance required.
7*d*	Range gate does not sweep left to right in response to automatic range scan.	Same as 7c (1) and (2) above.	Higher level of maintenance required.

Item No.	Trouble symptom	Probable trouble	Corrective measure
7*e*	, Unable to obtain proper crt presenta tion headset and loudspeaker audio or coordinate of moving target are incorrect.	(1) If crt presentation incorrect, faulty radar set control.	Higher level of maintenance required
		(2) If audio absent in both headset and loudspeaker (moving target present on crt), faulty radar set control	Higher level of maintenance required.
		(3) Audio present from headset but not from loudspeaker, faulty cable W2811, connector or loudspeaker.	Verify cable and connector are satisfactory. Higher level of maintenance required.
		(4) Audio present from loudspeaker but not from headset, faulty headset or radar set control	Higher level of maintenance required.
7*f*	Indicator lamp on plotting board does not show approximate location of moving target.	(1) Plotting board azimuth clutch not completely engaged.	Verify that azimuth clutch is properly engage using azimuth clutch control knob.
coupling		(2) Azimuth coupling or range coupling	Verify that azimuth and/or range
		between radar set control and plotting board not properly engaged.	are secure by examining allenhead wingbolts securing the radar set control to the plotting board
		(3) Faulty plotting board.	Higher level of maintenance required
		(4) Faulty radar set control	Higher level of maintenance required.
7*g*	Absence of crt video display or target azimuth and range resolution does not improve (AUTO MAN switch in MAN TRACK VIDEO 5 position).	(1) Faulty radar set control (2) Faulty receiver-transmitter or antenna.	Higher level of maintenance require
8*a* thru 8*e*	Power is not removed from equipment when power supply POWER switch is placed in OFF position	Faulty power supply.	Higher level of maintenance required

CHAPTER 5

CONVERSION FOR TRAVEL AND DEMOLITION

Section I. CONVERSION FOR TRAVEL

5-1. General

There is no short procedure for dismantling the radar wt when conversion for travel or short-distance travel is necessary. When the radar set is to be moved, the shelter must be placed on its transporting vehicle (trailer or truck), and the equipment must be completely dismantled and stored in the shelter. The procedure for dismantling the equipment is the reversal of the installation procedure. The same number of people and the same equipment required for installation (para 2-6e) are required for disassembling the radar set. For short-distance travel, the shelter need not be repacked in its original packing crate. The shelter contains the units of the radar set, thereby permitting transport of the radar set by vehicle or by air without additional packaging.

CAUTION

When the equipment is to be dismantled, be sure there are enough personnel and sufficient hoisting or moving apparatus on hand to eliminate the possibility of damage to the radar set or injury to personnel.

5-2. Conversion for Travel, Shelter Installation

When the equipment is operated from the shelter, follow the procedure outlined in *a* through *f* below, for shutting down and dismantling the radar set.

a. Stop the antenna in a position that allows the plotting board arm to rest in the center of the plotting board. Tighten the two plotting board arm locks by turning them clockwise (one lock is located on the bottom side of the plotting board (fig. 2-37) and the other arm lock (fig. 1-7) on the top).

b. Remove power from the radar set and shelter, following the procedure as stated in paragraph 3-16.

c. At the front of the shelter, on the outside, fasten the covers over the two air exhaust ports (fig. 1-2). Fasten the covers over the two air intake ports at the rear of the shelter.

d. Close and latch the window (fig. 2-16) on the curbside door of the shelter and slide the blackout cover (fig. 1-2) over it.

e. Fold the operator's chair and place it in its mounting bracket on the inside of the roadside door of the shelter (fig. 2-16). Secure it in place by means of the two snaps attached to the door.

f. Loosen the wingnut locks at the top and bottom of the center post (fig. 2-16). Swing out the bottom of the post and pull down, disengaging the pin at the top of the post from the shelter. Remove the center post from the shelter.

5-3. Disconnecting Inter-Unit Cabling (fig. 2-41)

a. Disconnect power cable W2813 which connects the generator to J2601 in the shelter cable port. Do not wind the cable on the reel as yet. Place a protective cover on the plug of cable W2813.

b. Disconnect cables W2804, W2805, and W2806 (if used in series) from J2602 in the shelter cable port. Place protective covers over the exposed plugs and receptacles.

c. Disconnect P2601 of cable W2601 from J1001 on the coordinator. Place the dust covers over the exposed connector and receptacle. Strap the connector to the metal plate (fig. 2-37) located below the heater on the roadside wall of the shelter.

d. Outside the shelter, loosen the wingnut on the ground terminal of the shelter cable port. Remove ground wire W2815 and pull up ground stake E2801. Wind the cable around the stake and place the stake aside.

5-4. Preparation of Remote Cables

a. Disconnect cables W2802 and W2803 that interconnect the modulator and the receiver-transmitter and replace the protective caps on the exposed plugs and receptacles. Be sure that the caps are secured tightly on the connectors. Place these cables in the storage box (Fig. 5-2) located at the roadside wall of the shelter.

b. Disconnect P2802 of antenna cable W2801 from J401 on the receiver-transmitter, and replace the protective caps on the exposed plug and receptacle.

c. Disconnect the main cable (W2804, W2805, or W2806) plug from J404 on the receiver-transmitter and place the protective covers on the plug and receptacle. If more than one section of the main cable was used in the installation, uncouple the cable sections and replace all protective covers on the exposed connectors.

d. Uncouple cable W2813 and W2814 and place the protective caps on the exposed connectors. Cable W2814 remains connected to the generator during transit.

e. Wind cables W2804, W2805, W2806, and W2813 on the cable reels as follows:

(1) Wind cable W2804 on the small (23 inch) reel.

(2) Wind cables W2805 and W2813 (in that order) on one of the large cable reels. (This reel is normally mounted on the roadside wall of the shelter, closest to the doors.)

(3) Wind cable W2806 on the remaining large reel. (Cable W2801 cannot be disconnected until the antenna has been lowered to the ground. When disconnected (para 5-4), it is also wound on this reel).

5-5. Preparation of Modulator and Generator Set

a. Lift the modulator by its carrying handles to the vicinity of the shelter.

b. Secure the generator.

c. Using four people, lift the generator set by its frame and carry to the vicinity of the shelter.

5-6. Lowering Antenna and Mast

a. Close and fasten the covers on the air intake and exhaust ports on the receiver-transmitter (fig. 1-11).

b. Remove the boom sections from the clamps on the curbside and roadside walls of the shelter and assemble the boom (para 2-16b). Remove the two dacron guy ropes from the curbside accessories box.

c. Attach the snap hooks on the ends of both dacron guy ropes to the shackle on the end of the first guy wire (B, fig. 2-30). Leave the opposite ends of the guy ropes free.

d. Snap down the operating control lever (A, fig. 2-30) on the winch hoist attached to the first guy-wire stake. Snap up the operating control lever on the winch hoist attached to the fourth guy-wire stake.

e. Refer to paragraph 2-16h for the winch-hoist operation. While one person at the first guy-wire stake loosens the first guy wire, a person at the fourth guy-wire stake will take up the slack in the fourth guy wire; always keep the guy wires taut to prevent any swaying of the antenna.

f. Continue lowering the antenna until the long pin on the end of the boom can be inserted through the shackle on the end of the first guy wire, while the opposite end of the boom is inserted into the boom socket on the receiver-transmitter (fig. 2-35).

g. Hook the dacron guy-rope locks through the top holes in the second and third guy-wire stakes (A, fig. 2-30) and draw the ropes taut (fig. 2-35). Make sure the boom is perpendicular with respect to the receiver-transmitter and in line with the mast.

h. Keep lowering the antenna (e above); take up slack in the guy wires if necessary.

I. When the antenna is close to the ground (fig. 2-34) make sure that the V-shaped antenna support leg (B, fig. 2-28) is securely locked in the OUT position to avoid damage to the radome when it is lowered to the ground.

j. Lower the antenna to the ground.

k. Disconnect antenna cable W2801 from J1901 (B, fig. 2-28) on the antenna. Free the cable from the cable clamps (C, fig. 2-29) on the mast and replace the dust caps on the exposed plug and receptacle. Replace the protective cover caps on the two air breather vents (A, fig. 2-28). Wind cable W2801 on the remaining reel with cable W2806 (para 5-4e).

l. Remove and disassemble the boom. Place the boom sections in their clamps at the curbside and roadside walls of the shelter (fig. 2-21).

m. Unhook the dacron guy rope locks from the second and third guy-wire stakes (fig. 2-30 through 2-33), and the snap hooks from the shackle on the first guy wire. Place the dacron guy ropes aside.

n. Disconnect the four guy wires from the antenna mast coupling and the winch hoist cables. Coil the guy wires, tie them together, and place them aside.

o. Operate the winch hoists and fully retract their cables. Unhook the four winch hoists from the guy wire stakes, remove the handles, and place the winch hoists and handles aside.

p. At the antenna, loosen the four hexagonal locknuts on the eyebolts and separate the antenna from the mast (A, fig. 2-29). Immediately attach protective covers to the exposed waveguide coupling of the mast and antenna.

q. At the receiver-transmitter, loosen the four hex locknuts on the eyebolts that secure the mast to the receiver-transmitter and immediately fasten dust covers securely over the exposed waveguide couplings on the mast section and the receiver-transmitter.

r. Loosen the hexagonal locknuts on the eyebolts and separate the mast sections (C, fig. 2-29). Fasten the protective covers securely over the exposed waveguide couplings immediately upon separation. Carry the antenna and mast sections to the vicinity of the shelter.

5-7. Removal of Receiver-Transmitter from Base Plate

a. Tip the receiver-transmitter upright and lower the four leveling jacks (fig. 2-27). Remove the hinge pins that secure the receiver-transmitter to the base plate.

b. Lift the receiver-transmitter straight up from the base plate until the ball on the receiver-transmitter clears the guide block assembly on the

base plate and carry the receiver-transmitter to the vicinity of the shelter.

5-8. Removing Base-Plate and Guy-Wire Stakes

a. Remove the three base plate stakes (fig. 2-24) from the ground.

b. Carry the base plate and stakes to the shelter. Slip the base plate over the dowels (fig. 2-16) on the inside of the roadside door of the shelter and secure it in place by inserting the hinge pins through the holes in the dowels. Place the base plate stakes aside.

c. With a sledge hammer, loosen the four guy-wire stakes and remove the stakes from the ground. If stake plates have been fastened to the stakes, remove the four bolts securing each plate to its stake and remove the plate. Replace the bolts in the stakes.

d. Place the guy-wire stakes aside. Mount the stake plates in their bracket on the inside of the roadside door (fig. 2-16). Secure them in place; use the clamp and wingnut.

e. If the fifth guy-wire stake with chain attached was used in the installation, unbolt the chain from the guy wire stake and place the chain aside. Mount the stake plate together with the others on the inside of the roadside door.

5-9. Installing Shelter on Transporting Vehicle

If the shelter was removed from the transporting vehicle in the installation of the radar set, remove the shelter operating components from the shelter before the shelter is placed on the transporting vehicle. For the removal of shelter operating components refer to paragraph 2-23. The method for placing the shelter on the transporting vehicle is similar to that given for its removal from the vehicle (para 2-9 and 2-10).

NOTE

If the chocks were removed from the sides and front of the shelter (fig. 2-9) after installation, they must be unbolted from their storage place on the front exterior wall of the shelter (B, fig. 1-2) and bolted again to the sides and front of the shelter if the transporting vehicle is a 3/4-ton or 1 1/2-ton trailer (M-105 type).

5-10. Repacking Shelter Operating Components

The procedure that follows applies not only to repacking with respect to shelter installation, but also to installation apart from the shelter (fixed station installation). The units are replaced in the direct inverse order in which they were removed.

a. If the speaker has been removed for fixed station installation, replace the speaker in its bracket at the curbside wall of the shelter. Secure it in place by means of the sliding clamp and wingnut.

b. If the radar set control is attached to the plotting board, detach it from the plotting board (para 2-23*h-j*). If the legs have been used to mount the plotting board (B, fig. 2-45), remove the legs and fasten them to the underside of the plotting board as follows:

(1) Unclamp the middle leg of the rear tripod leg and remove the leg from the plotting board.

(2) Remove the four securing pins from the U-shaped legs and remove the legs from the plotting board.

(3) Stow the tripod leg under the plotting board (A, fig. 2-45) and fasten in place with the two chain-captivated securing pins.

(4) Stow the U-shaped legs under the plotting board (A, fig. 2-45) and fasten in place with the four chain-captivated securing pins and the two leg straps.

c. Carry the plotting board to the shelter. Use three people. Manipulate the plotting board until the rollers on the sides of the plotting board are engaged in the tracks (fig. 2-37) on the curbside and roadside walls of the shelter. Push the plotting board back until the securing pins on the plotting board can be inserted into the holes in the walls of the shelter.

d. Using two people, carry the radar set control into the shelter. Remove the protective dust covers from the couplings on the plotting board and radar set control. Join the radar set control to the plotting board (para 2-26b through 2-26e).

e. Place the protective canvas cover over the plotting board. Make sure the air intake and exhaust ports on the radar set control (fig. 1-8) are closed. Replace the front cover on the radar set control.

f. Remove the plotting board securing pins from the holes in the curbside and roadside walls of the shelter. Using two people, push the plotting board up against the front wall of the shelter. Secure it to the wall by means of the four captive bolts, two above and two below (fig. 2-37).

g. Carry the coordinator into the shelter. Make sure the air intake and exhaust ports (fig. 1-6) are closed. Secure the coordinator to its shock mount under the plotting board (fig. 1-5) by swinging up the pressure clamps and tightening the two wingnuts (fig. 2-19) on the shock mount.

h. Carry the power supply into the shelter. Make sure the air intake and exhaust ports (fig. 1-9) are closed. Secure the power supply to its shock mount under the plotting board (fig. 1-5) by swinging up the pressure clamps and tightening the two wingnuts (fig. 2-19) on the shock mount.

5-11. Placing Contents into Accessories and Storage Boxes (figs. 5-1 and 5-2)

a. Place contents into the curbside accessories box (fig. 5-1) using the sequence below:

(1) Put the five guy-wire stakes, three base-plate stakes and the ground stake assembly (in that order) in the bottom of the rear compartment of the box (A and B, fig. 5-1).

(2) Place the winch hoist (B, fig. 5-1) and two measuring ropes (C, fig. 5-1) in the bottom of the rear compartment.

(3) Place the dacron guy ropes (B, fig. 5-1) and chain support (C, fig. 5-1) next to the buy-wire stakes in the bottom of the rear compartment.

(4) Lay the winch hoist handles, reversible ratchet wrench (with socket) and open end wrench, extension bar, and antenna guy-wire assemblies (C, fig. 5-1) in the rear compartment.

(5) Lay the shelter lifting cable (and shelter tiedown cables (D, fig. 5-11)), if not used on top, in the rear compartment.

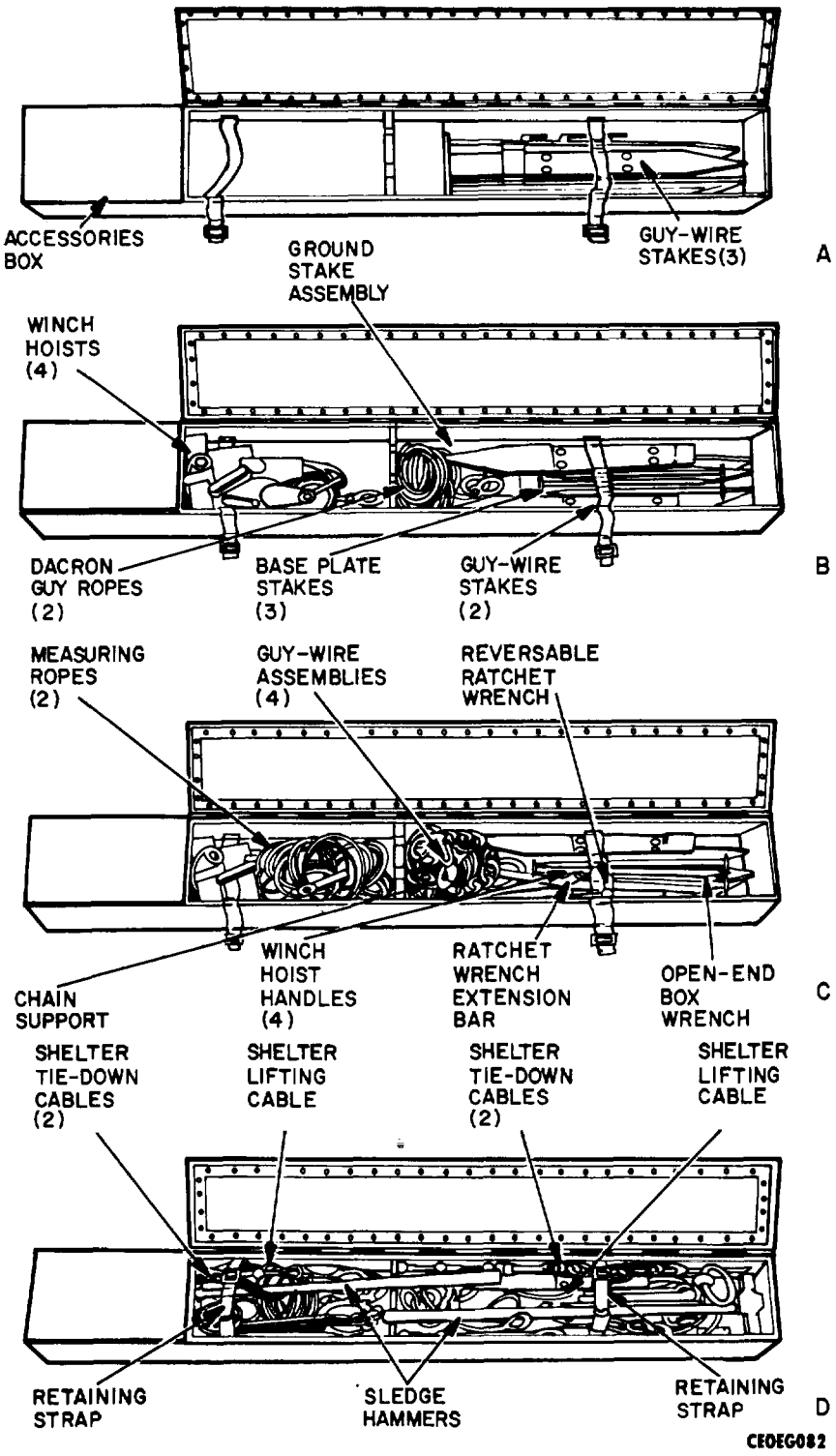


Figure 5-1. Location of Components Stored in Accessories Box.

(6) Lay the two sledge hammers on top so that their handles fit into the notches in the compartment separator.

(7) Secure the straps around the articles stored in each compartment.

b. Place contents into the roadside storage box (fig. 5-2) using the sequence below:

(1) Arrange the placement of the spares boxes so that both will have a securing strap around them.

(2) Next to the spares box (4J52A), place the headset at the rear of the storage box.

(3) Place the ac extension cable (W2816) be(4) Slip the two cables, W2802 and W2803, down between the spare boxes.

(4) Slip the two cables, W2802 and W2803, down between the back of the storage box and the other contents.

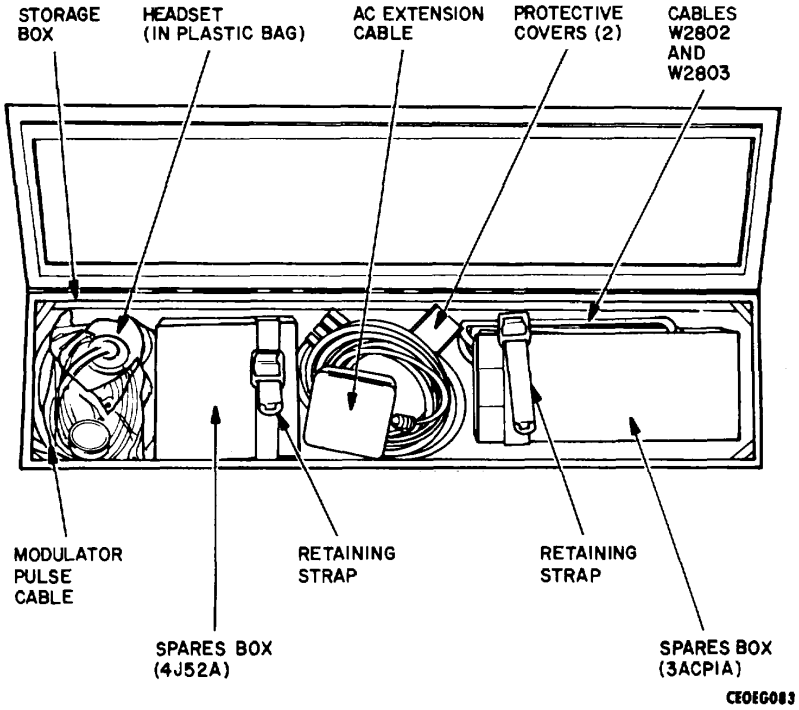


Figure 5-2. Location of Components Stored in Storage Boxes.

(5) Secure the two retaining straps making sure they encompass both the spares' boxes.

5-12. Repacking Remote Operating Components

a. Carry the mast sections into the shelter, and place them in the clamps on the curbside and roadside walls of the shelter (fig. 2-21). Secure them in place by tightening the wingnuts on the clamps.

b. Carry the cable reels into the shelter. Place them in the clamps provided on the curbside and roadside walls of the shelter. Secure them in place by tightening the wingnut over the clamp at the top of each reel.

c. Remove the protective dust covers from the antenna and receiver-transmitter mast couplings. Place the dust covers face-to-face and place them in the storage box (fig. 5-2) under the ac extension cable (W2816).

d. Unlock the antenna support leg (B, fig. 2-28) from its out position and swing it under the antenna. Secure it in place with the dzus fastener. Check to see that the breather caps are secured tightly over the breather holes (fig. 2-28) in the under side of the antenna. On the receiver-transmitter check to see that the air intake and exhaust port covers (fig. 1-11) are closed and secured in place.

e. Lift the antenna onto the receiver-transmitter and mate the two mast couplings making sure that the support leg on the antenna is toward the back of the receiver transmitter. (The back of the receiver transmitter is that which is shown in B, figure 2-27.) Use the ratchet wrench and secure the antenna to the receiver-transmitter by means of the four captive eyebolts and locknuts on the mast coupling (B, fig. 2-20).

f. Place the antenna and receiver-transmitter on the shock mount with the front (sloping side) of the receiver transmitter toward the front of the shock mount (side of shock mount with the pull handle (B, fig. 2-20).

g. Unscrew and remove the top portion of the turnbuckle assembly that is located at the rear of the shock mount (A, fig. 2-20). Slip the turnbuckle as-

sembly over the lower receiver-transmitter handle and up and under the upper receiver-transmitter handle. Replace the top portion of the turnbuckle assembly.

h. Hook the four shackles of the turnbuckle assemblies to the cast eyelets on the antenna mast couplings. Rotate the four turnbuckles until the turnbuckle assemblies are taut. Tighten the jamnuts on the turnbuckle assemblies.

I. Loosen the two wingnuts (A, fig. 2-20) at the rear of the shock mount and slide the notched plates away from the caster handles. Pull the caster handles forward. Holding the caster handles in this position, slide the notched plates back so that the caster handles sit in the forward notches of the notched plate. Tighten the wingnuts.

J. Use the carrying handles on the shock mount and lift the assembled antenna, receiver-transmitter, and shock mount into the shelter. Make sure that the pull handle (B, fig. 2-20) on the shock mount will be towards the doors of the shelter after the assembly is lifted to the shelter.

k. Push the shock mounted antenna and receiver-transmitter into the shelter until the mounting bolts (B, fig. 2-20) are alined with the corresponding holes in the floor shock mounts.

l. Loosen the two wingnuts (A, fig. 2-20) at the rear of the shock mount and slide the notched plates away from the caster handles. Push the caster handles toward the receiver-transmitter. (This retracts the caster and lowers the shock mount to the floor.) Holding the caster handles in position, slide the notched plates into place so that the caster handles sit in the rear notches of the notched plate. Tighten the two wingnuts to secure the notched plates in place.

m. Secure the shock mount to the floor of the shelter by tightening the four spring loaded mounting bolts (B, fig. 2-20) in the stock mount with the ratchet wrench.

n. Carry the modulator into the shelter and place it on its shock mount at the rear roadside corner of the shelter (fig. 2-16). Secure it in place by swinging up the pressure clamps (fig. 2-19) and tightening the two wingnuts on the front of the shock mount. Make sure that the air intake and exhaust port covers (figs. 1-10) are closed and secured in place.

5-13. Removal of Generator Set

Using at least four people, left the generator set by its frame into the prime mover.

5-14. Preparation for High-Altitude Shipment

NOTE

It is not necessary to open the air intake or exhaust ports for high altitude transport of Radar Set AN/TPS-26A, since each unit contains an air pressure relief valve. If the shelter is to be transported by aircraft, make sure that at least one air intake or exhaust port on each unit is left open, in order to avoid damage to the equipment due to changes in air pressure.

5-15. Immersion Proofing

a. Each unit of the radar set except the plotting board can be made immersion proof by replacing all air intake and exhaust ports (para 3-10) with receptacle covers and securing them tightly. To make sure that immersion does not damage any equipment, check the covers on each unit.

b. Cables will be damaged if immersed in water, unless the protective covers supplied for each plug connector are fastened securely. The accessories box inside the shelter is immersion proof when the cover is properly secured.

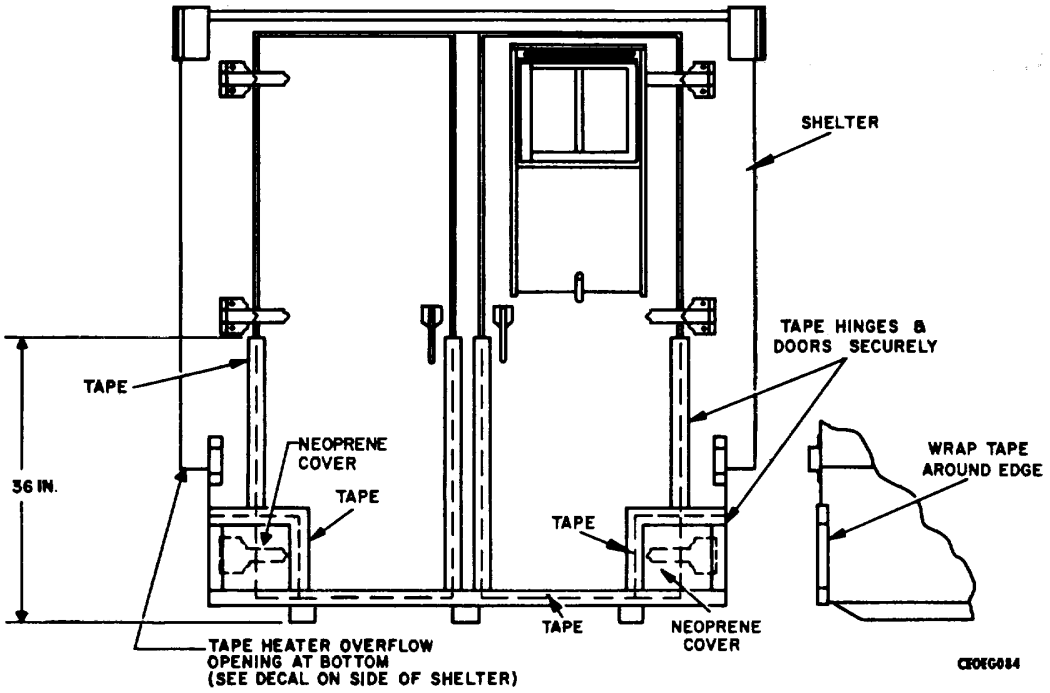


Figure 5-3. Preparation of Shelter for Deep Fording.

5-16. Deep Fording (fig. 5-3)

a. General The deep fording kit (not supplied with the radar set) is intended to allow the shelter to be deep-forded through deep water or to be put ashore during landing operations. It is installed over cracks and openings on the shelter and will protect the equipment within the shelter from water damage. The kit consists of a roll of 2-inch wide waterproof adhesive tape and two neoprene covers. Each cover is 1/32-inch thick, 12 inches long, and 10 inches wide. The adhesive tape is expendable and once used, should be discarded. The neoprene covers can be saved for future use. Both items should be obtained through regular supply channels.

b. Application Figure 5-3 illustrates a typical method for installation of the deep fording kit to the shelter of the radar set. The shelter is prepared for deep fording as follows:

(1) Hold a neoprene cover over the lower hinge of the roadside door and apply tape around the four edges of the neoprene cover so that half of the width of the tape is on the cover and the other half is in contact with the shelter. Press the tape firmly into place. Apply a second strip of tape around the edges so that half of the width of tape is in contact with the shelter, and the other half is in contact with the first strip of tape. Press the tape firmly into place.

(2) Apply a neoprene cover to the hinge of the curbside door as explained in (1) above.

(3) Apply the adhesive tape over the four cracks (formed by the doors, the shelter proper, and the centerpost) for a distance of 36 inches from the base of the shelter. Apply a second strip of tape on either side of the first strips of tape so that half of the width of tape is in contact with the shelter and the other half is in contact with the first strips of tape.

NOTE

At the two cracks formed by the hinged side of each door run the tape to a point where it overlaps the tape holding the neoprene covers in place.

(4) Apply tape (approximately 655 inches long) across the bottom of the shelter, making sure the tape covers the crack between the bottom of each door and the shelter proper. Run the tape around the corners of the shelter and press the tape firmly in place. Apply a second strip of tape as explained in (3) above.

(5) Apply tape over the gasoline overflow opening for the heater. The gasoline overflow opening is located at the bottom of the shelter well on the roadside exterior wall of the shelter. A decal on the roadside exterior wall of the shelter points out the location of the overflow opening. Apply a second strip of tape as explained in (3) above.

(6) Check to see that the cover of the heater exhaust port (A, fig. 1-2) is closed and secured tightly in place.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

5-17. Authority for Demolition

The demolition procedures given in paragraph 5-20 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.

5-18. Destruction Plan

If a destruction plan is not provided by higher authority one should be prepared by the organization using the equipment. Any or all of the methods of destruction given below may be used. In the destruction plan, personnel should be assigned specific destruction tasks so that a minimum of time will be consumed when and if the destruction of the radar set becomes necessary. Since the time available will be the major determining factor for the methods used in the destruction of the equipment, all personnel in the using organization should be familiar with all aspects of the complete destruction plan. The tactical situation also will determine in what manner the destruction order will be carried out. Therefore, the plan must be complete and easily carried out in the field and must provide for destruction as complete as available time, equipment, and personnel will permit under various circumstances. Because the time required for complete destruction may not always be available, the destruction plan (para 5-20) must establish priorities so that essential parts of the equipment will be destroyed in the order of their importance. Complete destruction of some units should always be accomplished in preference to partial destruction of all the units.

5-19. Destruction Priority

Destruction priority in the following order is suggested for Radar Set AN/TPS-25:

a. Highest priority should be given to instruction literature, to operating units and spares that may in any way disclose the operating frequency and tactical use of the equipment, and to critical circuitry and spares of the receiver-transmitter, antenna, and radar set control.

(1) The frequency sensitive parts of the radar set to be considered are as follows: the magnetron, the local oscillator, mixer, RF sections and fittings, the RF waveguide in each mast section, and the antenna; especially the reflector and the antenna feedhorns.

(2) The circuitry in the radar set control, and in particular, markings, servos, and dial mechanisms, share top destruction priority with the frequency sensitive parts of the equipment.

b. The modulator, which could disclose the power capabilities of the radar set is next in order or priority.

c. The portions of the receiver-transmitter not destroyed (a(l) above), the coordinator, power supply, plotting board, shelter, and engine generator should be destroyed in this order after the modulator.

d. If spare parts other than those specified in a above cannot be destroyed collectively, the individual parts should be destroyed in the same order as the units for which they are supplied.

WARNING

Spare radioactive electron tubes should be placed in a container of some sort, broken, and buried. Refer to warning notice appearing at the front of this manual.

5-20. Methods of Destruction

Any or all of the methods of destruction given below may be used. The time available will be the major determining factor for the methods to be used in most instances when destruction of the equipment is undertaken. The tactical situation also will determine in what manner the destruction order will be carried out. When speed is imperative, destruction by burning or by use of explosives may be undertaken and all other methods ignored. Should sufficient time be available and if it is desired to keep the location of the equipment hidden from the enemy for as long as possible, all other methods of destruction might be used first and fire or explosives then used to complete the destruction immediately before withdrawal. Keep in mind that it is mandatory to destroy completely some portions of the equipment rather than partially destroy all of the equipment components.

a. Preliminary. Destruction of the equipment can best be accomplished if the units of the radar set are removed from the shelter. To prepare the radar set for destruction proceed as follows:

NOTE

Subparagraphs (1) through (4) below apply to the radar set when operated from the shelter. The same general procedures should be adapted for other installations using buildings or bunkers as shelters.

(1) Open the doors of the shelter and remove the center post in the doorway.

(2) Cut the cables interconnecting the shelter components using cutting axes or shears (*b*(2) below) and remove all units from the shelter and lay them on the ground nearby.

(3) If at the time of demolition the antenna is erected, cut the first guy wire (toward sector of interest) holding the antenna in position and, after pulling the antenna to the ground, disconnect the antenna from the mast or mast sections and disconnect the mast section from the receiver-transmitter.

WARNING

Stand clear of the antenna-as it swings in its arc to the ground.

(4) Move the units into a position which will allow a distance between each unit sufficient enough to allow free movement of personnel destroying the units.

b. Cut. Use axes, handaxes, machetes, etc., to cut cabling and cording in and on the equipment. Use cutting pliers or shears to cut the interunit ground connection at the shelter.

(1) Cut the ground wire.

(2) Cut the unit interconnecting cables within a few inches of each end (near the unit receptacle) and in at least one other place along the cable length.

(3) Separate the units (a(4) above) and stand them in such a position that the chassis can be withdrawn from the cases, and cut all readily accessible internal cables and cabling harnesses.

c. Smash. Use sledges (supplied), axes, hammers, crowbars, and other heavy tools, and rifle butts, if necessary, to smash the interior and exterior of the equipment units.

(1) On the front panels, smash all cable connectors (with the cable ends attached), all controls and fuseholder projections, and all instruments (meters, dial faces, and dial counters).

(2) Smash the waveguide sections of the mast if possible, and lay the mast sections to one side to be buried.

(3) Use a heavy sledge to break the radome, and smash as much as possible, the antenna reflector, feedhorns, and servo mechanisms.

CAUTION

Be careful of flying debris as the radome is broken by the sledge. Be sure no sharp edges are protruding from the radome which could cause personal injury when destroying the antenna.

(4) In the receiver-transmitter, make sure the RF portion of the unit is demolished. Force the magnetron from its mounting with a sledge, crowbar, or both. Smash the magnetron with a sledge and lay it to one side to be buried or disposed of in some other manner.

(5) If possible, remove and smash all of the RF and IF components in the receiver-transmitter in the same manner as the magnetron (4) above. (6) Remove the radar set control chassis from its case, and smash the A-scope tube and servo mechanisms and all other tubes on the chassis.

WARNING

To minimize risk of injury, stand to one side as the A-scope tube is destroyed.

(7) Remove the modulator from its case and destroy the tubes on the chassis. Use a sledge or crowbar to break open and smash the large capacitors and transformers and the pulse forming network.

(8) Pull the coordinator from its case and smash all the tubes and components.

WARNING

Be careful of flying glass when destroying the tubes in the equipment components.

(9) With all the other units withdrawn from their cases smash all tubes and other top-of-the-chassis parts. Turn the units over and smash the circuit parts on the underside of the chassis.

(10) Using a sledge, smash all electrical components visible in the shelter. If possible smash the wooden structure.

WARNING

Make sure the gasoline containers at the rear of the shelter have been removed before destroying the shelter.

(11) If fire or explosives are not to be used for completion of the destruction, replace the units in their cases and, with a heavy sledge, bend the front panels and the sides of the cases so that the units cannot be pulled from their cases.

d. Burn. Gasoline, flame throwers, or other incendiary devices may be used to destroy the equipment, only upon direction of competent authority.

(1) Burn the instruction literature; use any available incendiary material to insure complete destruction.

NOTE

If time permits, remove and dispose of the magnetron and the IF amplifier chassis from the receiver-transmitter before attempting to burn the equipment.

WARNING

Be extremely careful when applying the torch to the equipment. When ignited, the equipment will burn almost spontaneously and emit intense heat.

(2) Burn the cut cables and the spare parts by pouring gasoline over them and igniting it or by using flamethrowers.

NOTE

It time is not available for detailed destruction, the equipment may be destroyed by smashing everything in sight within the shelter and throwing the antenna, mast sections, receiver-transmitter, and modulator into the shelter, pouring gasoline on and around the equipment and igniting it. This method of destruction should be used only when a specific order is issued at the equipment site.

e. Explosives. Explosives may be used for complete destruction of the equipment or to affect maximum damage prior to burning when time does not permit complete destruction by other means. Powder charges, fragmentation grenades, thermite bombs, or incendiary grenades may be used. Thermite bombs or incendiary grenades will be most effective for destroying the radar set. Regardless of the completeness of destruction afforded by explosives, it is desirable (if time permits) to remove and dispose of frequency sensitive parts and circuitry (particularly the magnetron and IF chassis).

WARNINGS

1. The use of small arms fire for destruction of equipment should be avoided. Such fire exposes personnel to the danger of ricochets.

2. Explosives should be used only on direct order of the officer or noncommissioned officer in charge at the equipment site. They should be used only by or under the direct supervision of personnel thoroughly trained to handle them.

3. Make sure that adequate cover is available and that sufficient time is allowed for personnel to take cover when explosives are to be used to destroy the equipment.

(1) When the equipment units are removed from the shelter and separated and explosives are to be used for destruction, use one explosive charge (preferably a thermite bomb or incendiary grenade) for each unit. A thermite bomb or incendiary grenade will generate enough heat so that the unit cases will be burned as well as being shattered by the explosion.

(2) Warn other personnel to take cover. Pull the unit to be destroyed part of the way out of its case. Pull the pin on the bomb or grenade, place the explosive in the unit case, push the unit back into the case, and take cover quickly.

(3) If time does not permit dismantling the equipment and separating the units for destruction, and the equipment must be destroyed while still in operating position, use the following procedures:

(a) Knock down the antenna and pour gasoline on and around the units. Open the modulator and receiver-transmitter, punch a hole in the radome, place incendiary grenades in the three units simultaneously and take cover quickly.

(b) Pour gasoline on and around the units in the shelter. Place incendiary devices in one or two places. Make sure that adequate provision is made for destruction of the radar set control and the coordinator. Take cover after placing the incendiary devices.

(c) Bury or scatter destroyed parts or throw them into nearby waterways. This is particularly important if a number of parts have not been completely destroyed. Pay particular attention to frequency sensitive parts of the equipment (magnetron, antenna reflector, waveguides, feedhorns, etc.). Do not dispose of parts intact; smash or otherwise destroy all critical parts at least partially before disposing of them.

APPENDIX A

REFERENCES

DA Pam 25-30	Consolidated Index of Army Publications and Blank Forms.
DA Pam 738-750	The Army Maintenance Management System (TAMMS).
FM 32-30	Radar Antijamming for the Operator (U).
TM 5-6115-271-14	Operator's, Organizational, Direct Support and General Support Maintenance Manual for Generator Set, Gasoline Engine Driven, Skid Mounted, Tubular Frame, 3 KW, 3 Phase, AC, 120/208 and 120/240 V, 28 VDC (;less engine) (DOD Model MEP-016A), 60 Hz (NSN 6115-00-017-8237), (Model MEP-021A) 400 Hz (6115-00-017-8238) and (Model MEP-026A), DC Hz (6115-00-017-8239).
TM 5-6115-271-24P	Organizational, Intermediate (field), Direct Support, General Support, and Depot Maintenance Repair Parts and Special Tools List for Generator Set, Gasoline Driven, Skid Mounted, Tubular Frame, 3 KW, 3 Phase, AC, 120/208 and 120/240 V (less engine) (DOD Model MEP-016A), 60 Hz (NSN 6115-00-017-8237), (Model MEP-021A), 490 Hz (6115-00-017-8238) and (Model MEP-026A), 28 VDC (6115-00-017-8239).
TM 11-5840-217-20	Organizational Maintenance Manual for Radar Sets, AN/TPS-25, AN/TPS-25A and AN/TPS-25(XE-2) (NSN 5840-00-082-4128)
TM 11-5840-217-20P	Organizational Maintenance Repair Parts and Special Tools Lists: Radar Sets, AN/TPS-25 and AN/TPS-25A (FSN 5840-082-4128).
TM 11-5840-217-34-1	Direct Support and General Support Maintenance Manual for Radar Set, AN/TPS-25 (NSN 5840-OQ-082-4128).
TM 11-5840-217-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for Radar Sets, AN/TPPS-25 and AN/TPS-25A (FSN 5840-082-4128).
TM 11-5840-217-35	Direct Support, General Support, and Depot Maintenance Manual: Radar Sets, AN/TPS-25, AN/TPS-25A and AN/TPS-25(XE-2).
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

APPENDIX B

ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

B-1. Scope

This appendix lists additional items you are authorized for the support of the AN/TPS-25, AN/TPS-25A and the AN/TPS-25 (XE-2).

B-2. General

This list identified items that do not have to accompany the AN/TPS-25, AN/TPS-25A and AN/TPS-25(XE-2) and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

B-3. Explanation of Listing

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i.e., CTA, MTOE, TDA, or JTA) which authorizes the item(s) to you.

If the item you require differs between serial numbers of the same model, effective serial numbers are shown in the last line of the description. If item required differs for different models of this equipment, the model is shown under the "Usable on" heading in the description column. These codes are identified as:

Code	*Used On*
AX3	AN/TPS-25
AX4	AN/TPS-25A

(Next printed page is B-2)

SECTION II ADDITIONAL AUTHORIZATION LIST

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION FSCM AND PART NUMBER	USABLE ON CODE	(3) U/M	(4) QTY AUTH
5805-00-543-0012	TELEPHONE SET TA-312/PT (80058)		EA	2
6135-00-120-1020	BATTERY, DRY BA-30 (81349)		EA	8

APPENDIX C

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

C-1. Scope

This appendix lists expendable supplies and materials you will need to operate and maintain the AN/TPS-25, AN/TPS-25A and AN/TPS-25(XE-2). These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

C-2. Explanation of Columns

a. Column 1-Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 2, App. C").

b. Column 2-Level This column identifies the lowest level of maintenance that requires the listed item.

C-Operator/Crew
O-Organizational Maintenance
F-Direct Support Maintenance
H-General Support Maintenance

c. Column 3-National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4-Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

e. Column 5- Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

(Next printed page is C-3)

SECTION II EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION PART NO. AND FSCM	(5) UNIT OF MEAS.
1	C,O	8305-00-205-3496	CLOTH, COTTON, LINT-FREE (81349)	YD
2	C,O	6850-00-105-3084	TRICHLOROTRIFLUOROETHANE CLEANING COMPOUND 0-T-620, TYPE I (81348)	QT
3	C,O	5350-00-260-3485	PAPER, ABRASIVE, FLINT (SANDPAPER) EXTRA-FINE (81348)	PKG
4	C,O	5350-00-145-0147	PRIMER, ZINC CHROMAK MIL-P-8585 (81348)	QT
5	C,O	8010-00-145-0147	ENAMEL, SEMIGLOSS, OLIVE DRAB, AIR-DRY TT-E-529 COLOR 240087 (80244)	GAL
6	C,O	7510-00-093-4798	TAPE, PRESSURE-SENSITIVE FRICTION; ADHESIVE CLOTH, BLACK OIL AND WATER RESISTANT FED SPEC L-T-0099 (81349)	ROLL
7	C,O	5970-00-644-3167	TAPE, ELECTRICAL, RUBBER 3/4-IN TL-183 (80063)	ROLL
8			DELETED	

GLOSSARY

Section I. ABBREVIATIONS

ac .....alternating current
afc .....automatic frequency control
aj .....antijamming

cw .....clockwise
ccw.....counterclockwise
cps .....cycles per second
crt.....cathode-ray tube

db.....decibel
dbm.....decibels referred to 1 milliwatt
dc .....direct current

fs .....full scale
ft.....foot, feet

IF.....intermediate frequency
in .....inch, inches

kc .....kilocycle
kva .....kilovolt-ampere
kw .....kilowatt

lb .....pound(s)

ma.....milliampere
mc .....megacycle

pf.....power factor
pps .....pulses per second
prf.....pulse repetition frequency

RF .....radio frequency
rpm.....revolutions per minute

tr.....transmit-receive

µ sec .....microsecond

v .....volt
vfs .....volts full scale
vswr .....voltage standing wave ratio

w .....watt
wt .....weight

Section II. DEFINITIONS

Ambient temperature-Surrounding temperature.
A-scope-An oscilloscope on which a presentation appears which indicates range of a target. Signals appear as vertical deflections on a horizontal base line.
Azimuth-See bearing.
Base line (crt)-The horizontal line formed by the movement of the sweep on the A-scope.
Bearing-The direction of the line-of-sight from the observer (radar antenna) to the target. Bearings may be measured relative to true North. All bearings are measured clockwise at the position of the observer, 0 mil to 6,400 mils.
Doppler effect--If the distance between the transmitter and reflecting object is decreasing, the received frequency is greater than the transmitted frequency. If this distance is increasing, the original frequency decreases.
Duty cycle-The ratio of the pulse width to the pulse repetition time, or the ratio of average power to peak power.
Echo-A radar signal that is reflected from a target, and received by the radar receiver.
Ghost signals-Echoes resulting from reflection of a single transmitted pulse from two or more targets before returning to the radar set, or pick-up of a target in the side or secondary lobes of the antenna radiation pattern.
Grass-Noise as it appears on the A-scope (displayed as random spikes along the base line).
Ground clutter-Radiation which is reflected from the ground and is returned as an echo to the receiver.
Interlock-A switch used to prevent equipment from being turned on before protective covers are in place.
Interpolate-To calculate intermediate values from observed values, according to some assumed law of change in value.
Jamming-Intentional flooding of an immediate area with signals designed to interfere with normal operation of the radar equipment.
Kilocycle-One thousand cycles; usually intended to mean 1,000 cycles per second.
Megacycle-One million cycles, used to mean 1,000,000 cycles per second.
Microsecond-One-millionth of a second.
Minimum discernible signal-Signal barely discernible from grass (noise) on the A-scope.
Phase difference-The time in electrical degrees by which one wave leads or lags another one.
Plotting-Recording the changing position of a moving target.
Pulse repetition frequency-The frequency (usually given in pulses per second) at which pulses are transmitted from the radar set.
Pulse width-The time duration of a pulse as measured at the half-power points.
Radome-Housing for the antenna.
Range-Distance (in meters) from the radar set of various echoes received from targets.
Sensitivity-A measure of the minimum signal to which a device shows a measurable response.
Shadow area-An area behind an obstruction which is shielded from the radar beam by the obstruction.
Sweep (time base)-Trace produced on the screen of a cathode-ray tube by the linear deflection of the electron beam.
Time base-See sweep.
TR switch-Disconnects the receiving apparatus from the antenna during the transmitted pulse.
Waveguide-A hollow conductor used for the transmission of electromagnetic energy.

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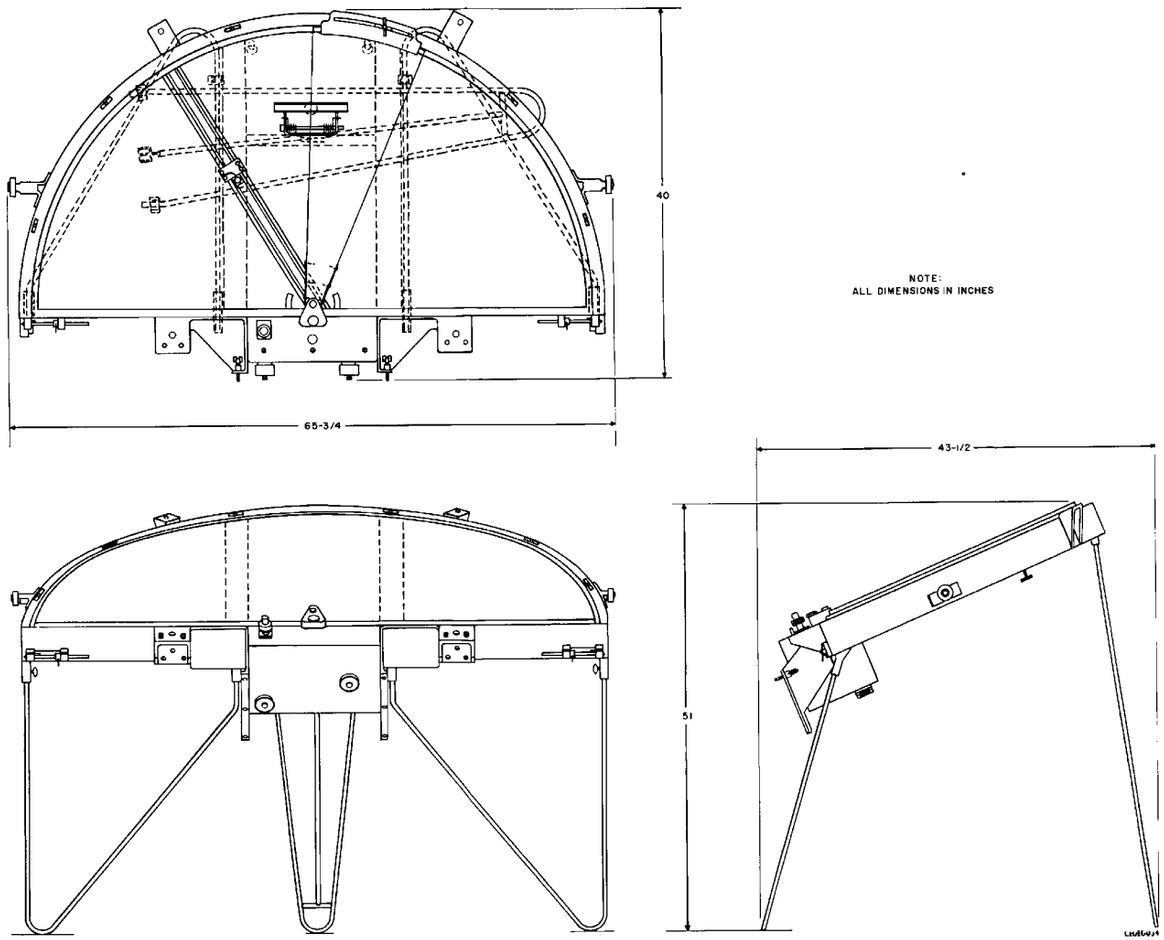

Figure 2-9. Tactical Display Plotting Board PT-441/TPS-25, Dimensional Drawing.

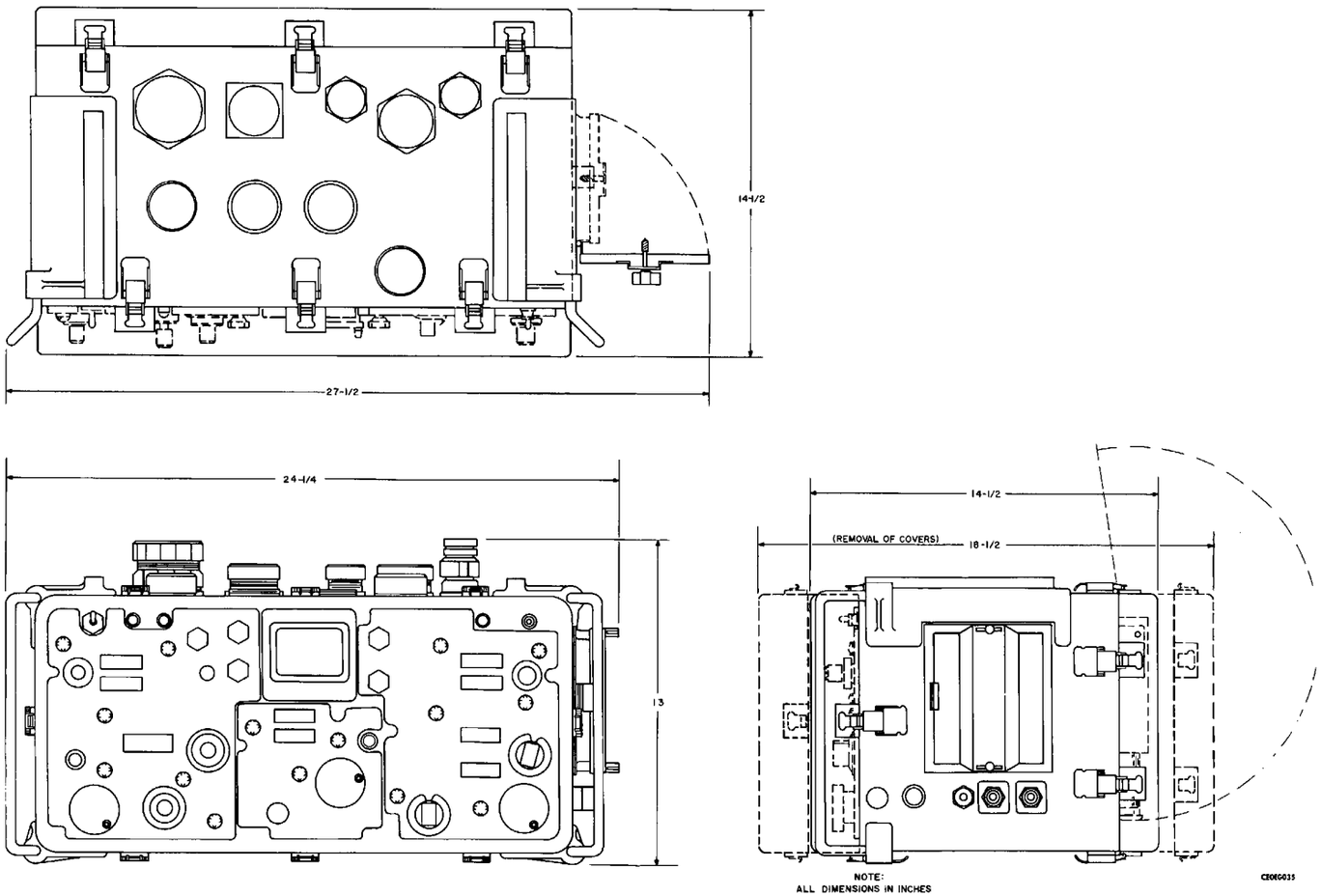

Figure 2-10. Radar Set Control C-2715/TPS-25, dimensional Drawing.

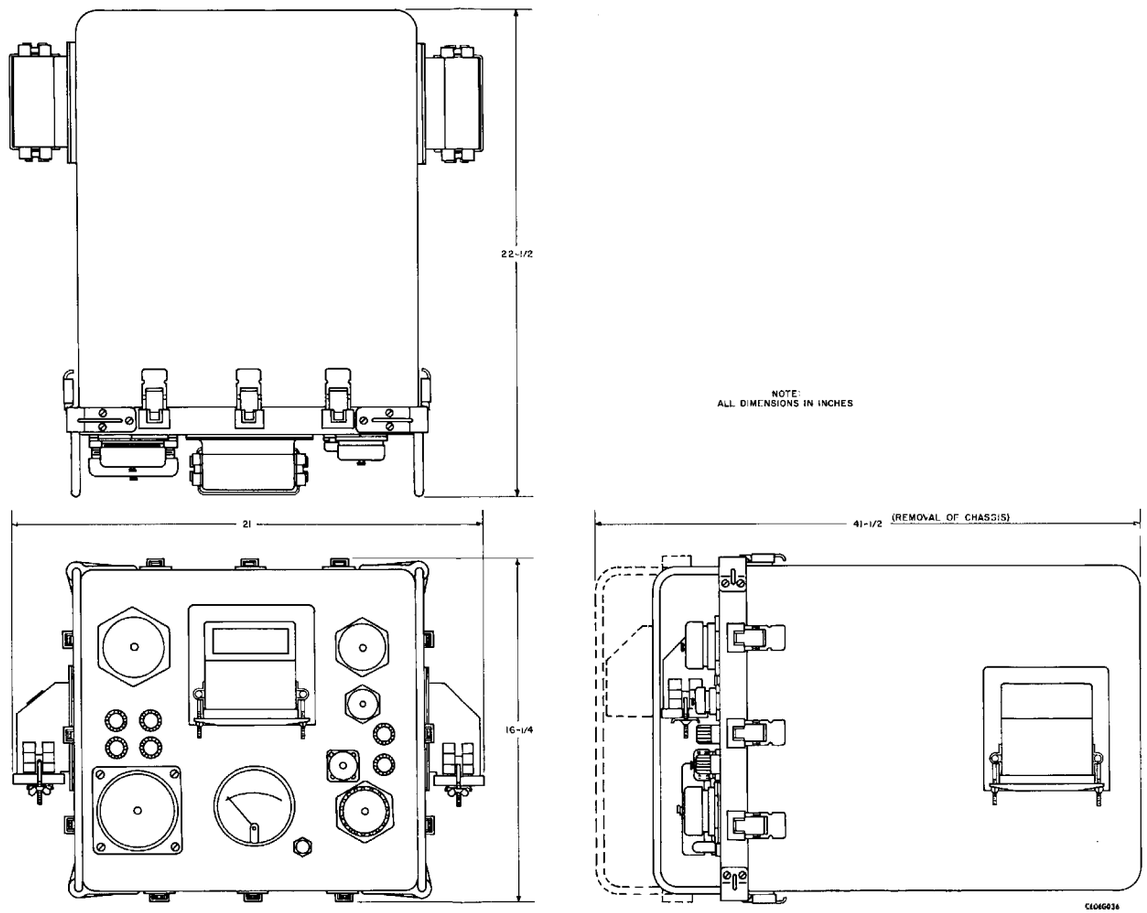

Figure 2-11. Servo Data Coordinator SN-231/TPS-25, Dimensional Drawing.

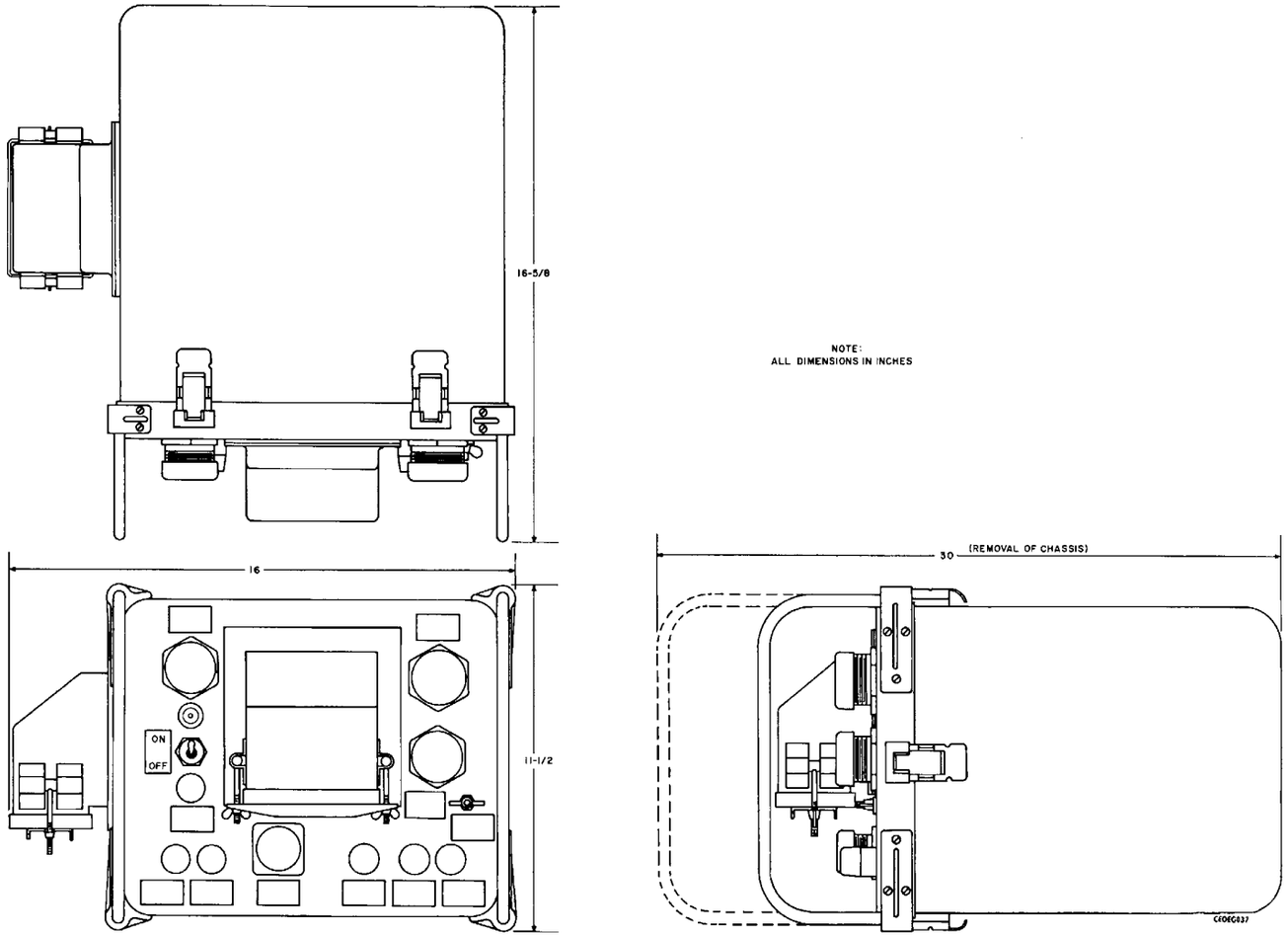

Figure 2-12. Power Supply PP-2166/TPS-25, Dimensional Drawing.

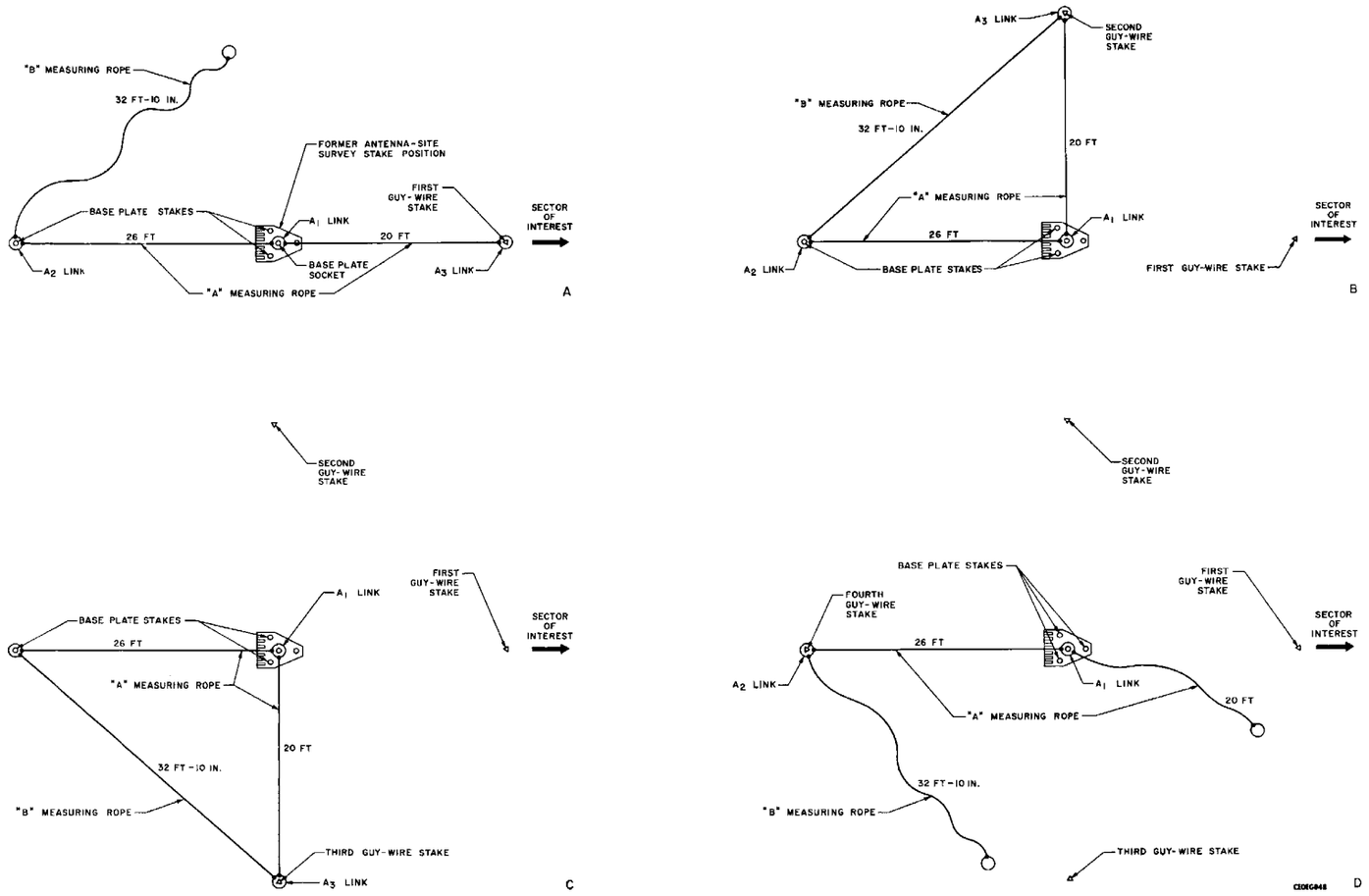

Figure 2-23. Layout of Guy-Wire Stake Positions.

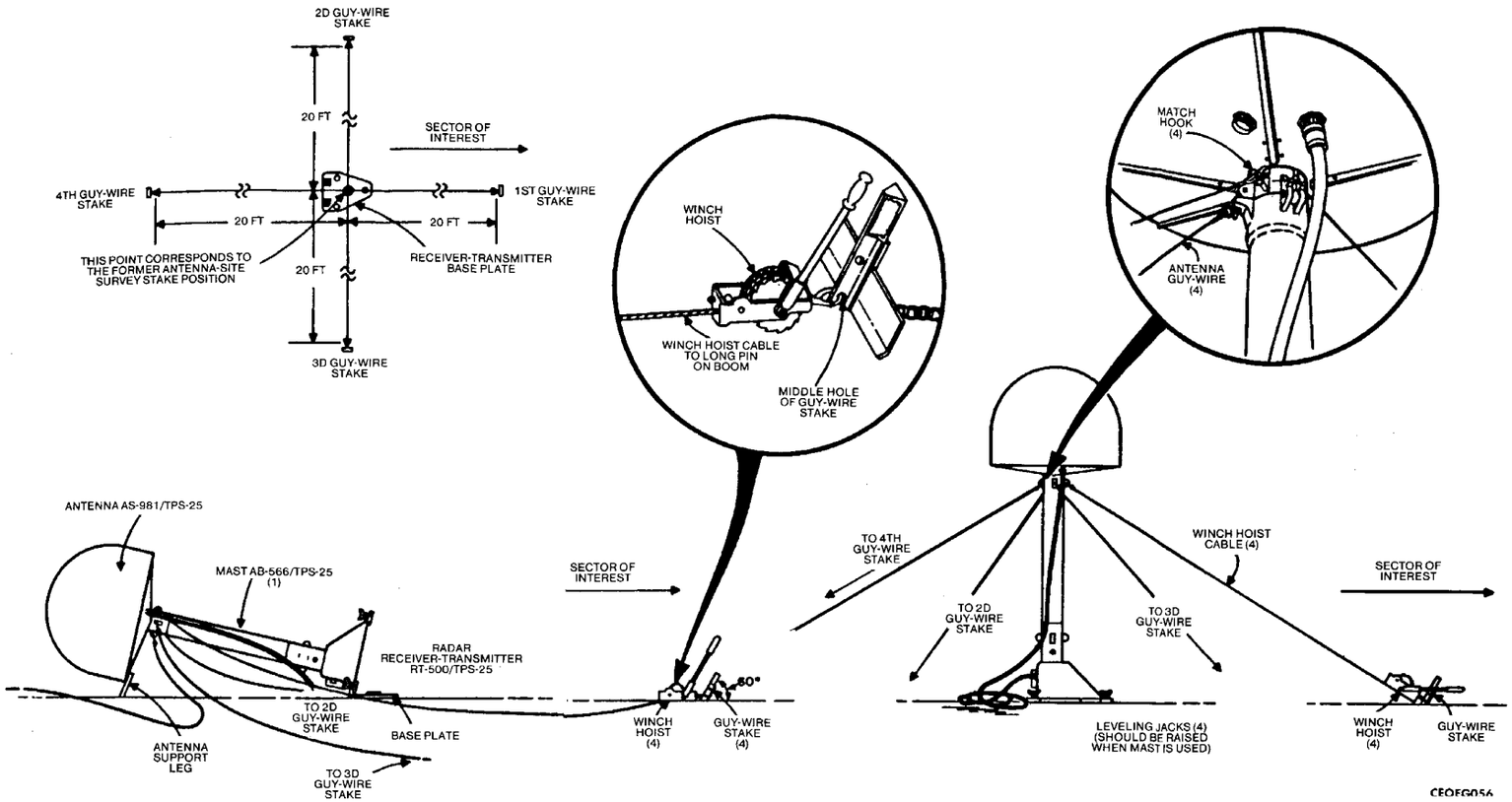

Figure 2-31. Antenna AS-981/TPS-25, Installation Using One Mast Section.

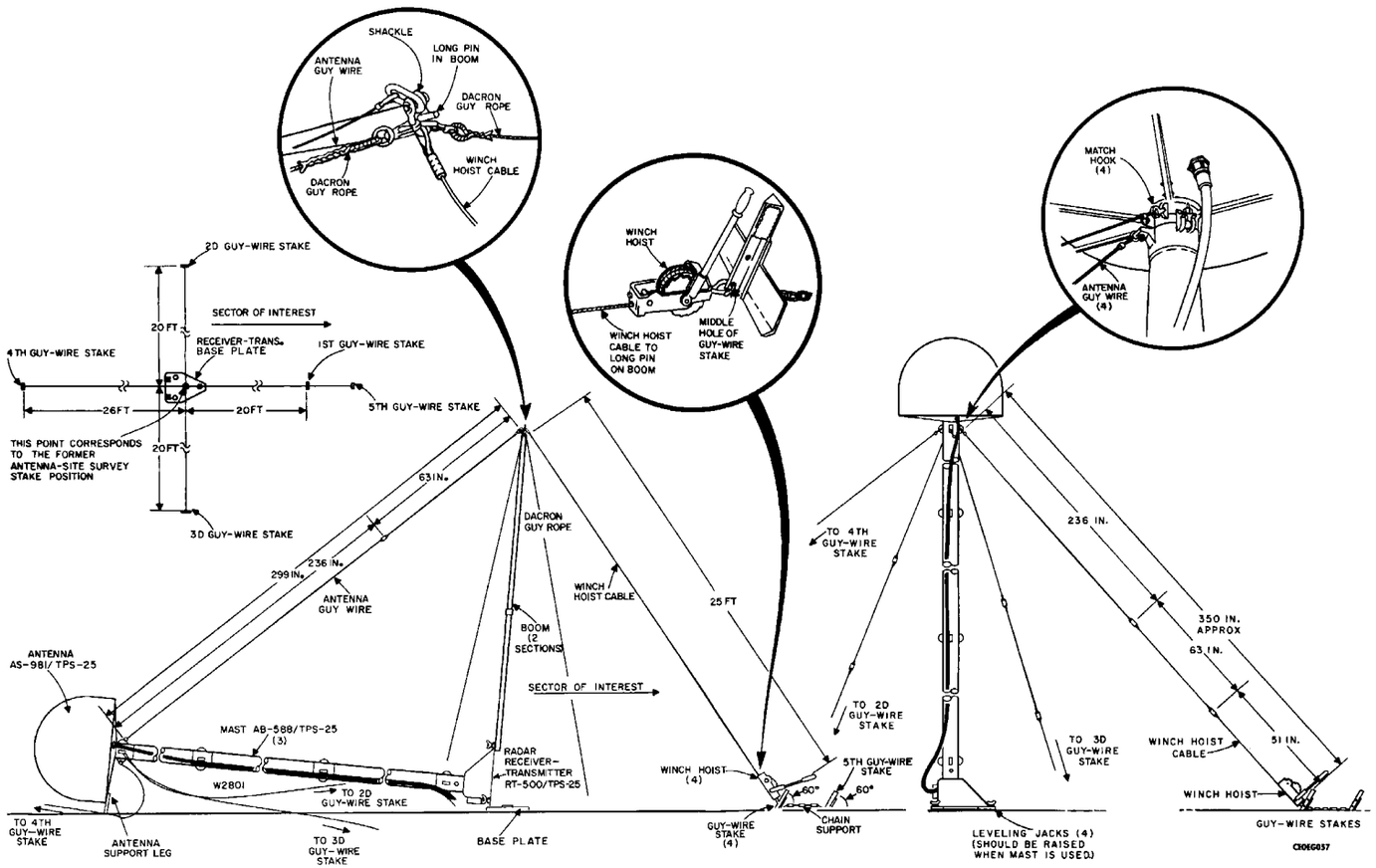

Figure 2-32. Antenna AS-981/TPS-25, Installation Using Three Mast Sections

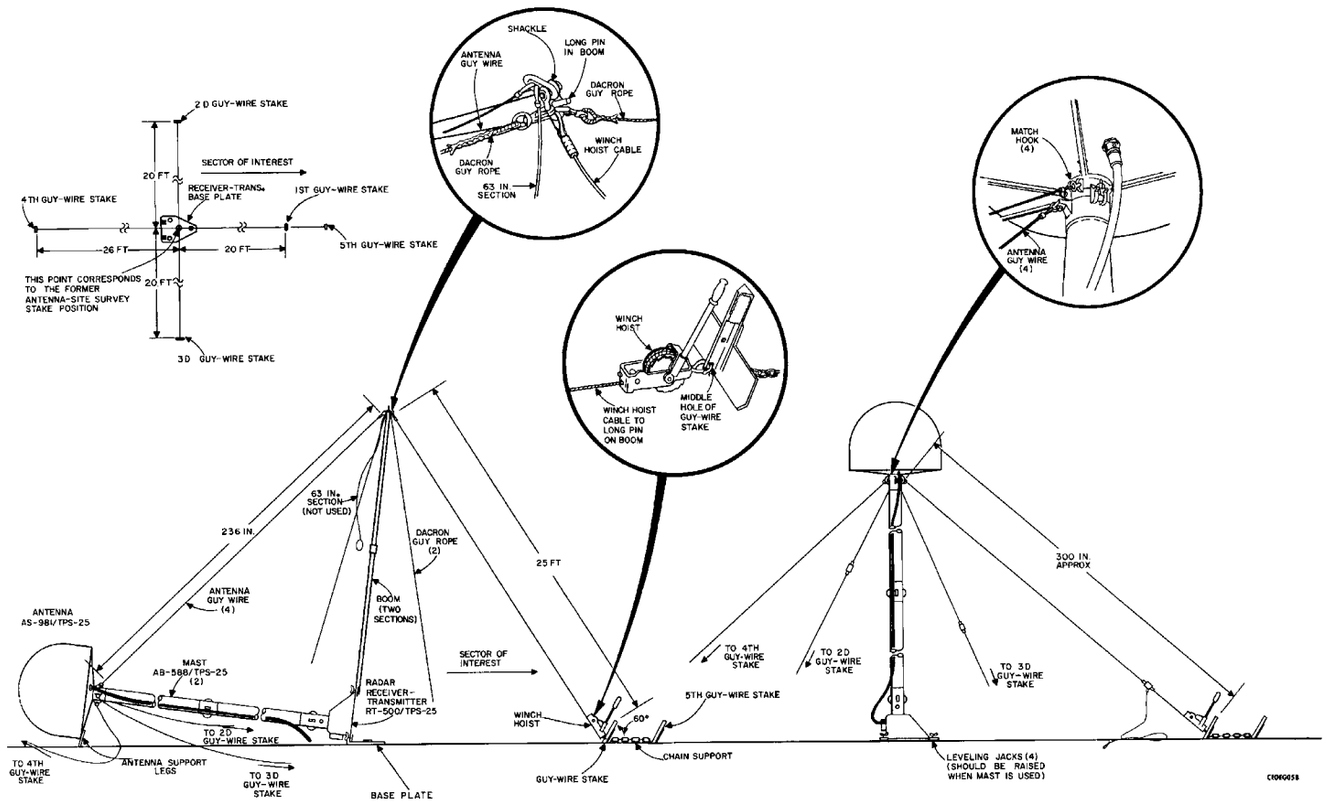

Figure 2-33. Antenna AS-981/TPS-25, Installation Using Two Mast Sections.

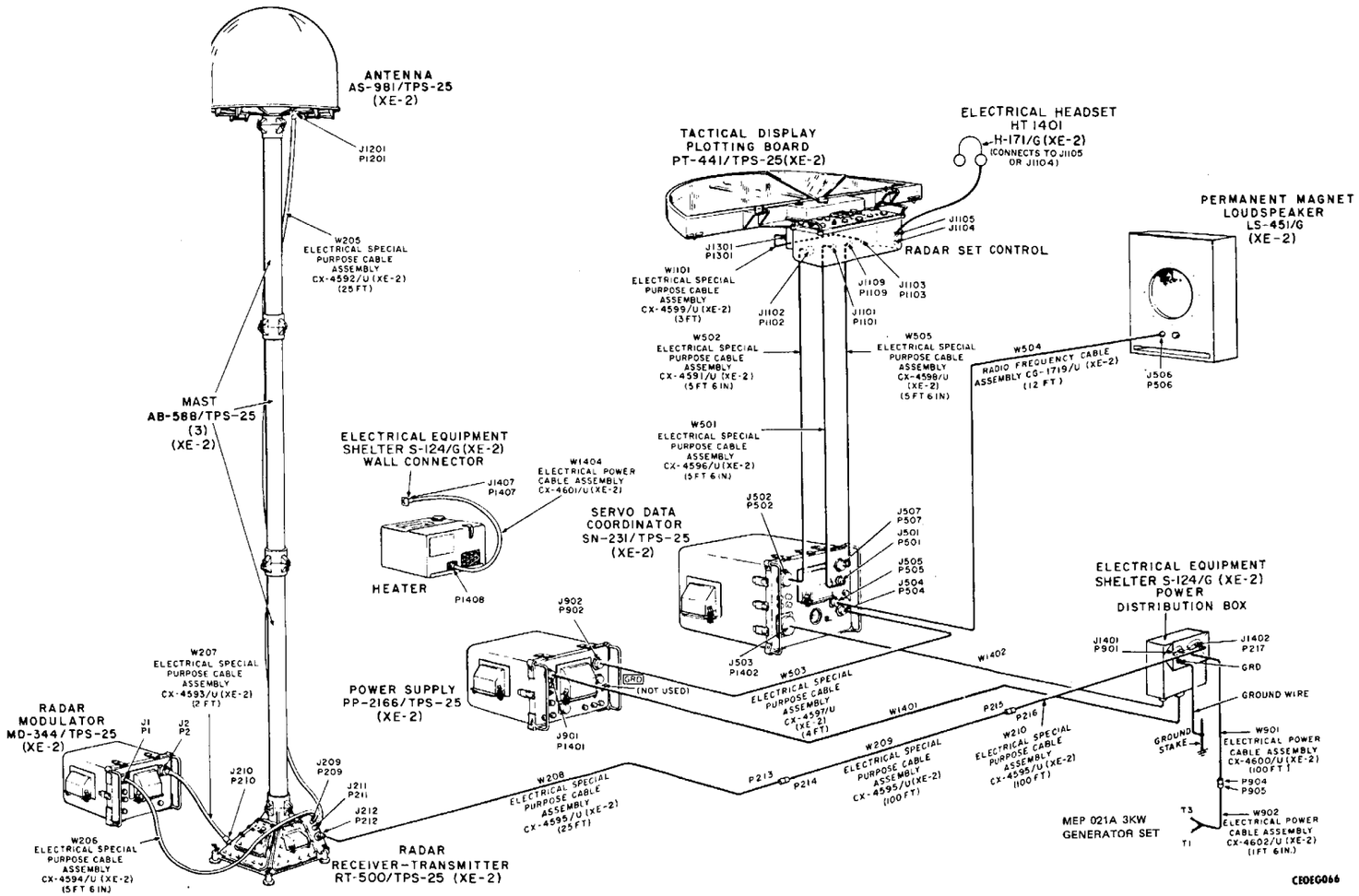

Figure 2-41. Radar Set AN/TPS-25(XE-2), Interconnection Diagram when Shelter is Used.

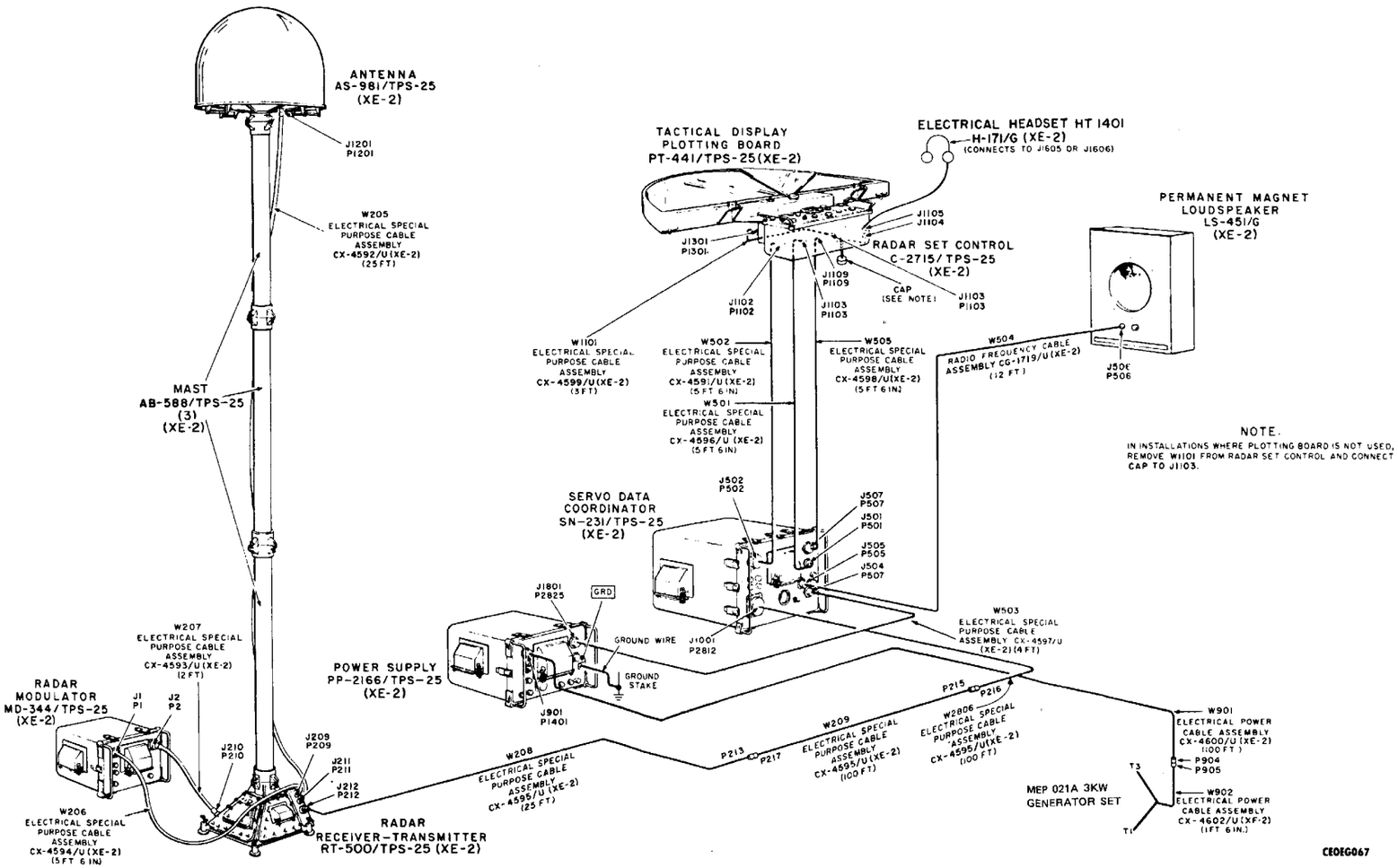

Figure 2-42. Radar Set AN/TPS-25(XE-2), Interconnection Diagram when Shelter is not Used.

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

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DATE SENT

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BE EXACT. . .PIN-POINT WHERE IT IS

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IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

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