TM 11-602

WAR DEPARTMENT TECHNICAL MANUAL

RADIO SET AN/MRC-1

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WAR DEPARTMENT • 15 DECEMBER 1944

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WAR DEPARTMENT,

WASHINGTON 25, D. C., 15 DECEMBER 1944.

TM 11–602, Radio Set AN/MRC–1, is published for the information and guidance of all concerned.

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BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

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

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CONTENTS

DESTRUCTION NOTICE

WHY — To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN — When ordered by your commander.

HOW — 1. Smash — Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.

2. Cut — Use axes, handaxes, machetes.

3. Burn — Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

4. Explosives — Use firearms, grenades, TNT.

5. Disposal — Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT

WHAT — 1. Smash — Tubes, coils, resistors, variacs, meters, transformers, capacitors, typewriters, all Boehme equipment, perforator, headsets, microphones, tuning units, crystals, shelters, etc.

2. Cut — All wiring.

3. Burn — Nameplates, instruction books, station logs, perforated and inked tape, all smashed components.

4. Bend — Frame, antenna masts, all parts.

5. Bury or scatter — Any or all of the above pieces.

DESTROY EVERYTHING

WARNING

HIGH VOLTAGE

is used in the operation of
this equipment.

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

SAFETY NOTICE

Voltages as high as 4,400 volts are used in the operation of this equipment. These voltages are dangerous to life.

Do not change tubes or make adjustments inside the set with the high voltage supply ON.

All panels are provided with interlocks to shut off high-voltage supply when panels are opened. A few service checks must be made inside the set with the high voltage on. When making these checks, always have present another person capable of rendering aid. Keep one hand in your pocket while making high-voltage measurements. This precaution will prevent touching the electrical circuit with more than one part of the body at one time.

Radio-frequency voltages as high as 5,000 volts may develop in this set. Do not touch the antenna leads while the set is turned on.

WARNING

Do not add gasoline to the vehicle or power unit fuel tank when the transmitter is on. Radio-frequency voltage may cause a spark which will result in an explosion. Turn off the radio transmitter and KEEP it off until refueling is finished.

1. Rescue

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An axe may be used to cut the high-voltage wire; however, be watchful of electric flashes which may result disastrously.

2. Symptoms

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breathing center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

3. Treatment

a. Start artificial respiration immediately. At the same time send for a doctor, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only,* remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. During transportation, other methods of resuscitation may be used, if the method of transportation prohibits the use of the Shaeffer prone pressure method. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth to mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing. (See artificial respiration chart ① and ②.)

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

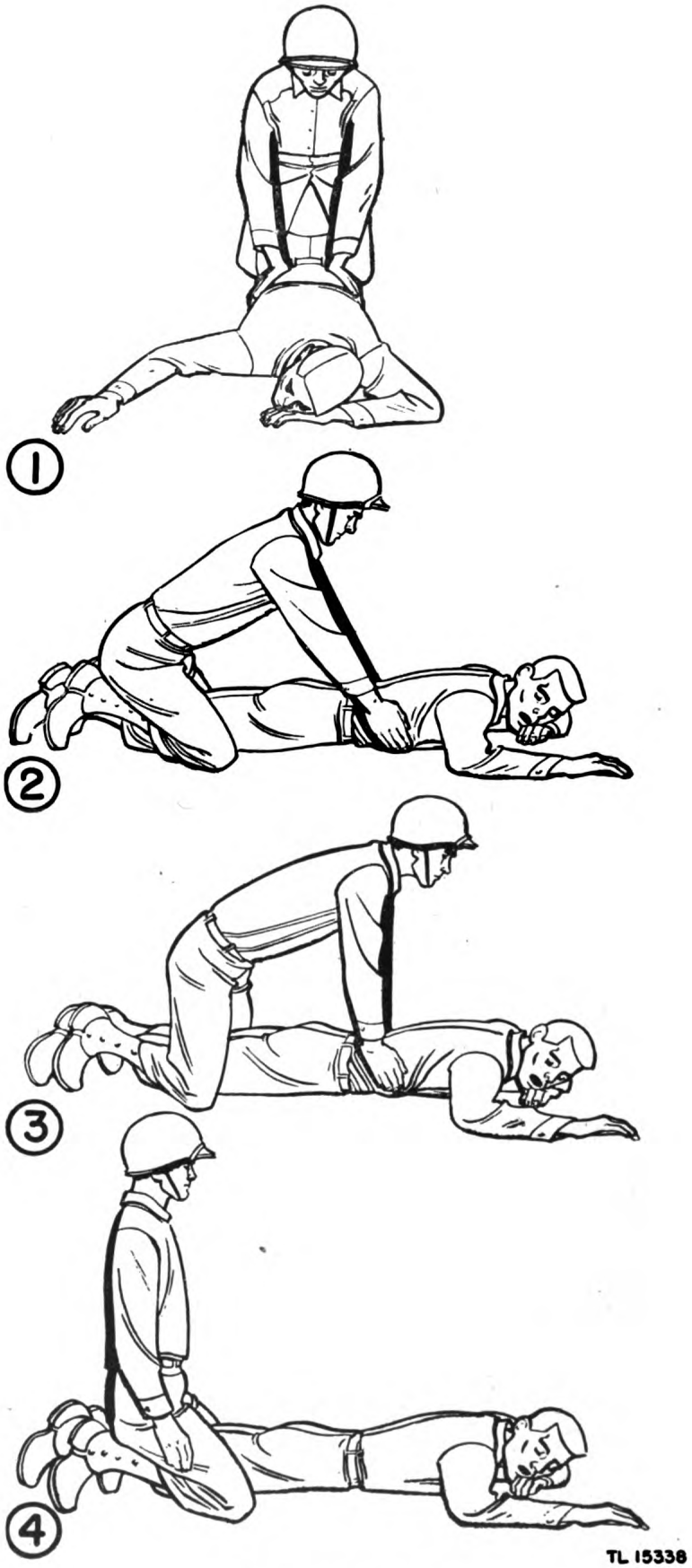
e. The resuscitating operator should straddle the victim's thighs, or one leg, in such a manner that—

(1) The operator's arms and thighs will be vertical while applying pressure on the small of the victim's back (artificial respiration chart ③).

(2) The operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib.

(3) The heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim. (See artificial respiration chart ①.)

(4) The operator's elbows are straight and locked.



Artificial respiration chart.

f. The resuscitation procedure is as follows:

(1) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(2) Swing back, suddenly releasing pressure, and sit on the heels. (See artificial respiration chart ④.)

(3) After 2 seconds' rest, swing forward again positioning the hands, and apply pressure for another second. (See artificial respiration chart ② and ③.)

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4 seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands.

Example: one thousand and one, one thousand and two, one thousand and three, one thousand and four, etc. This method of counting insures accurate timing. The exact frequency of the operating cycle of resuscitation is of utmost importance.

h. Artificial respiration should be continued without interruption until the victim regains normal breathing or until pronounced dead by a medical officer. It may be necessary to continue resuscitation for several hours. For this reason relief operators should be used if available.

4. Method of Relieving Operator

The relief operator kneels beside the operator, assuming the same position on an imaginary victim, and follows the operator through three or four complete cycles. When he is sure that he has the correct rhythm, on the next forward swing of the operator the relief operator places his hands on the top of the operator's hands without applying pressure. This indicates to the operator that the relief operator is ready to take over. On the backward swing, the operator moves off the victim, to the side, and the relief operator takes the position of the operator. On the next forward swing, the operator being relieved assumes the position on an imaginary victim beside the new operator, and follows through two or three complete cycles of the new operator, or until he is sure that the new operator has the correct rhythm. The operator being relieved remains alert to take over instantly if the new operator should falter or hesitate on the cycle. During the process of relief, the original operator should count aloud, by thousands, to give the relief operator the correct timing.

5. Inhalant Stimulants

If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostrils for comfortable breathing. Be sure that the inhalant is not held closer to the victim's nostrils and then only for short duration, 1 or 2 seconds every minute.

6. Liquid Stimulants

After the victim has regained consciousness, he may be given a glass of water with ½ teaspoon of aromatic spirits of ammonia added, or he may be offered hot coffee or hot tea as a stimulant. DO NOT GIVE AN UNCONSCIOUS VICTIM ANY LIQUIDS.

Cautions. a. After the victim revives, keep him lying quietly. Do not allow him to get up and walk even though he may feel that he is strong enough. Any injury which a person might have received, including electric shock, may bring about a condition of shock or fainting. This condition should be guarded against at all times. Shock is present if the victim is pale and has a cold sweat. His pulse is weak and rapid and his breathing is short and gasping.

b. Keep the victim lying flat on his back, with his head lower than the rest of his body, and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim may suddenly stop breathing and require additional artificial respiration. For this reason, he must be carefully watched. NEVER LEAVE A RESUSCITATED PERSON ALONE UNTIL IT IS *CERTAIN* THAT HE IS FULLY CONSCIOUS AND BREATHING NORMALLY.

CHAPTER 1

INTRODUCTION

Section I. DESCRIPTION

1. Purpose

Radio Set AN/MRC–1 comprises a radio system which provides facilities for high-speed, high-power c-w (continuous-wave) transmission and reception in addition to the normal functions of Radio Set SCR–399–( ). It is intended primarily for fixed station use but is completely mobile. The radio station is transportable, requiring three 2½-ton, 6 x 6, cargo trucks. Official nomenclature followed by ( ) is used to indicate all items of equipment regardless of model or procurement. For example, Radio Set SCR–399–( ) indicates all models of the equipment.

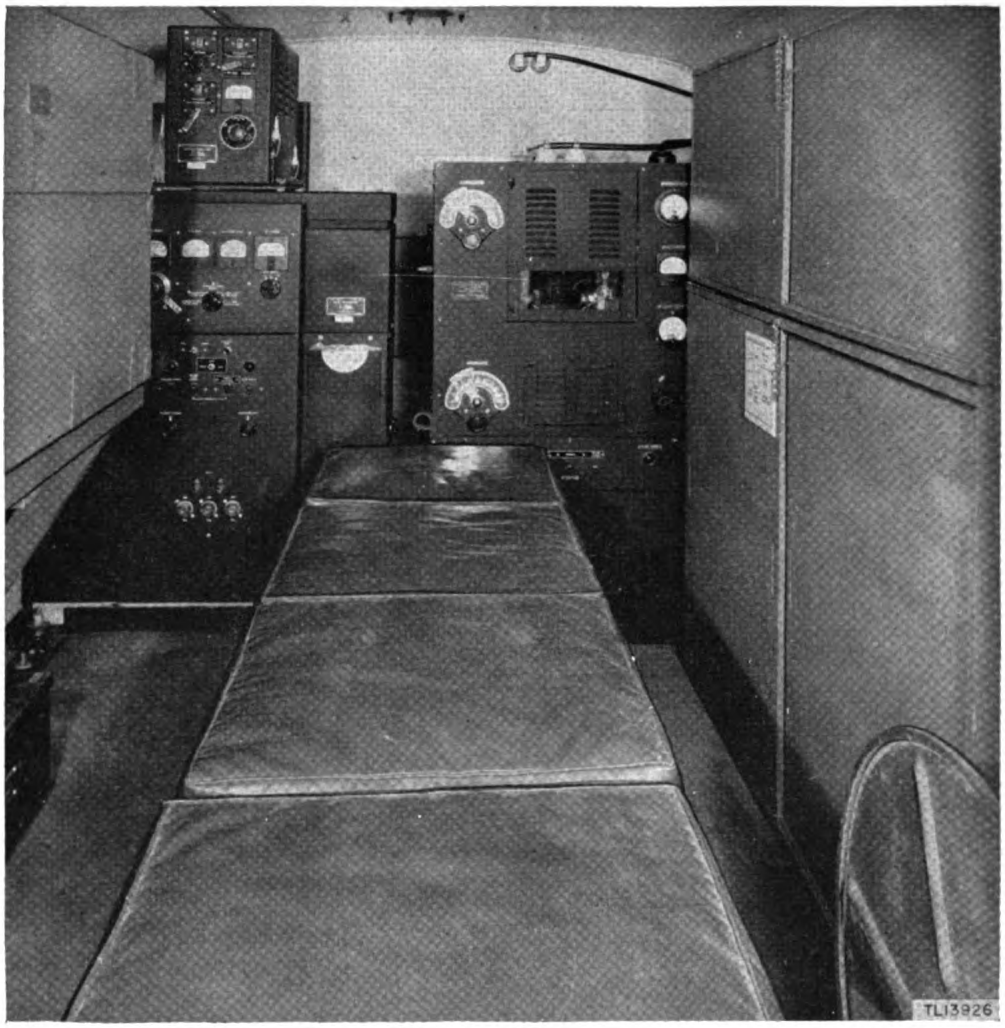


Figure 1. Radio Set AN/MRC–1—interior view, transmitting shelter.

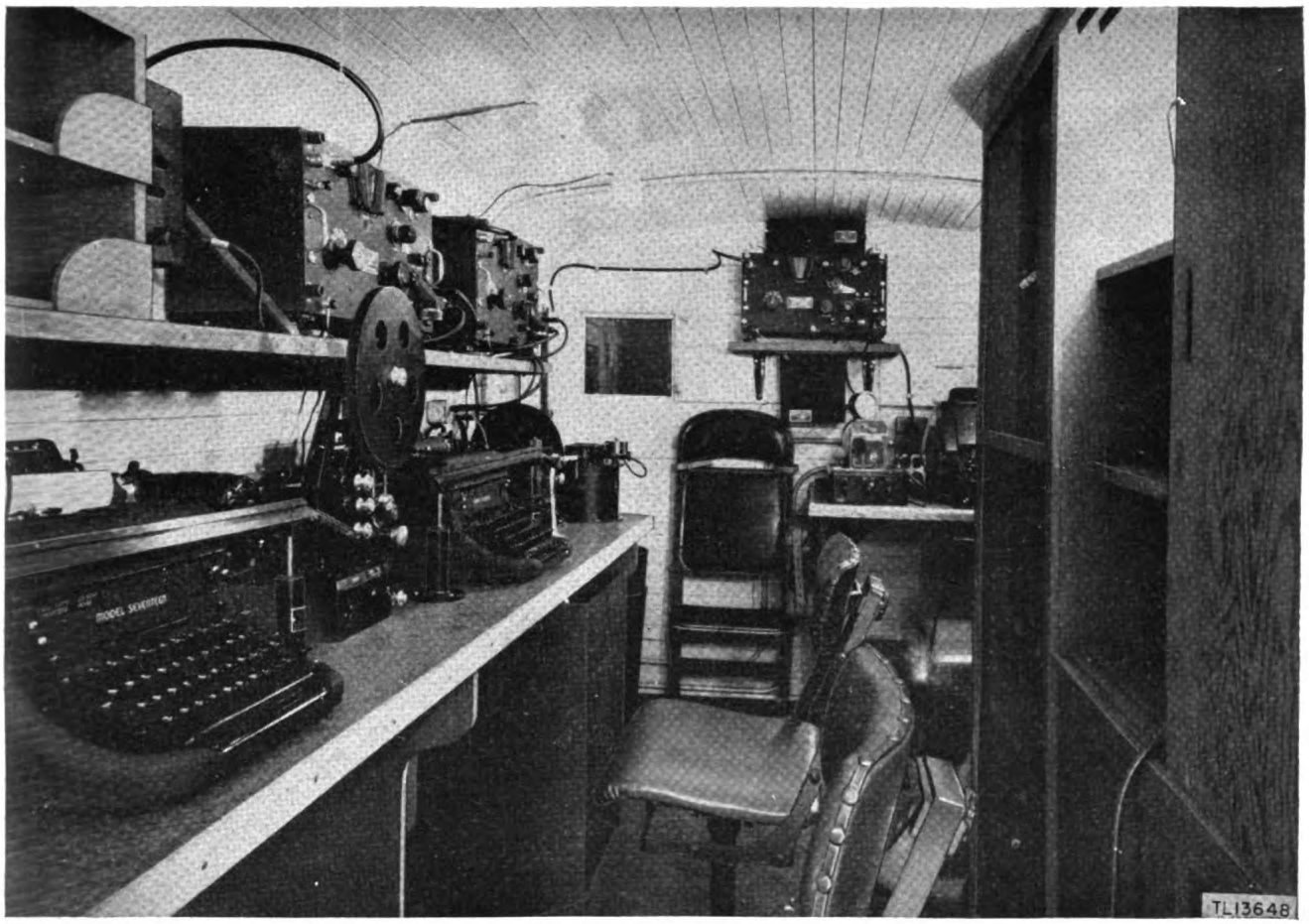


Figure 2. Radio Set AN/MRC–1—interior view, operating shelter.

2. Application

a. General. Radio Set AN/MRC–1 consists of a modified Radio Set SCR–399–( ), a 2-kw (kilowatt) amplifier, and a high-speed Boehme operating station. The system is housed in two shelters, a transmitting and an operating shelter. The transmitting shelter contains the transmitter, amplifier, and one a-m (amplitude-modulated) superheterodyne receiver. The operating shelter contains a complete high-speed Boehme station as described in *c* below. The set is designed for duplex (transmitting and receiving simultaneously on different frequencies) operation but may be used to transmit and receive on the same channel. A block diagram of the entire system is shown in figure 3. The functions of certain supplementary circuits are described in the following subparagraphs.

b. Radio Set SCR–399–( ). Radio Set AN/MRC–1 is a modified version of Radio Set SCR–399–( ). Radio Transmitter BC–610–E has been changed to Radio Transmitter T–62( )/MRC–1. The circuits common to Radio Set SCR–399–( ) will not be covered in this manual and the reader is referred to TM 11–281. Radio Set SCR–399–( ) operates with Radio Transmitter T–62( )/MRC–1 connected to Antenna Tuning Unit BC–939–A, whereas Radio Set AN/MRC–1 operates with Radio Transmitter T–62( )/MRC–1 connected to Power Amplifier AM–35( )/MRC–1. Voice operation can only be obtained by using Radio Set SCR–399–( ). Power Amplifier AM–35( )/MRC–1 cannot be used for voice operation.

c. Operating Shelter. The operating shelter contains three Radio Receivers BC-342–( ), whose operation and maintenance is fully covered in TM 11–850. Details of this receiver will not be covered in this manual and the reader is referred to the above technical manual. The shelter also contains a Boehme keying head drive and associated hand-keying circuit, a Boehme ink recorder, a Boehme automatic keying head, a Boehme recorder driving unit, a Boehme tape puller used in conjunction with tape recorder, two Boehme tape bridges, and two Boehme tape pullers with winding reels used in conjunction with the typewriter positions, and a Wheat-

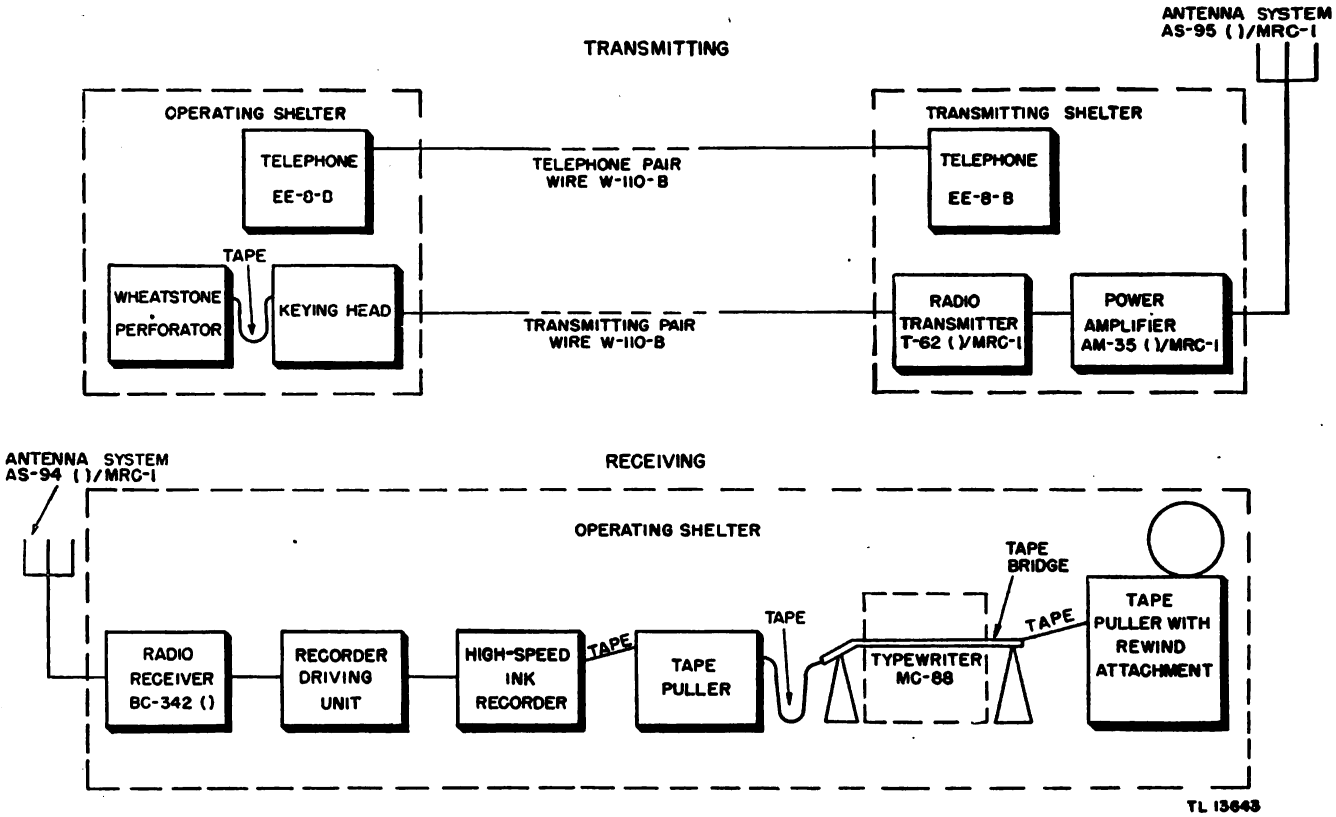


Figure 3. Radio Set AN/MRC–1—simplified block diagram.

stone teletype tape perforator. The installation, operation, and maintenance of this Boehme equipment is covered in TM 11–377. For further information on the Boehme equipment the reader is referred to the above mentioned technical manual. The rectifier (General Electric) is mounted directly below the main circuit breaker and furnishes direct current for the Boehme equipment. The shelter also contains two Typewriters MC–88, an electric heater, and an electric ventilator.

d. Antennas. Radio Set AN/MRC–1 is designed to operate with separate receiving and transmitting antennas. The receiving antenna system is composed of two 75-foot long, 30-foot high flattop antennas erected at right angles to each other. This provides selectivity of antenna directivity most suitable for the desired signal. There is also a whip antenna provided for the Radio Receiver BC–312–( ) mounted in the transmitting shelter. The transmitting antenna system consists of two doublet antennas each supported by three 50-foot plywood masts. The antenna itself is made up of sections of various lengths which are connected together to operate the antenna on different wavelengths. The total length of the antenna is dependent on the transmitting frequencies desired. A long wire or whip antenna may be used for operation of Radio Set SCR–399–( ).

e. Power Supply. Three Power Units PE–95–( ) are furnished with the set. One furnishes power for the transmitting shelter and one for the operating shelter with the third unit as a spare. Any auxiliary power required in the vicinity of the set must be taken from the operating shelter's power supply. Do not draw any power from the transmitting shelter power unit other than that required for transmitting. This is necessary to prevent overloading the transmitting power unit. Always use a 10-kw model. For further information see TM 11–904G or TM 11–904H.

3. Technical Characteristics

The table below lists the technical data and general characteristics of Radio Set AN/MRC–1.

Frequency range:
Radio Set SCR–399–( ):
Transmitter ..... 2 to 18 mc
Receiver ..... 1.5 to 18 mc

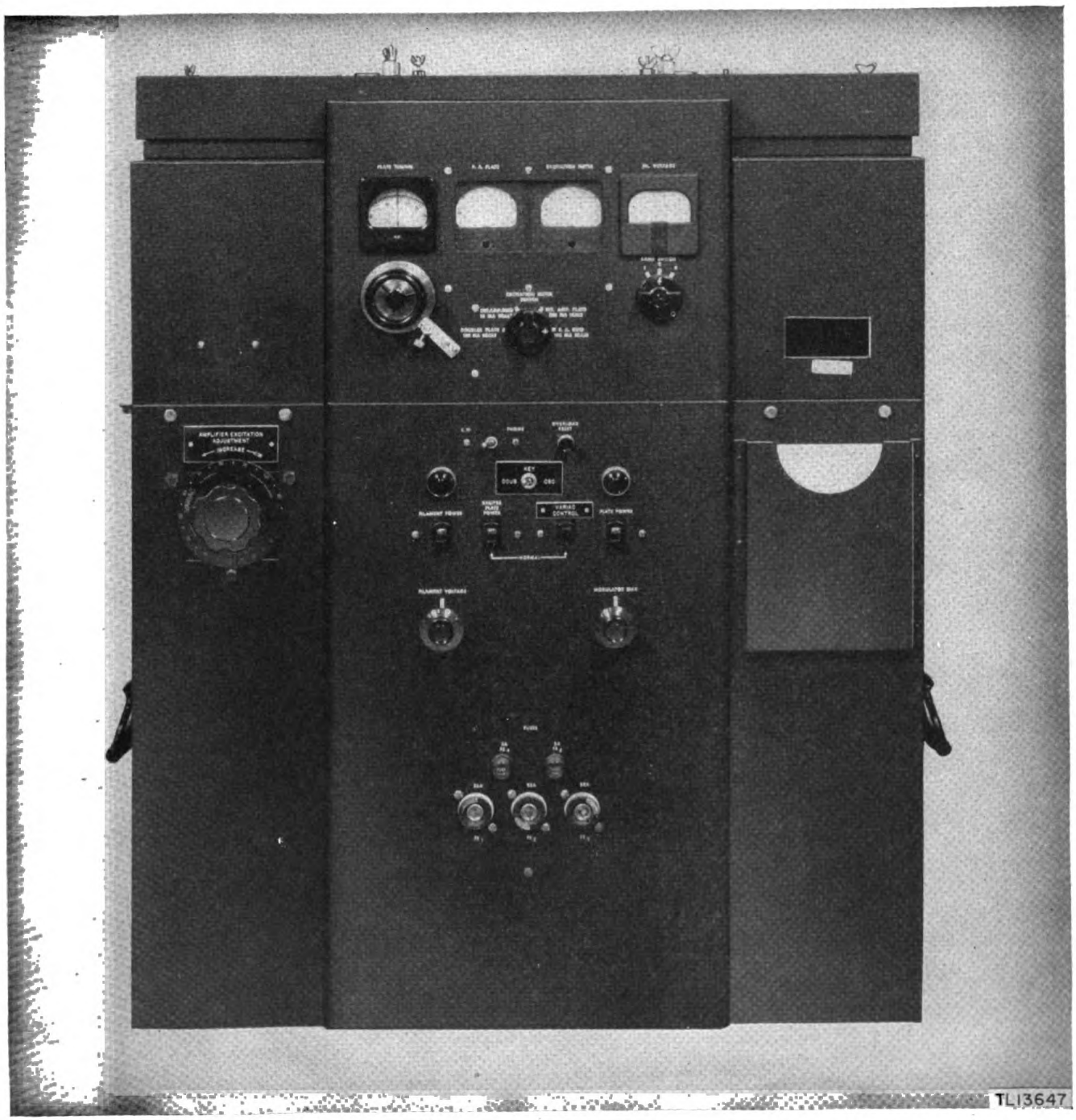


Figure 4. Radio Set AN/MCR–1, Radio Transmitter T–62( )/MRC–1

Radio Set AN/MRC–1:	
Transmitter (including power amplr)	2.0 to 13.0 mc
Receiver	1.5 to 18 mc
Type of signals emitted:	
Radio Set SCR–399–( )	Voice, cw
Radio Set AN/MRC–1	Cw
Type of signals which can be received	Voice, mcw, cw
Antenna type:	
Radio Set SCR–399–( ):	
Transmitting	Whip, long wire, doublet
Receiving	Whip, flattop
Radio Set AN/MRC–1:	
Transmitting	Doublet
Receiving	Flattop
Number of tubes:	
Power Amplifier AM–35( )/MRC–1	6
Remainder of components	See TM 11–281 and TM 11–377
Dial graduation:	
Power Amplifier AM–35 ( )/MRC–1	Federal type dials graduated 0 to 100.
Remainder of components	See TM 11–281
Type of transmitter:	
Radio Set AN/MRC–1	Cathode keying in the doubler circuit of Radio Transmitter T–62( )/MRC–1 driving Power Amplifier AM–35( )/MRC–1
Radio Set SCR–399–( )	See TM 11–281

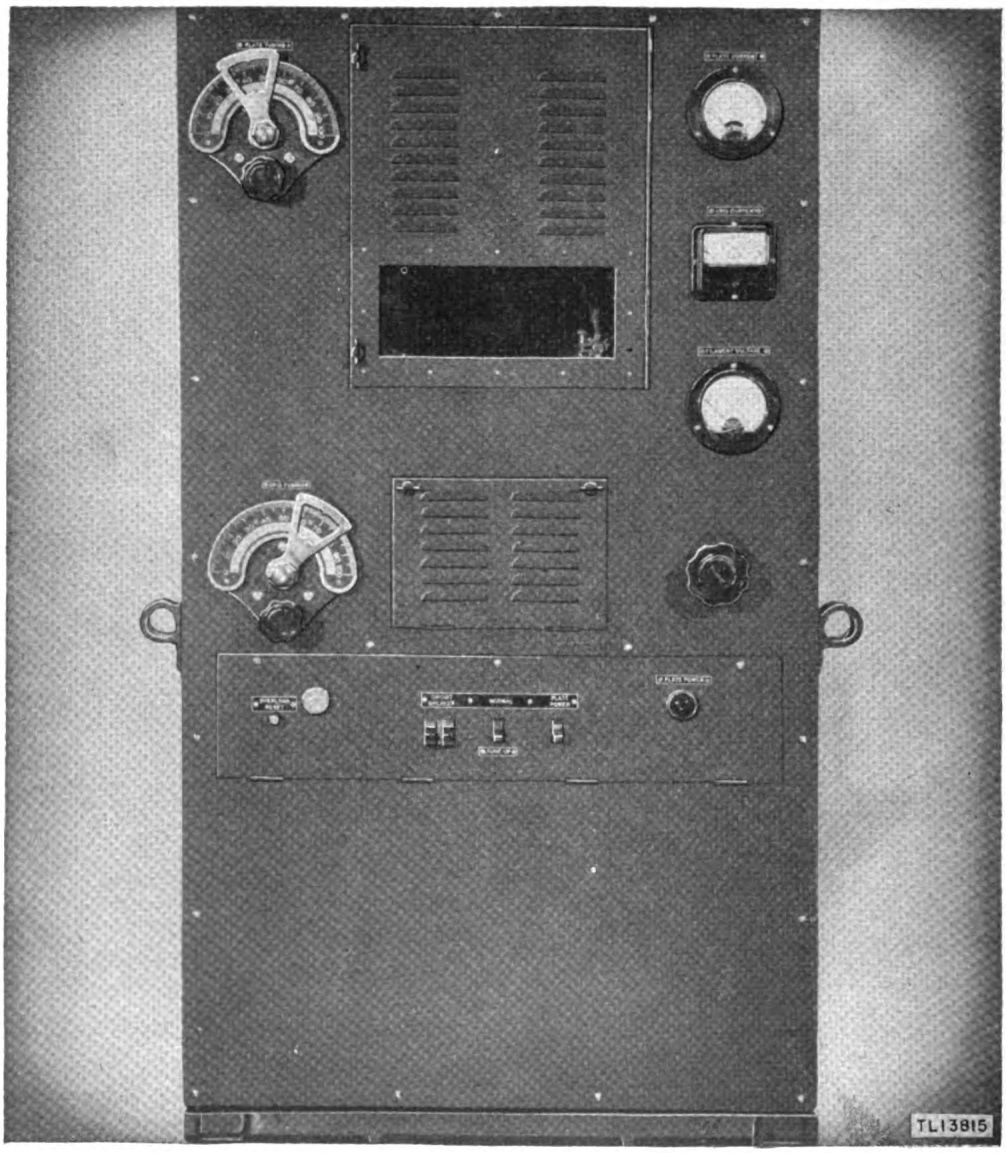


Figure 5. Radio Set AN/MRC–1, Power Amplifier AM–35 ( )/MRC–1.

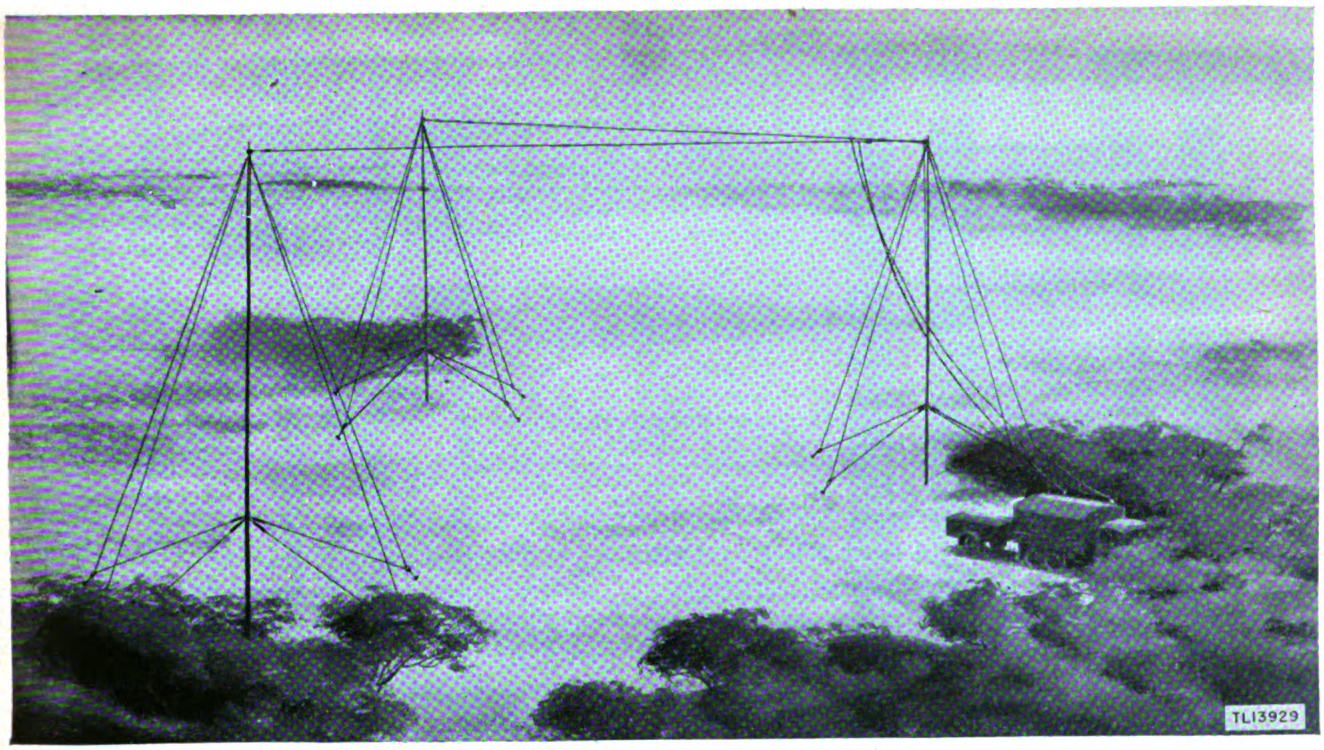


Figure 6. Radio Set AN/MRC–1—flattop receiving antenna.

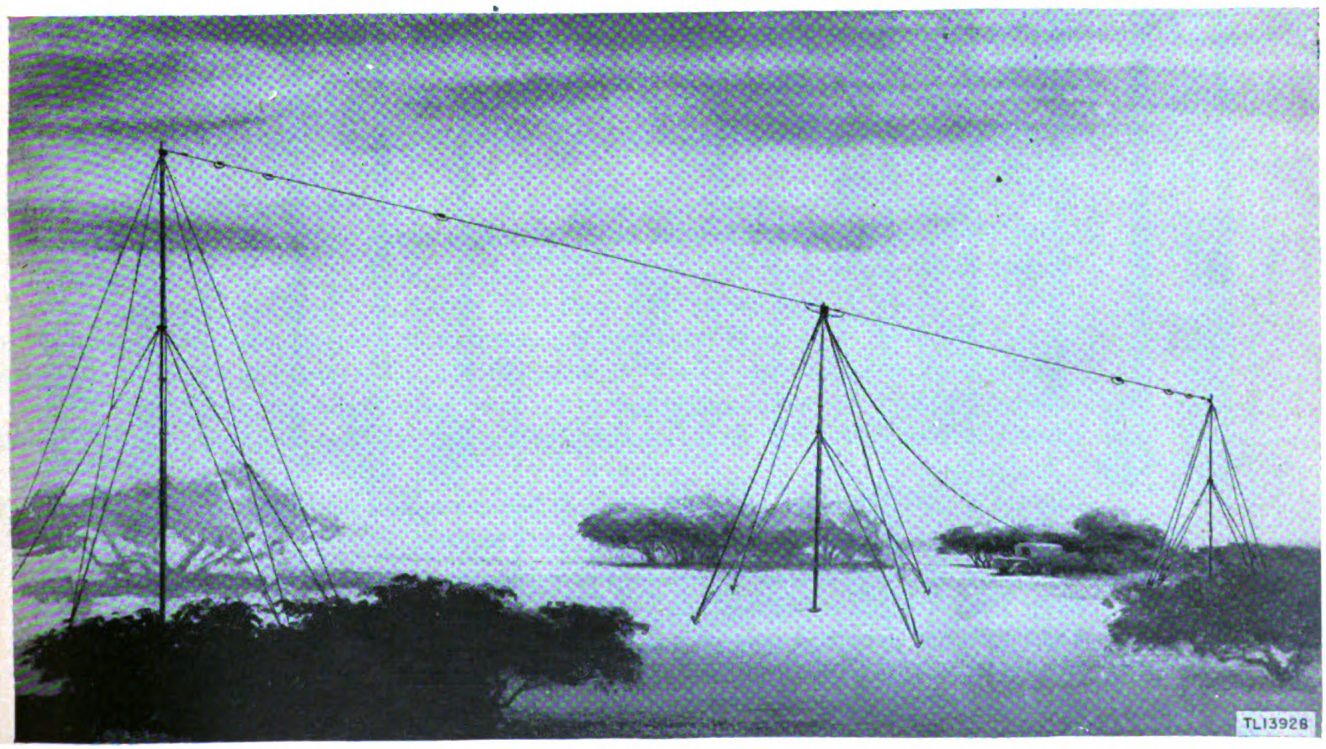


Figure 7. Radio Set AN/MRC–1—doublet transmitting antenna.

Power supply	2 Power Units PE–95–( ), one for transmitting shelter and one for operating shelter.			
Remote operation	Two shelters may be separated up to a distance of 1 mile.			
Performance characteristics:				
Power Amplifier AM–35( )/MRC–1:				
	Indicating meter	*Normal*	*Maximum*	*Minimum*
Line voltage (a–c)		115 volts	125 volts	110 volts
Filament voltage	Filament voltage	10 volts	10.2 volts	10 volts
P–a grid current (plate power OFF)	Grid current	250 ma	275 ma	250 ma
P–a grid current (plate power ON)	Grid current	230 ma	240 ma	210 ma
P–a plate current	Plate current	1,000 ma	1,100 ma	750 ma
Power output		2,000 watts	2,100 watts	1,200 watts
A–c input current (full load)		36 amp		
A–c input (full load)		3.75 kw		
D–c volts no load (line voltage 121 volts)		4,250 volts		
D–c volts at 2–kw output		3,100 volts		
Grid bias (no excitation)		275 volts		
Grid bias (full excitation)		430 volts		
A–c ripple (full load)		1 percent		
Tube JAN–866A filament voltage		2.5 volts		
Tube JAN–872A filament voltage		5.0 volts		
Remainder of components		See TM 11–281		

4. Communication With Other Radio Sets

Radio Sets AN–MRC–1 and SCR–399–( ) have frequency coverages of 2.0 to 13.0 mc (megacycles) and 2 to 18 mc respectively. The set can intercommunicate with any set covered by these frequencies.

5. Component Parts

a. TRANSMITTING SHELTER. The transmitting shelter contains one Radio Set SCR–399–( ), complete with the following modifications in component parts to change it into Radio Set AN/MRC–1. For component parts of Radio Set SCR–399–( ) see TM 11–281.

Quantity	*Article*
1	Analyzer BC–1052–( ).
1	Antenna Tuning Unit BC–939–( ) includes the following: 1 Capacitor CA–423. 1 capacitor; vacuum, 12 mmf.
4	Anticorona ball; for transmitting antenna, 2 in use, 2 running spares.
1	Axle RL–27–B.
12	Battery BA–30; 5 in use, 7 running spares.
2	Battery BA–34; 1 in use, 1 running spare.
2	Battery, storage, 6-volt.
1	Box BX–19–A; for running spare receiving tubes, fuses, and lamps.
1	Bracket; bumper, for mounting Cord CO–335 to bumper of truck.
1	Brush; bench.
7	Bulb; 50-watt, 115-volt, screw-type base, for trouble lamp and lamp fixtures, running spare.
2	Bulb; 50-watt, 12-volt, for trouble lamp, 1 running spare.
1	Chest CH–88–( ); wall for tuning units and coil units.
1	Chest CH–89–( ); seat bench, includes 3 back rests.
1	Chest CH–109–( ); battery complete with cordage and clamps necessary to connect to 2 storage batteries, includes: 7 fuses; 25-amp, 125-volt, plug-type, 1 in use, 6 running spares.
1	Chest CH–120–( ); main operating.
1	Chest CY–106–( )/MRC–1; for amplifier grid coil units, 1 running spare Tube JAN–833A and socket.
1	Chest CY–200/MRC–1; wall, for frequency meter set, tool equipment and Power Amplifier AM–35( )/MRC–1 coils and running spare parts.
2	Cord CD–201; for Key J–37, 1 in use, 1 running spare.
1	Cord CD–318–A; for Microphone T–45.
2	Cord CD–565; control, power, 4-ft, 1 in use, 1 running spare.
2	Cord CD–605; for Headset HS–30–U, 1 in use, 1 running spare.
1	Cord CD–652; power and control extension.
1	Cord CD–659; 12-ft 0-in., power, 12-volt battery, Chest CH–109–( ) to Junction Box JB–70–( ).

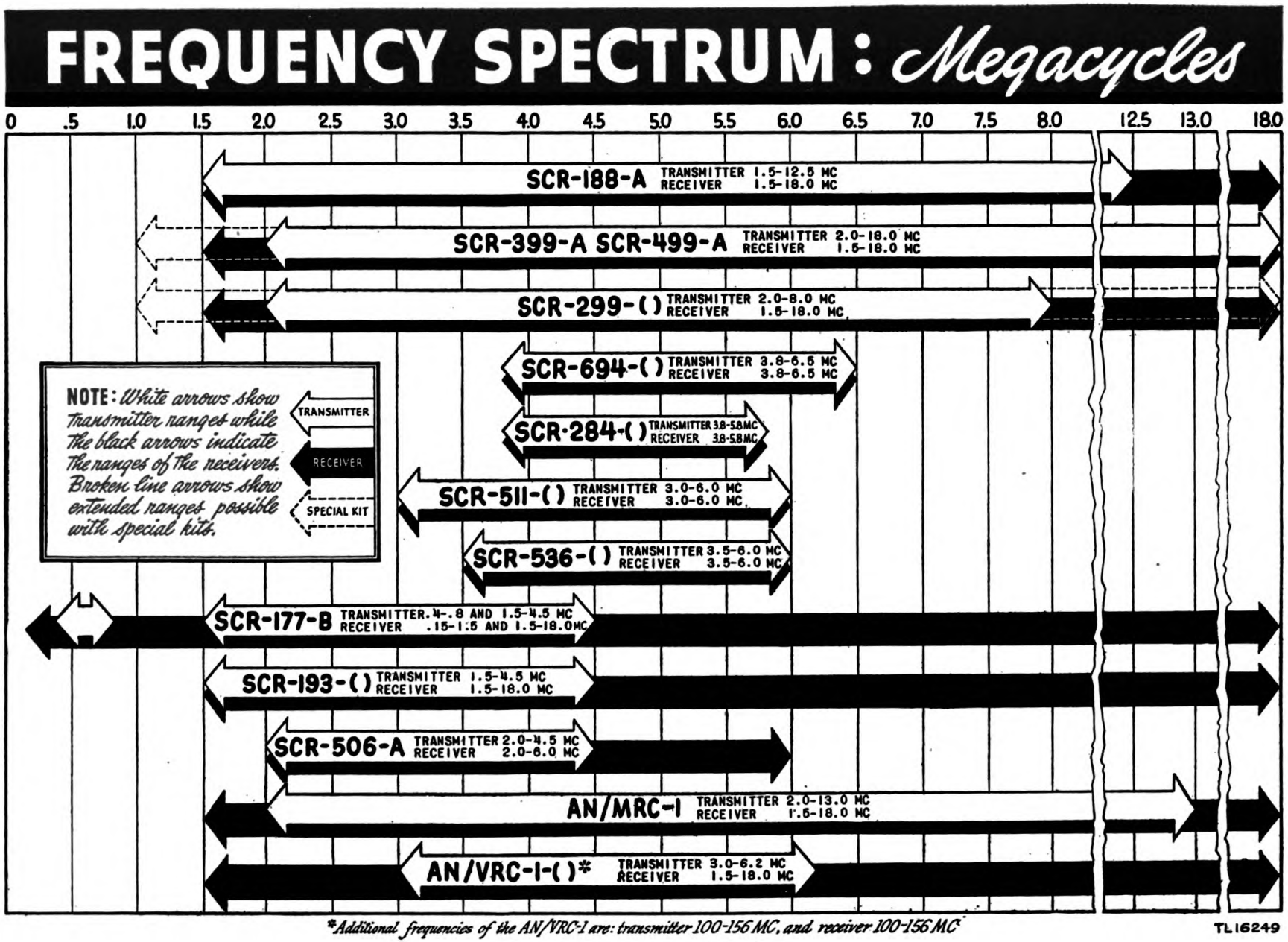


Figure 8. Frequency spectrum chart.

Quantity	*Article*
2	Cord CD–763; transmitter power cord, 1 in use, 1 running spare.
2	Cord CD–764; transmitter control cord, 1 in use, 1 running spare.
1	Cord CG–65/MRC–1; radio transmitter to power amplifier.
1	Cord CO–335, extends from Junction Box JB–70–( ) to Power Unit PE–95–( ).
1	Cord CX–135/MRC–1; part of power cord for power amplifier.
1	Cord CX–136/MRC–1; part of power cord for power amplifier.
1	Cord CX–137/MRC–1; part of power cord for power amplifier.
1	Cord CX–141/MRQ–2; Junction Box JB–70–( ) to Speech Amplifier BC–614–( ).
1	Cord CX–142/MRQ–2; Rectifier RA–63–( ) to Junction Box JB–70–( ).
1	Cord CX–143/MRQ–2; main audio.
2	Cord; 10-ft, 1-conductor, approx No. 7 AWG copper braid, for grounding to Stake GP–8.
1	Counterpoise CP–15–( ).
1	Fan, electric, 12-inch, GE Cat. No. 95 x 99, or equal.
1	Fire extinguisher; 4-lb size, carbon-dioxide type, Alfite No. 48, complete with holder.
1	Frame FM–59–( ); for two Reels DR–4.
1	Frequency Meter Set SCR–211–( ).
2	TM 11–300.
3	Ground clamp and braid assembly; for grounding Shelter HO–17 to truck, 2 in use, 1 running spare.
2	Headset HS–30–U; 1 in use, 1 running spare.
1	Heater; electric, 1,500-watt, 115 volt.
4	Insulator; antenna hold-down 7 x 1 in., 2 in use, 2 running spares.
1	Junction Box JB–70–( ).
2	Key J–37; 1 in use, 1 running spare.
2	Lamp fixture; for illuminating Chest CH–120–( ) and Radio Transmitter T–62( )/MRC–1, includes: 1 bulb: 50-watt, 115-volt, screw-type base.
2	Lamp; trouble, 115-volt, with 25-foot extension cord, includes: 1 bulb; 50-watt, 115-volt, screw-type base.
1	Lamp; trouble, 12-volt d-c, with 25-foot extension cord, includes: 1 bulb; 50-watt, 12 volt.
1	Loudspeaker LS–3.
1	Mast Base MP–47–A.
2	Mast Base AB–15/GR; 1 in use, 1 running spare.
1	Mast Base Bracket MP–50–A; for Mast Base AB–15/GR.
2	Mast Section MS–49; 1 in use, 1 running spare.
2	Mast Section MS–50; 1 in use, 1 running spare.
2	Mast Section MS–51; 1 in use, 1 running spare.
2	Mast Section MS–52; 1 in use, 1 running spare.
2	Mast Section MS–53; 1 in use, 1 running spare.
2	Mast Section MS–53; for 7-section antenna.
2	Mast Section MS–116–A; 1 in use, 1 running spare.
2	Mast Section MS–117–A; 1 in use, 1 running spare.
2	Mast Section MS–118–A; 1 in use, 1 running spare.
1	Microphone T–17.
1	Microphone T–45.
2	Microphone T–50–( ); 1 in use, 1 running spare.
2	Mounting FT–178; for Radio Receiver BC–312–( ).
1	Power Amplifier AM–35–( )/MRC–1, includes: 2 coil units; Barker-Williamson, type 1684, or equal. 2 coil units; Barker-Williamson, type 1685, or equal. 2 coil units; Barker-Williamson, type 1686, or equal.

Quantity	*Article*
	2 coil units; Barker-Williamson, type 1687, or equal.
	2 coil units; Barker-Williamson, type 1688, or equal.
	2 coil units; Barker-Williamson, type 1689, or equal.
	1 Coil Unit C–387–D.
	1 Coil Unit C–388–C.
	1 Coil Unit C–389–C.
	1 Coil Unit C–390–C.
	1 Coil Unit C–447–B.
	1 Coil Unit C–448–B.
	1 Capacitor CA–423.
	6 lamps; pilot, G.E. type S6–110v, 2 in use, 4 running spares.
	1 shock mounting.
	4 Tubes JAN–833A; 2 in use, 2 running spares.
	4 Tubes JAN–872A; 2 in use, 2 running spares.
	2 Tubes JAN–866A.
	2 neutralizing indicators, includes:
	14 lamps, 1 in use, 13 running spares.
	2 neutralizing tools; polystyrene rod.
1	Radio Receiver BC–312–( ).
1	Radio Transmitter T–62( )/MRC–1; Radio Transmitter BC–610–E modified to provide excitation of power amplifier, includes;
	1 shock mounting
	2 sets tuning charts.
	3 Tuning Units TU–47.
	3 Tuning Units TU–48.
	3 Tuning Units TU–49.
	3 Tuning Units TU–50.
	3 Tuning Units TU–51.
	3 Tuning Units TU–52.
	3 Tuning Units TU–53.
	3 Tuning Units TU–54.
	2 Coil Units C–387–D.
	2 Coil Units C–388–C.
	2 Coil Units C–389–C.
	2 Coil Units C–390–C.
	2 Coil Units C–447–B.
	2 Coil Units C–448–B.
	2 Coil Units C–449.
	2 Capacitors CA–423; 1 in use, 1 running spare.
	14 fuses; standard 25-amp, plug fuse, 125-volt, 2 in use, 12 runinng spares.
	7 fuses; standard, 20-amp, plug fuse, 125-volt, 1 in use, 6 running spares.
	7 fuses; 5-amp, 250-volt, 1 in use, 6 running spares.
	7 fuses; FU–50, 1 in use, 6 running spares.
	4 Lamps LM–27; 2 in use, 2 running spares.
	4 Lamps; 120-volt, 6-watt, 2 in use, 2 running spares.
	12 Tubes JAN–866A; 2 in use, 10 running spares.
	7 Tubes JAN–2A3; 2 in use, 5 running spares.
	12 Tubes JAN–807; 2 in use, 10 running spares.
	4 Tubes JAN–6V6GT; 1 in use, 3 running spares.
	4 Tubes JAN–6L6; 1 in use, 3 running spares.
	10 Tubes JAN–OD3/VR–150; 3 in use, 7 running spares.
	8 Tubes JAN–5Z3; 2 in use, 6 running spares.

Quantity	*Article*
	8 Tubes JAN–100TH; 2 in use, 6 running spares.
	4 Tubes JAN–250TH; 1 in use, 3 running spares.
1	Rectifier RA–63–( ).
50 ft	Rope RP–5.
1 set	Running spares for radio transmitter and associated equipment, includes:
	1 capacitor; mica, 0.002–mf ±10%, 1,000 v d-c (working)
	1 capacitor; mica, 0.001–mf ±10%, 2,500 v d-c (working), low loss, fixed, ASA CM 45A102K, ASA Spec. C75.3–1942.
	1 capacitor; mica, 0.002–mf, 6,000 v d-c (working), ASA CM70202J, ASA Spec. C75.3–1942.
	1 capacitor; bathtub, paper, 0.35–mf, ±10%, 400 v d-c (working), oil-filled, No. 7476.
	1 capacitor; paper, molded, 0.002–mf ±20%, 1,000 v d-c (working).
	1 capacitor; electrolytic, 10–10–30–30–mf —10% +75% 25 v d-c (working).
	1 capacitor; oil-filled, 8.5–8.5–mf, —10% +20%, 1,000 v d-c (working), special.
	1 capacitor; oil-filled, 3–mf, —10% +40%, 4,000 v d-c (working).
	1 capacitor; oil paper, metal can, 0.005–mf, +20%, 1,000 v d-c (working).
	1 capacitor, dual oil-filled paper, 0.05 mf, ±15%, 1,000 v.
	1 ceramicon; 40–mmf, ±5%, 500 v d-c (working).
	2 ceramicons; 50–mmf ±5%, 500 v d-c (working).
	1 ceramicon; 60–mmf ±5%, 500 v d-c (working), T.C.–0.00015, special.
	1 ceramicon; 65–mmf ±5%, 500 v d-c (working), T.C.–0.00015, special.
	1 ceramicon; 75–mmf ±5%, 500 v d-c (working), T.C.–0.00075, special.
	1 ceramicon; 135–mmf ±5%, 500 v d-c (working), T.C.–0.00015.
	1 ceramicon; 140–mmf ±5%, 500 v d-c (working) T.C.–0.00015.
	1 ceramicon; 155–mmf ±5%, 500 v d-c (working), T.C.–0.00015.
	1 ceramicon; 160–mmf ±5%, 500 v d-c (working), T.C.–0.00015.
	1 ceramicon; 170–mmf ±5%, 500 v d-c (working), T.C.–0.00015.
	1 ceramicon; 185–mmf ±5%, 500 v d-c (working), T.C.–0.00015.
	1 relay; plate power.
	1 relay; antenna shorting, 110-volt.
	1 relay; phone–cw, coil, 110-volt.
	1 relay; 115-volt a-c.
	1 relay; overload, 700–ma, d-c.
	1 relay; 12-volt d-c, Clare, inductance 1.5–h, ±20% at 1,000 cps.
	1 relay; 115-volt a-c, DPDT.
	18 Lamps LM–27.
	12 Lamps; 120-volt, 6-watt.
	1 choke; 2.5–mh, r-f.
	2 choke; 1–mh, r-f, 4-pie, ±10%, 20-ohm d-c.
	1 choke; 10–mh, r-f, with hardware and lugs.
	1 choke; CH–500, r-f, 2.5-mh, ±10%, 8.5-ohm d-c.
	2 switches; interlock, Cutler and Hammer No. 1796.
	1 switch; wafer, 2-section, 5-position, type H, special.
	1 switch; wafer, 1-section, 3-position, type H, special.
	1 switch; telephone lever, send-receive, type A–7697.
	1 switch; meter, 2-section, 4-position, type H.
	1 switch; push-button, Utah, type PS–3.
	1 switch; 4PDT.
	1 switch; SPST, marked.
	1 switch; DPDT, toggle, 15/32 shaft, 3-amp, 250 v d-c (working).
	1 circuit breaker; 50-amp, molded phenolic compound, type thermostat PLM 50.
	20 bars; insulator.

Quantity	*Article*
	4 bars; ceramic for tank coils.
	4 spacers; ceramic for tank coils.
	1 resistor, 16-ohm, 600-watt, heater element.
	1 shunt; meter, 150-ma ±0.5%.
	1 shunt; meter, 300-ma ±0.5%.
	1 resistor; wire-wound, 700-ohm, ±5%, 20-watt.
	1 resistor; wire-wound, 750-ohm, ±5%, 10-watt.
	1 resistor; wire-wound, 5,600-ohm, ±5%, 20-watt.
	1 resistor; wire-wound, 40,000-ohm, ±5%, 20-watt.
	1 resistor; wire-wound, 75,000-ohm, , ±10%, 200-watt.
	1 resistor; variable, 2,500-ohm, ±5%, 100-watt.
	1 resistor; variable, 100,000-ohm, ±20%.
	1 resistor; carbon, variable, ½-meg, ±20%.
	1 resistor; carbon, variable, 1-meg, ±20%.
	1 resistor; variable, 15-ohm, 75-watt.
	1 resistor; variable, 500-ohm, 50-watt, 912–00719 IRC.
1 set	Running spares for power amplifier; includes:
	1 blower; 115-v a-c.
	1 cap; plate.
	2 chokes; r-f, 1-mh, 300-ma.
	2 chokes; r-f, 1-mh, 1-amp.
	2 capacitors; neutralizing.
	1 capacitor; oil-filled, 6-mf, 4,000-v.
	1 capacitor; mica, 12,500-volt, 0.00015-mf.
	1 capacitor; mica, 2,500-volt, 0.004-mf.
	1 relay; DPST, a-c, 115-v, 60-amp.
	1 relay; thermal time-delay.
	1 relay; overload.
	1 relay; underload, SPST, double break, 600-ma.
	1 resistor; 1,500-ohm, 100-w, IRC.
	1 resistor; 60,000-ohm, 200-w, IRC.
	2 resistors; 20-ohm, 5 inches long, 1 inch diam.
	1 socket; Birnbach type 434.
	1 socket; Birnbach type 435.
	2 socket assemblies; UT103.
	1 switch, SPST 30-amp.
	2 switches.
	1 switch; circuit-breaker, 25-amp.
	4 bars, HD plug.
	4 spacers; ceramic for amplifier tank coils.
1	Shelter HO–17; mobile.
1	Speech Amplifier BC–614–( ); includes:
	2 Lamps LM–27; 1 in use, 1 running spare.
	4 Tubes JAN–80; 1 in use, 3 running spares.
	7 Tubes JAN–6J5; 2 in use, 5 running spares.
	3 Tubes JAN–6SQ7; 1 in use, 2 running spares.
	10 Tubes JAN–6SN7GT; 3 in use, 7 running spares.
	3 Tubes JAN–6SR7; 1 in use, 2 running spares.
	1 shock mounting.
2	Stakes GP–8; for grounding connections, 1 in use, 1 running spare.
3	Straps ST–19–A.
2	TM 11–602.

Quantity	*Article*
2	TM 11–281.
1	Telephone EE–8–B.
2	TM 11–333.
1 set	Tools and repair equipment, includes:
	1 can carbon tetrachloride.
	1 Flashlight TL–122–C.
	1 Hammer TL–39.
	1 Hydrometer HY–2.
	1 Knife TL–29.
	1 can machine oil, 12-oz.
	2 pr pliers, gas, 6-inch.
	1 pr Plier TL–103, diagonal, 5-inch.
	1 Screwdriver TL–21.
	1 Screwdriver, common, heavy-duty, integral handle, 6-inch.
	1 lb Solder M–31, rosin core.
	1 Soldering Iron TL–120.
	3 rolls Tape TL–83.
	1 roll Tape TL–192.
	1 wrench, 8-inch, adjustable, crescent, single-end.
	4 solder lugs, No. 550.
	4 solder lugs, No. 331.
	4 solder lugs, No. 2045.
15 ft	Wire; No. 18, black.
15 ft	Wire; No. 18, stranded red.
15 ft	Wire; No. 18, stranded blue.
15 ft	Wire; No. 18, stranded yellow.
15 ft	Wire; No. 18, stranded green.
15 ft	Wire; No. 18, stranded brown.
15 ft	Wire; No. 14, solid tinned.
1	Torch TL–130.
15 ft	Wire W–28.
2 reels	Wire W–110–B on 2 Reels DR-4.

b. OPERATING SHELTER. The operating shelter and its contents are new components as far as Radio Set SCR–399–( ) is concerned. Components added to Radio Set SCR–399–( ) to provide the operating shelter for Radio Set AN/MRC–1 are:

Quantity	*Article*
10	Battery BA–30; 4 in use, 6 running spares.
100	Blotter; white, 3 x 9½ inches basis 80.
2	Bottle; glass, amber, 1 qt, approximate size 3¾ x 2¾ x 8⅜ inches rectangular with screw cap.
3	Box BX–19–A; for spare receiving tubes, fuses, and lamps.
1	Box CY–102/MRC–1; receptacle for inked teletype tape.
1	Box CY–201/MRC–1; for keying heads.
1	Box CY–202/MRC–1; for spare ink recorder.
1	Box CY–203/MRC–1; for drying fluid, oil, and ink bottles.
1	Box CY–326/MRC–1; for accessories.
50 ft	Braid; ⅜-in. No. 1232.
2	Bridge; tape, includes: two instruction books for tape bridge.
1	Broom; floor.
1	Brush; bench.
10	Bulb; 50/60-watt, 115-volt, screw-type base, 4 in use, 6 running spares.

Quantity	*Article*
1	Cabinet CY–99/MRC–1; large wall cabinet.
1	Cabinet CY–100/MRC–1; double storage cabinet.
1	Cabinet CY–101/MRC–1; single storage cabinet.
1	Case CY–103/MRC–1; message form holder.
2	Chair; folding, metal.
3	Chair; swivel, metal.
3	Chest CH–56; for Radio Receiver BC–342–( ).
8 yd	Cheesecloth; dusting.
1	Connector; 30-amp, 250-volt, 2-pole.
2	Cord CD–135–A; 1 in use, 1 running spare.
3	Cord CD–307–A.
4	Cord CD–314–A; 3 in use, 1 running spare.
4	Cord CD–370; 3 in use, 1 running spare, receiver to ac.
2	Cord CG–146/MRC–1; 2 ft 0 in., receiver to antenna feed-through insulator.
1	Cord CG–146/MRC–1; 3 ft. 8 in., receiver to antenna feed-through insulator.
2	Cord CX–147/MRC–1; 1 in use, 1 running spare, receiver to junction box.
2	Cord CX–148/MRC–1; 1 in use, 1 running spare, ink recorder to d-c line and junction box.
1	Cord CX–285/MRC–1; power.
2	Cover CW–34/MRC–1; for Typewriter MC–88 and tape bridge.
2	Cover CW–35/MRC–1; for tape puller with reel and rewind assembly.
1	Cover CW–36/MRC–1; for tape puller.
1	Cover CW–37/MRC–1; for ink recorder and tape reel.
1	Cover CW–38/MRC–1; for teletype.
1	Cover CW–39/MRC–1; for keying head and drive.
2 pts	Drying fluid; for high-speed ink recorder, in glass bottle, approx 2½ x 2½ x 6¼ in.
6	Erasers; typewriter.
2	Filter F–13/MRC–1; key click.
1	Fire extinguisher; 4-lb size, carbon-dioxide type, Alfite No. 48, complete with holder.
1	Funnel; plastic.
6	Fuse, cartridge, 10 amp; spare for rectifier.
1	Ground Rod GP–26.
3	Headsets HS–33–U.
1	Heater; electric, 1,500-watt, 115-volt.
3	Holder, message, WE type 5B or equal; 2 in use, 1 running spare.
8 capsules	Ink powder; blue, for ink recorder.
12	Insulator; feed-through for receiver antenna, 9 in use, 3 running spares.
3	Jack JK–33–A; running spares.
3	Jack JK–34–A; running spares.
3	Key J–47; 2 in use, 1 running spare.
1	Key ring and chain; with snap hook, to hold pen cleaners.
1	Keying head drive.
2	Keying heads; 1 in use, 1 running spare, complete with the following: 1 biasing key 1 contact wrench. 1 feeler gauge. 1 punch. 1 spring tension wrench. 1 tommy bar. 2 contact screw assemblies. 2 gaskets, front cover. 4 pecker pins.

Quantity	*Article*
	2 spring toggles.
	2 screws, machine.
	1 tongue contact.
	1 bearing pin.
	4 springs, pecker pin, hard.
	2 toggle blocks.
	1 bottle of oil, SAE #20.
1	Keying amplifier, complete with the following:
	8 Tubes JAN–42; 4 in use, 4 running spares.
	4 Tubes JAN–82; 2 in use, 2 running spares.
	2 Tubes JAN–84; 1 in use, 1 running spare.
2	TM 11–377.
1	Lamp; trouble, 115-volt, with 25-ft extension cord, includes: 1 bulb; 50-watt, 115-volt, screw-type base.
3	Loudspeaker LS–3.
6	Mounting FT–178; for receiver.
2	Mucilage; 4-oz bottle.
2	Oil; furnished in 4-oz bottle, approx 4⅜ x 1⅝ in. square.
1	Operating Table MT–213/MRC–1.
1	Operating Table MT–214/MRC–1.
200	Paper clip No. 1.
1 pkg	Paper; carbon
3 doz	Pencil M–139.
1 gross	Pencil M–140.
4	Plug PL–55; running spare.
4	Plug PL–68; running spare.
1	Potentiometer, Boehme Type 4–D–129, or equal; running spare for keying head drive.
3	Radio Receiver BC–342–( ).
2	TM 11–850.
2	Recorder; ink, tape, high-speed, 1 in use, 1 running spare, complete with the following:
	1 coil, moving.
	6 arms, pen, complete.
	2 hose, rubber.
	2 hose, rubber.
	6 pens.
	2 bearing, jewel, small bore.
	1 bearing, jewel, large bore.
1	Rectifier; power unit, includes the following:
	2 instruction books for G.E. rectifier.
	1 fuse; cartridge, 10-amp.
	3 bulbs; rectifier, 1 in use, 2 running spares.
5	Ribbons, typewriter, 5 running spares.
1	Shelter HO–17 or Shelter HO–27.
1 set	Spare parts for ink recorder; includes:
	4 screws.
	6 pen cleaners.
2	Skid; wooden, for loading and unloading shelters.
10,000	Standard form No. 14–A; telegram, large 8 x 10½ in.
100	Standard form SC–No. 138.1; revised 1942, operator's received number sheet.
300	Standard form SC–No. 138.2; revised 1942, operator's sent number sheet.
1 pad	Standard form SC–No. 158; route delivery list.
1 pad	Standard form SC–No. 160; local delivery list.

Quantity	*Article*
2	Switch; foot-controlled, contact closed when pressed, single-circuit.
350 rolls	Tape; paper, white, 15/32 in. wide.
400 rolls	Tape; paper, white, ⅜ in. wide, ungummed.
3	Tape puller, includes: 1 set motor brushes, 1 running spare. 1 potentiometer, IRC–PR–50, 1 running spare.
2	Tape rewinder reel attachment assembly.
1	Tape reel; modified.
1	Telephone EE–8–B.
2	Wheatstone perforator; 4TWPE3/1SS with standard communication key board, complete with the following: (1 in use, 1 running spare) 2 punching die assemblies, 1 in use, 1 running spare. 1 silencing cover. 1 kit of tools; including the following: 1 open-end wrench, ½ x ¾ in. 1 open-end wrench, ⅜ x 7/16 in. 1 open-end wrench. 1 socket wrench.
2	TM 11–602.
2	TM 11–333.
1	Tool Equipment TE–48 or Tool Equipment TE–113.
1	Transformer; matching, 4,000-ohm primary, 500-ohm secondary, 3-watt capacity.
1	Tube JAN–82; spare for recorder driving unit.
1	Tube JAN–84; spare for recorder driving unit.
2	Typewriter MC–88; complete with the following: 1 accessory box. 1 desk mounting plate; right (63226). 1 desk mounting plate; left (63225). 1 type brush. 1 typewriter cleaning brush. 4 frame support screws. 4 rubber fastening screws, special for ½-in. extension. 2 instruction books for Typewriter MC–88.
2	Waste basket; office type.
15 ft	Wire No. 18, black.
15 ft	Wire No. 18, stranded red.
15 ft	Wire No. 18, stranded blue.
15 ft	Wire No. 18, stranded yellow.
15 ft	Wire No. 18, stranded green.
15 ft	Wire No. 14, solid-tinned as made by Belden Co.
20 ft	Wire No. 6 AWG, stranded conductor-insulated, braided.
25 ft	Wire No. 14 AWG, 2-conductor, stranded, 30% rubber-insulated, 40% rubber jacket overall.

c. Power Units. Three Trailers K–52–( ) are provided complete with three Power Units PE–95–( ). One unit is towed by the operating shelter truck, one by the transmitting shelter truck, and the third, a running spare, is towed by the third truck.

(1) *Transmitting shelter.* 2 Trailers K–52–( ); with two Power Units PE–95–( ), 1 in use, 1 running spare.

(2) *Operating shelter.* 1 Trailer K–52–( ); withPower Unit PE–95–( ).

d. Antenna Systems. The following antenna systems are normally carried by the third truck.

(1) *Transmitting location, Antenna System AS–95( )/MRC–1.*

Quantity	*Article*
6	Antenna Support AB–38( )/CR.
1	Chest CY–107( )/MRC–1.
3	Cord CG–145/MRC–1; 2 in use, 1 running spare.
50	Connector.
24	Insulator; pyrex 7¼ in. long.
4	Insulator IN–86; running spares.
1	Tape; steel, measuring, ⅜ in. wide, 100 ft., graduated in inches and feet.
2,500 ft.	Wire W–28; with reel.

(2) *Operating Location, Antenna System AS–94( )/MRC–1.*

2	Chest CY–105( )/MRC–1.
8	Guy GY–22–A; 6 in use, 2 running spares.
6	Guy GY–24–A; 4 in use, 2 running spares.
8	Guy plate; 6 in use, 2 running spares.
2	Hammer, sledge, 6-lb., double-face, with handle.
8	Insulator IN–86; 4 in use, 4 running spares.
4	Mast Base MP–19; 3 in use, 1 running spare.
24	Mast Section MS–44–A; 18 in use, 6 running spares.
2	Reel RL–29.
24	Stake GP–2; 18 in use, 6 running spares.
400 ft.	Wire W–29.

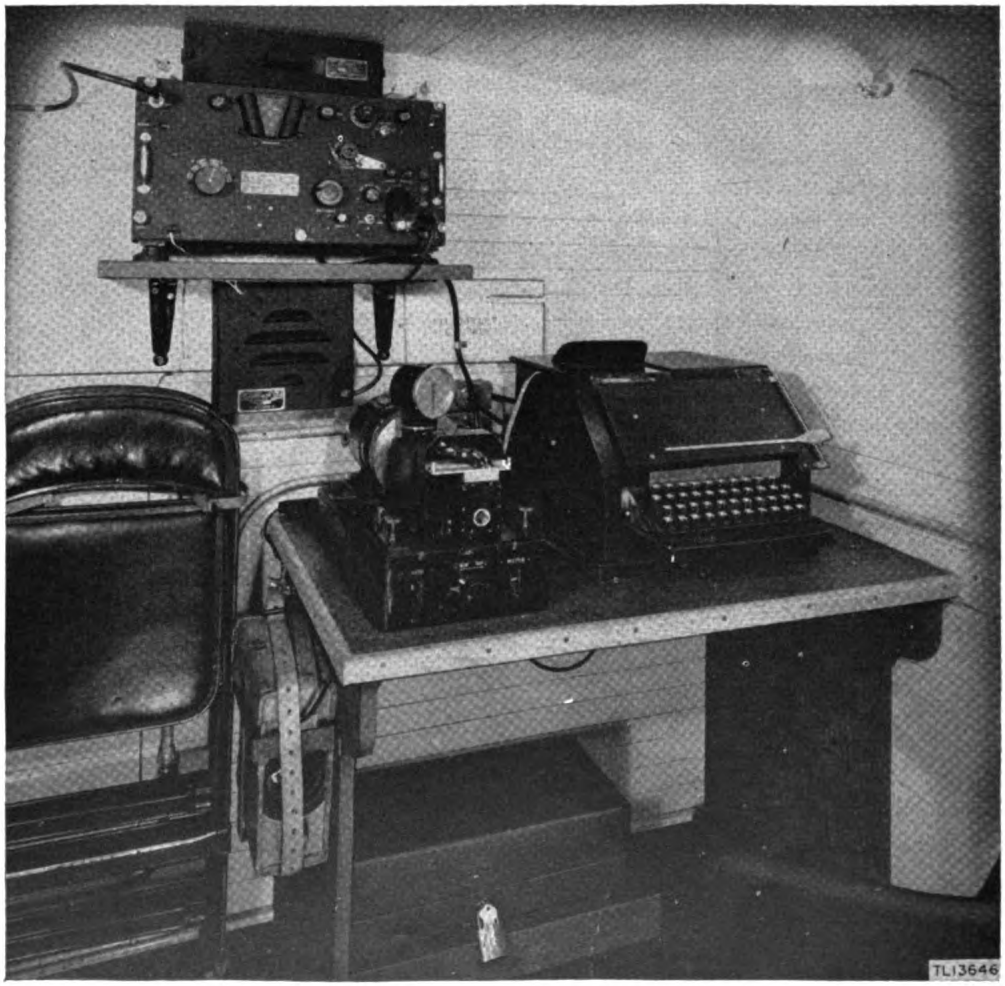


Figure 9. Radio Set AN/MRC–1—transmitting table.

6. Packaging Data

No. of cases	Item	Unit weight (lb)	Total weight (lb)	Dimensions	Approximate unit cu displ (cu ft)	Approximate total cu displ (cu ft)
1	Shelter HO–17, Transmitting	8,105	8,105	13′2″ x 7′6½″ x 6′5″	643.5	643.5
1	Shelter HO–17, operating	7,365	7,365	13′2″ x 7′6½″ x 6′5″	643.5	643.5
3	Power Unit PE–95–( )	4,965	14,895	6′4½″ x 9′ x 6′4½″	362.7	1,088
6	Antenna System AS–95( )/MRC–1	350	2,100	8′4″ x 1′5″ x 1′5″	19	114
1	Antenna gear	280	280	21″ x 46″ x 20″	11	11
1	Battery electrolyte	200	200	2′ x 2′2″ x 1′6″	6.5	6.5
Total 13			32,945			2,506.5

7. Transmitting Shelter

The transmitting shelter consists of Shelter HO–17 with the transmitting shelter components mounted inside. (See par. 5 and fig. 1.)

a. Housing. For information on Shelter HO–17 see instruction leaflet for Shelter HO–17.

b. Radio Transmitter T–62( )/MRC–1. Radio Transmitter T–62( )/MRC–1 is mounted in the front left side of the transmitting shelter. The transmitter has been moved to the left from its position in Radio Set SCR–399–( ). Antenna Tuning Unit BC–939–A is mounted on top of it.

c. Power Amplifier AM–35( )/MRC–1. Power Amplifier AM–35( )/MRC–1 is mounted in the front right of Shelter HO–17 next to Radio Transmitter T–62( )/MRC–1.

d. Chest CH–120–A. Chest CH–120–A is mounted on the left middle of the housing. The chest contains Junction Box JB–70–A, Speech Amplifier BC–614–E, and Radio Receiver BC–312–( ).

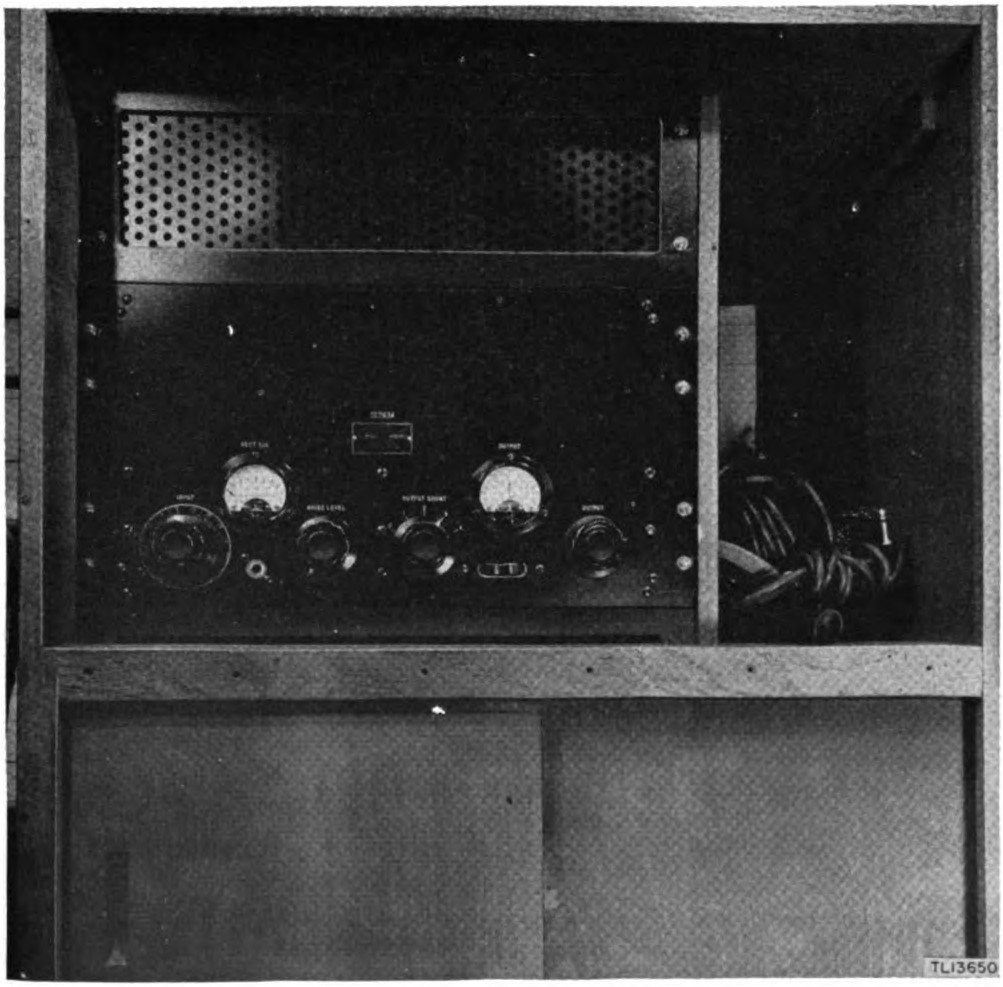


Figure 10. Radio Set AN/MRC–1—recorder driving unit.

8. Operating Shelter

The operating shelter consists of Shelter HO–17 with the operating shelter components mounted inside. (See par. 5 and fig. 2.)

a. Housing. For information on Shelter HO–17 see instruction leaflet for Shelter HO–17.

b. Receivers. Two Radio Receivers BC–342–( ) with Loudspeakers LS–3 mounted beside them are mounted on the left wall of Shelter HO–17. The third receiver is mounted on the front wall with its speaker mounted underneath the receiver.

c. Receiving Table. Table MT–213/MRC–1 is permanently installed along the left wall of the shelter. It holds the typewriters, tape bridges, tape pullers, and high-speed ink recorder. (See fig. 2.)

d. Transmitting Table. Table MT–214/MRC–1 is permanently installed along the right front of the shelter. It holds the teletype tape perforator and the keying head and keying head drive. (See fig. 9.)

e. Recorder Driving Unit. The recorder driving unit is mounted in the cabinet on the right-hand wall of Shelter HO–17.

Section II. INSTALLATION

9. Unpacking New Equipment

Unpack the equipment carefully and inspect it for possible damage during shipment. Check all components against the list indicated in paragraph 5 to determine if quantities and types are correct. This list is supplied as a guide and should not be used as a basis for issue. Radio Transmitter T–62( )/MRC–1 is shipped with all tubes, coils, and tuning units, packed separately and without crystals. In checking equipment see TM 11–281, 11–904G, 11–904H, 11–377, 11–300, 11–333, and 11–850. Both shelters are packed with 200 pounds of silica gel for moistureproofing.

10. Transmitting Shelter

Remove bracing, sides, and seals from around Shelter HO–17. Remove tape and seals from doors and cracks. Open door in back of housing and remove all shoring inside housing. Follow procedure given in TM 11–281. Remove silica gel.

a. Remove all wrapping from the transmitter and power amplifier.

b. Unpack Antenna Tuning Unit BC–939–A which is strapped to the seat chest. Mount it on top of Transmitter T–62( )/MRC–1.

c. Unpack the mast bases, mast brackets, and bumper clamp which are also strapped to the seat bench. Mount the mast bases and mast brackets according to the directions in TM 11–281. Do not mount a curbside receiving antenna mast bracket or base.

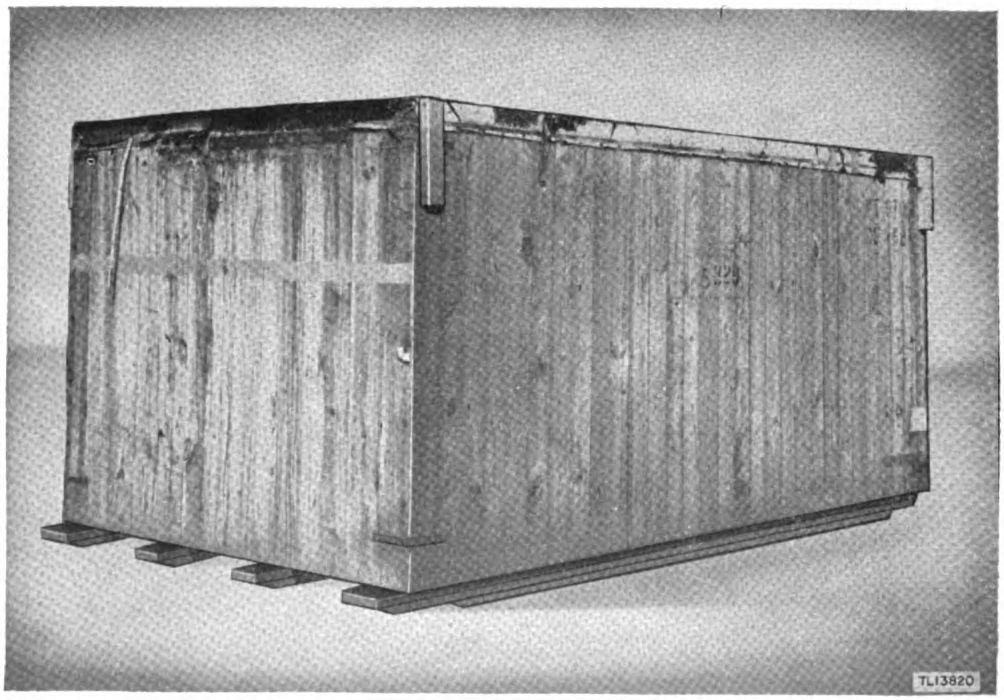


Figure 11. Radio Set AN/MRC–1—exterior view, transmitting shelter, packed for overseas shipping (crated operating shelter identical).

d. Check battery found in Chest CH–109–A. Unpack electrolyte and charge battery as described in TM 11–281.

e. Connect cording as shown in figure 50 and TM 11–281.

doors and cracks. Open door in back of housing and remove all shoring inside housing. Remove silica gel.

a. Remove all wrappings from typewriters, Boehme equipment, etc.

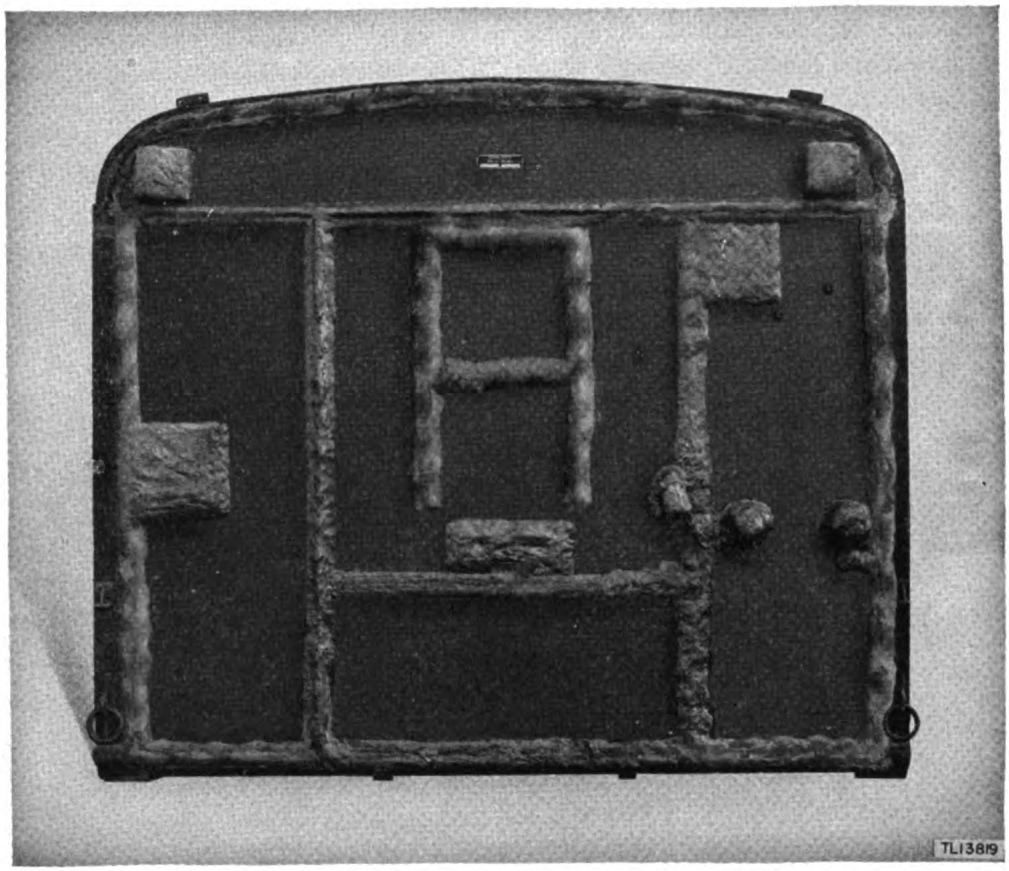


Figure 12. Radio Set AN/MRC–1 exterior view, transmitting shelter, crate removed (operating shelter same).

f. If shelter is not on a truck and mobility is desired, mount Shelter HO–17 on a 2½-ton, 6 x 6, cargo truck as shown in TM 11–281.

g. Connect bumper bracket to left rear bumper and clamp Cord CD–335 to bumper bracket.

h. Hook one power unit on transmiter truck and spare unit on antenna truck.

i. Connect Cord CO–316 to receptacle in bumper bracket.

j. Unpack tubes and place them in Radio Transmitter T–62( )/MRC–1 and Power Amplifier AM–35( )/MRC–1. (See par. 90.) Tubes are shipped installed in the receiver.

k. Remove packing from all chests and boxes.

11. Operating Shelter

Remove bracing, sides, and seals from Shelter HO–17. (See fig. 13.) Remove tape and seals from

b. Remove chests strapped to floor of shelter.

c. Remove receivers from chests and mount them in place provided. (See fig. 2.)

d. Check and assemble all Boehme equipment. (See TM 11–377.)

e. Open chest and cabinets and remove all packing.

f. Connect cording as shown in figures 47, 48, and 49.

g. If mobility is desired, place Shelter HO–17 on a 2½-ton, 6 x 6, cargo truck as described for Shelter HO–17 in TM 11–281.

h. Attach bumper bracket to bumper and connect power unit.

i. Antenna system AS–94( )/MRC–1, usually carried by the third truck, is strapped to the floor of Shelter HO–17 and after unpacking should be placed in the third truck.

12. Power Unit PE-95-( )

Three Power Units PE–95–( ) come packed separately. For unpacking and installation instructions see TM 11–904G or 11–904H. The power units will probably come with batteries installed but if they are shipped less batteries, the batteries will be found in a separate wooden case. The batteries should be unpacked in that case and handled as if they were installed in the power unit. It is merely necessary to install them in the unit as described in TM 11–904G or TM 11–904H.

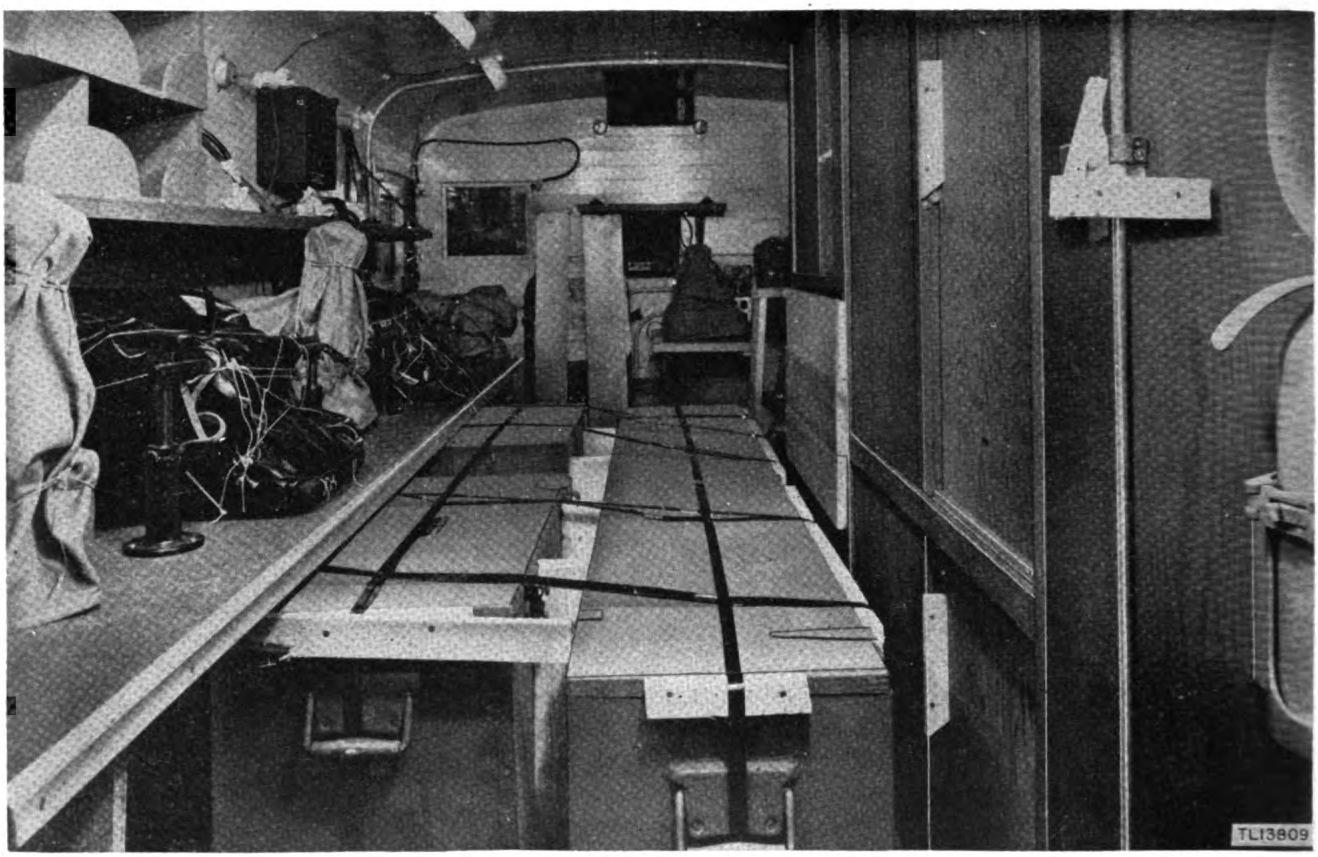


Figure 13. Radio Set AN/MRC–1—operating shelter, interior view, packed for overseas shipping.

13. Battery Electrolyte

Battery acid is packed separately, two cases to a crate. Unpack carefully and proceed to charge batteries which have been shipped dry-charged. (See TM 11–904G, TM 11–904H, and TM 11–281.)

Caution: Add acid to water slowly and stir well with a glass rod. Do not add the water to the acid. Adding concentrated acid to water causes excessive heat to be generated and there is danger of the acid splattering and causing serious acid burns.

Note. If distilled water is not available, rain water that has not touched metal can be used. If neither is available, *pure, clean* drinking water can be used, but only as a last resort. Any tight nonmetallic container can be used for mixing acid. Two possible expedients are: old storage battery cases with the cell dividers knocked out; or a tight wooden box which has been soaked in clean water overnight to swell and close the seams.

14. Antennas

Antenna system AS–95( )/MRC–1 is packed in six cases containing the antenna system and one case containing the antenna gear. Unpack the cases carefully, taking care not to lose small parts. The antenna gear is packed in chest CY–107( )/MRC–1 which is kept in the third truck. Remove the receiving Antenna System AS–94( )/MRC–1 from Shelter HO–17 and unpack it. Place the spare units in the third truck.

15. Antenna System AS-95 ( )/MRC-1

The necessary wire, insulators, connectors, coaxial feed line, and masts are furnished to construct two doublet transmitting antennas. Three masts are used to support each antenna; the center mast supports the weight of the transmission line. (See fig. 7.) Antenna System AS–95( )/MRC–1 is made up of sections which can be connected together by

jumpers allowing preselection of various lengths for operating on different frequencies. (See fig. 14.) Before erecting the antenna it will be necessary to decide on the lengths desired for the various sections. This is done as follows:

a. Antenna System AS–95( )/MRC–1 is a half-wave doublet designed to operate on the fundamental frequency or any odd harmonic of the fundamental frequency. Figure 15 is a graph of frequency plotted against length showing the fundamental, third, fifth, and seventh harmonics.

b. By referring to figure 15, select the proper antenna lengths for the operating frequencies to be used when transmitting.

Example: Assume that operation is desired with one antenna on frequencies of 2,500, 2,650, 2,900, and 3,900 kc (kilocycles). By referring to the graph it will be found that these frequencies require antenna lengths of 187, 177, 161, and 120 feet respectively.

c. The shortest length antenna must be constructed first. In the case of the above example the shortest antenna is the 120-foot, 3,900-kc antenna.

d. Divide the length of the shortest antenna in half. In the example this would be $120 \div 2 = 60$ feet. The antenna now consists of two quarter-wave sections. Connect the quarter-wave sections together at the center with the coxial cable terminating block. Connect insulators on the outer ends of the antenna sections. Leave sufficient wire on the ends to act as insulator jumpers. Do this for all sections.

e. Select the next shortest length antenna desired. In the example this is the 161-foot, 2,900-kc antenna. Subtract the length of antenna already constructed from this new length. Divide this result in half and connect the sections to the insulators on each end of the antenna. The result will be $161 - 120 = 41$ feet. Dividing the result in half gives $41 \div 2 = 20.5$ feet. Add 20.5 feet to the end of each of the previously constructed 60-foot antenna sections. Be sure there is an insulator between the two sections.

f. Repeat the above operation for the next size antenna. Connect the two sections, by means of insulators, to the antenna. In the example the next antenna is the 177-foot, 2,650-kc antenna. Subtracting the two antenna lengths gives $177 - 161 = 16$ feet. Dividing the result by 2 gives $16 \div 2 = 8$

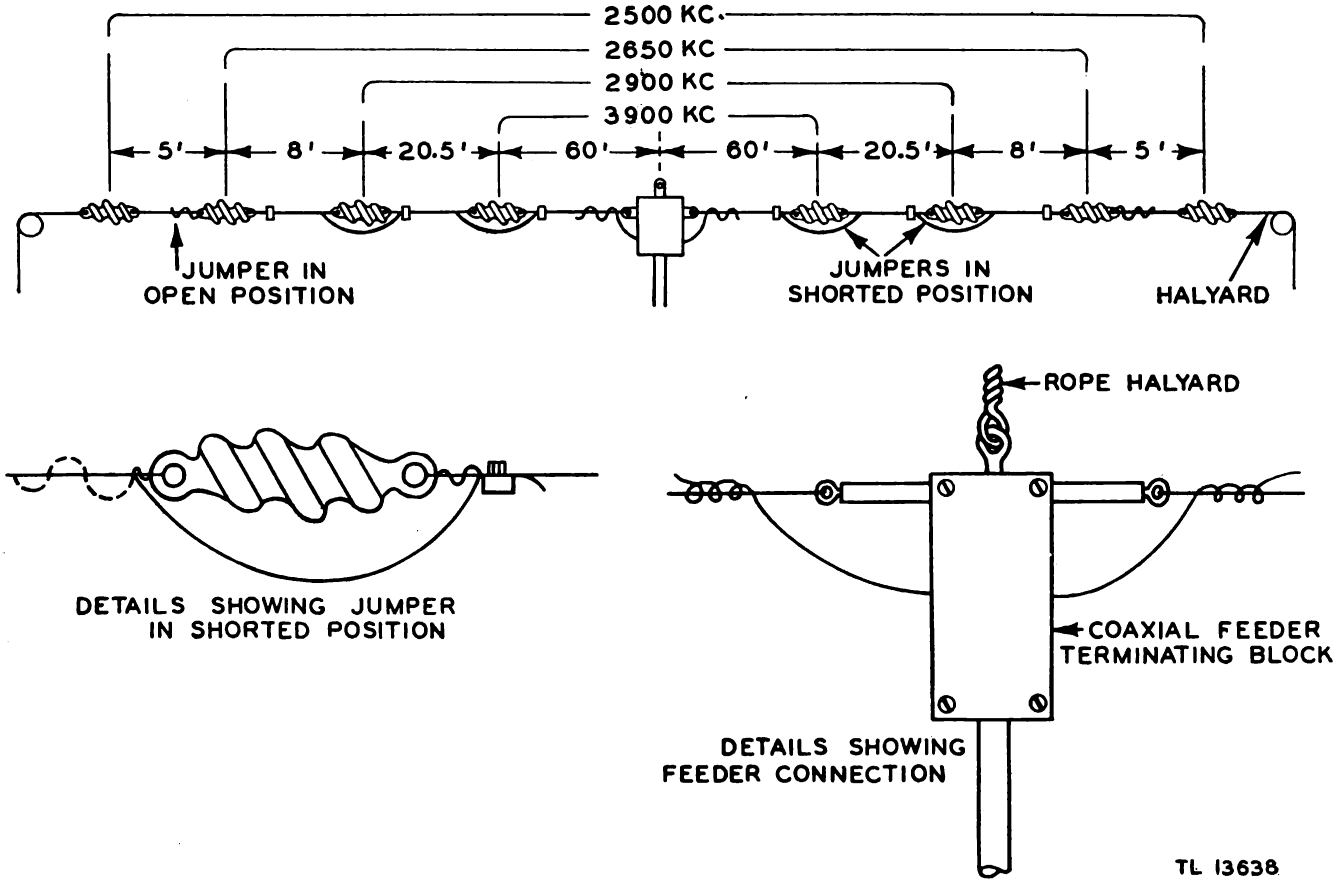


Figure 14. Radio Set AN/MRC–1—transmitting antenna connections.

feet. Add 8 feet to each end of the antenna system, remembering to connect these lengths to the insulators and not directly to the antenna.

g. For the 187-foot, 2,500-kc antenna, subtract and divide as follows: 187 — 177 = 10 feet; 10 ÷ 2 = 5 feet. Add 5 feet to each end of the system.

h. The various antenna lengths may now be selected by the use of jumpers across the various

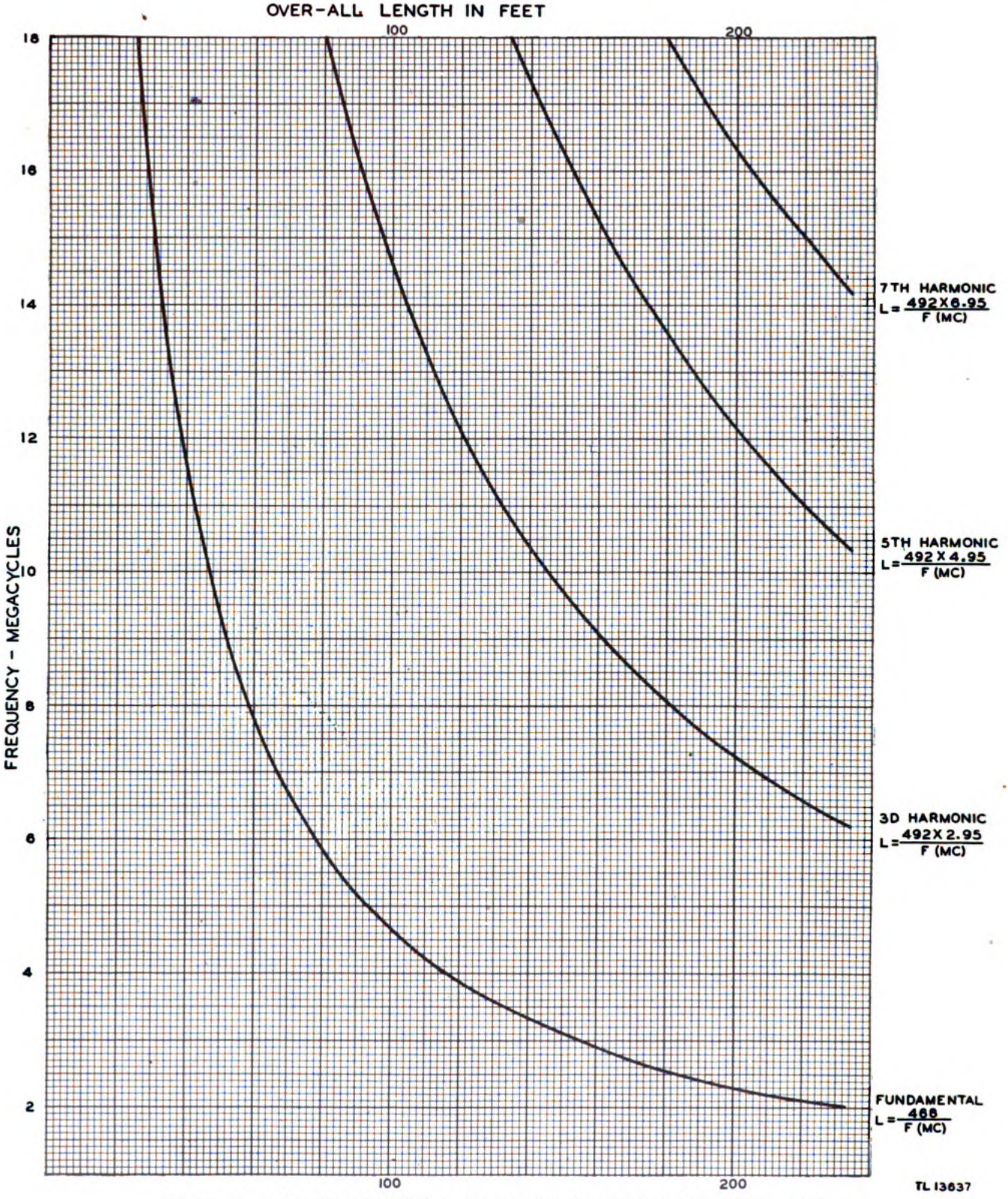


Figure 15. Radio Set AN/MRC–1—frequency vs. length chart of doubtlet antenna.

insulators. (See fig. 14.) Each antenna length selected will operate on the fundamental and odd harmonics of the fundamental of the frequency the antenna is cut for. In the example the antenna will be the correct length for the following frequencies:

Fundamental (kc)	3d harmonic (kc)	5th harmonic (kc)
2,500	7,800	13,000
2,650	8,250	13,800
2,900	9,000	15,100
3,900	12,100	Above 18,000

Note. See figure 15 for formulas to calculate harmonics.

i. The actual length of the antenna for any one frequency will deviate slightly from the length found on the frequency vs. length graph, depending upon the height of the antenna above ground, condition of the ground, and the proximity of trees or other large objects. The resonant frequency of an antenna can be found by tuning to either side of the frequency the antenna is cut for. The frequency giving the highest plate current reading on the p-a (power-amplifier) meter for a fixed value of coupling will be the resonant frequency of the antenna.

j. Tests made with the doublet antenna indicate a 2½ percent deviation from the resonant frequency may be tolerated without noticeable effect on the signal strength.

16. Antenna System AS-95( )/MRC-1, Erection

Erect the antenna masts as described in the instruction book packed with the antenna. Erect the masts approximately 20 to 30 feet farther apart than the maximum antenna length desired, with the center mast at the midpoint. Simultaneously hoist the antenna wires up the outer poles and the coaxial terminating block up the center pole. Be sure the antenna wires are connected to the terminating block before hoisting the antenna. Tie-off the coaxial lead-in in order to put less lateral strain on the center mast.

17. Antenna System AS-94( )/MRC-1

The necessary wire, insulators, connectors, and masts are furnished to construct two flattop receiving antennas. The two antennas are erected at right angles to each other to allow selection of the direction giving greatest signal strength. (See fig. 6.) Antenna System AS–94( )/MRC–1 is a flattop antenna designed to operate as a receiving antenna on all frequencies covered by Radio Set AN/MRC–1. It consists of a 75-foot long, 30-foot high horizontal wire antenna. Two antennas are usually erected at right angles to each other with one pole being a common mast. The lead-ins from each antenna should be near this common mast. (See fig. 6.)

18. Antenna System AS-94( )/MRC-1, Erection

a. Select positions for antenna masts keeping the masts approximately 90 feet apart. Remember the antennas are at right angles to each other with both lead-ins at the common mast so that the maximum signal strength is obtained broadside.

b. Place the base plate in the desired mast position remembering to keep the base sleeve pointed

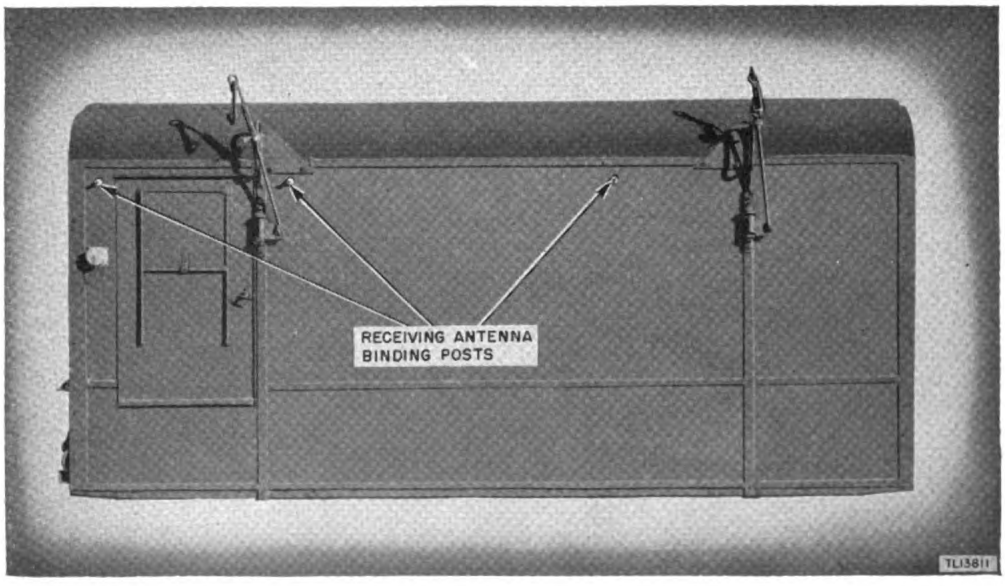


Figure 16. Radio Set AN/MRC–1—receiving antenna binding posts.

in the direction the antenna will run. Select either antenna direction for common mast.

c. Fasten the base plate to the ground by means of two ground stakes. (See fig. 17.)

d. Assemble six Mast Sections MS–44–A at each mast position. Place one guy plate between the first and second sections and one on the top sections. (See fig. 18.)

e. Slip the first mast section over the mast base sleeve. Point the masts in the direction of the

Figure 17. Radio Set AN/MRC–1—receiving antenna base plate.

antenna. The common mast may point in the direction of either antenna.

f. Starting at each mast base plate and facing along the mast sections, pace-off 20 feet at an angle of 45° to either side of the mast sections and place a ground stake at each position. Turn around and, starting at the plate, pace-off 20 feet at an angle of 45° with an imaginary back-projection of the mast sections. Place a ground stake at each position.

Figure 18. Radio Set AN/MRC–1 —receiving antenna mast assembly.

The stakes should form a square with 40-foot diagonals and the mast base plate on the intersection of the diagonals. (See fig. 19.)

g. Drive the stakes in about 6 to 8 inches with the bottoms of the stakes pointing towards the mast base plate.

h. Unreel two Guys GY–22–A at each mast position.

i. Clip the tops of the guys to the top guy plate. (See fig. 20.) Keep one complete guy in the back and one in the front of the masts. The guy plates have five holes in them, four of which form a square. Clip the front guy in the two holes which have the fifth hole between them. The fifth hole should face the direction of the antenna.

j. Unreel one antenna halyard at each mast.

k. Fasten the halyard pulley to the fifth hole.

l. Connect an antenna insulator on the end of each halyard.

m. Fasten one end of each antenna wire to the insulator at its respective outside mast. (See fig. 21.)

n. Pace-off 75 feet of antenna wire and tie the antenna wire at the 75-foot mark to an insulator at the common mast. The wire left hanging will be the antena lead-in.

o. Hook the rings on the back guy of each mast over the rear ground stakes. (See fig. 22.)

p. Hook the rings of the other guys of each mast to the front stakes. Make sure the guys are opened to full length.

q. Pick up the center of the rear guy (ring with clip) and walk towards the mast base plate while another man picks up the top of the pole and walks

toward the base, lifting the mast head-high as he goes. (See fig. 23.)

r. Snap the rear guy clip to the ring between the first two mast sections.

s. Snap the same clip of the front guy to the ring.

t. While one man holds the antenna erect, adjust the length of the guys until the mast is vertical, contains no bows, and guys are taut. (See fig. 24.)

be firmly connected to the ground bolt located on the side of the shelter near the escape door.

20. Auxiliary Antenna

The output of Power Amplifier AM-35( )/MRC–1 may be matched to a doublet antenna or to transmission lines having a surge impedance of 70 to 200 ohms. Output impedance and coupling may be

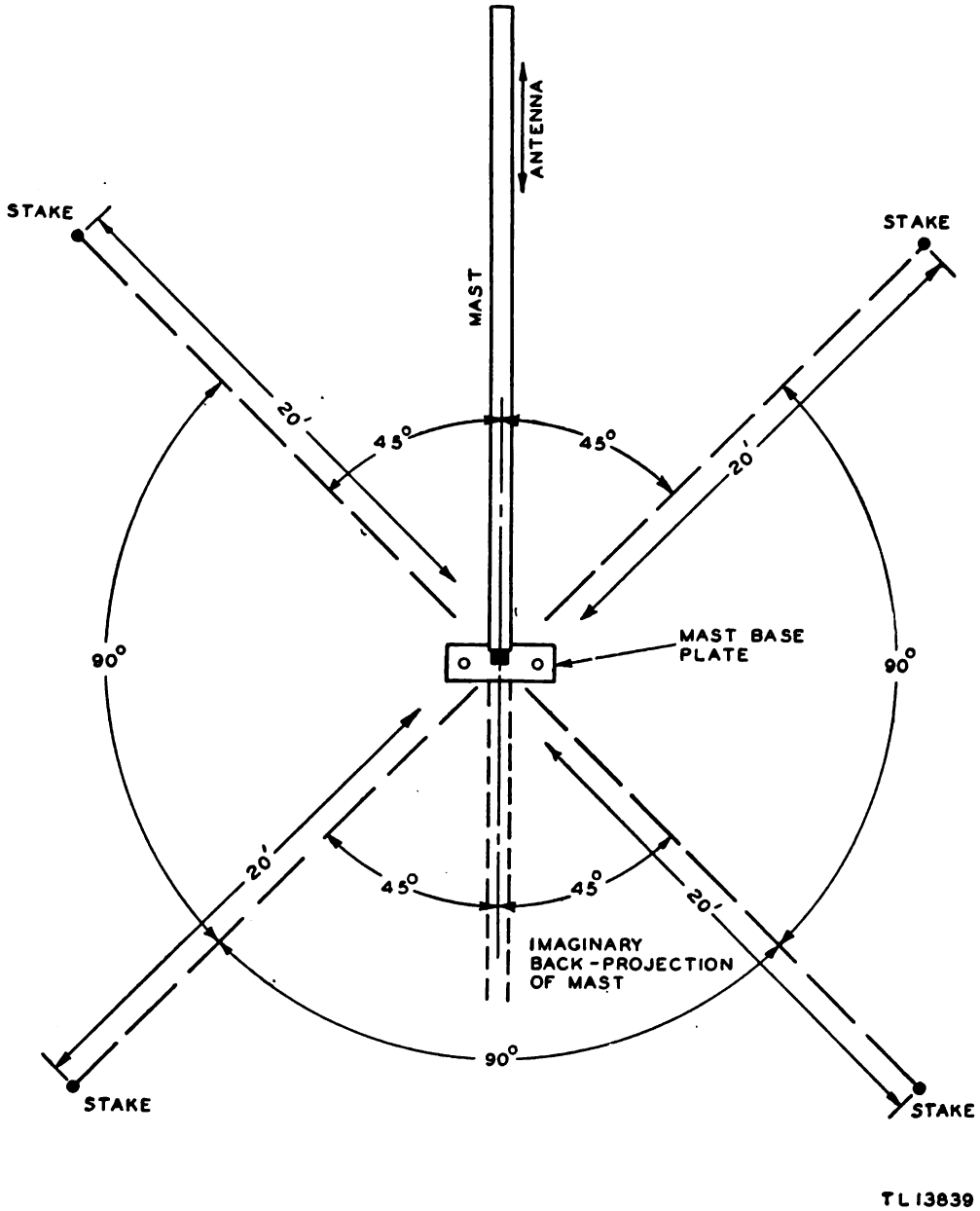


Figure 19. Radio Set AN/MRC–1—receiving antenna stake diagram.

19. Ground Connections

Each shelter is provided with a ground rod and heavy stranded wire. The rod should be driven in the ground as far as practicable and a tight connection made to the grounding wire. The wire should

varied by the rotary link coil within the plate tuning coils.

21. Interconnection of Shelters

Two lines of Wire W–110–B must be connected

between the two shelters. One pair acts as the *telephone pair* and the other as the *transmitting pair.* The telephone pair is used for communication between the two shelters by means of Telephones EE–8–B while the transmitting pair is used to key the transmitter from the operating shelter up to distances of 1 mile.

a. At the operating shelter both pairs are connected to the terminal block mounted on the left side of the transmitting table.

b. At the transmitting shelter the telephone pair is connected directly to the telephone and the transmitting pair is plugged into the KEY jack on Speech Amplifier BC–614–E.

c. It is necessary to observe polarity on the transmitting pair in order to key the transmitter properly. Reversal of the wires will cause the transmitter to be keyed continuously. If the transmitter is keyed continuously, merely reverse the polarity of the transmitting pair.

Figure 20. Radio Set AN/MRC–1—receiving antenna guy clips.

Figure 21. Radio Set AN/MRC–1—receiving antenna wire connection.

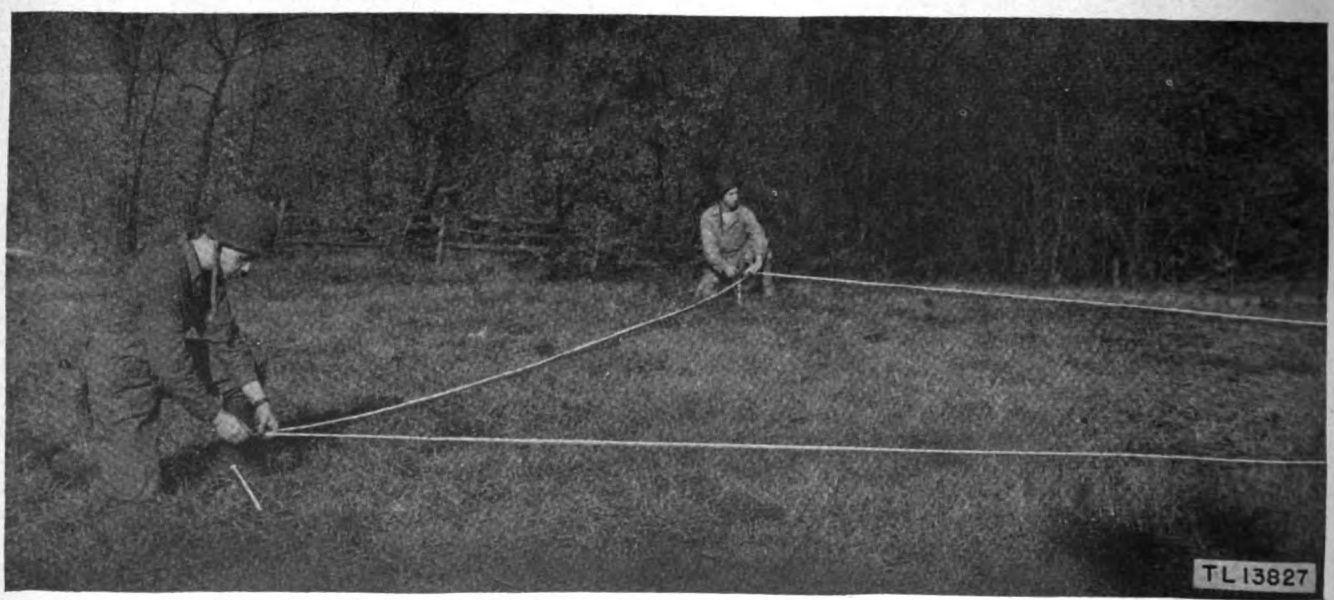


Figure 22. Radio Set AN/MRC–1—receiving antenna guy rings.

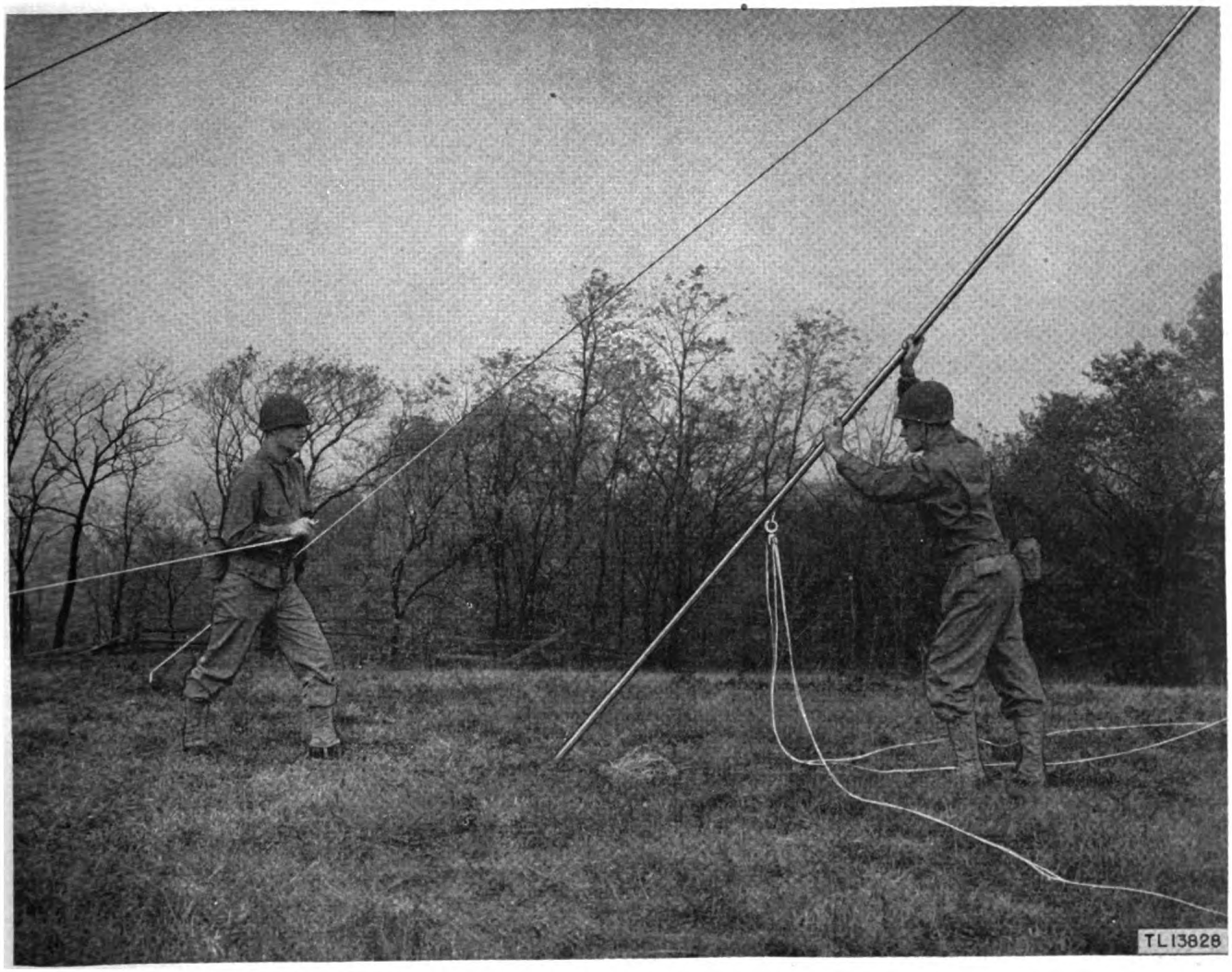


Figure 23. Radio Set AN/MRC–1—receiving antenna erection.

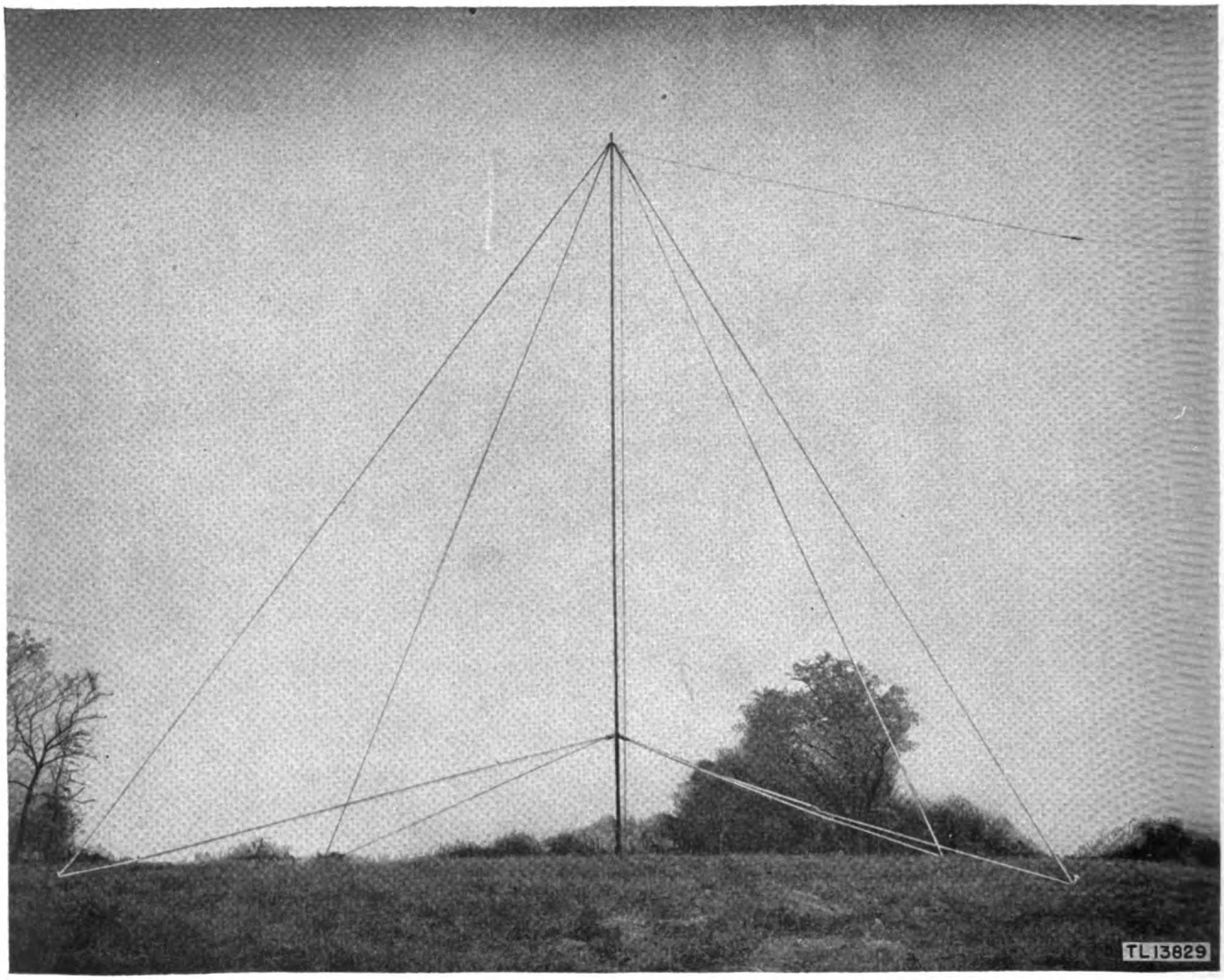


Figure 24. Radio Set AN/MRC–1—receiving antenna erected.

CHAPTER 2

OPERATING INSTRUCTIONS

Section 1. CONTROLS AND THEIR USE

22. Description

The controls of Radio Set SCR–399–( ) are discussed in TM 11–281; the controls of the Boehme equipment are discussed in TM 11–377. The functions of the controls found only in Radio Set AN/MRC–1 are described below.

23. Transmitting Shelter

a. Power Amplifier AM–35( )/MRC–1. (1) *Plate power.* The power amplifier PLATE POWER switch controls the plate power of Power Amplifier AM–35( )/MRC–1. The switch is located on the lower center of the front panel. Throwing the switch ON applies plate power to the amplifier tubes and lights the PLATE POWER pilot lamp located to the right of the switch. (See fig. 5.)

(2) *Normal-tune up.* The NORMAL-TUNE UP switch allows the use of reduced plate power when tuning the amplifier. With the NORMAL-TUNE UP switch in the NORMAL position and the PLATE POWER switch ON, full plate power is delivered. Reduced plate power is delivered with the switch in the TUNE UP position.

(3) *Circuit breaker.* The CIRCUIT BREAKER is located in the a-c (alternating-current) input circuit of the amplifier. It acts as a power on-off switch for the entire amplifier.

(4) *Overload reset.* The OVERLOAD RESET permits resetting of the overload relay after an overload has actuated the relay and cut off the plate power. To reset the relay pull the OVERLOAD RESET handle.

(5) *Increase filament.* The INCREASE FILAMENT control varies the filament voltage to amplifier Tubes JAN–833A as indicated by the FILAMENT VOLTAGE meter located above the control. A pilot light to the left of the CIRCUIT BREAKER indicates the presence of filament voltage.

(6) *Grid tuning.* The GRID TUNING dial varies the capacitance in the tuned grid circuit of the amplifier. Grid current is indicated by the GRID CURRENT meter located directly above the FILAMENT VOLTAGE meter.

(7) *Plate tuning.* The PLATE TUNING dial varies the capacitance in the tuned plate circuit of the amplifier. Plate current is indicated by the PLATE CURRENT meter located above the GRID CURRENT meter.

(8) *Interlock switches.* All doors, panels, etc., contain interlock switches which disrupt the plate power when the door or panel is opened.

(9) *Thermostats.* The power amplifier contains thermostats which allow plate power to come on only when the ambient temperature reaches 65° F., At 80° F., the thermostats turn off the external rectifier heaters.

b. Radio Transmitter T–62( )/MRC–1. The functions of all controls of Radio Transmitter BC–610–E are the same as described in TM 11–281, with the exception of the three components added to provide Radio Transmitter T–62( )/MRC–1. Only those three controls will be described here. (See fig. 4.)

(1) *Key doub-osc.* The KEY DOUB-OSC switch allows the exciter, Radio Transmitter T–62( )/MRC–1, to be keyed either in the oscillator stage or in the buffer-doubler stage. (See par. 71.) Place in KEY DOUB for high-speed operation.

(2) *Variac control.* The VARIAC CONTROL switch at NORMAL applies full pate power to the exciter transmitter. With the switch in the VARIAC CONTROL position the plate power is controlled by the VARIAC.

(3) *Variac.* The VARIAC controls the plate power of Radio Transmitter T–62( )/MRC–1 when the VARIAC CONTROL switch is on VARIAC CONTROL.

24. Operating Shelter

For a description of the Boehme equipment controls see TM 11–377. For a description of the receivers see TM 11–850.

a. Diversity. A switch located on the wall behind the ink recorder provides manual diversity. This switch allows selection of either of the two receivers each of which is connected to one of the two flattop antennas at right angles to each other.

b. Circuit Breaker. A dual circuit breaker is mounted on the rear wall of the shelter directly below the ventilating fan. The inside switch con-

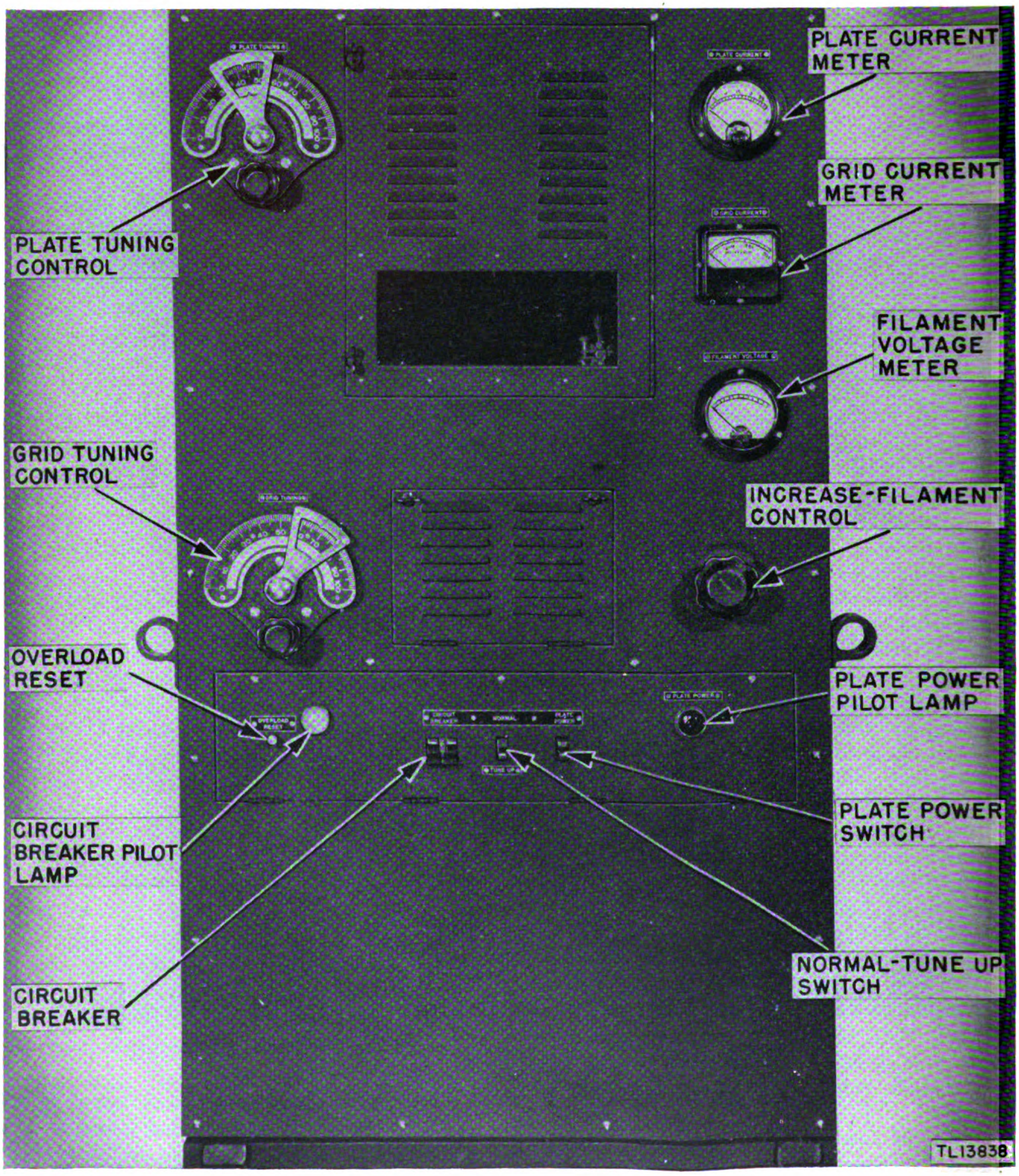


Figure 25. Radio Set AN/MRC–1—amplifier controls.

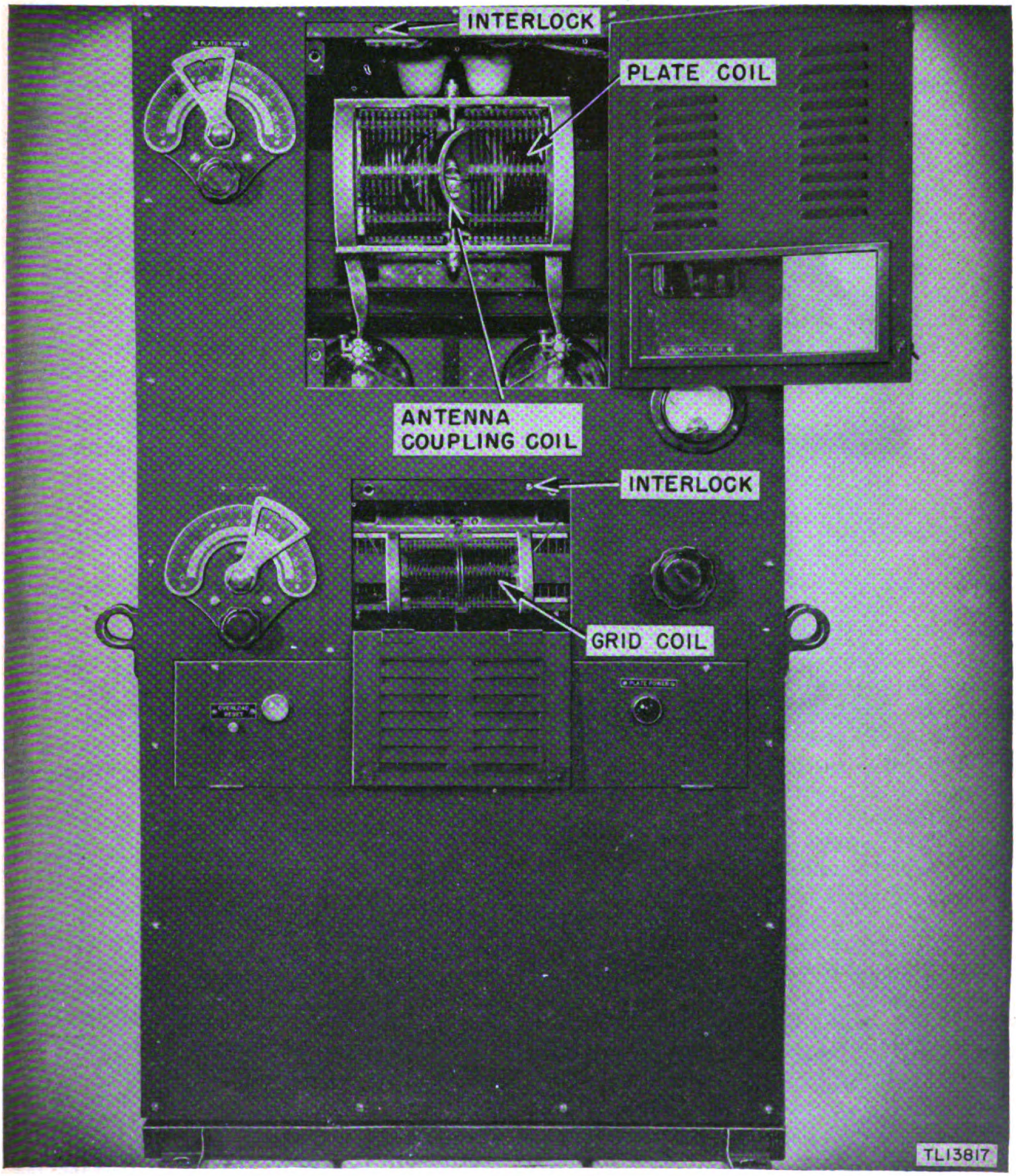


Figure 26. Radio Set AN/MRC–1—amplifier coils.

trols the power to all units except the heater and blower. The outside switch provides power for the heater and blower.

25. Power Units

Descriptions of the controls for the power units may be found in TM 11–904 G or TM 11–904H.

Section II. OPERATION

26. Starting Procedure, Transmitting

When the set has been installed as described in chapter 1, put the set into operation by using the starting procedure below:

a. TRANSMITTING SHELTER. (1) Connect the power unit to the transmitting shelter.

(2) Prepare antenna for frequency desired. (See par. 15.) After erecting (par. 16), connect to transmitting shelter.

(3) Place VARIAC CONTROL switch on the exciter transmitter to VARIAC CONTROL. Do not use VOICE operation with switch in this position.

(4) Check to see that Radio Transmitter T–62( )/MRC–1 is connected directly to the amplifier and not to Antenna Tuning Unit BC–939–A.

(5) Place KEY DOUB-OSC on the desired position. (See par. 71.)

(6) Check to see that Cord CG–65/MRC–1 is connected from the amplifier to the antenna.

(7) Check to see that Tubes JAN–833A are in sockets properly and that all connections are tight.

(8) Check to see that rectifier tubes are in place.

(9) Check neutralization first time set is placed in operation after extended periods of inactivity, after replacement of parts, and after equipment has been subjected to severe vibration in transit. See paragraph 99 for specific instructions on neutralizing power amplifier.

(10) Install required plate tuning coil and tuning unit in Radio Transmitter T–62( )/MRC–1.

(11) Install required plate and grid tuning inductors (see tuning charts) in Power Amplifier AM–35( )/MRC–1. For frequencies between 2 and 2.3 mc, install Vacuum Capacitor CA–423 beneath grid coil. (See fig. 35.)

(12) Start power unit.

(13) Referring to TM 11–281, tune Radio Transmitter T–62( )/MRC–1 to desired frequency. Preset channels and set VARIAC until P.A. PLATE meter reads 100 ma (milliamperes). This will vary across the dial.

(14) Place power-amplifier NORMAL-TUNE UP switch on TUNE UP.

Caution: For initial operation of amplifier or after changing amplifier rectifier tubes, *run in* mercury vapor tubes before applying plate power. For specific instructions see paragraph 91.

(15) Throw Power Amplifier AM–35( )/MRC–1 circuit breaker to ON. This switch actuates the amplifier filaments, relays, and green panel indicator. In approximately 25 seconds the time-delay relay will function, providing bias voltage and energizing the plate-power relay. Adjust FILAMENT-INCREASE control until FILAMENT VOLTAGE meter reads 10 volts.

(16) Set grid and plate tuning dials of Power Amplifier AM–35( )/MRC–1 to approximate readings found in tuning chart.

(17) Tune grid tuning dial of the power amplifier until resonance is obtained as indicated by highest grid current reading on the GRID CURRENT meter.

Note. When tuning the power amplifier, Radio Transmitter T–62( )/MRC–1 must be keyed either by using the hand key or by throwing EXCITER PLATE POWER switch to ON. This latter switch keys the unit continuously. Don't leave the signal on the air longer than necessary. Enemy RDF may plot your position.

(18) If grid current reading is higher or lower than 200 ma, adjust AMPLIFIER EXCITATION ADJUSTMENT (VARIAC) on Radio Transmitter T–62( )/MRC–1 until a reading of 200 ma is obtained on the power-amplifier GRID CURRENT meter.

(19) Open panel to right of PLATE TUNING dial and adjust the antenna coupling coil (located inside the plate coil) to approximately 180° (minimum) coupling, (See fig. 27.) Close panel.

(20) Throw Power Amplifier AM–35( )/MRC–1 PLATE POWER switch to ON.

(21) Tune PLATE TUNING dial on the amplifier for minimum reading on the PLATE CURRENT meter.

(22) Adjust antenna coupling coil a few degrees at a time, each time returning PLATE TUNING dial for minimum reading. Continue this until a maximum reading is found. Always throw PLATE POWER switch OFF when adjusting coupling, but remember to throw switch back ON. Depending on frequency and accuracy of antenna length, a maximum reading of 350 ma should be obtained.

(23) When the maximum reading has been ob-

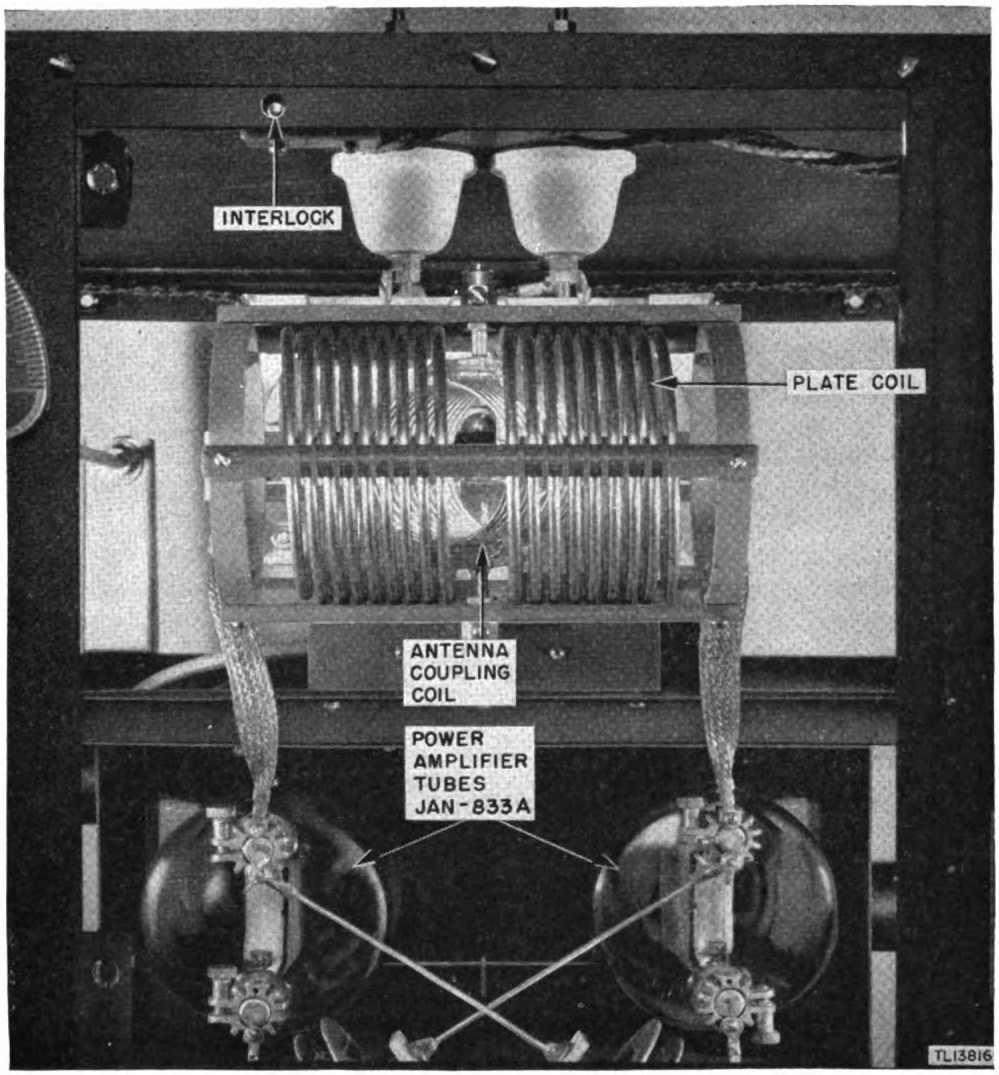


Figure 27. Radio Set AN/MRC–1—amplifier antenna coupling coil.

tained, throw the NORMAL-TUNE UP switch to NORMAL. Final reading should be 750 to 1,100 ma as indicated on the PLATE CURRENT meter.

(24) If this final reading should exceed 1,100 ma, throw the NORMAL-TUNE UP switch back to TUNE UP, reduce the antenna coupling a few degrees, and retune until the final reading is less than 1,100 ma.

(25) Where full antenna coupling is required, be sure coil is properly phased for maximum output by completely reversing antenna coupling coil. Note the change and use position giving best output.

(26) If high enough output is not obtained, check for proper phasing of coil by completely reversing the antenna coupling coil and using position providing maximum output.

(27) For remote keying from the operating shelter, plug incoming keying line into KEY jack on Speech Amplifier BC–614–E.

(28) If Radio Set SCR–399( ) operation is desired instead of high-power operation, connect Radio Transmitter T–62( )/MRC–1 directly to Antenna Tuning Unit BC–939–A instead of to the power amplifier and proceed as instructed in TM 11–281.

b. Operating Shelter. (1) Throw the main circuit breaker to the ON position. In about 30 seconds direct current will be available to operate the Boehme high-speed keying and recording equipment.

(2) Check to see that the transmitting pair and telephone pair are properly connected to the terminal block.

(3) Check to see that the teletype perforator is set in its felt-lined box in such a manner that the felt on the back of the box does not exert much pressure against any of the moving parts of the

perforator. Such pressure will cause erratic operation. This erratic operation will result in the punching of elongated holes or improper spacing of characters.

(4) Thread the tape in the perforator as described in the instruction book on the teletype perforator.

27. Operation, Transmitting

a. Place the perforator and keying head in operation and operate as described in TM 11–377, and the instruction book on the Wheatstone teletype tape perforator.

b. If the transmitter keys improperly as indicated by continuous keying, reverse the polarity of the transmitting pair. It should then key correctly.

c. Communication between the shelters is available by means of the telephone pair and Telephones EE–8–B located in each shelter.

d. Hand keying may be used by throwing the KEY-AUTO switch on the keying head drive to KEY and by operating the hand key mounted to the right of the ink recorder.

e. Automatic hand-key break-in operation while transmitting at high speeds is provided, as described in TM 11–377.

f. Hand keying is available in the transmitting shelter by merely operating the hand key connected to Junction Box JB–70–A.

g. Voice operation may be used only by connecting Radio Transmitter T–62( )/MRC–1 directly to the antenna (through antenna tuning unit), as described in TM 11–281. Power Amplifier AM–35( )/MRC–1 is biased for Class C operation (TM 11–455) and will not operate as a Class B linear amplifier, necessary for this type of voice operation. Do not operate Radio Transmitter T–62( )/MRC–1 on voice when using VARIAC CONTROL.

28. Starting Procedure, Receiving

When the operating position has been installed as described in part one, put the set into operation as indicated below.

a. Check cording of Boehme equipment. (See fig. 3.)

b. Throw the main circuit breaker to ON. This supplies direct current to the Boehme equipment.

Caution: All outlets painted red are d-c (direct-current) outlets. Do not plug a-c receivers into these outlets.

c. It is necessary that polarity be correct on the ink recorder, otherwise the recorded signal will be inverted. The power plug to the ink recorder is marked for correct polarity. If the recorded signal appears inverted on the tape, reverse the power plug.

d. Select the receiver giving the strongest signal by switching the manual diversity switch to the indicated receiver. This switch is located on the wall behind the ink recorder.

29. Operation, Receiving

a. For step-by-step operating instructions of the Boehme equipment, see TM 11–377.

b. Foot switches are provided for each tape puller to allow the operator to control the amount of tape going over the tape bridge.

c. Ink may be prepared by dissolving the contents of one ink capsule in a quart of water. Quart bottles for storing ink are furnished with the equipment.

d. With no signal, adjust the recorder driving unit as follows:

(1) Adjust OUTPUT control until meter reads 25.

(2) Set OUTPUT SHUNT control on POSITION 3.

(3) Set NOISE LEVEL control to full counterclockwise position.

e. Start tape puller for ink recorder and adjust ink flow to produce a fine line.

f. Tune in signal on desired receiver.

g. Adjust INPUT of the recorder driving unit until RECT. SIG. meter reads half scale or slightly more.

h. The recorder should now be working and can be further adjusted as described in TM 11–377.

i. The recorder tape should be fed through the slot in the table to the dual bottom basket Box CY–102/MRC–1. This basket may be filled, turned end-for-end and the tape will come out the same as it went in, cutting down the possibility of tangling and tearing.

j. Receiver disabling will be necessary when the set is operated nonduplex, or duplex with the transmitting and receiving frequencies close together. When high-power Boehme operation is used it will be necessary to disable the receivers manually. To accomplish this, throw the SEND-RECEIVE switch on the front panel of the receivers to SEND when transmitting. This must be done on all receivers, both in receiving and transmitting shelters, operating on or very near the transmitting frequency. When the set is operated as Radio Set SCR–399-( ), the receiver in the transmitting shelter can be

put on automatic disabling by placing the receiver disabling switch on Junction Box JB–70–A to Radio Receiver BC–312–( ). The functions of the SEND-RECEIVE switches on the receivers are covered in TM 11–850.

30. Stopping Procedure

a. Transmitting Shelter. (1) Throw PLATE POWER switch on power amplifier to OFF.

(2) Throw CIRCUIT BREAKER on power amplifier to OFF.

(3) Throw PLATE POWER switch on Radio Transmitter T–62( )/MRC–1 to OFF.

(4) Throw FILAMENT switch on transmitter to OFF.

(5) Turn off receiver.

(6) Push STOP button on Power Unit PE–95–( ) until unit stops.

b. Operating Shelter. (1) Turn power switch on each unit to OFF.

(2) Press STOP button on Power Unit PE–95–( ) until unit stops.

31. General Operating Precautions

The operation of Radio Set AN/MRC–1 is basically simple. Practice will make it easy. *Keep in mind the following points:*

a. Don't attempt to transmit, using VOICE operation, while Radio Transmitter T–62( )/MRC–1 is on VARIAC control.

b. Check neutralization periodically. If the set is not neutralized properly it is quite possible to receive a severe electrical burn or shock when attempting to adjust the coupling coil. The amplifier may not follow keying or may oscillate by itself on a wholly different frequency than the assigned channel.

c. Remember there are extremely high voltages present in both the transmitter and amplifier. Take care when working on this set. Do not wedge the interlock switches shut. When working on the set with the high voltage on, always have a second man standing by in case of emergency.

d. The transmitting pair connecting the two shelters together is polarized. If the transmitter keys continuously, reverse the polarity of this line.

e. All sockets in the operating shelter painted red are d-c outlets. Don't connect the a-c receivers or any other a-c equipment to these sockets.

f. The ink recorder is polarized. If the recorded signal comes out inverted, reverse the polarity of the power plug.

g. Keep the antennas clear of trees and other large objects. Failure to do this will cut down both the transmitting and receiving signals. Remember a doublet antenna sends and receives best toward its broadside direction.

h. For specific operating details of the various pieces of equipment see the related technical manuals included in the set. Don't attempt to operate this set on the basis of this technical manual alone.

Section III. EQUIPMENT PERFORMANCE CHECK LIST

32. Purpose and Use of Check List

a. General. The equipment performance check list (pars. 33 and 34) will help the operator to determine whether Radio Set AN/MRC–1 is functioning properly. The check list gives the item to be checked, the condition under which the item is checked, the normal indication and tolerances of correct operation, and the corrective measures that the opertor can take. The preparatory items are checked before starting, starting items when starting, equipment performance items during operation, and stopping items when stopping. The performance items on this check list should be checked at least once during a normal operating period or at least four times a day during continuous operation. The stopping items are to be checked at the end of each operation period.

b. Action or Condition. For some items the information given in the action or condition column consists of the settings of various switches and controls under which the items are to be checked. For other items it represents an action that must be taken in order to check the normal indication given in the normal indication column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the operator will perceive when he checks the items. In the case of meter readings, the allowable tolerances of the readings are given. When a meter reads between the limits specified, operation can be considered satisfactory. A meter reading outside the limits given is a sign of impending trouble. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those that the operator can make without turning the equipment in for repairs. Ref-

erence to chapter 5 in the table indicates that the correction of the trouble cannot be effected during operation and that trouble shooting by an experienced repairman is required. If the set is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. However, if the tactical situation requires that communication be maintained and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

33. Equipment Performance Check List, Radio Set SCR- 399-( ) Equipment

a. POWER UNIT PE–95–( ).

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	CIRCUIT BREAKER ON-OFF switch. (main power switch if commercial source is used).	Set at ON.		

b. JUNCTION BOX JB–70–A.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	2	Transmitter control switch.	Set at TRANS. OFF.		
	3	C.W. SIDETONE switch.	Set to OFF for voice transmission. Set at TO BC–312 for c–w transmission.		
	4	REMOTE CONTROL EE–8 switch.	*a.* Set to NORMAL unless remote control operation of transmitter is desired. *b.* Set at TO BC–312 TELEPHONE for remote voice operation. *c.* Set to proper TELEGRAPH position for remote c–w operation.		
	5	Keys J–37.	Keys plugged in KEY jacks.		
	6	BATTERY SOURCE switch.	*a.* Set at PE–95 if 12-volt supply of Power Unit PE–95–( ) is used. *b.* Set at AUX. if 12-volt supply in Chest CH–109–A is used.		
	7	RECEIVER OUTPUT switch.	Set at NORMAL.		
	8	Headsets HS–30–( ).	Headsets plugged into proper HEADSETS jacks (one on either side of START–STOP switch).		
	9	RECEIVER DISABLING switch.	Set BC–312 switch at ON.		
	10	RECEIVER OUTPUT switch.	Set at NORMAL.		

c. RECTIFIER RA–63–A.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	11	Main control switch.	If 12-volt battery in chest is used, set switch to TRICKLE.		

d. RADIO RECEIVERS BC–312–( ) AND BC–342–( ).

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	12	SEND–REC. switch.	Set switch at SEND.		
	13	BAND CHANGE switch.	Set to correct band.		
	14	FAST TUNING control.	Set to approximate frequency required.		
	15	C.W.–OSC. switch.	*a.* Set to ON for c–w reception.		

e. RADIO TRANSMITTER T–62( )/MRC–1.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	16	FILAMENT POWER switch.	Set at OFF (down).		
	17	PLATE POWER switch.	Set at OFF (down).		
	18	EXCITER PLATE POWER switch.	Set at NORMAL (down).		
	19	VARIAC CONTROL switch.	Set at NORMAL (down).		
	20	C.W.–PHONE switch.	Set at C.W. or PHONE as desired.		
	21	Tuning units.	Check selection of proper tuning unit.		
	22	BAND SWITCH.	Set to channel corresponding to desired tuning unit.		
	23	Coil unit.	Check selection of proper coil unit for frequency desired.		
	24	M.O.–XTAL switch of tuning unit.	*a.* Set switch to M.O. for master oscillator control. *b.* Set switch to XTAL for crystal frequency control. Check selection of proper crystal holder for frequency desired.		
	25	PLATE TUNING wheel.	Previously set to proper reading.		

f. ANTENNA TUNING UNIT BC–939–A.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	26	Antenna range switch.	Set to desired band.		
	27	COUPLING INCREASE knob.	Previously set to desired position.		
	28	FREQUENCY crank.	Crank for band being used has been set to desired position.		

g. JUNCTION BOX JB–70–A.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	29	START button.	Push START button to control Power Unit PE–95–( ).	Power Unit PE–95–( ) starts. Normal line voltage (110 to 125 volts) indicated on A.C. LINE VOLTAGE METER ON Power Unit PE–95–( ) panel.	*a.* Check Cords CO–335 and CO–316. *b.* Check for discharged battery in Power Unit PE–95–( ).
	30	Electric lights.	Turn on electric lights in Chest CH–120–A, and in shelter over transmitter.	Lamps light up.	Change lamps. Check associated cords and plugs.

h. RADIO TRANSMITTER T–62( )/MRC–1.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	31	FILAMENT POWER	Set switch at ON (Wait 1 minute for filaments to reach operating temperature. Wait 30 minutes if transmitter is damp).	*a.* Green pilot lamp and plate tuning dial on transmitter lights. *b.* Red pilot lamp on Speech Amplifier BC–614–E lights. *c.* FIL. VOLTAGE meter reads 5.3 to 5.3 volts.	*a.* If only one lamp lights, replace the other lamp. If both lamps are out, check fuses FS 1, 2, 4, and Cord CD–763. Check that V13, V14, and V15 are firmly seated in their sockets. *b.* Replace lamp if lamps in a (above) light. *c.* Adjust FILAMENT VOLTAGE control.

i. JUNCTION BOX JB–70–A.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	32	Transmitter control switch.	*a.* For c–w transmission, set to TRANS. ON. *b.* For voice transmission, set to TRANS. OFF.	*a.* Red pilot lamp on transmitter lights. Plate power relay RY1 clicks. *b.* Red pilot lamp is out.	*a.* If the relay clicks but the red pilot does not light, check fuse FS3. (See Ch. 5.) *b.* See Chapter 5.

j. RADIO RECEIVERS BC–312–( ) AND BC–342–( ).

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	33	OFF–M.V.C.–A.V.C. switch.	Turn to M.V.C. or A.V.C. position. (Set Rectifier RA–63–A switch to HI CHARGE).	Dial lights unless dial light switch is provided. The dynamotor starts.	Check panel fuses. Check Cords CD–565 and CD–566 and associated plugs.
	34	VOL control.	Rotate clockwise.	Signal or noise is heard.	See TM 11–850.

k. RADIO TRANSMITTER T–62( )/MRC–2.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	35	EXCITATION METER SWITCH.	Key J–37 held closed or microphone press-to-talk switch operated. EXCITATION METER SWITCH set to: *a.* DOUBLER PLATE. *b.* INT. AMP. GRID. *c.* INT. AMP. PLATE. *d.* P.A. GRID.	 *a.* 25 to 45 ma. *b.* 1 to 8 ma. *c.* 125 to 175 ma. *d.* 60 to 100 ma.	*a.* If the meter does not indicate in any position, check: (1) The installation and tuning of the tuning unit. (2) The setting of the BAND SWITCH. (3) The position of the M.O.–XTAL switch on the tuning unit. *b.* If the meter readings are improper, retune the transmitter, replace V^8, V^9, V^{10}, or V^{11}, if necessary.
	36	P.A. PLATE meter.	*a.* Voice operation; microphone press-to-talk switch operated. *b.* C–w operation; Key J–37 closed.	*a.* 200 to 260 ma. *b.* 200 to 300 ma.	Retune transmitter. Check coil unit L^7. Operate OVERLOAD RELAY. Check antenna coupling. Replace V^6, V^7, or V^{16} if necessary. (See Ch. 5.)

l. ANTENNA TUNING UNIT BC–939–A.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	37	ANTENNA CURRENT meter.	Key J–37 held closed or microphone press-to-talk switch operated. Operating frequency is: *a.* 2 to 8 meg. *b.* 8 to 12 meg. *c.* 12 to 18 meg.	ANTENNA CURRENT meter reads: *a.* 7 to 14 amp. *b.* 5 to 12 amp. *c.* 2½ to 10 amp.	Check control settings, tuning, coupling, and antenna range switch. (See Ch. 5.)

m. SPEECH AMPLIFIER BC–614–E.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	38	MODULATOR PLATE meter.	Microphone press-to-talk switch operated and: *a.* With no modulation. *b.* With modulation.	MODULATOR PLATE meter reads. *a.* 35 to 50 ma. *b.* 200 ma on voice peaks.	*a.* Check fuse FS^5 and adjustment of MODULATOR BIAS control. *b.* Check gain control of CARBON MIC. 1 or DYNAMIC MIC. 2, tube V^5, and fuse FS_1. (See Ch. 5.)

n. JUNCTION BOX JB–70–A.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	39	Key J–37 (c–w operation).	Key operated.	Side tone heard. Relays in Junction box and receiver should click. P.A. PLATE, EXCITATION, and ANTENNA CURRENT meter needles should flick. The receiver is disabled.	Check key cord, plug, and jack. (See Ch. 5.)
	40	Microphone (voice operation).	Press-to-talk switch operated.	Meters indicate as in items 35 to 38. Receiver disabled.	Check microphone cord, amphenol plug, and receptacle.

o. RADIO RECEIVERS BC–312–( ) AND BC–342–( )

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	41	VOL control.	Control rotated clockwise.	Increased output will be heard in the headset or loudspeaker.	Tighten setscrew. See TM 11–850.
	42	Headset or loudspeaker.	Set operating normally. Plug inserted completely.	Signal is heard.	Check plug and cable connections. Tune receiver.
	43	ALIGN INPUT control.	When rotated.	Response varies.	See TM 11–850.

p. JUNCTION BOX JB–70–A.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STOP	44	Transmitter control switch.	Set to TRANS. OFF.	Red pilot light out.	See Chapter 5.

q. RADIO TRANSMITTER T–62( )/MRC–1.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STOP	45	FILAMENT POWER switch.	Set to OFF.	*a.* Green pilot lamp and plate tuning dial lamp go out. *b.* Pilot lamp on Speech Amplifier BC–614–E goes out. *c.* No voltage indication on FIL. VOLTAGE meter.	See Chapter 5.

r. RADIO RECEIVERS BC–312–( ) AND BC–342–( ).

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STOP	46	OFF–M.V.C.–A.V.C. switch.	Turn to OFF position.	Receiver turned off.	See TM 11–850.

s. JUNCTION BOX JB–70–A.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STOP	47	STOP button.	Push red STOP button.	Power Unit PE–95–( ) stops.	See Chapter 5.

t. RECTIFIER RA–63–A.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STOP	48	Main control switch.	Set at OFF. Check the battery with the hydrometer.	1.265 specific gravity at 70° F.	Recharge the battery with Rectifier RA–63–A. Add distilled or battery-approved water to battery if insufficient liquid is present to obtain a reading on hydrometer.

34. Equipment Performance Check List, Other Equipment (Excluding Boehme Equipment)

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Antenna System AS–95 ( )/MRC–1.	Inspect antenna.	Cut to frequency.	Cut antenna to correct length.
	2	Antenna System AS–94 ( )/MRC–1.	Inspect antenna.	Antennas at right angle to each other.	Erect antennas at right angle.
	3	Telephone pair.	Operate telephones.	Communication available between shelters.	Connect telephones to ends of line. Check telephones.
STARTING	4	Amplifier grid current meter.	Apply excitation to amplifier.	Meter indication when excitation applied.	Connect coaxial line, Cord CG–65/MRC–1. Insert proper grid coil in amplifier.
	5	Amplifier plate current meter.	Tune plate tank circuit.	Proper meter indication when tuning plate tank circuit.	Close panels securely insert proper plate coil. Check neutralization.
	6	Antenna coupling coil.	Adjust antenna coupling coil.	Indication on plate meter when coil moved.	Connect antenna. Match amplifier output to doublet 70- to 200-ohm transmission line. Cut antenna to correct length.
EQUIPMENT PERFORMANCE	7	Transmitter.	Key transmitter.	Keys properly.	Connect transmitter pair. Reverse polarity of transmitting pair.
	8	Ink recorder.	Record signal.	Proper recorded signal.	Reverse power plug polarity.
	9	All meters.	Check readings.	Proper readings (part one).	Retune set. Check neutralization. Check antenna.
	10	Radio Set SCR–399–( ).	Tune Radio Transmitter T–62( )/MRC–1.	Correct plate and antenna tuning indications.	Disconnect transmitter from amplifier and connect it to Antenna Tuning Unit BC–939–A.

34. Equipment Performance Check List, Other Equipment (Excluding Boehme Equipment) (cont'd)

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STOPPING	11	All switches	Turn all switches off.	Following stopping procedure, power should shut off in all circuits.	Defective switch.
	12	Antennas		Disassemble and pack sections in cases.	

CHAPTER 3

PREVENTIVE MAINTENANCE

Section I. PREVENTIVE MAINTENANCE TECHNIQUES

35. Meaning of Preventive Maintenance

Preventive maintenance is a systematic series of operations performed at regular intervals on equipment, when turned off, to eliminate major break-downs and unwanted interruptions in service, and to keep the equipment operating at top efficiency. To understand what is meant by preventive maintenance, it is necessary to distinguish between preventive maintenance, trouble shooting, and repair. The prime function of preventive maintenance is to *prevent* break-downs and, therefore, the need for repair. On the other hand, the prime function of trouble shooting and repair is to locate and correct *existing* defects. The importance of preventive maintenance cannot be overemphasized. The entire system of radio communication depends upon each set's being *on the air* when it is needed and upon its *operating efficiency*. It is therefore vitally important that radio operators and repairmen maintain their radio sets properly.

Note. The operations in this section are considered first and second echelon (organization operators and repairmen) maintenance.

36. Description of Preventive Maintenance Techniques

a. GENERAL. Most of the electrical parts used in Radio Set AN/MRC–1 require routine preventive maintenance. Those requiring maintenance differ in the amount and kind required. Because hit-or-miss maintenance techniques cannot be applied, definite and specific instruction are needed. This section of the manual contains these specific instructions and serves as a guide for personnel assigned to perform the six basic maintenance operations, namely: Feel, Inspect, Tighten, Clean, Adjust, and Lubricate. Throughout this manual the lettering system for the six operations will be as follows:

F — Feel
I — Inspect
T — Tighten
C — Clean
A — Adjust
L — Lubricate

The first two operations establish the need for the other four. The selection of operations is based upon a general knowledge of field needs. For example, the dust encountered on dirt roads during cross-country travel filters into equipment no matter how much care is taken to prevent it. Rapid changes in weather (such as heavy rain followed by blistering heat), excessive dampness, snow, and ice tend to cause corrosion on exposed surfaces and parts. Without frequent inspections and the necessary performance of tightening, cleaning, and lubricating operations, equipment becomes undependable and subject to break-downs when the equipment is most needed.

b. FEEL. The feel operation is used most often to check rotating machinery, such as blower motors, drive motors, etc., and to determine if electrical connections, bushings, etc., are overheated. Feeling indicates the need for lubrication or the existence of similar types of defects requiring correction. The maintenance man must become familiar with the normal operating temperatures of motors, etc., in order to recognize signs of overheating.

Note. It is important that the feel operation be performed as soon as possible after shut-down and always before any other maintenance is done.

c. INSPECT. Inspection is the most important operation in the preventive maintenance program. A careless observer will overlook the evidences of minor trouble. Although these defects may not interfere with the performance of the equipment, valuable time and effort can be saved if they are corrected before they lead to major break-downs. Make every effort to become thoroughly familiar with the indications of normal functioning, in order to be able to recognize the signs of a defective set. Inspection consists of carefully observing all parts of the equipment, noticing their color, placement, state of cleanliness, etc. Inspect for the following conditions:

(1) Overheating, as indicated by discoloration, blistering, or bulging of the parts or surface of the container; leakage of insulating compounds; and oxidation of metal contact surfaces.

(2) Placement, by observing that all leads and cabling are in their original positions.

(3) Cleanliness, by carefully examining all re-

cesses in the unit for accumulation of dust, especially between connecting terminals. Parts, connections, and joints should be free from dust, corrosion, and other foreign matter. In tropical and high-humidity locations, look for fungus growth and mildew.

(4) Tightness, by testing any connection or mounting which appears to be loose.

d. TIGHTEN, CLEAN, AND ADJUST. These operations are self-explanatory. Specific procedures to be followed in performing them are given wherever necessary throughout chapter 5.

Caution: Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

Whenever a loose connection is tightened, it should be moistureproofed and fungiproofed again by applying the varnish with a small brush. See section IV for details of moistureproofing and fungiproofing.

e. LUBRICATE. Lubrication refers to the application of grease or oil to the bearings of motors or other rotating shafts. It may also mean the application of a light oil to door hinges or other sliding surfaces on the equipment.

37. Vacuum Tubes

Note. Avoid handling tubes immediately after shut-down. Severe burns may result from contact with the envelopes of hot tubes.

a. INSPECT (I). (1) Inspect glass and metal tube envelopes, tube caps, and tube connector clips for accumulation of dirt and for corrosion. When tubes with loose plate or grid caps or envelopes are found, replace them if possible.

(2) Examine the clips that make contact with the grid and plate caps for corrosion and for loss of tension with resulting looseness. Also check the condition of the leads soldered to the clips. The wires should be free of frayed or broken strands.

(3) Inspect the firmness of tubes in their sockets. Make the inspection by pressing the tubes down in their sockets and testing them in that position, *not* by partially withdrawing the tubes and jiggling them from side to side. Movement of the tube tends to weaken the pins in the base and unnecessarily spread the contacts in the socket. It is desirable to inspect the sockets of the tubes at the time the tubes are removed.

(4) When it is necessary to remove a tube from its socket, especially if it is a high-power tube, great care must be used. Never jar a warm tube. Connections to the grid and plate caps must always be removed.

b. TIGHTEN (T). Tighten all loose connections to the tube sockets or to the tubes. If the connections are dirty or corroded, clean them before tightening. When tightening locknuts that hold sockets to insulated bushings, do not apply excessive pressure. Too much pressure will crack the bushings.

c. CLEAN (C). (1) Clean the tubes, but only if inspection shows cleaning to be necessary. Tubes operated at high voltages and with exposed grid or plate connections must be kept free of dirt and dust because of the possibility of leakage at the terminals. In contrast, tubes operating at low voltages and not having exposed grid and plate caps do not require frequent cleaning. However, do not allow dirt to accumulate on low-voltage tubes.

(2) Remove dust and dirt from the glass envelope with a clean lint-free, dry cloth. If proper care is taken, the grid and plate caps may be cleaned with a piece of #0000 sandpaper. Wrap the paper around the cap and *gently* run the paper along the surface. Excessive pressure is not needed; neither is it necessary to grip the cap tightly. Wipe the cap with a clean dry cloth.

(3) When tube sockets are being cleaned and the contacts are accessible, fine sandpaper may be used to remove corrosion, oxidation, and dirt.

d. ADJUST (A). Adjust loose tube connector clips. Do not bend tube connector clips during adjustment.

38. Capacitors

a. INSPECT (I). (1) Inspect the terminals of large fixed capacitors for corrosion and loose connections. Carefully inspect the mountings to discover loose mounting screws, studs, or brackets. Examine the leads for poor insulation, cracks, and evidences of dry rot. Cut away frayed strands on the insulation. If the wire is exposed, wrap it with tape. The terminals of the capacitors should not be cracked or broken.

(2) Thoroughly inspect the case of each large fixed capacitor for leaks, cracks, and discoloration.

(3) Inspect the plates of variable capacitors for dirt, dust, or lint. Examine the movable set of plates for signs of damage or misalignment that would cause them to touch the fixed plates during tuning. Rotate the movable plates, using the panel tuning control, and check for proper operation of the capacitor, drive shafts, and belts.

b. TIGHTEN (T). Tighten loose terminals, mountings, and connections on the capacitors when neces-

sary. Do not break the bushings or damage the gaskets.

c. CLEAN (C). (1) Clean the cases of fixed capacitors, the insulating bushings, and all connections that are dirty or corroded. The capacitor cases can usually be cleaned with a dry cloth. However, if the deposit of dirt is hard to remove, moisten the cloth with dry-cleaning solvent.

(2) Clean the plates of variable capacitors with a small brush, removing all dust and lint.

39. Inductors

a. INSPECT (I). Inspect all inductors for general cleanliness. Look for poor or loose connections at the terminals. Check for loose or shorted turns, charred insulation, and charred or blistered forms.

b. TIGHTEN (T). Tighten all loose connections. In tapped inductances with screw connections to the taps, be very careful not to tighten the screws too tightly as damage to the turns of the inductors will result.

c. CLEAN (C). Clean inductors with a soft brush. Use #0000 sandpaper to remove corrosion from the terminals. Be careful to avoid damaging the turns of the inductor.

40. Resistors

a. INSPECT (I). Inspect all resistors for general cleanliness. Look for poor or loose connections at the resistor ends. Examine for discoloration as an indication of overload. If such condition is found, report this condition to a higher echelon for trouble shooting and repair. Some resistors used in this set are of the pig-tail type. Do not move these resistors unnecessarily as such movement may break the connections and render the resistor useless.

b. TIGHTEN (T). Tighten all loose connections at the resistor ends. Pigtail type resistors are usually soldered to lugs. If one of these connections is found loose, it will be necessary to resolder the connection. Use only rosin-core solder for making such repairs.

c. CLEAN (C). Clean resistors with a soft brush. Use #0000 sandpaper for removing corrosion from resistor connections. Do *not* use sandpaper to clean the body of resistors. Make no attempt to remove discoloration.

41. Switches

a. INSPECT (I). Inspect all switches for mechanical action. Toggle switches can only be checked mechanically by flipping the switch to see if contact is made and broken instantaneously. Press push-button type interlock switches to check the mechanical action, noting especially the spring tension which returns the push button. Look for signs of corrosion on switch contacts and blades. Inspect for general cleanliness. Examine for cracked insulators and loose mountings.

b. TIGHTEN (T). Tighten all loose mounting nuts and screws. Tighten loose connections. If a solder connection is poor or loose, resolder this connection, using rosin-core solder only.

c. CLEAN (C). Remove all dust and dirt from the switches with a soft brush. Use crocus cloth to remove corrosion from metal surfaces and contacts. Use extra caution while cleaning the switch contacts as they are easily bent or otherwise damaged. If deposits of dirt or other foreign matter are not removed readily with a soft brush, dip the brush in dry-cleaning solvent.

42. Potentiometers, Rheostats, and Variacs

a. INSPECT (I). Most potentiometers and rheostats are inclosed in dust-proof cases. Do not open inclosed potentiometers and rheostats. Examine for cleanliness, loose connections, and loose mounting screws.

b. TIGHTEN (T). Tighten all loose mounting screws and nuts on all potentiometers, rheostats, and variacs. Tighten all loose connections. If a soldered connection is found to be poor, resolder with rosin-core solder.

c. CLEAN (C). Remove all dust and dirt from potentiometers, rheostats, and variacs with a soft brush. Clean open wire-wound resistors with crocus cloth. Do not apply great pressure while cleaning with crocus cloth. A light polish is considered satisfactory. Use #0000 sandpaper for removing corrosion from the connections.

43. Transformers

a. INSPECT (I). Inspect transformers for loose mounting bolts. Check the terminals to see that they are clean and tight. Examine the case for signs of overheating such as discoloration or blisters. Check case and terminals for dirt, dust, and corrosion.

b. TIGHTEN (T). Tighten all mounting screws and terminal connectors. Keep all core bolts tight to avoid noise from loose laminations.

c. CLEAN (C). Clean the case and terminal strip with a soft cloth and brush. If terminals are corroded, clean them with a piece of #0000 sandpaper.

44. Terminal Strips

a. INSPECT (I). Inspect the terminal strips for loose connections. Examine for dust, dirt, and corrosion. If connections to terminal strips are found to be misaligned to such an extent that a short circuit might result, correct this condition.

b. TIGHTEN (T). Tighten any loose or poor connections. Be certain that connections are clean before tightening. Tighten any loose terminal strip mountings.

c. CLEAN (C). Clean corrosion from connections with #0000 sandpaper. Use a soft brush to remove dust and dirt. If accumulations of dust and dirt are difficult to remove, dip the brush in dry-cleaning solvent.

45. Meters

a. INSPECT (I). Inspect the meters for general cleanliness. Look for poor or loose connections to the meters. Check to see that the meters read 0 when the power is turned off.

b. TIGHTEN (T). Tighten all loose meter mountings. Tighten loose meter connections. Be sure meter connections are clean before tightening. Use caution while tightening connections to avoid damaging the meter case or stripping the threads on the meter studs or nuts.

c. CLEAN (C). Remove dust and dirt from the meters with a clean, dry cloth. Clean corrosion from meter connections with #0000 sandpaper.

d. ADJUST (A). Adjust the meters so that they will read 0 with all power turned off. Adjustment to meters should be made before cleaning because the friction of a clean dry cloth on the meter glass often sets up static charges on the meter glass which will deflect the needle and give the impression that the meter is out of adjustment. If a meter is adjusted when a static charge is on the glass, the meter will not read correctly when the static charge drains off.

46. Pilot Lights

a. INSPECT (I). Pilot lights indicate when power is applied to the equipment. Inspect pilot lights for loose connections or corroded contacts. Pilot lamps whose glass has become blackened through use should be replaced since this blackening is an indication that the lamp has been in service for its expected life term. Inspect lamps to see that they are tight in their sockets.

b. TIGHTEN (T). Tighten loose pilot lamp mountings and loose connections.

c. CLEAN (C). Clean pilot light reflector glass. Wipe dust from pilot lamps. Remove corrosion from pilot light contacts and connections with #0000 sandpaper.

47. Multiple Connectors

a. INSPECT (I). Inspect multiple connectors for loose connections, dirt, and corrosion. Look for bent or loose fitting pins. Examine for broken strands of wire at the connections to the pins. Solder loose strands to the pins or the adjacent wires of the same lead. Tape the exposed wires to avoid short circuits.

b. CLEAN (C). Clean dust and dirt from the multiple connectors with a soft brush. Accumulations of dirt that are not readily removed with a dry brush may be removed by dipping the brush in dry-cleaning solvent. Corrosion at the pins will result in poor contact. Remove corrosion with #0000 sandpaper. Do not attempt to remove individual pins from the connector.

48. Rotary Shafts and Gears

a. INSPECT (I). Inspect all gears and rotating shafts for cleanliness and corrosion. Examine the bearing surfaces of the shafts for need of lubricant.

b. CLEAN (C). Clean all gears with a small stiff brush. Remove all dirt and dust from the rotating shafts with a clean dry cloth. Rust and corrosion should not be permitted to accumulate. Remove all corrosion and rust with #0000 sandpaper.

49. Cords and Cables

a. INSPECT (I). Inspect all cords and cables for cracks or cuts in the insulation. If the insulation damage is slight, wrap the damaged section with tape. If the damage is severe, report the damage so that replacement can be made. Inspect the placement of cables to be sure that the cables are not placed in such a position that damage will result. See that cords and cables do not become kinked. Avoid sharp right-angle bends in all cables. See that cable clamps are tight but not tight enough to cut the insulation. Keep grease and oil off the insulation of cords and cables. Grease and oil will deteriorate rubber insulation rapidly.

b. TIGHTEN (T). Tighten all cable clamps.

c. CLEAN (C). Remove all grease and oil from rubber insulation. Keep all cables clean and off the floor.

50. Blowers

a. INSPECT (I). Inspect blowers for loose mounting bolts and general cleanliness.

b. TIGHTEN (T). Tighten mountings securely to avoid vibration.

c. Clean (C). Remove all grease and oil from the exterior of motors and blower housings. Use a clean cloth dampened in dry-cleaning solvent, and wipe the unit dry after cleaning.

d. LUBRICATE (L). Apply six drops of OE oil, engine SAE 10 or SAE 30 to blower motor oiling tubes every three months. After oiling, wipe off any spillage from the exterior of motors.

51. Knobs and Controls

a. INSPECT (I). Inspect all knobs and controls for cleanliness and tightness. See that knobs do not bind on the panel.

b. TIGHTEN (T). Tighten all loose knobs. If a knob is found to be rubbing on the panel, loosen the knob, move it back on the shaft, and tighten it in place. Controls which do not operate freely should be investigated. If the cause for trouble is of such a nature that it cannot be corrected in a few minutes, it should be reported to a higher echelon for trouble shooting and repair.

c. CLEAN (C). Remove all dust and dirt from knobs with a clean dry cloth.

d. ADJUST (A). Adjust dials for correct position by checking with capacitors at maximum or minimum capacity. Check tension in steel belt drive on the plate tank capacitor, and adjust if excessive slack or backlash is present.

52. Cabinets, Chassis, and Mountings

a. INSPECT (I). Inspect for dirt, rust, and corrosion. Look for loose screws, nuts, and bolts. Make certain that adjustments on coils and capacitors are not mistaken for screws. If such adjustments are tampered with, the operation of the equipment will be impaired.

b. TIGHTEN (T). Tighten all loose mounting screws, nuts, and bolts on the cabinets, chassis, and mountings.

c. CLEAN (C). Remove all dust and dirt from the cabinets, chassis, and mountings. Use #0000 sandpaper to remove rust and corrosion. Use touch-up paint to cover bare metal spots.

53. Relays

a. INSPECT (I). Inspect relays for burned or pitted contacts, overheated coils, loose connections, corrosion, dust, and dirt. Check to see that the moving element operates freely and does not stick.

b. TIGHTEN (T). Tighten all mounting screws and connections. *Do not* tighten adjustment screws of relays.

c. CLEAN (C). Clean dust and dirt from relays with a soft brush. If contacts are dirty, they may be cleaned with a small piece of crocus cloth.

Caution: Cleaning of relay contacts should only be attempted by qualified personnel. Relay contacts are easily bent or thrown out of adjustment and extreme care must be exercised when cleaning.

d. ADJUST (A). Relays should be adjusted so that, when the contacts are closed, they are under tension, and when the contacts open, they should break cleanly. Adjustment of relays should be done only by qualified personnel.

54. Insulators

a. INSPECT (I). Inspect insulators for accumulations of dirt and dust. Examine them carefully for cracks or chips, and replace any insulators found to be defective.

b. CLEAN (C). Remove all dust and dirt with a clean dry cloth. If deposits of dirt are not removed readily with a dry cloth, it may be dampened with water. After cleaning, the insulator should be dried thoroughly with a clean cloth.

55. Guys

a. INSPECT (I). Inspect all guy wires for frayed or broken strands, corrosion, and correct tension.

b. TIGHTEN (T). Tighten all guy wires to the proper tension to maintain correct position of the mast, free of bends or twists.

c. CLEAN (C). Corrosion may be removed from metal guys with #0000 sandpaper. Paint with touch-up paint after cleaning.

56. Masts

a. INSPECT (I). Inspect masts for loose joints, loose base, chipped paint, and other signs of deterioration.

b. TIGHTEN (T). Tighten all mounting bolts, and clamp joints.

c. CLEAN (C). Corrosion may be removed from metal masts with #0000 sandpaper. Paint all spots not used for electrical contact with touch-up paint after cleaning. Keep wooden masts well painted to protect them from the weather.

57. Antennas, Lead-ins, and Feeders

a. INSPECT (I). Inspect the antennas and their connections for signs of corrosion and general cleanliness. The feeders or lead-in should have no sharp right-angle bends.

b. CLEAN (C). Remove all dust, dirt, and other foreign matter from the antenna and lead-in. Use #0000 sandpaper to remove rust or corrosion. Touch up bare metal spots with touch-up paint.

Section II. ITEMIZED PREVENTIVE MAINTENANCE

58. Introduction

Itemized preventive maintenance operations on Radio Set AN/MRC–1 are covered by components in their respective technical manuals as listed below:

TM 11–281, Radio Set SCR–399–A and SCR–499–A.

TM 11–377, Boehme Automatic Keying and Recording Equipment.

TM 11–850, Radio Receivers BC–312–( ), BC–314–( ), BC–342( ), and BC–344–( ).

TM 11–904G, Power Unit PE–95–G and –H.

TM 11–904H, Power Unit PE–95–G and –H.

TM 11–333, Telephone EE–8–A, EE–8–B, and EE–8.

TM 11–300, Frequency Meter Sets SCR–211–( ).

59. Power Amplifier AM-35( )/MRC-1

For ease and efficiency of performance, it is suggested that the preventive maintenance on Power Amplifier AM–35( )/MRC–1 be broken down into operations that can be performed at different time intervals. In this section the preventive maintenance work to be performed on the amplifier at specified time intervals is broken down into units of work called items. The general techniques involved and the application of the FITCAL operations in performing preventive maintenance on individual parts are discussed in section I, chapter 3. When performing preventive maintenance, see section I, chapter 3, if more information is required on the following items. All work is to be performed with the power removed from the equipment. After preventive maintenance has been performed on a given day, the equipment should be put into operation and checked for satisfactory performance.

60. Common Materials Needed

The following materials will be needed in performing preventive maintenance:

Common hand tools (TE–41 or equivalent).
Clean soft rags.
Water.
Camel's-hair brush.
Metal polish.
Emery cloth.
#0000 sandpaper.
Set of socket wrenches.
Set of end wrenches.
Bristo setscrew wrench.

Note. Leaded gasoline will not be recommended as a cleaning fluid for any purpose. Solvent, dry-cleaning, Federal Specification P–S–661a, is available as a cleaning fluid, through established supply channels. Oil, Fuel, Diesel, U.S. Army Specifications 2–102B, may be used for cleaning purposes when dry-cleaning solvent is not at hand. Since unleaded gasoline is available only in limited quantities, and only in certain locations, it should be used for cleaning purposes only when no other agent is suitable. Carbon tetrachloride or fire-extinguishing liquid (carbon tetrachloride base) will be used, if necessary, *only on contact parts of electronic equipment.*

61. Item 1. Exterior of Power Amplifier AM-35( )/MRC-1

OPERATIONS.

ITC	Cabinet.
ITC	Knobs and controls.
ITCA	Meters (exterior panel side only).

REMARKS. These operations should include only those which can be accomplished without removing the side panels of cabinet.

62. Item 2. Cords and Cables

OPERATIONS.

ITC	Cords and cables.
ITC	Multiple connectors.

63. Item 3. Radio-frequency Section of Amplifier Unit

PRELIMINARY STEPS. Disconnect all power and excitation cables from amplifier before removing side panels to perform preventive maintenance.

ITC	Vacuum tubes.
ITC	Capacitors.
ITC	Resistors.
ITC	Inductances.
ITC	Terminal strips.
ITC	Chassis and mountings.
ITCL	Blower motors.

64. Item 4. Power Supply Section of Amplifier Unit

PRELIMINARY STEPS. Disconnect all power and excitation cables from the amplifier before removing side panels to perform preventive maintenance on the amplifier.

ITC	Capacitors.
ITC	Chokes.
ITC	Power transformers.
ITC	Vacuum tubes.
ITC	Resistors.
ITC	Terminal strips.
ITCA	Relays.
ITC	Chassis and mountings.
ITC	Pilot lamps.

65. Item 5. Antennas

IC	Insulators.
IT	Guys.
ITC	Masts.
ITC	Antennas, lead-ins, and feeders.

66. Preventive Maintenance Check List

a. GENERAL. The following check list is a summary of the preventive maintenance operations to be performed on Power Amplifier AM–35( )/MRC–1. The suggested time intervals shown on the check list may be varied at any time by the local commander. However, for best performance of the equipment, it is recommended that the operations be performed at least as frequently as called for in the check list. The echelon column indicates which operations are considered first echelon maintenance and which operations are considered second echelon maintenance.

b. CHECK LIST.

Item No.	Operations	Item	When performed							Echelon
			Before operation	After operation	Daily	Weekly	Monthly	Semi-annually	Yearly	
1	I T C A	Exterior of Power Amplifier AM–35( )/MRC–1	X		X					1st
2	I T C	Cords and cables			X					1st
3	I T C A L	R–f section of amplifier unit				X				2d
4	I T C A	Power supply section of amplifier unit				X				2d
5	I T C	Antennas				X				2d

F Feel — I Inspect — T Tighten — C Clean — A Adjust — L Lubricate

Section III. LUBRICATION

Note. No lubrication order is furnished for Power Amplifier AM–35( )/MRC–1. For lubrication of components other than the power amplifier see the respective technical manuals.

Section IV. MOISTUREPROOFING AND FUNGIPROOFING

67. Problems Encountered

The operation of Signal Corps equipment in tropical areas where temperature and relative humidity are extremely high requires special attention. The following items represent problems which may be encountered in operation:

a. Electrolytic action takes place in resistors, coils, chokes, transformer windings, etc., causing eventual break-down.

b. Resistors, capacitors, coils, chokes, transformer windings, etc., fail.

c. Hook-up wire and cable insulation break down. Fungus growth accelerates deterioration.

d. Moisture forms electrical leakage paths on terminal boards and insulating strips.

68. Treatment

A moistureproofing and fungiproofing treatment has been devised which if properly applied provides a reasonable degree of protection against fungus, insects, corrosion, salt spray, and moisture. The treatment involves the use of a moisture- and fungi-resistant varnish applied with a spray gun or brush. See TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment, for a detailed description of the varnish-spray method of moistureproofing and fungiproofing and the supplies and equipment required in this treatment.

Caution: Varnish spray may have toxic effects if inhaled. To avoid inhaling spray, use respirator if available; otherwise, fasten cheesecloth or other cloth material over nose and mouth.

69. Step-by-Step Instructions for Treating Radio Set AN/MRC-1

a. Power Amplifier AM-35( )/MRC-1. (1) *Preparation.* Make all repairs and adjustments necessary for the proper operation of the equipment.

(2) *Disassembly.* (*a*) Remove side and rear panels of unit.

(*b*) Thoroughly clean amplifier by removing all oil, dirt, rust, dust, fungus, grease, etc., adhering to any of the components.

(3) *Masking.* No masking is necessary.

(4) *Drying.* The amplifier cannot be conveniently placed in an oven. Use infra red lamps to dry cabled wiring thoroughly.

Caution: *Do not exceed 160° F.* If wax should begin to melt on any of the components, lower temperature and increase baking time 1 hour for each 10° F., drop in temperature.

(5) *Varnishing.* (*a*) *Do not use spray-gun method on this equipment.*

(*b*) Apply varnish by using a brush only. Brush three coats of varnish (Lacquer, Fungus-resistant, Spec No. 71–2202 (Stock No. 6G1005.3), or equal) on all insulated wiring. Allow a 15- to 20-minute drying period after each coat.

(6) *Reassembly.* Reassemble equipment by following disassembly instructions in reverse order, removing any masking tape in the process. Check over-all performance of equipment. Lubricate units in accordance with lubrication instructions.

(7) *Marking.* Mark the set with "MFP" and the date of treatment.

Examples MFP—8 June 1944.

b. Keying Head Drive. (1) *Preparation.* Make all repairs and adjustments necessary for the proper operation of the equipment.

(2) *Disassembly.* (*a*) Remove bottom base plate.

(*b*) Thoroughly clean keying head drive by removing all oil, dirt, rust, dust, grease, fungus, etc., adhering to any of the components.

(3) *Masking.* Mask potentiometer and contacts of key switch.

(4) *Drying.* Place the keying head drive in heat chamber and bake from 2 to 3 hours at 160° F.

Caution: *Do not exceed 160° F.* If wax should begin to melt in any of the components, lower temperature and increase baking time 1 hour for each 10° F. drop in temperature.

(5) *Varnishing.* (*a*) *Do not use spray-gun method on this equipment.*

(*b*) Apply varnish by using a brush only. Brush three coats of varnish (Lacquer, Fungus-resistant, Spec No. 71–2202 (Stock No. 6G1005.3), or equal) on all insulated wiring and lamination of key switch.

(6) *Reassembly.* See a(6) above.

(7) *Marking.* See a(7) above.

c. Recorder Driving Unit. (1) *Preparation.* Make all repairs and adjustments necessary for the proper operation of the equipment.

(2) *Disassembly.* (*a*) Remove unit from case.

(*b*) Thoroughly clean recorder driving unit by removing all oil, dirt, rust, dust, fungus, grease, etc., adhering to any of the components.

(3) *Masking.* Mask:

(*a*) Potentiometers.

(*b*) Selector wafer switch.

(*c*) Contacts of jack.

(*d*) Contacts of sockets.

(4) Drying. See *b*(4) above.

(5) *Varnishing.* (*a*) *Do not use spray-gun method on this equipment.*

(*b*) Apply varnish by using a brush only. Brush three coats of varnish (Lacquer, Fungus-resistant, Spec No. 71–2202 (Stock No. 6G1005.3), or equal) on all insulated wiring and lamination of key jack and terminal strip.

(6) *Disassembly.* See a(6) above.

(7) *Marking.* See a(7) above.

Note. Components comprising Radio Set SCR-399-( ) will be treated in accordance with instructions contained in the following: TM 11-281, TB 11-850-1 and TB 11-333-2.

CHAPTER 4

AUXILIARY EQUIPMENT

(NOT USED)

CHAPTER 5

REPAIR INSTRUCTIONS

Note. Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on WD, AGO Form 468 (Unsatisfactory Equipment Report). For particulars, see paragraph 97. If Form 468 is not available see TM 38–250. Failure or unsatisfactory performance of equipment used by Army Air Forces will be reported on Army Air Forces Form 54 (unsatisfactory report).

Section I. THEORY OF EQUIPMENT

70. General

a. Radio Set AN/MRC–1 is designed for high power, high-speed operation on continuous wave, or medium power mobile operation on voice or low-speed continuous wave. The operating and transmitting shelters can be located at distances up to 1 mile apart.

b. The transmitter may be keyed by the Boehme head from the operating shelter, or manually keyed or voice modulated from either the operating or the transmitting shelter. Reception is possible at either location.

c. On voice or mobile operation, the Radio Transmitter T–62( )/MRC–1 must be used without the Power Amplifier AM–35( )/MRC–1.

71. Radio Transmitter T-62( )/MRC-1

Note. All parts referred to in this paragraph are parts of Radio Transmitter T–62( )/MRC–1.

Radio Transmitter T–62( )/MRC–1 is similar to Radio Transmitter BC–610–E. (See TM 11–281.) The following changes have been made in converting Radio Transmitter BC–610–E for use as an exciter unit:

a. KEYING CIRCUIT (fig. 28). The keying circuit has been modified to allow the transmitter to be keyed in either the oscillator or doubler stage. This selection is accomplished by means of double-pole, double-throw switch SW_{16}, located on the center of the transmitter front panel.

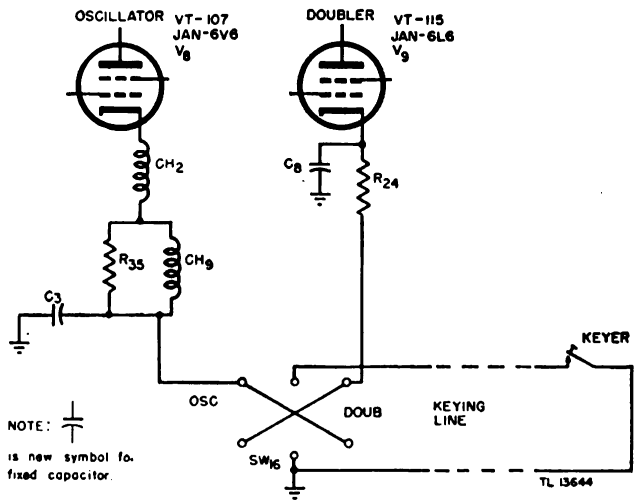


Figure 28. Radio Transmitter T–62( )/MRC–1—keying circuit.

(1) *Oscillator keying.* With switch SW_{16} in the OSC position, the cathode circuit of the doubler stage is complete to ground, and the cathode of the oscillator stage is placed on the keying line. Closing the key completes the oscillator cathode circuit, keying the transmitter. Do not key the oscillator at high speed when using crystal control. The crystal is unable to follow the rapid keying because of mechanical inertia. Do not key the oscillator at high speeds when using MO control, because the signal may become *chirpy* due to oscillator instability.

(2) *Doubler keying.* With switch SW_{16} in the DOUB position, the cathode circuit of the oscillator is complete to ground and the oscillator functions continuously. The cathode circuit of the doubler is placed on the keying line so that closing the key completes the doubler circuit and provides excitation for the remaining stages.

b. HIGH-VOLTAGE CONTROL (fig. 29). To control the output of Radio Transmitter T–62( )/MRC–1 to provide the correct excitation to the power amplifier, a VARIAC has been placed in the primary circuit of plate supply transformer T_6. This variac is used when tuning and on high-power c-w operation *only*. On voice or low-power c-w operation, the VARIAC is removed from the circuit by placing the VARIAC CONTROL switch in NORMAL position. This switch controls relay RY_6 which, when energized, connects the primary of T_6 directly to the a-c power source without passing through the VARIAC.

Note. For preliminary tuning of the power amplifier in Radio Transmitter T–62( )/MRC–1, SW_4 should be in the VARIAC position and the variac set low to avoid excessive plate current.

72. Power Amplifier

Power Amplifier AM–35( )/MRC–1 is a standard design, Class C, push-pull r-f amplifier using two

triode Tubes JAN–833A V_1 and V_2. (See fig. 30.) The power output is 2 kw with an a-c input of 3.75 kw. Excitation is supplied by Radio Transmitter T–62( )/MRC–1 link coupled through coaxial cable.

C_3 is used in parallel with C_2 to increase the capacitance of the tank circuit for operation from 2.0 to 2.3 mc. Fixed bias is used and fed through the center tap on L_1 secondary. Fixed mica capacitor C_1 is an r-f (radio-frequency) bypass for the grid circuit. Resistors R_1 and R_2 are noninductive parasitic suppressors.

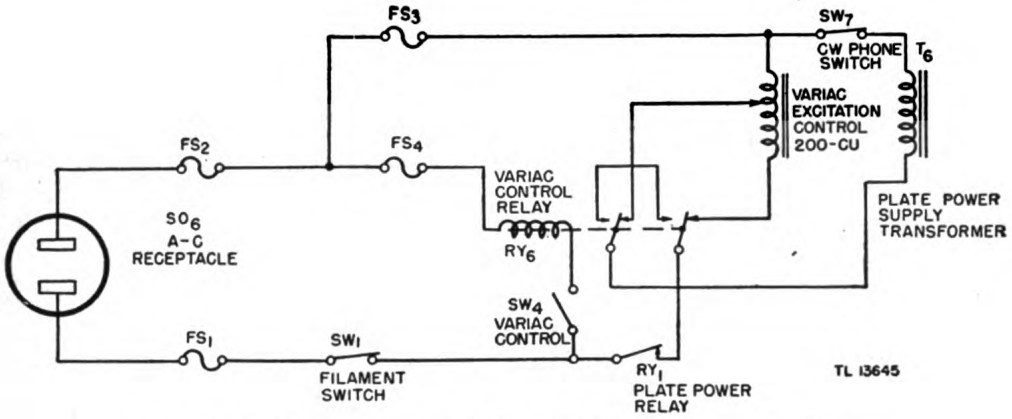


Figure 29. Radio Transmitter T–62( )/MRC–1—variac control circuit.

Note. Power amplifiers having Serial Nos. 1, 2, 3, 4, and 5 are slightly different in construction as regards bleeders, transformer mounting, and lack of tube heaters and thermostats. These differences and a chart of reference numbers are listed in paragraph 100. However no difficulty will be encountered due to these differences.

a. The coaxial cable is connected to receptacle J_1. The excitation is coupled to the p-a grids through inductor L_1. The secondary is tuned by split-stator variable capacitor C_2. A plug in vacuum capacitor

b. The plate-tank circuit consists of inductor L_2 which is tuned by split-stator variable capacitor C_{12}. Capacitors C_{10} and C_{11} are r-f bypasses for the plate circuit. The plate voltage is fed to the center tap of L_2 through r-f choke L_3. Capacitors C_4, C_5, C_6, and C_7 are r-f bypasses for the filaments which

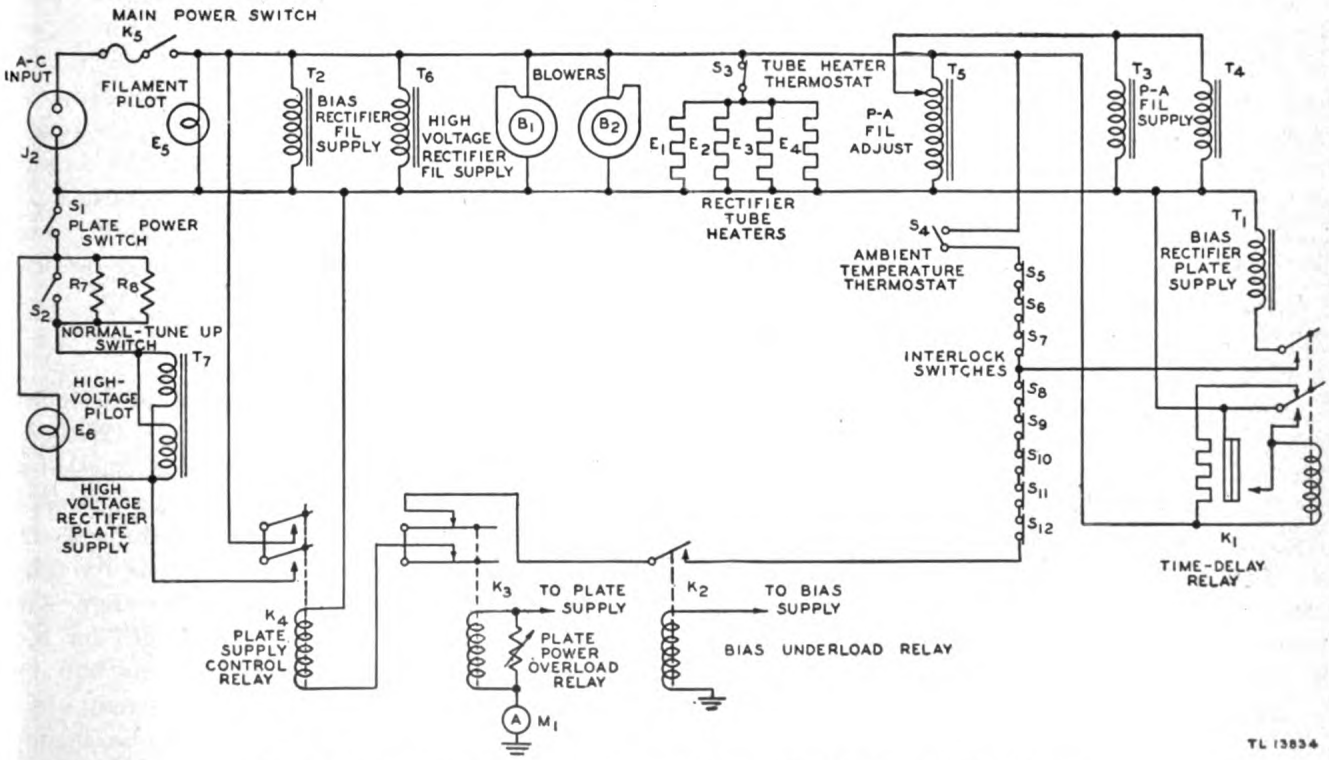


Figure 30. Power Amplifier AM–35( )/MRC–1—simplified a-c circuit diagram.

are grounded at T_3 and T_4. The antenna is link coupled to the plate tank L_2. The power amplifier is cross neutralized. Capacitors C_8 and C_9 are the neutralizing capacitors, and are adjusted so that the current fed through them to the grid circuit balances the current fed through the interelectrode capacities of the tubes. Because cross neutralization is used, the unbalance effect of inductance is removed and the power amplifier will remain neutralized over the entire band.

c. Two separate power supplies are used; one for the grid bias and the other for the plate supply.

(1) The bias supply uses two mercury vapor rectifier Tubes JAN–866A in a conventional full-wave circuit. Power transformer T_2 supplies the filament power for the bias rectifier tubes V_3 and V_4. The center tap of T_2 is grounded. Transformer T_1 supplies the plate voltage. R-f chokes L_4 and L_5 suppress noise from the rectifier. The d-c output from the center tap of T_1 is filtered by tapped choke L_6 and oil capacitors C_{14} and C_{15}. This combination acts as a two-section choke input filter. Resistor R_4 in series with the bias underload relay K_2 is a bleeder across the power supply. R_3 is the grid leak bias resistor. The grid circuit is completed to the grids through grid current meter M_1 and to ground through R_4.

(2) The high-voltage supply uses two mercury-wave rectifier Tubes JAN–872A V_5 and V_6 in a conventional full-wave circuit. The filament voltage is supplied by transformer T_6. Transformer T_7 supplies the plate voltage, and its center tap is grounded through plate power overload relay K_3, and plate current meter M_2. The positive side is taken from the center tap of T_7 and filtered through L_7 and C_{13}, a choke input filter. Resistors R_5 and R_6 in series form a bleeder for the high-voltage supply.

d. The 110-volt, a-c supply enters the set at J_2. Circuit breaker K_5 is the main power switch. When this switch is placed in the ON position the circuit is completed to all the filament transformers, the blowers B_1 and B_2, the filament pilot light E_5, and the tube heaters E_1, E_2, E_3, and E_4 through the thermostat S_3. Transformers T_2 and T_6 run directly off the line, but the voltage to the p-a filament transformers T_3 and T_4 is controlled by VARIAC T_5. The thermostat on tube heaters S_3 opens when the tubes have reached their proper operating temperature.

(1) When K_5 is ON, the circuit is also completed to the thermostatic time-delay relay K_1. When the circuit is first closed current flows through the heater which causes the thermostatic contacts to close in about 30 seconds. When the thermostatic contacts close the relay coil is energized, closing the relay holding contacts and opening the heater circuit contacts. The third set of contacts on K_1 completes the circuit to the bias rectifier plate supply transformer T_1 through the interlock switches S_5, S_6, and S_7 and the ambient temperature thermostat S_4. If the temperature of the set is too low or either of the access doors on the front panel or the access door to the bias rectifier tubes is open, the bias supply will not come on. The time-delay relay K_1 prevents power from being applied to the plates of the bias rectifiers before the filaments have heated.

(2) When plate power switch S_1 is placed in the ON position, the circuit is completed to high-voltage rectifier plate supply transformer T_7 and plate power pilot light E_6 through the contacts on K_4. When NORMAL-TUNE UP switch S_2 is in the TUNE UP position, resistors R_7 and R_8 are placed in series with the primary of T_7 limiting the plate current of the amplifier tubes to a safe value during tuning operations. S_2 is placed in the NORMAL or closed position for operation. The circuit for K_4 is completed through the contacts on K_2 and K_3, the interlock switches S_5 to S_{12}, and the ambient temperature thermostat S_4. K_3 opens if there is an overload on the power amplifier, and remains open until reset by the OVERLOAD RESET button on the front panel. K_2 remains open until sufficient current flows through its coil to energize it. If the bias supply fails, K_2 will open. If K_2 is open or K_3 closed, the circuit to K_4 is broken which removes the plate voltage from the amplifier tubes. If the plate power switch is turned on before the bias supply is working, the plate power will not come on. This prevents damage to the amplifier tubes.

73. Antenna System

Power Amplifier AM–35( )/MRC–1 is designed for use with Antenna System AS–95( )/MRC–1. The antenna must be cut to the correct length for the operating frequencies. The antenna operates as a doublet and is fed at the center through the coaxial cable. There is no provision made for tuning the antenna at the amplifier; therefore, the sections must be cut to the proper length for the operating frequency so that the antenna will be naturally resonant. Changing the resonant frequencies of the antenna is accomplished by changing the shorting jumpers on the antenna.

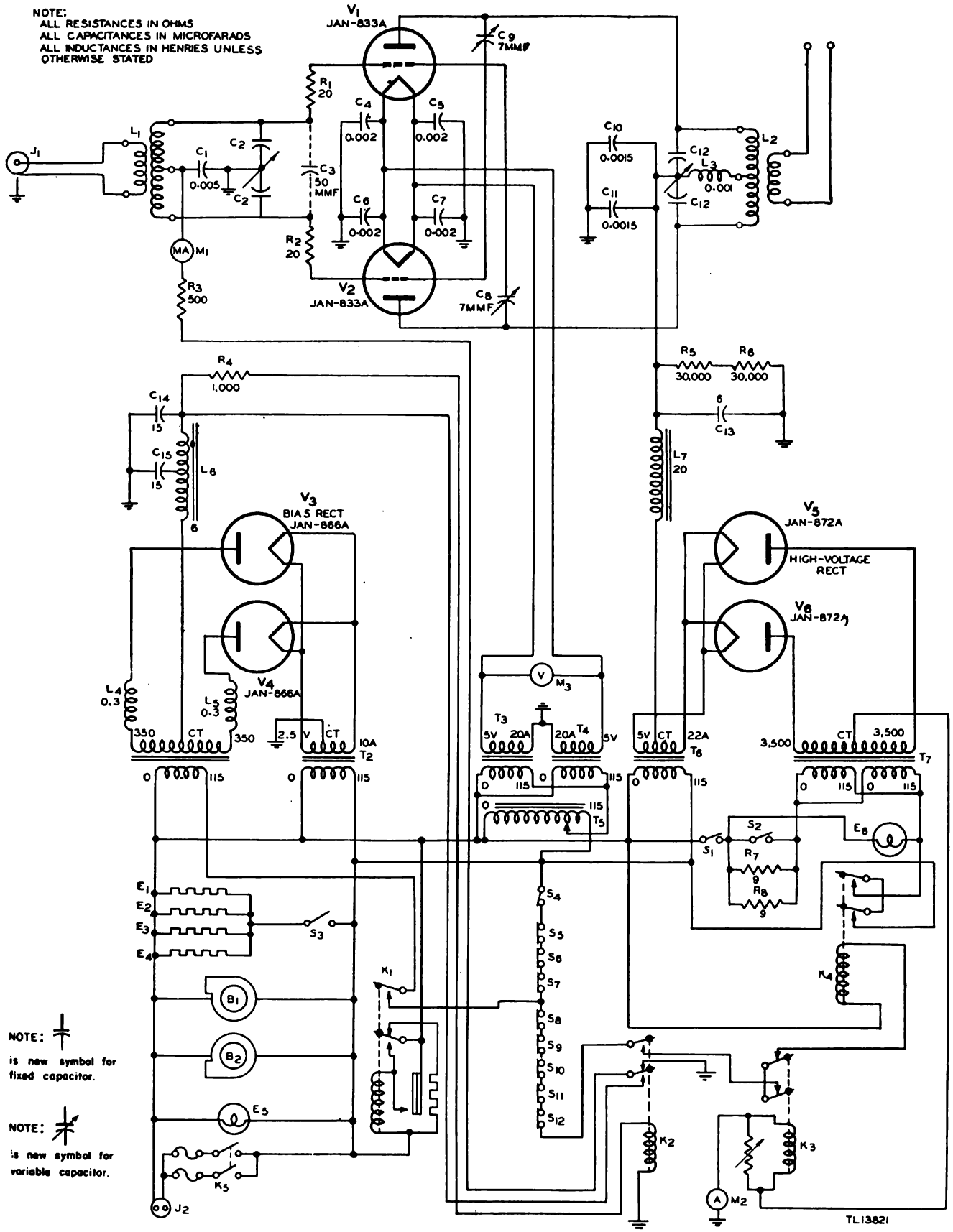


Figure 31. Power Amplifier AM-35( )/MRC-1—complete schematic diagram.

74. Shelter Wiring

The transmitter shelter contains a conventional Radio Set SCR–399–( ) with slight modifications. Radio Receiver BC–342–( ) has been removed and replaced with the Radio Receiver BC–312–( ). The interconnecting cording must be reversed so that controls on Junction Box JB–70–A will operate correctly. The remote keying line is plugged into the auxiliary key jack J_{101} on Speech Amplifier BC–614–E. This jack is in parallel with keying relay RY_{200} in the junction box so that the keying relay is not used. RY_{200} is also the disabling control, therefore, automatic disabling is not possible when operating from the operating shelter over the remote keying line. Relay RY_{200} is not capable of following high-speed keying and should not be used. See TM 11–281 for wiring and intraconnections of the transmiting shelter.

75. Operating Position

The receiving and operating components are located in the operating shelter which is located at a distance up to one mile from the transmitting position. Two wire lines of field Wire W–110–B connect the two positions. One is used for keying the transmitter and the other for telephone intercommunication between the two positions.

a. KEYING EQUIPMENT. Conventional Boehme high-speed tape equipment is used for keying. The tape is punched on a Wheatstone perforator. Detailed description may be found in the instruction book. The tape is run through a keying head. Detailed description of the keying head and associated equipment may be found in TM 11–377. The keying head is connected to the keying line through the terminal block.

b. RECEIVING EQUIPMENT. Three Radio Receivers BC-342–( ) (TM 11–850) are provided in the operating shelter. Two are fed from two untuned flattop antennas (Antenna System AS–94( )/MRC–1). The antennas are erected at right angles to each other and one receiver is connected to each antenna. The third receiver is a spare and may be used to monitor the transmitter. The receiver providing the better signal should be selected by means of the switch mounted in back of the operating bench. On medium and low speed, the operator may copy the output of the receivers directly, but on high speed the receiver output is fed to the recorder driving unit through a matching transformer. The driving unit operates the ink recorder which makes a tape transcription of the signal. The tape passes to the operator through the tape bridge. The tape is moved by tape pullers which are controlled by the foot switches. For a complete description of the automatic recording equipment see TM 11–377.

c. POWER SUPPLY. The primary power supply for the equipment in the operating shelter is Power Unit PE–95–( ). This power supply is covered in TM 11–904G or 11–904H. The a-c power enters at the rear of the shelter and is available through the outlet boxes at the back of the operating tables. D-c power is supplied by a tungar rectifier power unit. See the instruction book for detailed description. The d-c power is also available through outlet boxes. The rectifier is powered by the a-c supply. The a-c power to the heater and blowers is controlled by the left circuit breaker while a-c power to the rectifier and other components is controlled by the right circuit breaker. These circuit breakers are mounted inside the housing opposite the a-c input line.

Section II. TROUBLE SHOOTING

76. Introduction

No matter how well equipment is designed and manufactured, faults are bound to occur in service. When such faults do occur, the repairman must locate and correct them as rapidly as possible. This section contains information designed to aid those engaged in the important duty of trouble shooting. (Remember, however, that preventive maintenance will minimize the necessity of trouble shooting.)

a. TROUBLE-SHOOTING DATA. Take advantage of the material supplied in this manual to help in rapidly locating faults. Consult the following trouble-shooting data when necessary:

(1) *Block diagram of set.*

(2) *Complete schematic diagrams.* These diagrams include all parts and show all the connections (power, input, and output) to other units.

(3) *Simplified and partial schematics.* These diagrams are particularly useful in trouble shooting because they enable the electrical functioning of the circuits to be followed more clearly than on the regular schematics, thus speeding trouble location.

(4) *Voltage and resistance data at socket connections.*

(5) *Illustrations of components.* Front, top, and bottom views aid in locating and identifying parts.

b. TROUBLE-SHOOTING STEPS. The first step in servicing a defective radio set is to sectionalize the fault. *Sectionalization* means tracing the fault to

the component responsible for the abnormal operation of the set. The second step is to localize the fault. *Localization* means tracing the fault to the defective part responsible for the abnormal condition.

(1) Use of the equipment performance check list and the starting procedure aids in tracing the fault to the defective component. The procedures to be followed are explained in c and d below.

(2) Some faults such as burned-out resistors, r-f arcing, etc., can be located by sight, smell, and hearing. The majority of faults, however, must be located by checking voltages and resistances.

c. Starting-procedure Sectionalization. The starting procedure is the systematic method used to put the set on the air. This procedure is used in sectionalization when the cause of the set failure is not known. In most cases, it will trace the defect to a particular component. The steps of the starting procedure are performed in sequence until an abnormal result is obtained. As each step is performed, note the visible and audible results of the action.

d. Localization. Localization is tracing the fault to a particular part. Paragraphs 81 and 82 describe the method of localizing faults within the individual components. These sections contain trouble-shooting charts which list symptoms and their causes. The charts also give the procedure for finding out which of the probable troubles is the exact one. In addition, there are resistance and voltage charts.

77. Voltage Measurements

a. General. Voltage measurements are an almost indispensable aid to the repairman, because most troubles either result from abnormal voltages or produce abnormal voltages. Voltage measurements are made easily, because they are always made between two points in a circuit and the circuit need not be interrupted.

(1) Complete information on normal operating voltages is given in the voltage charts. Unless otherwise specified, these voltages are measured between the indicated points and ground.

(2) Always begin by setting the voltmeter on the highest range so that the voltmeter will not be overloaded. Then, if it is necessary to obtain increased accuracy, set the voltmeter to a lower range.

(3) In checking cathode voltage remember that a reading can be obtained when the cathode resistor is open. The resistance of the meter may act as a cathode resistor. Thus, the cathode voltage may be approximately normal only as long as the voltmeter is connected between cathode and ground. Before the cathode voltage is measured, a resistance check should be made with the circuit cold to determine if the cathode resistor is normal.

b. Precautions Against High Voltages. Certain precautions must be followed when measuring voltages above a few hundred volts. High voltages are dangerous and can be fatal. *Remember this equipment uses dangerous voltages.* These voltages may be fatal. In addition high r-f current is present in the tank and antenna circuits. Very serious burns may be produced by r-f currents. Do not measure voltage at any point where there is high r-f current. The r-f current will burn out the voltmeter regardless of which scale is used. Grids, plates, and coupling or antenna circuits should not be measured. When it is necessary to measure high voltages, observe the following rules:

(1) Connect the ground lead to the voltmeter.

(2) Place one hand in your pocket.

(3) If the voltage is less than 300 volts, connect the test lead to the hot terminal (which may be either positive or negative with respect to ground).

(4) If the voltage is greater than 300 volts, shut off the power, connect the hot test lead, step away from the voltmeter, turn on the power, and note the reading on the voltmeter. Do not touch any part of the voltmeter, particularly when it is necessary to measure the voltage between two points both of which are above ground. Use the multiplier if the voltage is thought to be above the normal range of the meter.

c. Voltmeter Loading. It is essential that the voltmeter resistance be at least 10 times as large as the resistance of the circuit across which the voltage is measured. If the voltmeter resistance is comparable to the circuit resistance, the voltmeter will indicate a lower voltage than the actual voltage present with the voltmeter removed from the circuit.

(1) The resistance of the voltmeter on any range can always be calculated by the following simple rule: resistance of voltmeter equals the ohms per volt multiplied by the full-scale range in volts. Two examples are shown below:

(*a*) What is the resistance of a 1,000-ohm-per-volt voltmeter on the 300-volt range?

R=1,000 ohms per volt $\times$ 300 volts=300,000 ohms

(*b*) What is the resistance of a 20,000-ohm-per-volt voltmeter on the 300-volt range?

R=20,000 ohms per volt $\times$ 300 volts= 6 megohms

(2) To minimize voltmeter loading in high-resistance circuits, use the highest voltmeter range. Although only a small deflection will be obtained

(possibly only 5 divisions on a 100-division scale), the accuracy of the voltage measurement will be increased. The decreased loading of the voltmeter will more than compensate for the inaccuracy which results from reading only a small deflection on the scale of the voltmeter.

(3) When a voltmeter is loading a circuit, the effect can always be noted by comparing the voltage reading on two successive ranges. If the voltage readings on the two ranges do not agree, voltmeter loading is excessive. The reading (not the deflection) on the highest range will be greater than on the lowest range. If the voltmeter is loading the circuit heavily, the deflection of the pointer will remain nearly the same when the voltmeter is shifted from one range to another.

(4) The voltage and resistance drawings used in this manual are based on readings taken with an actual meter. The ohm-per-volt sensitivity of the meter which was used is printed on the drawings. The trouble shooter should use a meter having the same ohm-per-volt sensitivity. Because the meter used in testing for the voltage will produce the same amount of loading as the meter used in measuring the voltage, it is unnecessary to consider the effect of loading.

78. Resistance Measurements

a. Normal Resistance Values. When a fault develops in a circuit, its effect will very often show up as a change in the resistance values. This is particularly true in high-power work, where voltage measurements may not always be possible. To assist in the localization of such faults, trouble-shooting data includes the normal resistance values as measured at the tube sockets and at key terminal points. These values are measured between the indicated points and ground, unless otherwise stated. Often it is desirable to measure the resistance from other points in the circuit, in order to determine whether the particular points in the circuit are normal. The normal resistance values at any point can be determined by referring to the resistance values shown in the schematic diagram, or by use of the resistor color code.

b. Precautions. (1) Before making any resistance measurements, turn off the power. An ohmmeter is essentially a low-range voltmeter and battery. If the ohmmeter is connected to a circuit which already has voltages in it, the needle will be knocked off scale and the voltmeter movement may be damaged.

(2) Capacitors must always be discharged before resistance measurements are made. This is very important when checking power supplies that are disconnected from their load. The discharge of the capacitor through the meter will burn out the movement and in some cases may endanger life.

c. Correct Use of Low and High Ranges. It is important to know when to use the low-resistance range and when to use the high-resistance range of an ohmmeter. When checking the circuit continuity, the ohmmeter should be set on the lowest range. If a medium or high range is used, the pointer may indicate zero ohms, even if the resistance is as high as 500 ohms. When checking high resistances or measuring the leakage resistance of capacitors or cables, the highest range should be used. If a low range is used, the pointer will indicate *infinite* ohms, even though the actual resistance is less than a megohm.

d. Parallel Resistance Connections. In a parallel circuit the total resistance is less than the smallest resistance in the circuit. This is important to remember when shooting trouble with the aid of a schematic diagram.

(1) When a resistance is measured and the value is found to be less than expected, make a careful study of the schematic to be certain that there are no resistances in parallel with the one that has been measured. Before replacing a resistor because its resistance measures too low, disconnect one terminal from the circuit and measure its resistance again, to make sure that the low reading does not occur because some part of the circuit is in parallel with the resistor.

(2) In some cases it will be impossible to check a resistor because it has a low-voltage transformer winding connected across it. If the resistor must be checked, disconnect one terminal from the circuit before measuring its resistance.

e. Checking Grid Resistance. When checking grid resistance, a false reading may be obtained if the tube is still warm and the cathode is emitting electrons. Allow the tube to cool, or reverse the ohmmeter test leads so that the negative ohmmeter test lead is applied to the grid.

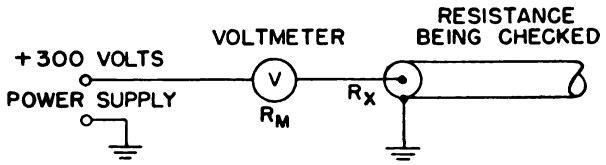
f. Tolerance Values for Resistance Measurements. *Tolerance* means the normal difference that is expected between the rated value of the resistor and its actual value.

(1) Most resistors that are used in radio circuits have a tolerance of at least 20 percent. For example, the grid resistor of a stage might have a rated value of 1 megohm. If the resistor were measured and found to have a value between 0.8 and 1.2 megohms,

it would be considered normal. As a rule, the ordinary resistors used in circuits are not replaced unless their values are off more than 20 percent. Some precision resistors and potentiometers are used. When a resistor is used whose value must be very close to its rated value, the tolerance is usually stated on the diagram or in the maintenance parts list.

(2) The tolerance values for transformer windings are generally between 1 and 5 percent. As a rule, suspect a transformer which shows a resistance deviating more than 5 percent from its rated value. Allow the transformer to cool off before the resistance test is made.

g. HIGH-RESISTANCE MEASUREMENTS. Many leakages will not show up when measured at low voltages. Most ohmmeters use a maximum test voltage of 15 volts on the highest resistance range. Where it is necessary to measure resistance above a few megohms or the leakage resistance between conductors of a cable, make the test using an applied voltage of 100 volts or more. Where it is possible to ground one end of the resistance being checked, one of the low-voltage power supplies in the equipment can be used to provide about 300 volts for making these high-resistance measurements. The manner in which such measurements are made is indicated in figure 32. This method should be used only when the resistance being measured is very high. Be careful not to handle the meter after the circuit has been completed. Use meter which has



$$R_X = \frac{300}{V} R_M \text{ (APPROX.)}$$

EXAMPLE

V = 5 VOLTS. THE METER IS USED ON ITS 300 VOLT RANGE AND HAS A RESISTANCE OF 1,000 OHMS-PER-VOLT.

$R_M = 300 \times 1{,}000 = 300{,}000$ OHMS.

$R_X = \frac{300}{5} \times 300{,}000 = 18$ MEGOHMS.

TL35530

Figure 32. Measurement of high resistance.

an ohm-per-volt sensitivity of 1,000 ohms or more. The resistance of the meter is equal to the ohm-per-volt sensitivity multiplied by the range to which the meter is set. The derivation of the formula $R_x = \frac{300R_m}{V}$ is shown below. R_x is the unknown resistance, R_m is the meter resistance, and V is the voltmeter reading.

$$\frac{R_x}{R_m} = \frac{300\text{-}V}{V}$$

If R_x is very large, V will be small in comparison to 300. Assuming that 300-V can be replaced by 300, the formula $\frac{R_x}{R_m} = \frac{300}{V}$ is obtained. When solved for R_x this gives $R_x = \frac{300R_m}{V}$. When making the measurement, the meter should first be put on the 300-volt scale to protect it in case R_x is very low. If the voltage used is not 300 volts, the correct value should be inserted in the formula in place of 300.

79. Capacitor Tests

Capacitors which are leaky or shorted can be found by resistance checks of the stage. A capacitor which is suspected of being open can best be checked by shunting a good capacitor across it. In r-f circuits, keep the lead to the capacitor as short as the original leads. In low-frequency circuits (less than 1 mc) the test capacitor leads may be several inches long.

80. Current Measurements

a. Current measurements, other than those indicated by panel meters, are not ordinarily required in trouble shooting in the radio set. Under special circumstances where the voltage and resistance measurements by themselves are not sufficient to localize the trouble, a current measurement can be made by opening the circuit and connecting an ammeter to measure the current. This procedure is not recommended except in very difficult cases.

Caution: A meter has least protection against damage when it is used to measure current. Always set the current range to the highest value. Then if necessary, decrease the range to give a more accurate reading. Avoid working close to full-scale reading because this increases the danger of overload.

b. In most cases, the current to be measured flows through a resistance which is either known or can be measured with an ohmmeter. The current flowing in the circuit can be determined by dividing the voltage drop across the resistor by its resistance value. The drop across the cathode resistor is a convenient method of determining the cathode current.

81. Use of Meters on Equipment

a. GENERAL. Many components of this set have meters on their panels. Observation of these meters and intelligent interpretation of the readings not only makes it possible to avoid many troubles, but also helps correct troubles when they occur. The technical manuals or instruction books provided describe the correct readings of the panel meters of all components except the power amplifier and the transmitter.

b. TRANSMITTER. TM 11–281 describes correct meter indications of the transmitter with the exception of the plate meter when tuning up. When tuning the transmitter, the variac should be set low enough to avoid damage to the p-a tube in the transmitter. If the plate current is above 290 ma the reading of the variac must be decreased. When the transmitter has been tuned and the variac is being adjusted to give the proper excitation to the power amplifier, the reading of the plate current meter on the transmitter should be about 200 ma. If the reading is much higher there is probably trouble or improper tuning. If the plate current necessary to give the proper excitation shows a gradual increase with time, it is an indication that the amplifier tube is going bad, the tubes in the power amplifier are going bad, or the set is going out of neutralization. Whenever there is an abnormal meter reading, a major break-down may be avoided by investigating the reading and finding the cause of it before going on.

c. POWER AMPLIFIER. There are three meters on the power amplifier. Much trouble shooting can be accomplished by careful observation of these meters.

(1) The filament voltage meter must be watched carefully to avoid improper filament voltage which may seriously damage the tubes. If the filament meter shows rapid fluctuations or a tendency to drop when the set is loaded, check the power unit and associated cables and wiring.

(2) The grid current meter indicates the power input to the amplifier and the tuning of the set. If there is a tendency for the grid current to drop more than about 20 ma when the set is loaded, check the neutralization. Variation in the way the set tunes from one operation to the next is a sign of trouble.

(3) The plate current meter is the most important meter on the power amplifier. Any deviation from the normal on this meter is an indication of trouble or misadjustment. The plate current should be minimum when the grid current is maximum. Specific faults and their corrections are covered in paragraph 86. Do not disregard gradual changes which show aging of tubes or parts. Sudden changes in readings indicate trouble. *Do not disregard warning indications of the meter readings.*

82. Tube Checkers

Tube checkers are used to check the emission of electrons from the cathode and to test for shorted elements. Tube checkers will not test the performance of high-voltage tubes or rectifiers or of some special tubes in the modulator and rectifier. Tube checkers are useful, however, for checking receiving tubes used in the various components.

a. Results obtained from a tube checker are not always conclusive, because the conditions are not the same as those under which the tube operates in the set. For this reason the final test of a tube must be its replacement with a tube which is known to be good. In many cases it is quicker and more reliable to replace a suspected tube with a good one than to check it with the tube checker.

b. An operating chart and an instruction book or technical manual are provided with the tube checker. This chart indicates the setting of the tube checker for each tube type. The number of controls, their arrangement, and their settings vary with different types of tube checkers.

c. Particulars of tube checking are given in paragraph 89.

83. Replacing Parts

Careless replacement of parts often makes new faults inevitable. Note the following points:

a. Before a part is unsoldered, note the position of the leads. If the part, such as a transformer, has a number of connections to it, tag each of the leads.

b. Be careful not to damage other leads by pulling or pushing them out of the way.

c. Do not allow drops of solder to fall into the set, since they may cause short circuits.

d. A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to find.

e. When a part is replaced in an r-f circuit, it must be placed exactly as the original one. A part which has the same electrical value but different physical size may cause trouble in high-frequency circuits. Give particular attention to proper grounding when replacing a part. Use the same ground point as in the original wiring. Failure to observe these precautions may result in decreased gain or possibly in oscillation of the circuit.

84. Test Equipment

A good workman must have the proper tools and understand their use. The test equipment provided with Radio Set AN/MRC–1 is adequate for most cases.

a. Operating Shelter. The operating shelter is provided with Tool Equipment TE–48 or Tool Equipment TE–113, and a teletype tool set. The multitester contained in Tool Equipment TE–48 will make any electrical tests that may be necessary on any of the components or the wiring of the shelter itself.

b. Transmitting Shelter. The transmitting shelter contains that test equipment normally provided with Radio Set SCR–399–A. (See TM 11–281.) In addition a neutralizing indicator is provided. The neutralizing indicator is simply an incandescent lamp across a pick-up loop.

85. Trouble-Shooting Procedure for Transmitting Shelter

When there is a fault in this equipment it must be found and corrected quickly and accurately. The following tables give the symptoms and probable causes of many common faults. Use resistance and voltage measurements to find the exact part at fault.

Caution: If bleeder resistors R_4, R_5, R_6, or relay K_2 in the power amplifier are open *dangerous voltages may exist after power has been turned off.* Ground all high-voltage points with an insulated prod before doing any work or making any adjustments on the set.

86. Trouble Chart for Transmitting Shelter

Symptoms	Probable trouble	Corrections
1. Power Unit PE–95–( ) refuses to start when START button on Junction Box JB–70–A is pushed.	1. START and STOP leads interchanged or disconnected in trailer terminal board. Weak battery in Power Unit PE–95–( ) might operate start relay, but cannot turn over engine. See TM 11–904G or 11–904H for detailed description of power unit troubles.	1. Switch leads at power unit, or repair break in lead. Hand crank engine, or substitute good battery.
2. Power Unit PE–95–( ) starts but no power is supplied to Shelter HO–17–( ).	2. Generator not functioning. (Check voltage at generator). Open a–c cord, or plug or socket not making contact. (Check voltage at input to Shelter HO–17.) A–c line in Shelter HO–17 open or switch not making proper contact.	2. See TM 11–904G or 11–904H. Check each section of cording, plugs, and sockets. Replace wiring or part at fault.
3. No filament supply to Radio Transmitter T–62( )/MRC–1.	3. See TM 11–281 for detailed description of transmitter troubles.	
4. No plate power when on VARIAC control of transmitter.	4. Relay RY_6 stuck or contacts dirty. VARIAC slider not making contact, or winding burned out. See TM 11–281 for other causes.	4. Clean contacts. Replace relay if contacts badly burned. Clean contacts. Replace VARIAC if burned out.
5. No filament voltage in Power Amplifier AM–35( )/MRC–1.	5. Poor contact or broken wire in connector J_2. Circuit breaker K_6 not making contact.	5. Clean contacts. Repair wire. Check contacts. Clean contacts or replace circuit breaker.
6. Filament pilot light lighted but low or no grid current on grid current meter M_1.	6. Short in coaxial cable or plugs. Open connection at coaxial cable J_1. No grid coil L_1 in place, wrong coil used, coil plugged in incorrectly, vacuum capacitor C_3 wrongly used, or wrongly omitted. Capacitor C_1 shorted. Bleeder resistor R_4 open. Choke L_6 open. Amplifier tube filaments not lit or poor emission. Filament adjuster T_6 not contacting or open. Resistor R_1 or R_2 open. Bias under load relay coil is open.	6. Replace if shorted or arced over. Resolder contact. Check tank circuit and frequency. Clean contacts. Replace coil if it has arced over. Replace. Replace. Replace. Adjust filament voltage. Substitute tubes. Check contacts. Adjust and clean. Replace if winding is open. Replace. Replace.

86. Trouble Chart for Transmitting Shelter (contd)

Symptoms	Probable trouble	Corrections
7. Grid circuit does not resonate.	7. Wrong grid coil or coil plugged in incorrectly.	7. Check frequency and coil.
	Vacuum capacitor wrongly used or wrongly omitted.	Check to see if capacitor is in.
	Amplifier not neutralized.	Neutralize.
8. No plate current. Plate supply control relay K_4 open.	8. Time-delay relay K_1 not closed.	8. Adjust contacts. Replace if coil or heater is open.
	Interlocks not all closed.	Close all access doors to transmitter.
	Bias supply not drawing current. Bleeder open.	Replace bleeder.
	Bias supply not drawing current. Bias rectifier tubes bad.	Replace tubes.
	K_2 improperly adjusted.	Adjust.
	Plate overload relay K_3 is tripped.	Press reset button.
	Overload in plate circuit.	
	Set on OPERATE instead of TUNE.	Open TUNE OPERATE switch S_2.
	Filter capacitor C_{13} shorted.	Replace.
	Short in high-voltage wiring.	Check with ohmmeter. If shorted find short by inspection.
	K_3 improperly adjusted.	Adjust.
	Winding of K_4 open.	Replace.
	Ambient temperature thermostat S_4 open.	Check contacts. Replace if not operating.
9. No plate current. K_4 closed.	9. Poor contacts on K_4.	9. Clean and adjust.
	Plate power switch S_1 not making contact.	Clean and ajdust contacts.
	Rectifier tubes bad.	Replace tubes.
	Choke L_7 open.	Replace.
	Choke L_8 open.	Replace.
10. Plate tank does not resonate.	10. Wrong coil L_2 or coil not plugged in correctly.	10. Check coil and frequency.
	Overcoupling.	Reduce coupling.
	Not neutralized.	Neutralize.
11. Plate tank does not load properly.	11. Not enough coupling.	11. Increase coupling.
	Open in antenna circuit.	Check connections at both ends of coaxial feeder.
	Wrong antenna.	Check antenna length and frequency.
		Check shorting jumpers.
12. Arcing in plate tank.	12. No load or wrong antenna.	12. Check steps above.
13. Circuit breaker trips shortly after set is turned on.	13. Break-down in filament transformer T_2 or T_6.	13. Replace.
	Filter capacitor C_{12}, C_{14}, or C_{15} shorted.	Replace.

87. Sectionalizing Trouble in Operating Shelter

Detailed steps on trouble shooting the various components are available in the technical manuals or instruction books pertaining to those components. General checks to sectionalize the trouble to a particular component are given below. Use the appropriate manual to localize the trouble.

Symptom	Component probably at fault
Power unit will not start or no output.	Power unit PE–95–( ).
No power in Shelter HO–17.	Cording from power unit or circuit breaker.
No audio output from Radio Receiver BC–342–( ).	Radio receiver.
Insufficient output from recorder driving unit.	Check driving unit and connection to receiver.
Ink recorder does not record correctly.	Check ink recorder.
Perforator not operating.	Check perforator.
No keying signal at transmitter.	Check keying head.
	Check connection to field wire line.
	Check line.

88. Resistance and Voltage Measurements

a. Resistance Measurements. Resistance measurements are particularly valuable when working on the power amplifier since many circuits cannot be measured with a voltmeter because of high voltage or r-f current, or both. The table below gives the resistance from all tube connections to ground, and the resistance across many of the major parts in the set. Readings below are approximate values only.

Point to point		Resistance (ohms)
Plate of amplifier tube	Ground	60,000
Grid of amplifier tube	Ground	500
Filament of amplifier tube	Ground	0
Bias rectifier tube plate	Ground	1,200
Bias rectifier filament	Ground	0
High-voltage rectifier plate	Ground	35
High-voltage rectifier filament	Ground	60,000
High-voltage rectifier plate	Plate	50
High-voltage rectifier filament	Amplifier plate	50
Bias rectifier plate	Plate	50
Bias rectifier choke start	Finish	130

Point to point		Resistance (ohms)
Bias rectifier choke start	Tap	65
Bias rectifier choke tap	Finish	65
A–c input	A–c input	0 K_8 closed ∞ K_8 open

Note. Above measurements are made with power disconnected, no excitation, coils in place, and switches in normal position unless otherwise indicated.

b. ALTERNATING-CURRENT VOLTAGE MEASUREMENTS. Voltage measurements should not be made while the set is on except as given in the table. The a-c voltages at the primary and secondary of all transformers are given below.

Transformer	Primary (volts)	Secondary (volts)	
		End to end	End to center tap
Bias supply plate transformer T_1	115	700	350
Bias supply filament transformer T_2	115	2.5	1.25
P–a filament transformers T_3 and T_4	115	5.0	----------
P–a filament adjust (Variac) T_5	115	variable	----------
H–v supply filament transformer T_6	115	5.0	2.5
H–v supply plate transformer T_7	115	7,000*	3,500*

* Do not measure without special equipment.

c. DIRECT-CURRENT VOLTAGE MEASUREMENT. Bias voltage should be 275 volts with no excitation. This voltage may be measured at the grid coil. Plate voltage may be estimated by checking the reading of the plate current meter with no excitation. The plate voltage is then equal to the plate current times 60,000. A normal indication is 70 ma.

89. Tube Checking

The vacuum tubes used in Radio Set AN/MRC–1 vary greatly in size and design. Most of these tubes may be checked with the tube checker in Test Set I–56–( ). The mercury vapor rectifier tubes and the high-power amplifier tubes in the transmitter and power amplifier cannot be checked with any standard tube checkers. In any case it must be remembered that a tube checker is not infallible.

a. MERCURY VAPOR RECTIFIER TUBES. Mercury vapor rectifier tubes are used in all cases where there is a high current drain and high voltage. These tubes have a very low internal voltage drop, about 15 volts, and can handle large values of current. These excellent qualities are due to the mercury vapor inside the tube. This mercury is in liquid form when the tube is cold. The heat from the filament vaporizes the mercury. When the tube is operating correctly there will be a bluish glow from the tube. The intensity of this glow depends partially on the load on the tube. When the glow is very pale and there is low output, the tube is probably bad. These tubes will wear out and the usual indication is a change in the intensity of the glow. When mercury vapor tubes are replaced they must be *run in.* (See par. 91.) The filament continuity may be checked with an ohmmeter. Tubes may be inspected from the access doors in the rear.

b. POWER-AMPLIFIER TUBES. The final amplifier tube in the transmitter and the amplifier tubes in the power amplifier are high-vacuum triodes with high plate dissipation. The filaments can be checked for continuity, and a visual inspection of the tube when cold may show troubles such as burned plates or broken grid wires. When in operation the plates should be a medium red. If the plates are bright red or yellow, something is wrong with the tuning or the circuit. Turn off the set and check. When operating, the amplifier tubes in the power amplifier should have a red spot in the center of each plate approximately the size of a silver dollar. If the tubes are suspected of causing trouble, the best check is to substitute a good tube for the suspected one.

90. Removing and Installing Power-Amplifier Tubes JAN-833A

Care must be used in removing or installing the p-a tubes. These tubes are ruggedly constructed, but careless handling can easily damage them.

a. INSTALLING. These tubes are fastened by their filament caps, which connect to adjustable clamps. Plate and grid connections are made to the caps on top of the tube. To install the tubes proceed as follows:

(1) Loosen the knurled fasteners on the filament connectors so that the tube will fit in easily.

(2) Gently place the tube so that the filament caps slide into the connectors. The flat side on one of the filament caps must be placed so that it is on top, or the tube will not fit in.

(3) When the filament caps are firmly seated, tighten the knurled fasteners finger tight. *Do not use pliers or a wrench.*

(4) Loosen the plate and grid connectors, and put them on. The plate connector goes on the top cap. It is the connector with the heavy braid. The grid connector which goes on the bottom cap is fastened to the upright resistor below the top of the tube.

(5) Tighten the plate and grid connectors by

means of the knurled fasteners. Tighten them finger tight. *Do not use pliers or a wrench.*

b. REMOVING. Although these tubes are heavily built, they can be broken by rough handling. Do not attempt to force any connections. These tubes become extremely hot when in use. *Do not attempt to remove a tube until it has cooled off. Serious burns will result if hot tubes are touched.* To remove tubes, proceed as follows:

(1) Loosen knurled fasteners on the plate and grid.

(2) Carefully pull the connectors off the plate and grid caps. Do not bend or twist the connectors, and do not use prying tools.

(3) Reach in along side of the tube and loosen the fasteners on the filament caps. Grasp the tube firmly and pull it straight out. Do not bend or twist as this may snap the seals at the filament caps.

(4) The plate connector must be bent out of the way of the tube. The resistor near the grid cannot be moved. Therefore, to completely remove the tube, it must be raised slightly after the filament caps have been pulled from the connectors.

91. Running in Mercury Vapor Tubes

Before a new mercury vapor rectifier tube is placed in service, it should be run with filaments lit and no plate voltage. This process vaporizes any mercury on the tube elements which might otherwise cause break-down of the tube when plate voltage is applied. To *run in* the tubes, open the grid coil access door so that the interlock is open and turn on filaments for 10 minutes.

Section III. REPAIRS

92. Care of Tools

Careful handling of tools is essential in the maintenance of signal equipment. Grasp tools firmly. Do not drop them against breakable parts of the set. A tool dropped in the chassis of a component of Radio Set AN/MRC–1 may damage tubes, resistors, or other delicate components. It may require great effort to recover small tools dropped in some components. Work can be performed rapidly and efficiently with well kept tools. When a job has been completed, wipe the tools with a rag slightly dampened with oil. Occasionally oil the hinge rivets of pliers and similar tools to keep them working freely. Inspect the handles of driving tools to see that they are tight and free from chips and splinters. When tools are to be stored for a long time, cover the surfaces with Grease, Lubricating, Special, Ordnance Department Spec No. AXS–637, or equal, as a preservative. Do not use thin oil because its tendency to break down may permit moisture to corrode or rust the metal.

93. Replacement of Parts

a. GENERAL. Most of the parts in the various components of Radio Set AN/MRC–1 are readily accessible and are easily replaced if they are found to be faulty. Instructions for repairs of all components other than Power Amplifier AM–35( )/MRC–1 are covered in the manuals pertaining to the particular component. When replacing any part it is important to restore all wiring as close as possible to its original condition. Wires should be tagged when they are removed and a rough sketch of the part and the wiring should be made by the repairman before the part is removed. This is particularly important where there are a number of wires, other wiring must be disturbed, or the wires are carrying r-f currents. Unauthorized personnel must not attempt repairs.

b. POWER AMPLIFIER AM–35( )/MRC–1. The power amplifier is well built and replacement of parts is quite simple. High voltages and currents are present in many circuits, so all high-voltage points must be grounded before replacement of any part is attempted. To insure good operation all parts and wiring must be restored to their original position after replacement. All joints must be made well. When soldering, particular care must be taken to insure strong, low-resistance connections. All panels and covers are secured by bayonet lock fasteners. To replace any part in the power amplifier follow the directions given below.

Caution: Do not drop nuts or screws. If they drop into shock mounting they will be very difficult to recover.

(1) *Bleeder resistors.* All the bleeder resistors are mounted in a bank in the right rear of the transmitter. To remove any of them, unsolder the wires at the top and bottom, and then loosen the wingnuts. On the plate supply bleeders it will also be necessary to remove the bracket at the top. The bleeders can now be removed.

(2) *Dropping resistors R_7 and R_8.* Remove the

right side panel and then remove the bolts at either end of the two resistors. These resistors are mounted on the center deck of the transmitter. When the mounting bolts have been removed, remove the bolts holding the leads.

(3) *Parasitic suppressors R_1 and R_2.* Remove the appropriate side panel and loosen the screws at the bottom and the top of the resistor. The resistor can now be removed.

(4) *Plate Tuning Capacitor C_{12}.* Remove the left panel and proceed as follows:

(*a*) Loosen locknut on drive belt while holding sleeve on belt to prevent twisting the belt. Then turn sleeve counterclockwise until belt comes apart.

(*b*) Remove plate coil and then remove plate leads from jack bar on capacitor.

(*c*) Loosen three inner jacks and remove leads from back of jack bar. Do not use excessive pressure against jack bar.

(*d*) Remove mounting bolts on each leg of capacitor.

(5) *Grid Tuning Capacitor C_2.* Remove the left side of the case and proceed as follows:

(*a*) Remove parasitic suppressors R_1 and R_2, and all tube connections.

(b) Remove shield can above grid coil by taking out four screws holding it.

(*c*) Remove grid coil L_1 and vacuum capacitor C_3 below the coil.

(*d*) Unsolder ground strap directly below neutralizing capacitors and remove bypass capacitor C_1.

(*e*) Remove screws holding ground strap on shield of amplifier tubes and tuning capacitor.

(*f*) Loosen three center jacks on jack bar, and remove cable and bias lead.

(*g*) Loosen setscrews on flexible coupling and remove four mounting screws from bottom of tuning capacitor. Pull out tuning capacitor and neutralizing assembly.

(6) *Plate Bypass Capacitors C_{10} and C_{11}.* Remove the left side panel and then remove the leads from the top and the mounting screws from the base.

(7) *Filament Bypass Capacitors C_4, C_5, C_6 and C_7.* Remove the back of the amplifier first. Proceed as follows:

(*a*) Remove a-c connections from terminal block located between blowers.

(*b*) Remove twelve screws holding rear cover of tube housing. Remove rear cover with blowers.

(*c*) Unsolder leads on bypass capacitors and remove mounting screws. Remove capacitors.

(8) *Grid Bypass Capacitor C_1.* Remove this part with grid tuning capacitor (step (5)).

(9) *Plate Supply Filter Capacitor C_{13}, Plate Power Supply Transformer T_7, and Plate Choke L_7.*

(*a*) Remove four mounting bolts holding amplifier to shelter floor.

(*b*) Remove right side panel, and tip set so that nuts in base are accessible.

(*c*) Remove four mounting nuts from base, and restore set to upright position.

(*d*) Slide set around; remove electrical connections and bolts.

(*e*) Remove plate power supply transformer and filter capacitor from right side of set. Remove filter choke from rear. Remove plate supply rectifier tubes before moving choke.

(10) *Transformers and chokes.* Remove remaining transformers and choke as follows:

(*a*) Remove left side panel of set except in case of bias choke L_6, in which case back cover must be removed.

(*b*) Remove all leads from part and then remove four mounting screws from bottom of part.

(*c*) Remove bias rectifier tubes so they will not be damaged, and then remove part.

(11) *Bias Supply Filter Capacitors C_{14} or C_{15}.* Remove the right side panel and proceed as in step (10) above, except two nuts must be removed instead of four bolts.

(12) *Plate Supply Radio-frequency Choke L_3.* Remove this part after taking off the right side panel by unsoldering leads and removing the mounting screws in the stand-off insulators.

(13) *Relays.* (*a*) Remove three screws in control panel on front of set, and pull hinged panel out so that relays are accessible.

(*b*) Unfasten all leads to relay, and then remove mounting screws.

(14) *Interlock switches.* Unsolder the leads and remove the two mounting screws.

(15) *Control switches.* The switches which are mounted behind the control panel may be easily removed as follows:

(*a*) Drop front panel out of way as in step (13). Open access door to grid inductor, and remove grid coil.

(*b*) Leads to switches may be removed either from front or top, with exception of one lead on circuit breaker K_5. Remove this lead after mounting screws are removed by turning part so that screw holding lead is accessible.

(*c*) Remove mounting screws from front of

switch, and part is free except as noted in preceding step.

(16) *Rectifier tubes.* Take off the plate cap and twist the tube counterclockwise while pushing down. This frees the locking pin in the base and the tube may be removed. Removal of p-a tubes is covered in paragraph 90.

(17) *Variac T_5.* (*a*) Remove knob on front panel by loosening two setscrews.

(*b*) Remove right side panel.

(*c*) Remove cover plate from terminal connections by taking out two holding screws, and unsolder leads.

(*d*) Remove three nuts on mounting studs and slide out variac.

(18) *Neutralizing capacitors.* (*a*) Entire neutralizing assembly may be removed as outlined in step (5).

(*b*) To remove any single plate, open plate coil access door, remove coil and back-off holding nuts on lower side. Remove plate.

(19) *Meters.* (*a*) Remove right side panel.

(*b*) Remove two nuts holding the leads and remove leads.

(*c*) Remove three screws on mounting bolts and pull out meter from front panel.

(20) *Pilot lights.* Drop the front panel as in step (13), unclip the lights from the jewel, and unscrew the light.

(21) *Blower assembly.* (a) Remove rear cover of set.

(*b*) Remove leads from terminal block on rear of tube housing and unsolder motor leads from mounting lug.

(*c*) Take out three mounting screws and motor and blower will come out. Because the blower fits very closely in the housing, it may be necessary to turn or twist motor to free blower. Note that oil cup on motor is upright.

(22) *Replacement.* To replace any of the parts mentioned above follow the steps given in reverse order. When replacing tuning capacitors, make sure that 0 dial reading coincides with fully meshed plates and that the belt drive on the plate tuning capacitor is lined up correctly with the holding pins.

94. Emergency Repairs

Trouble may exist in a component or part of Radio Set AN/MRC–1 when the equipment is urgently needed. By becoming familiar with the equipment it may be possible to make emergency repairs which will keep the set on the air although the efficiency or output may decrease.

a. Operating Shelter. A resourceful operator should have little difficulty in keeping the set on the air under adverse conditions.

(1) If a receiver goes bad, substitute another one. There are three available. In case the antenna is destroyed or otherwise not functioning, an emergency antenna may be made out of any piece of wire.

(2) If the automatic receiving equipment is not functioning and it is impossible to quickly substitute a good component for the faulty one, operation is possible on medium speed, copying manually.

(3) If the automatic sending equipment is not functioning, it is possible to use a hand key.

(4) If the keying line to the transmitter is out, but the telephone is working, lines can be switched so that sending is still possible although there will be no intercommunication.

b. Transmitting Shelter. In case of major failure at the transmitter location, emergency repairs will probably be more difficult, but there are many improvisations possible.

(1) The transmitter may be used without the power amplifier although power will be reduced. Couple the antenna through the antenna tuning unit to the transmitter.

(2) Three power units are available, and only two are in use. Substituting the spare for the faulty unit will prevent interrupted communications.

(3) Emergency antennas can be easily erected. The emergency antenna should approximate the original in length and method of feed if possible.

c. General. More specific information regarding emergency repairs and substitutions is available in the manual pertaining to that equipment. Emergency repairs to Power Amplifier AM–35( )/MRC–1 are not good practice because high voltage and power are present. Extreme damage to personnel and equipment may be the result of *tinkering*. Such repairs should be attempted only under emergency conditions.

95. Rustprooofing and Repainting

a. If the finish on the case on any component becomes badly scratched or damaged, the repairmen should touch up the exposed surfaces to prevent rust and corrosion. Using #00 or #000 sandpaper, clean the surface down to the bare metal until the finish is bright and smooth. Apply paint with a small brush.

Caution: The use of steel wool is not recommended. Although it removes rust rapidly, the small

particles of metal which often fall into the case cause grounding or internal electrical shorting of circuits.

b. If a complete repainting job is necessary, proceed as follows:

(1) Remove all control knobs on front panel.

(2) Loosen rust and corrosion with dry-cleaning solvent.

(3) Using #00 or #000 sandpaper, clean surfaces down to bare metal until finish is bright and smooth.

(4) Mask all openings and any hinges or joints with masking tape.

(5) Spray-paint entire case using a paint which is authorized by existing regulations.

(6) Touch up all areas that were masked with tape.

96. Special Tools

a. A neutralizing indicator is included to aid in neutralizing the transmitter. This tool consists of a

WAR DEPARTMENT

UNSATISFACTORY EQUIPMENT REPORT

(Technical service)

FOR Signal Corps — MATÉRIEL — DATE: 17 Oct 44

FROM (Organization) 89 Sig Repair Co (Station) APO 450 San Francisco, Cal

TO (Next superior headquarters) Signal Officer Ninth Army (Station) (Technical service)

COMPLETE MAJOR ITEM

NOMENCLATURE: Power Amplifier AM-35 ()/MRC-1 — TYPE: Mobile

MODEL — MANUFACTURER: Barker-Williamson

U. S. A. REG. NO.: Order No. 486-CCGSA-45 — SERIAL NO.: 8 — DATE RECEIVED: 10 Aug 44

EQUIPMENT WITH WHICH USED (IF APPLICABLE): Radio Set AN/MRC-1

NOMENCLATURE OF DEFECTIVE COMPONENT

PART NO.: 3C326-300 — TYPE: Choke, r-f, 1-MH 300-ma

MANUFACTURER: National — DATE INSTALLED: 18 Aug 44

LENGTH OF SERVICE

DATE OF INITIAL TROUBLE: 22 Sept 44

TOTAL TIME INSTALLED: YEARS —, MONTHS 1, DAYS 4

TOTAL PERIOD OF OPERATION BEFORE FAILURE (FILL IN WHERE APPLICABLE)

YEARS	MONTHS	DAYS	HOURS	MILES	ROUNDS
—	1	4	420 hrs operating time		

DESCRIPTION OF TROUBLE AND PROBABLE CAUSE

GIVE TYPE OF FAILURE, MECHANICAL, ELECTRICAL, WORKMANSHIP, MATERIAL, DESIGN

Choke in bias rectifier opened

UNUSUAL SERVICE CONDITIONS

GIVE BRIEF DESCRIPTION

High operating temperatures, average 110°

TRAINING OR SKILL OF USING PERSONNEL (CHECK ONE): POOR — FAIR — GOOD

DESCRIPTION OF ANY REMEDIAL ACTION TAKEN

Blower used to cool equipment

RECOMMENDATIONS

Heavier choke be installed

1ST IND.

OFFICE — STATION — DATE

(Technical service)

TO CHIEF Signal Officer, Washington 25, D.C.

NAME — STATION — RANK

ORIGINATING OFFICER

SIGNATURE: R.N. Dunlap

NAME: R.N. DUNLAP

RANK AND TITLE: Capt Sig C

ORGANIZATION: 89 Sig Repair Co

INSTRUCTIONS

1. It is imperative that the Chief of Technical Service concerned be advised at the earliest practical moment of any constructional, design, or operational defect in matériel. This form is designed to facilitate such reports and to provide a uniform method of submitting the required data.

2. This form will be used for reporting manufacturing, design or operational defects in matériel with a view to improving and correcting such defects, and for use in recommending modifications of matériel.

3. This form will not be used for reporting failures, isolated material defects or malfunctions of matériel resulting from fair-wear-and-tear or accidental damage nor for the replacement, repair, or the issue of parts and equipment. It does not replace currently authorized operational or performance records.

4. Reports of malfunctions and accidents involving ammunition will continue to be submitted as directed in the manner described in AR 750-10 (Change No. 3).

5. It will not be practicable or desirable in all cases to fill all blank spaces of the report. However, the report should be as complete as possible in order to expedite necessary corrective action. Additional pertinent information not provided for in the blank spaces should be submitted as inclosures to the form. Photographs, sketches or other illustrative material are highly desirable.

6. When cases arise where it is necessary to communicate with a chief of service in order to assure safety to personnel, more expeditious means of communication are authorized. This form should be used to confirm reports made by more expeditious means.

7. This form will be made out by using or service organizations and forwarded in duplicate through command channels to the chief of technical service. The office of the chief of technical service receiving the report will forward an information copy to the Commanding General, Army Ground Forces or Army Air Forces, whichever is applicable, and to the Commanding General, Army Service Forces.

8. Necessity for using this form will be determined by the using or service troops.

W. D., A. G. O. Form No. 468
1 December 1943

16—87786-1 U. S. GOVERNMENT PRINTING OFFICE

TL13837

Figure 33. WD, AGO Form 468 (Unsatisfactory Equipment Report)—sample form.

loop of insulated wire and an incandescent lamp which is placed across the terminals of the loop. If the loop is placed near a circuit containing r-f currents, the loop will pick up sufficient energy to light the lamp.

b. A neutralizing tool is included for adjustment of the neutralizing capacitors while the set is on. This consists of a polystyrene rod about 18 inches long with a piece of friction tape on the end to provide a grip by means of which the plates of the neutralizing capacitors may be turned.

c. Two oak skids are provided for use in moving the shelters on or off the trucks. For method of using these skids see TM 11–281.

97. Unsatisfactory Equipment Report

a. When trouble in equipment used by Army Ground Forces or Army Service Forces occurs more often than repair personnel feel is normal, WD, AGO Form 468 (Unsatisfactory Equipment Report) should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C. See TM 38–250 for complete instructions of the handling of this report.

b. When trouble in equipment used by Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form 54 should be filled out and forwarded through channels.

c. This form is provided to supply a uniform method of submitting unsatisfactory equipment data to the chief of technical service at the earliest practical moment.

d. This form will *not* be used to report isolated defects or poor operation due to normal wear and tear, or accidental damage during battle conditions or amphibious landings.

e. This form is *not* to be used for replacement, repair, or issue of parts and equipment.

f. The use of this form should be limited to reporting those cases of recurring equipment failures that can be attributed to poor design, poor workmanship or material, and improper usage or care by personnel. Such cases should be accompanied by drawings and samples when possible, with recommendations showing the suggested remedy. All information called for on the form should be supplied when possible.

g. An example of a form properly filled out for Radio Set AN/MRC–1 is shown in figure 33.

Section IV. ADJUSTMENT AND ALIGNMENT

98. General Adjustments

a. There are a great many components of Radio Set AN/MRC–1 that require delicate adjustments to put them in good operating condition and keep them running at top efficiency. It is the responsibility of the repairman to see that all components are adjusted and aligned correctly. The tools used in adjustment must be particularly well cared for. If some of these tools are damaged it may be impossible to adjust the equipment correctly.

b. The Boehme equipment requires careful mechanical and electrical adjustment for proper operation. The method of adjustment and the minimum test requirements for this equipment are covered in TM 11–377.

c. The Wheatstone perforator requires many delicate mechanical adjustments. These adjustments are covered in the instruction book for the perforator.

d. The three Radio Receivers BC–342–( ) and Radio Receiver BC–312–( ) are covered in TM 11–850. The alignment procedure and minimum test requirements are described completely.

e. Power Units PE–95–( ) are covered in TM 11–904G or 11–904H.

f. Adjustment and neutralization of Radio Transmitter T–62( )/MRC–1 is covered in TM 11–281.

99. Adjustment and Neutralization of Power Amplifier AM-35( )/MRC-1

Be careful when working on the power amplifier. *Remember* there are dangerous r-f potentials when the transmitter is on even though the power amplifier is *off*.

a. Cross neutralization is used in the p-a tubes. Neutralization is accomplished as follows:

(1) Tune up Radio Transmitter T–62( )/MRC–1 on about 12 mc. Use Tuning Unit TU–53 and Coil Unit C–448. Follow the tuning procedure as outlined in paragraph 26. Turn off plate voltage.

(2) Plug grid Coil Unit C–448 and plate coil No. 1689 into their sockets in Power Amplifier AM–35( )/MRC–1. These are the highest frequency coils and should be used when neutralization is to be checked.

(3) Do *not* attach antenna transmission line.

(4) Turn on power amplifier but do not turn on the plate power. Turn on transmitter plate power.

(5) Tune grid circuit for maximum reading on

grid current meter M_1, and adjust excitation for 200 ma.

(6) Open the upper access door of the power amplifier and hold the neutralizing indicator so that there is close coupling to the plate coil (indicator loop may be inserted in coil frame). Now turn the plate tuning from 0 to 100. If the neutralizing indicator lamp does not light, the power amplifier is neutralized. If the lamp lights, the set is probably not neutralized and the following steps should be taken.

(7) Turn off the plate power of the transmitter and the filament power of the power amplifier. Loosen the nut on the grid plate of each neutralizing capacitor C_8 and C_9 slightly. Adjust both capacitors equally. Either reduce or increase the capacitance.

(8) Turn on the power and proceed as in (6) above. If the neutralizing indicator does not light, the power amplifier is neutralized. If it still lights, turn the neutralizing capacitors by means of the polystyrene neutralizing tool.

(9) Repeat the procedure in (6) and (8) above until the power amplifier is neutralized, or a minimum indication on the neutralizing indicator lamp is obtained.

(10) If it is impossible to neutralize the power amplifier, obtain minimum indication and follow the above procedure, adjusting one neutralizing capacitor at a time for minimum indication. Adjustment of the second neutralizing capacitor should give complete neutralization.

Note. It is not always possible to obtain no indication with the neutralizing indicator. In such cases adjust for minimum brilliance of the indicator lamp.

(11) When the transmitter is completely neutralized turn off all power and carefully tighten the nuts on the grid plates of the neutralizing capacitors. Recheck neutralization.

(12) To further check the neutralization, apply plate power and hand key the transmitter while observing the plate current meter M_2. If the plate current is much greater than 100 ma when the key is up, there is a tendency toward self-oscillation.

(13) In case the neutralizing indicator is not available or all lamps are burned out, the grid current meter may be used as a neutralizing indicator. Follow the procedure given above, except tune for no dip in the grid current meter rather than minimum brilliance of the neutralizing indicator lamp.

Note. Do not couple indicator too closely at first, or the lamp may be burned out by excessive current. Avoid extreme brilliance of the indicator lamp.

b. Four main relays are provided in the power amplifier for control and protection. The protective relays must be properly adjusted to give the right protection to the circuit elements they guard. These relays are adjusted as follows:

(1) The overload protect relay K_3 is adjusted by means of the rheostat mounted in back of it. The relay should operate at 1.2 to 1.3 amp. (amperes) to give proper protection to the amplifier tubes. Adjust as follows:

(*a*) Turn set on and tune up normally.

(*b*) Detune power amplifier while watching plate current. If overload relay trips between 1.2 and 1.3 amp it is properly adjusted. If not, continue adjustment.

(*c*) Turn potentiometer clockwise to increase operating current and counterclockwise to decrease the operating current. Repeat steps (*a*) and (*b*) above and continue adjustment until the relay operates at correct current value.

(2) Bias underload relay K_2 should not require adjustment. It should operate at about 275 ma. This point may be checked by measuring bias voltage when the set is turned on. The relay should operate when bias voltage is greater than 100 volts.

(3) Time-delay relay K_1 should have a time delay of 20 to 40 seconds. If timing is wrong, thermostatic contacts may be adjusted from right side. Allow 15 minutes for contacts to cool before timing relay.

(4) Circuit breaker K_5 is factory set to trip at 50 amp and is not adjustable.

(5) Plate power relay K_4 should not require adjustment other than cleaning and oiling.

c. There are two thermostats to insure proper operating of the set. They are factory set and they can be tested but not adjusted.

(1) Tube heater thermostat S_3 will open when temperature exceeds 80° F., and close when temperature is below 70° F.

(2) Ambient temperature thermostat S_4 will open when temperature falls below 55° F., and closes when temperature reaches 65° F.

Section V. PRESETTING

Note. There is no provision made for complete presetting of any of the transmitting components other than the exciter stages of Radio Transmitter T-62( )/MRC-1. The method of presetting the tuning units is covered in TM 11-281.

APPENDIX

Section I. EQUIPMENT CHANGES

100. General

Models of Power Amplifier AM–35( )/MRC–1 having Serial Nos. 1, 2, 3, 4, and 5 differ slightly in construction from later models. These differences are listed below.

a. CONSTRUCTION. (1) The transformers, choke, and capacitors on the center deck of the transmitter are mounted with their terminals on top rather than below.

(2) The bleeders are mounted differently and there are two rather than four.

(3) The neutralizing assembly is mounted differently, being slightly higher in the earlier models.

(4) Mycalex replaces bakelite in insulators and brackets.

b. CIRCUITS. All circuits are the same, with slight additions and changes which do not change the fundamental operation of the set.

(1) The plate supply bleeder R 38 has been replaced by resistors R_5 and R_6 in series. The total resistance has not been changed.

(2) The tapped resistor in the bias supply circuit R 37 has been replaced by two resistors. Resistor R_4 takes the place of the bleeder section and R_3 takes the place of the grid leak section. The total resistance from grid to ground has not been changed, and the values are such that there is no change in operating characteristics.

(3) Tube heaters are not present on earlier models, nor are the associated thermostats present.

(4) The value of the parasitic suppression resistors R 41 and R 42 in the grid circuit have been changed. The new reference numbers are R_1 and R_2.

(5) Reference numbers have been changed. The chart below gives the original reference numbers and the equivalent reference numbers as used in this manual.

(6) Bias underload relay K_2 has been changed, and its wiring has been changed.

Present ref No.	Part	Original ref No.
R_1	Parasitic suppressor	Replaces R 41
R_2	Parasitic suppressor	Replaces R 42
R_3	Grid leak resistor	Replaces top section R 37
R_4	Bias rectifier bleeder resistor	Replaces lower section R 37
R_5	Top section of high-voltage rectifier bleeder resistor	Replaces R 38
R_6	Lower section of high-voltage rectifier bleeder resistor	
R_7	Plate voltage-dropping resistor	Same as R 39
R_8	Plate voltage-dropping resistor	Same as R 40
C_1	Grid bypass capacitor	Same as C 65
C_2	Grid tuning capacitor	Same as C 61
C_3	Grid padding capacitor (Plug in vacuum capacitor)	New part none
C_4	Filament bypass capacitor	Same as C 63
C_5	Filament bypass capacitor	Same as C 64
C_6	Filament bypass capacitor	Not originally listed
C_7	Filament bypass capacitor	Not originally listed
C_8	Neutralizing capacitor	Same as C 69
C_9	Neutralizing capacitor	Same as C 70
C_{10}	Plate bypass capacitor	Same as C 62
C_{11}	Plate bypass capacitor	Not originally listed
C_{12}	Plate tuning capacitor	Same as C 60
C_{13}	Plate supply filter capacitor	Same as C 68
C_{14}	Bias supply filter capacitor	Same as C 66
C_{15}	Bias supply filter capacitor	Replaces C 67
L_1	Grid tank coil	Same as L 2
L_2	Plate tank coil	Same as L 1
L_3	R–f plate choke	Same as CH 11
L_4	Noise suppressor	Not originally listed
L_5	Noise suppressor	Not originally listed
L_6	Bias supply filter choke	Same as CH 12
L_7	Plate supply filter choke	Same as CH 13
K_1	Time-delay relay	Same as RY 12
K_2	Bias underload relay	Replaces RY 10
K_3	Plate power overload relay	Same as RY 13
K_4	Plate power control relay	Same as RY 11
K_5	Main circuit breaker	Same as CB 30
S_1	PLATE POWER switch	Same as SW 20
S_2	NORMAL TUNE UP switch	Same as SW 21
S_3	Tube heater thermostat	New part none
S_4	Ambient temperature thermostat	New part none
S_5 to S_{12}	Interlock switches	Same as SW 22 to SW 29
T_1	Bias supply plate transformer	Same as T 14
T_2	Bias supply filament transformer	Same as T 10
T_3	Power amplifier filament transformer	Same as T 12
T_4	Power amplifier filament transformer	Same as T 13
T_5	Variac (p–a filament adjust)	Same as T 16
T_6	H–v supply filament transformer	Same as T 11
T_7	H–v supply plate transformer	Same T 15
V_1	Tube JAN–833A amplifier	Same as V 20
V_2	Tube JAN–833A, amplifier	Same as V 21
V_3	Tube JAN–866A, bias rectifier	Same as V 22
V_4	Tube JAN–866A, bias rectifier	Same as V 23
V_5	Tube JAN–872A, high-voltage rectifier	Same as V 24
V_6	Tube JAN–872A, high-voltage rectifier	Same as V 25
M_1	Grid current meter	Same as M 11
M_2	Plate current meter	Same as M 10
M_3	Filament voltage meter	Same as M 12
E_1 to E_4	Rectifier tube heaters	New part none
E_5	Filament pilot light	Same as LM 1
E_6	Plate power pilot light	Same as LM 2
J_1	Coaxial cable receptacle	Same as SO 239
J_2	A–c input receptacle	Same as REC 1
B_1	Blower	Same as BL 1
B_2	Blower	Same as BL 2

Section II. MAINTENANCE PARTS LIST

Refer to the AN/MRC–1 sections (when published), of the Army service Forces Signal Supply Catalogs SIG–7 Organizational Spare Parts, and SIG–8 Higher Echelon Spare Parts.

Section. III. REFERENCES

101. Army Regulations

AR 380–5	Safeguarding Military Information.

102. Parts List

*SIG 1	Introduction to ASF Signal Supply Catalog.
*SIG 2	Complete Index to ASF Signal Supply Catalog.
SIG 3	List of Items for Troop Issue.
SIG 4–1	Allowances of Expendable Supplies.
SIG 4–2	Allowances of Expendable Supplies for Schools, Training Centers, and Boards.
SIG 5	Stock List of All Items.
*SIG 6	Sets.
SIG 7 (series)	Organizational Spare Parts.
SIG 8 (series)	Higher Echelon Spare Parts.
*SIG 10	Fixed Plant.
SB 11–6	Dry Battery Supply Data.
SB 11–8	Chests for Running Spares.

103. Technical Manuals on Components

TB SIG 21	Installation of Loudspeaker LS–3.
TM 11–281	Radio Sets SCR–399–A and SCR–499–A.
TM 11–300	Frequency Meter Sets SCR–211–( ).
TM 11–303	Test Sets I–56–C, –D, –H, and –J.
TM 11–321	Test Set I–56–E.
TM 11–333	Telephones EE–8–A, EE–8–B, and EE–8.
TM 11–377	Boehme Automatic Keying and Recording Equipment.
TM 11–472	Repair and Calibration of Electrical Measuring Instruments.
TM 11–850	Radio Receiver BC–312–( ), BC–314–( ), B–342–( ), and BC–344–( ).
TM 11–904G	Power Units PE–95–G and –H.
TM 11–904H	Power Units PE–95–G and –H.
TM 11–2613	Voltohmmeter I–166.
TM 11–2626	Test Unit I–176.
TM 11–2627	Tube Tester I–177.

104. Painting, Preserving, and Lubrication

SB 11–10	Signal Corps Kit and Materials for Moisture and Fungi-resistant Treatment.
TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.

105. Shipping Instructions

U.S. ARMY Spec No. 100–14A	Army-Navy General Specifications for Packaging and Packing for Oversea Shipment.

106. Decontamination

TM 3–220	Decontamination.

107. Demolition

FM 5–25	Explosives and Demolitions.

*When published.

108. Camouflage

FM 5–20	Camouflage, Basic Principles.

109. Other Technical Publications

FM 21–6	List of Publications for Training.
FM 21–7	List of Training Films, Film Strips, and Film Bulletins.
FM 21–8	Military Training Aids.
FM 21–40	Defense Against Chemical Attacks.
FM 24–5	Signal Communication.
FM 24–6	Radio Operator's Manual, Army Ground Forces.
FM 24–9	Combined United States-British Radiotelephone (R/T) Procedure.
FM 24–11	Combined Operating Signals.
FM 24–12	Army Extract of Combined Operating Signals.
FM 24–18	Radio Communication.
TB SIG 5	Defense Against Radio Jamming.
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 66	Winter Maintenance of Ground Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TM 1–455	Electrical Fundamentals.
TM 11–227	Signal Communication Equipment Directory, Radio Communication Equipment.
TM 11–310	Schematic Diagrams for Maintenance of Ground Radio Communication Sets.
TM 11–314	Antennas and Antenna Systems.
TM 11–453	Shop Work.
TM 11–454	The Radio Operator.
TM 11–455	Radio Fundamentals.
TM 11–462	Reference Data.
*TM 11–483	Suppression of Radio Noises.
*TM 11–496	Training Text and Laboratory Exercises for Amplitude-modulated Radio Sets.
TM 11–499	Radio Propagation.
TM 38–250	Basic Maintenance Manual.

110. Forms

WD, AGO Form 468	Unsatisfactory Equipment Report.

111. List of Abbreviations

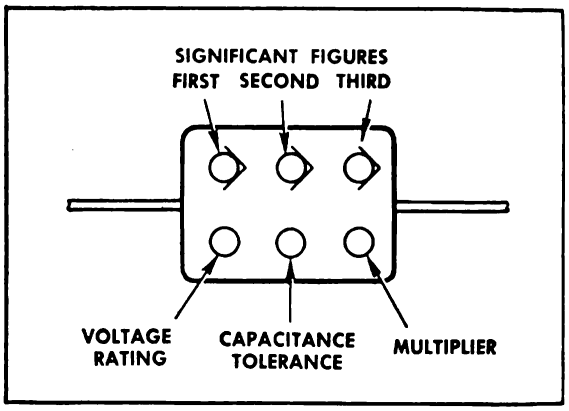
a-c	alternating current	lb	pound
amp	amperes	ma	milliamperes
amplr	amplifier	mc	megacycles
ant	antenna	mcw	modulated continuous waves
assem	assembly	mh	millihenry
aux	auxiliary	mf	microfarads
avc	automatic volume control	mmf	micromicrofarads
ct	center tap	mvc	manual volume control
cu ft	cubic feet	osc	oscillator
c-w	continuous wave	p-a	power amplifier
d-c	direct current	plt	plate
doub	doubler	pwr	power
fil	filament	rect	rectifier
kc	kilocycles	recvr	receiver
kw	kilowatts	ry	relay

*When published.

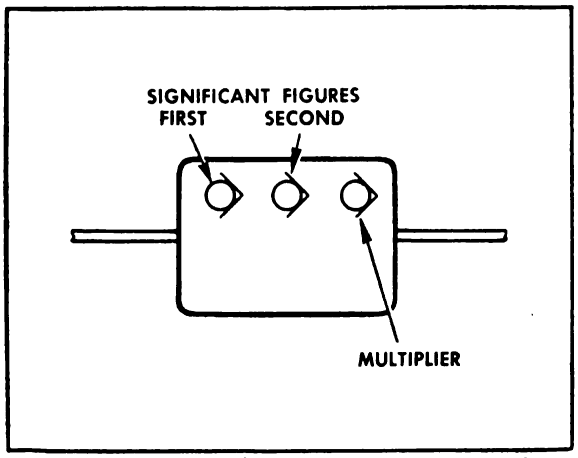
spkr	speaker
sup	supply
sw	switch
temp	temperature
term	terminal
tp	telephone
xmtg	transmitting
2d	second

CAPACITOR COLOR CODES

RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

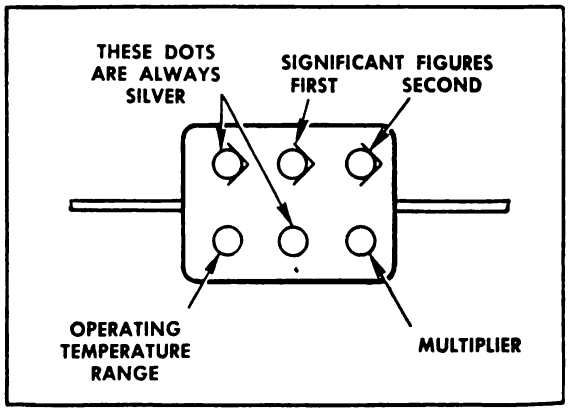


RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



Capacitors marked with this code have a voltage rating of 500 volts.

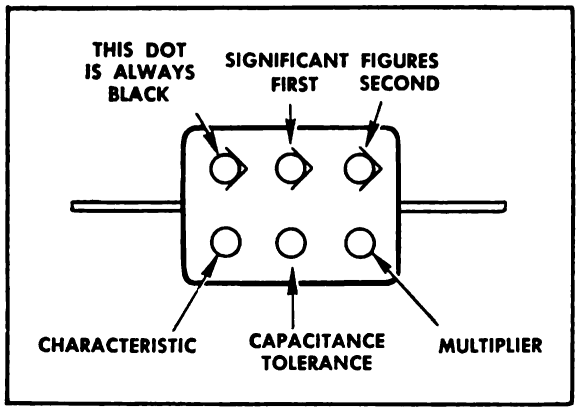
AWS 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



The silver dots serve to identify this marking. The sixth dot shows whether the capacitor has a maximum operating temperature of 167°F (black) or 185°F (brown).

COLOR	SIGNIFICANT FIGURE	MULTIPLIER		VOLTAGE RATING (VOLTS)	CHARACTERISTIC (AWS MICA-DIELECTRIC)
		RMA MICA- AND CERAMIC-DIELECTRIC AWS MICA- AND PAPER-DIELECTRIC	AWS CERAMIC-DIELECTRIC		
BLACK	0	1	1		A
BROWN	1	10	10	100	B
RED	2	100	100	200	C
ORANGE	3	1000	1000	300	D
YELLOW	4	10,000		400	E
GREEN	5	100,000		500	F
BLUE	6	1,000,000		600	G
VIOLET	7	10,000,000		700	
GRAY	8	100,000,000	0.01	800	
WHITE	9	1,000,000,000	0.1	900	
GOLD		0.1		1000	
SILVER		0.01		2000	
NO COLOR				500	

AWS 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



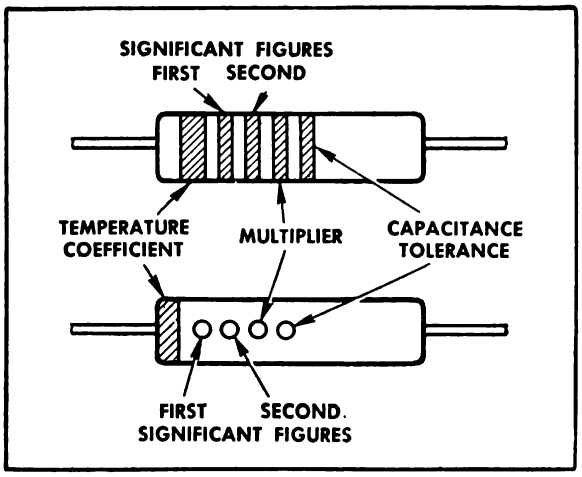
The black dot serves to identify the AWS marking. Capacitors marked with this code are rated at 500 volts, except the following. AWS type CM35 capacitors with capacitances of 6,800, 7,500, and 8,200 micromicrofarads, and AWS type CM40 capacitors with capacitances of 9,100 and 10,000 micromicrofarads are rated at 300 volts.

RMA: *Radio Manufacturers Association*

AWS: *American War Standard (American Standards Association)*

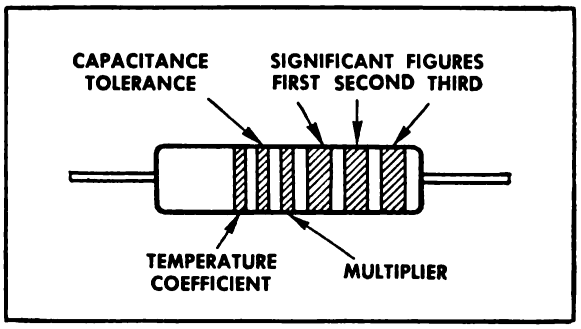
NOTE: These color codes give all capacitances in *micromicrofarads*.

AWS COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



Capacitors marked with this code have a voltage rating of 500 volts.

RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS

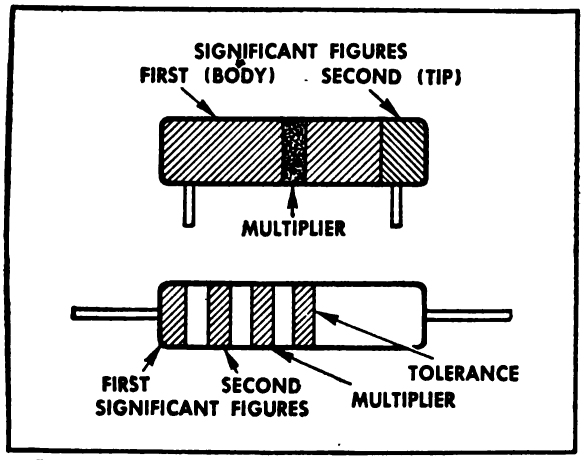


Capacitors marked with this code have a voltage rating of 500 volts.

CAPACITANCE TOLERANCE				TEMPERATURE COEFFICIENT OF CAPACITANCE $\times 10^{-6}$ MMF/MMF/°C
RMA & AWS MICA- AND PAPER-DIELECTRIC (PERCENT)	RMA CERAMIC-DIELECTRIC (PERCENT)	AWS CERAMIC-DIELECTRIC GREATER THAN 10 MMF (PERCENT)	AWS CERAMIC-DIELECTRIC LESS THAN 10 MMF (MMF)	
20	20	20	2.0	0
1	1	1		− 30
2	2	2		− 80
3	3	2.5	0.25	−150
4	4			−220
5	5	5	0.5	−330
6	6			−470
7	7			−750
8	2.5			+ 30
9	10	10	1.0	Not specified
5				
10				
20				TL 13417

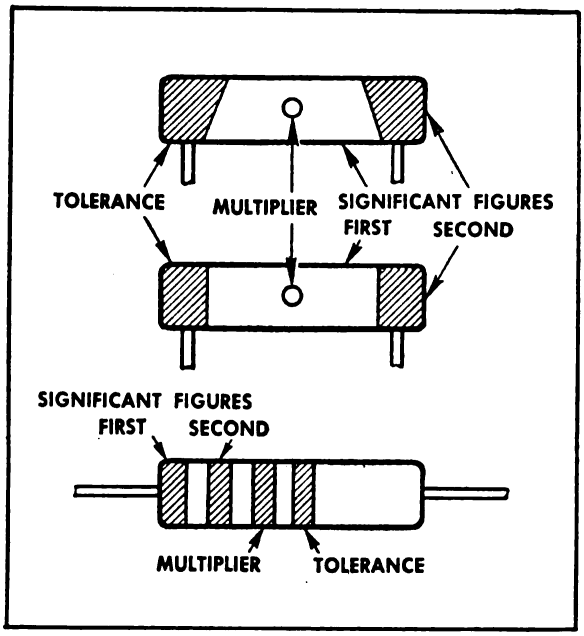
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS



Insulated fixed composition resistors with axial leads are designated by a natural tan background color. Non-insulated fixed composition resistors with axial leads are designated by a black background color.

AWS COLOR CODE FOR FIXED COMPOSITION RESISTORS



The exterior body color of insulated resistors may be any color except black. The usual color is natural tan. The exterior body color of uninsulated resistors with axial leads may be either black or white. The exterior body color of uninsulated resistors with radial leads may be black or it may be the color of the first significant figure of the resistance value.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	
RED	2	100	
ORANGE	3	1000	
YELLOW	4	10,000	
GREEN	5	100,000	
BLUE	6	1,000,000	
VIOLET	7	10,000,000	
GRAY	8	100,000,000	
WHITE	9	1,000,000,000	
GOLD		0.1	5
SILVER		0.01	10
NO COLOR			20

RMA: *Radio Manufacturers Association*
AWS: *American War Standard (American Standards Association)*

TL 3418

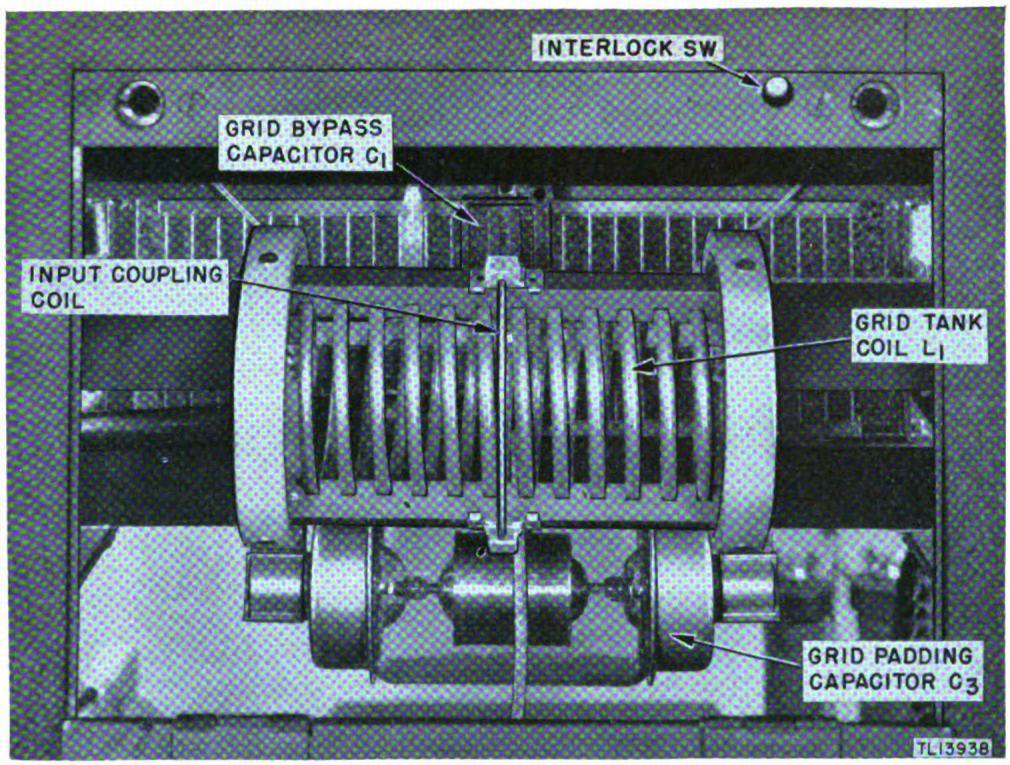


Figure 35. Power Amplifier AM-35( )/MRC-1—grid tank coil access door open.

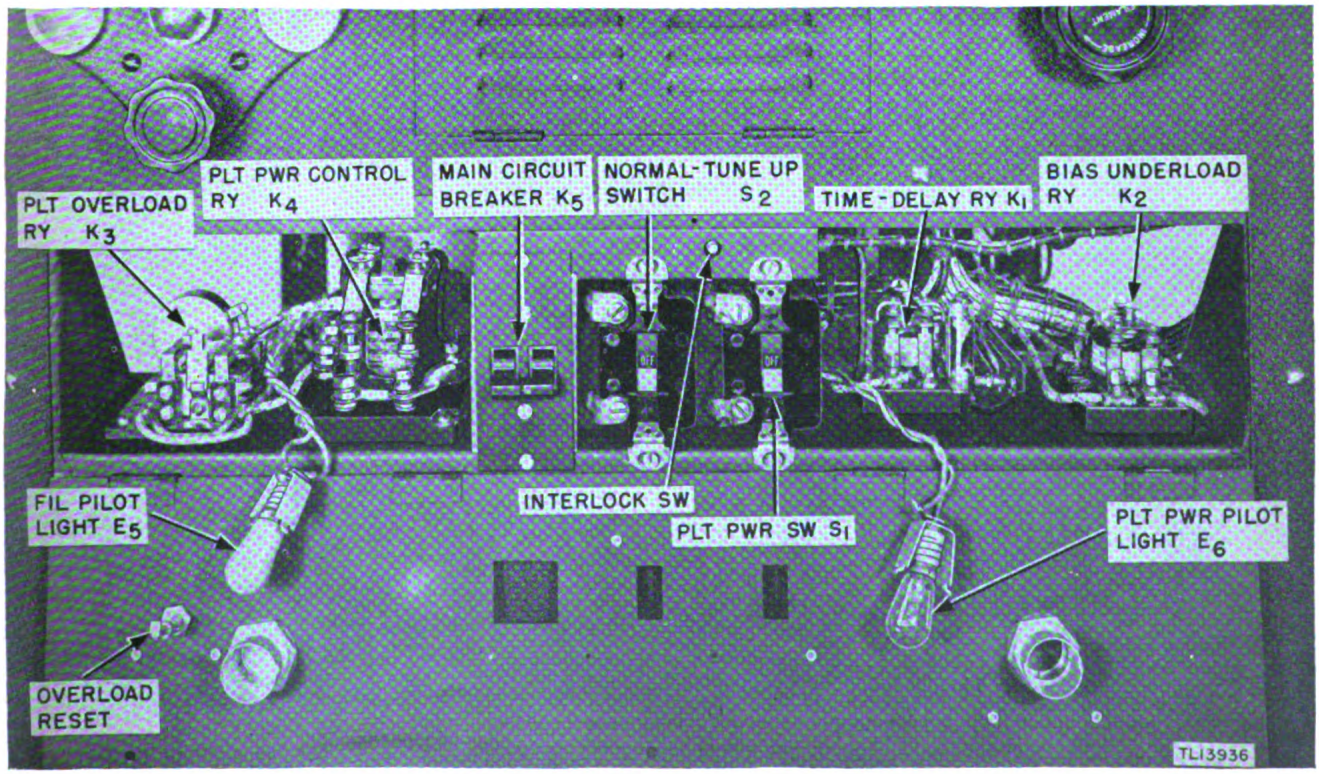


Figure 36. Power Amplifier AM-35( )/MRC-1—switch panel open.

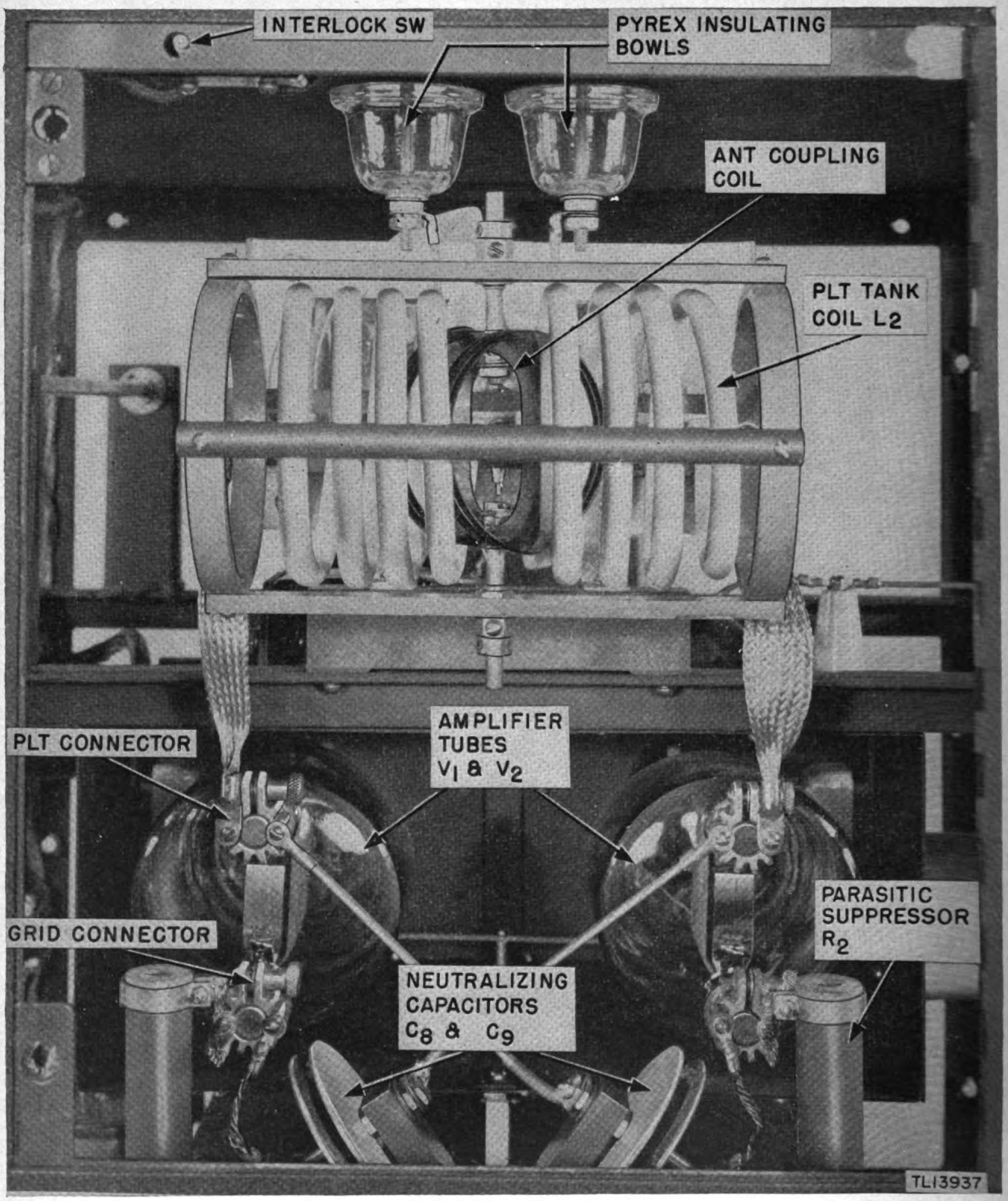


Figure 37. Power Amplifier AM-35( )/MRC-1—plate-tank coil access door open.

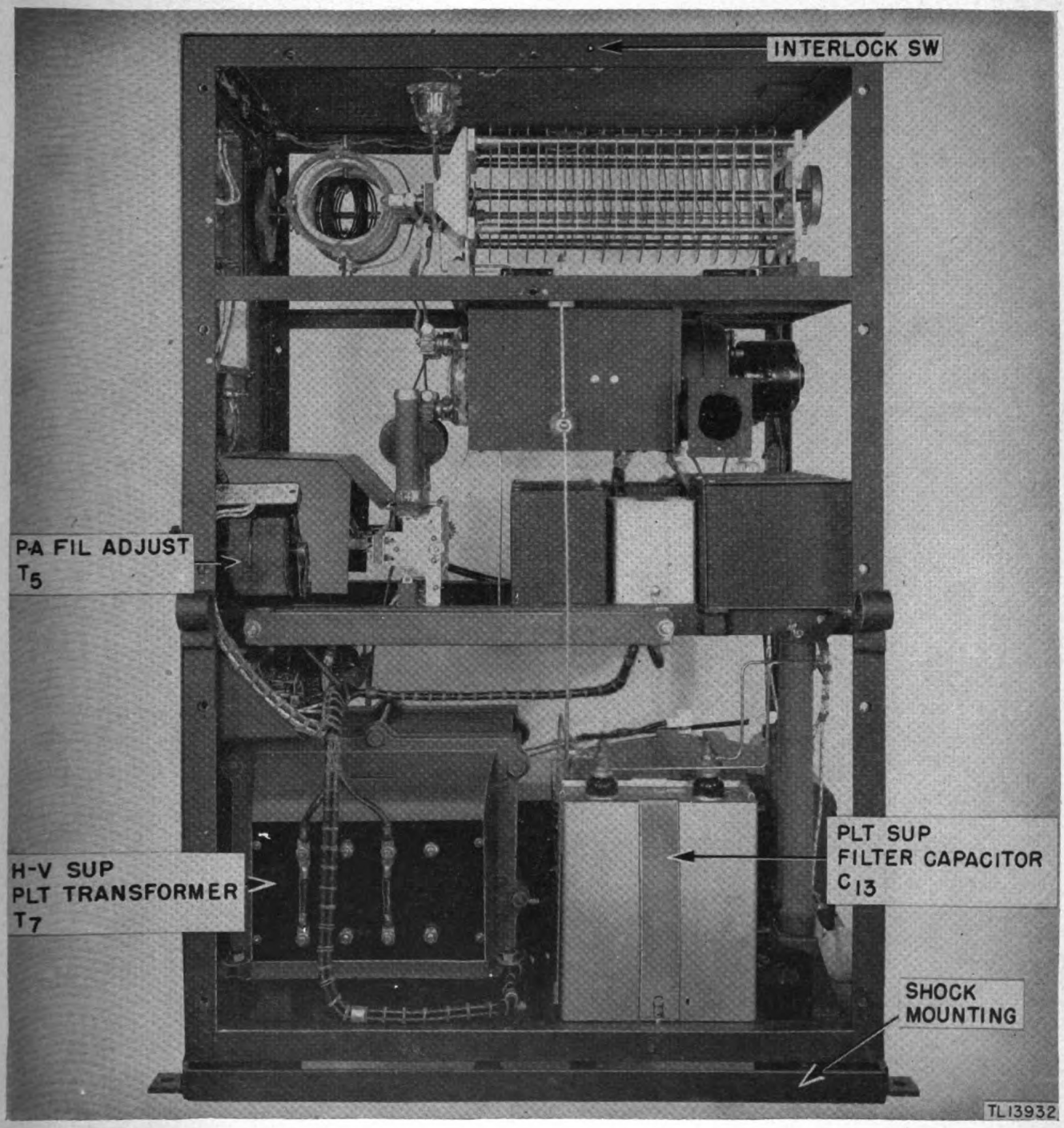


Figure 38. Power Amplifier AM-35( )/MRC-1—right side view, panel removed.

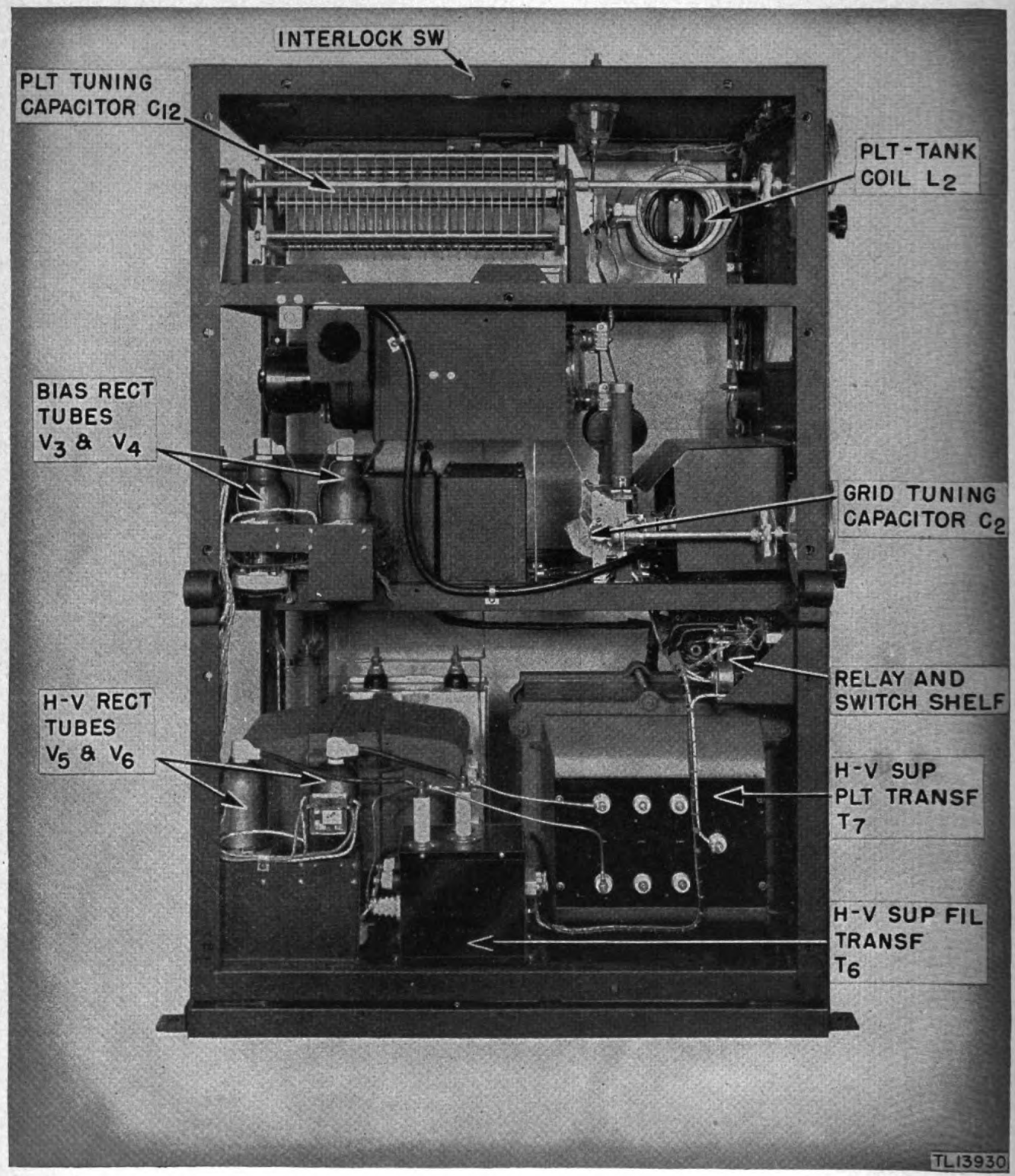


Figure 39. Power Amplifier AM-35( )/MRC-1—left side view, panel removed.

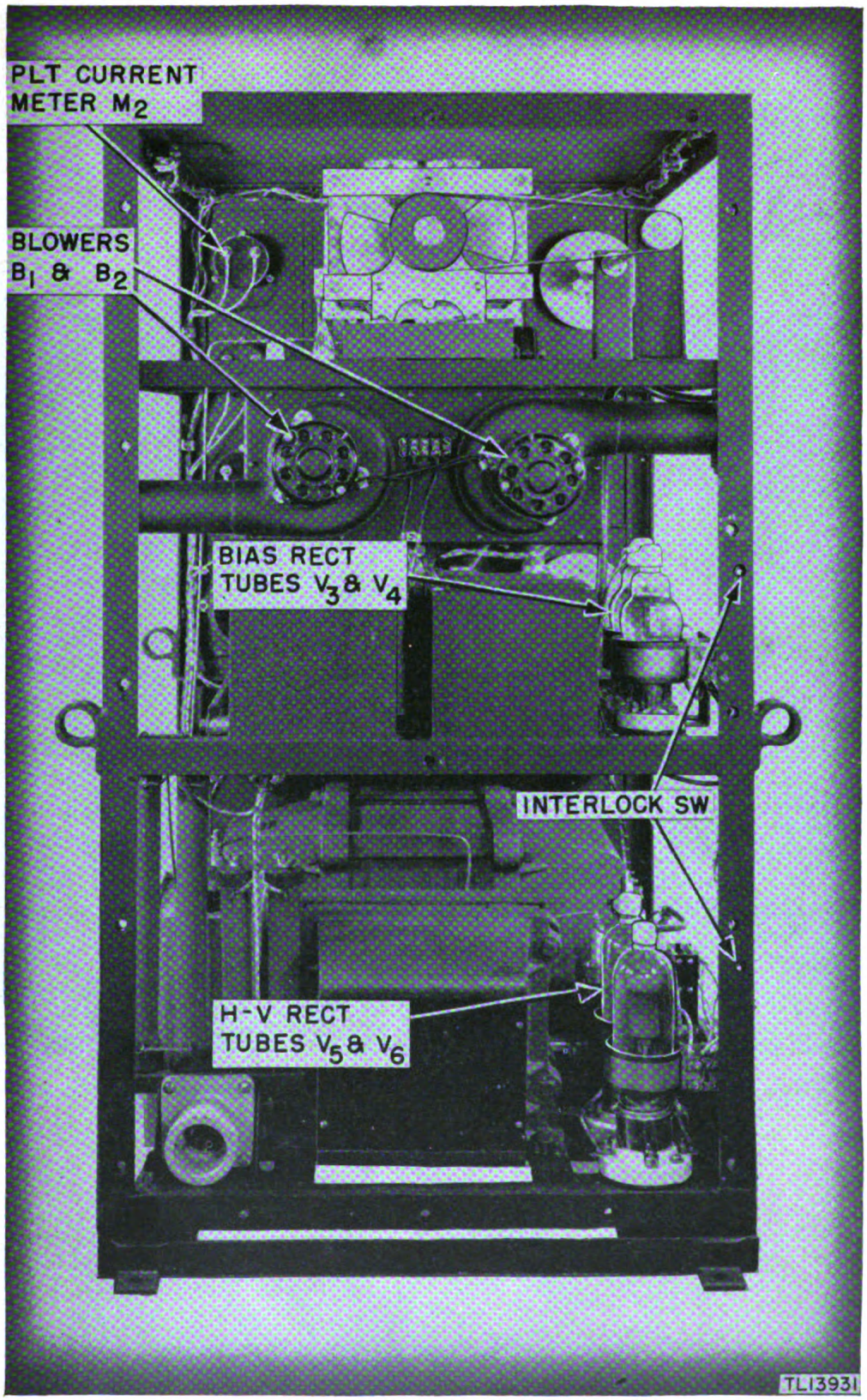


Figure 40. Power Amplifier AM-35( )/MRC-1—rear view, panel removed.

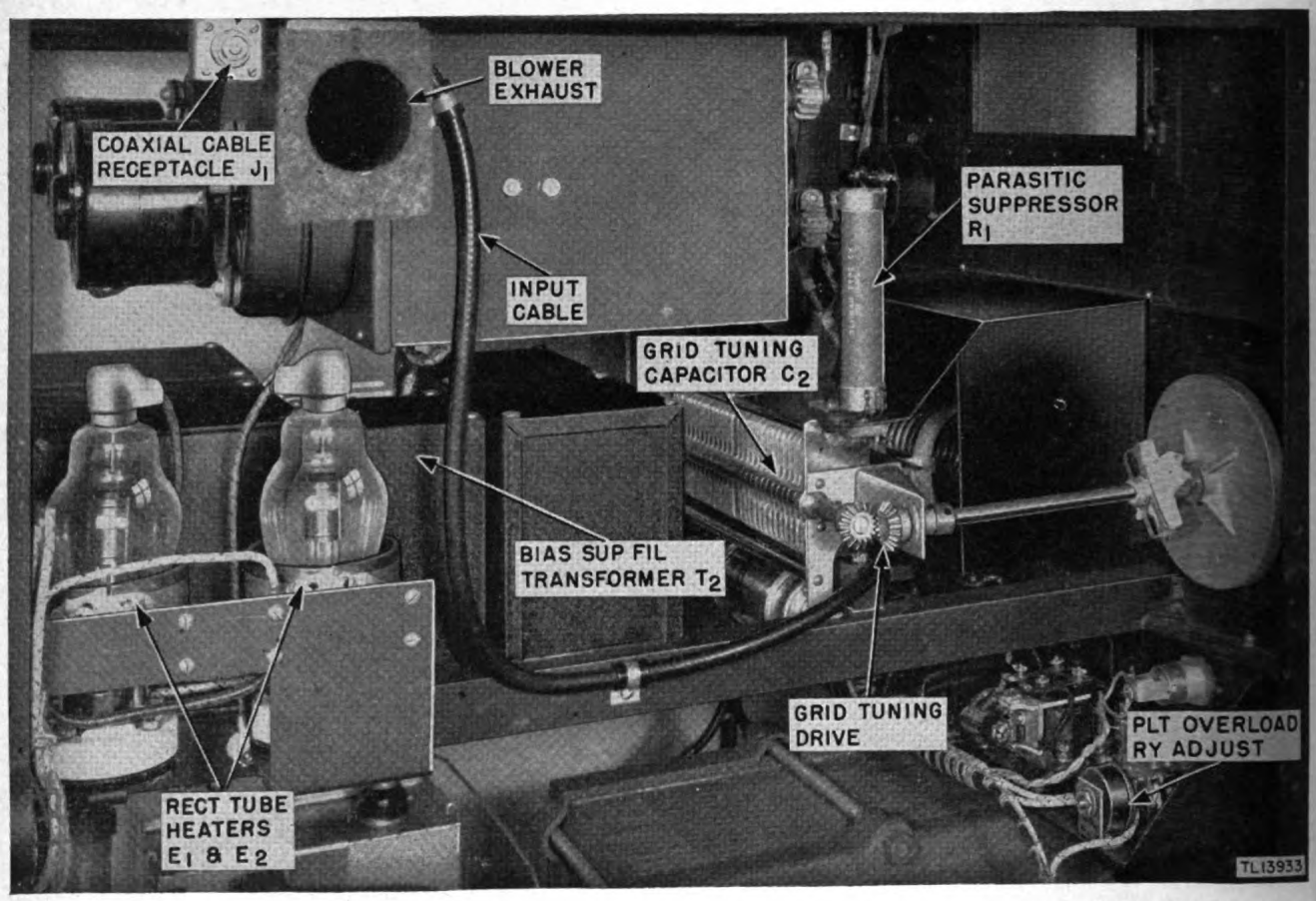


Figure 41. Power Amplifier AM–35( )/MRC–1—close-up, upper left side, panel removed.

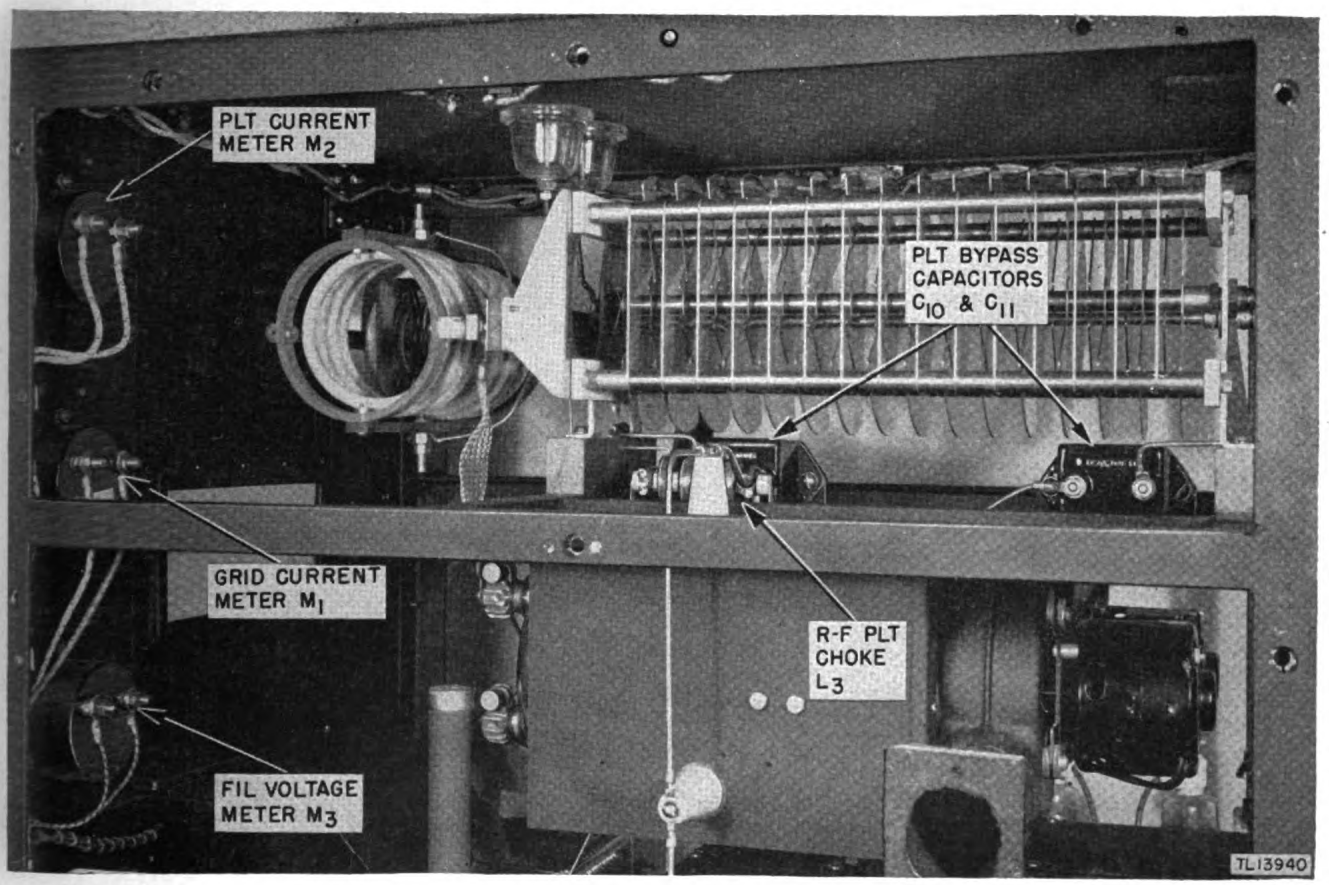


Figure 42. Power Amplifier AM–35( )/MRC–1—close-up, upper right side, panel removed.

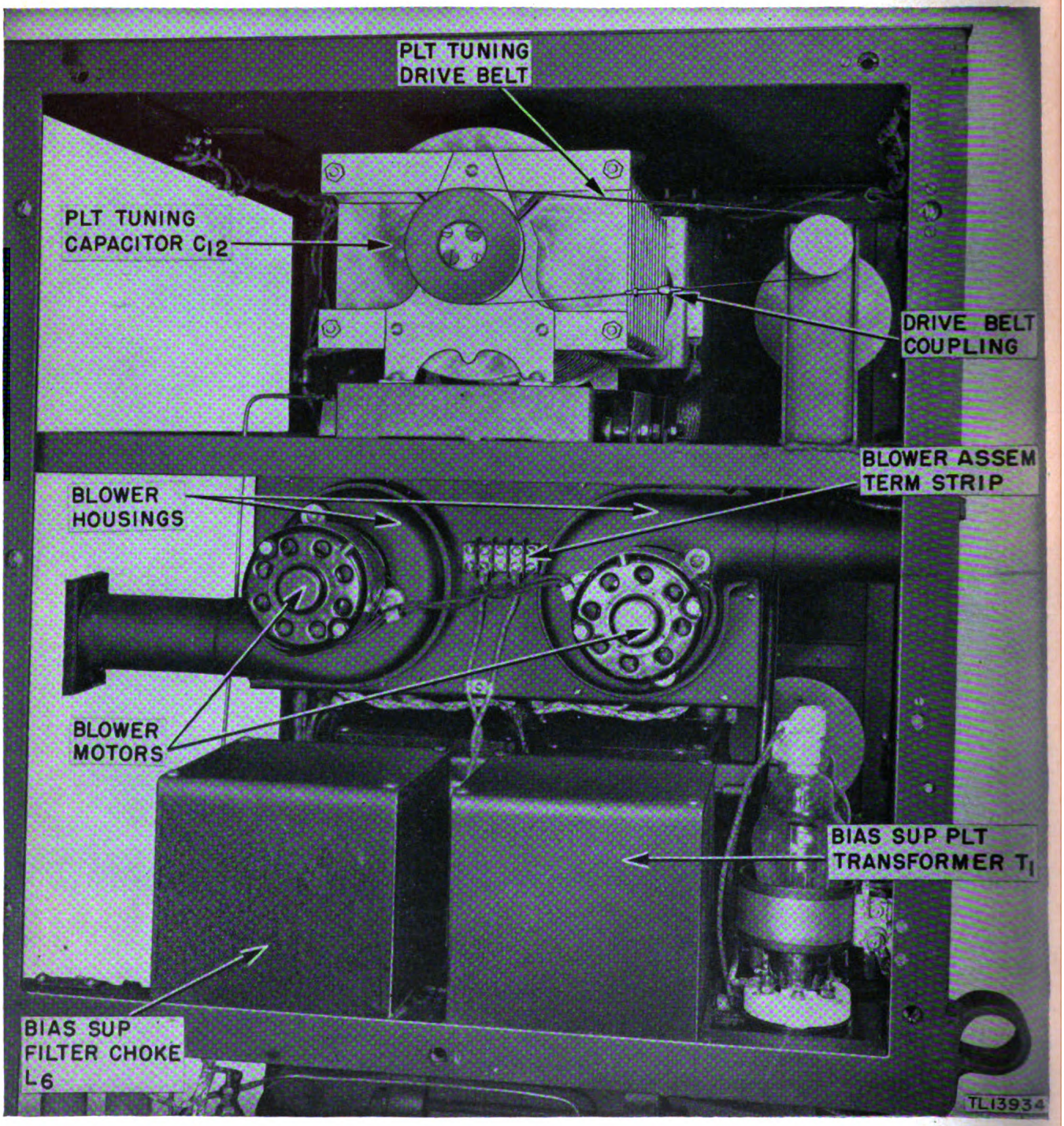


Figure 43. Power Amplifier AM-35( )/MRC-1—close-up, upper rear section, panel removed.

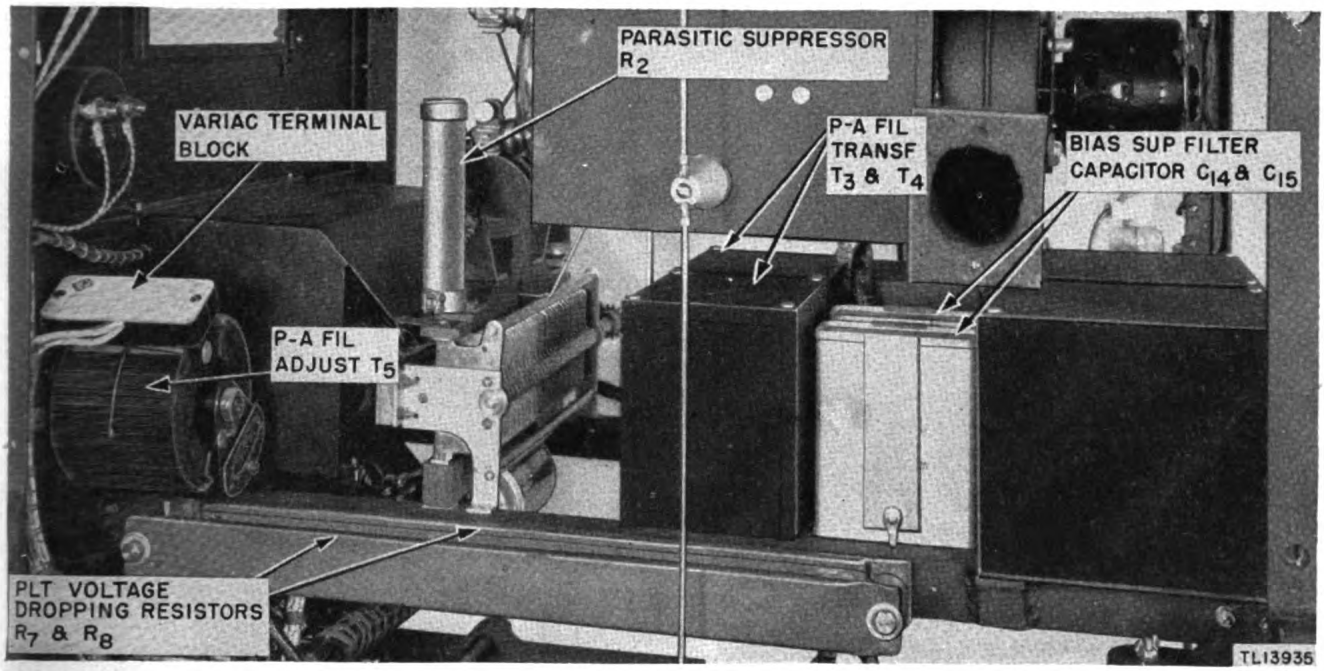


Figure 44. Power Amplifier AM–35( )/MRC–1—close-up, center section right side, panel removed.
Note: Tube heater thermostat S_3 and ambient temp thermostat S_4 are reversed in this figure.

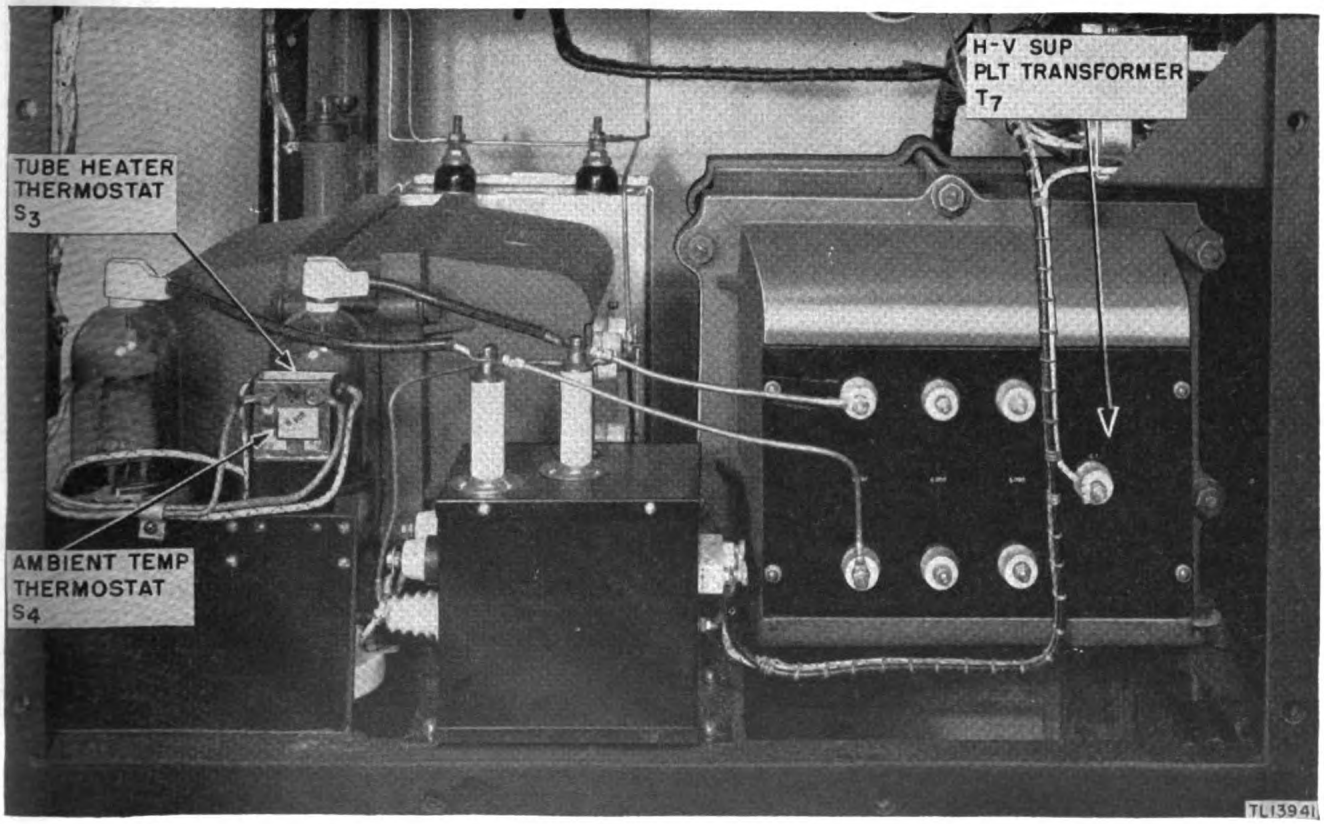


Figure 45. Power Amplifier AM–35( )/MRC–1—close-up, lower left side, panel removed.

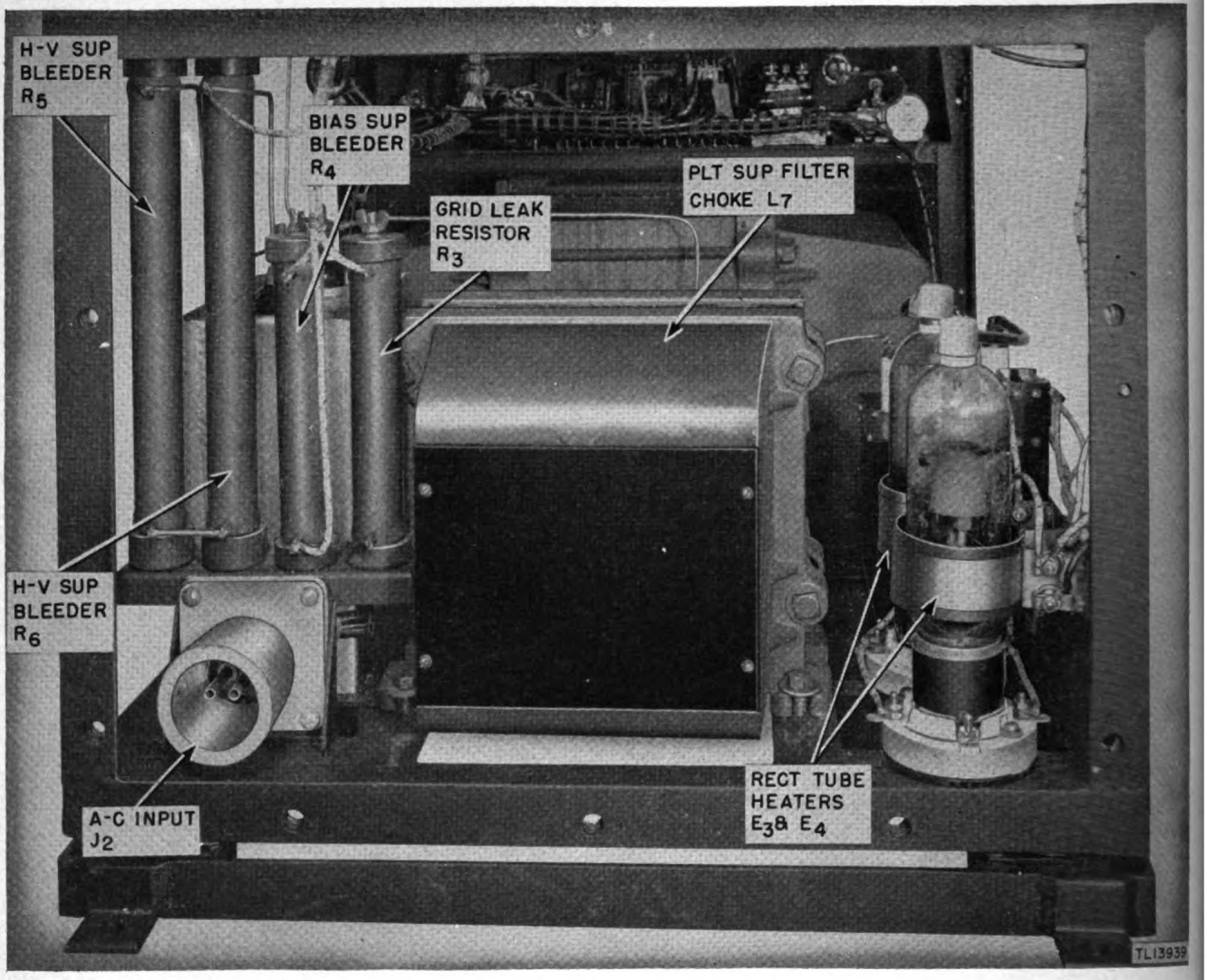


Figure 46. Power Amplifier AM–35( )/MRC–1—close-up, lower rear section, panel removed.

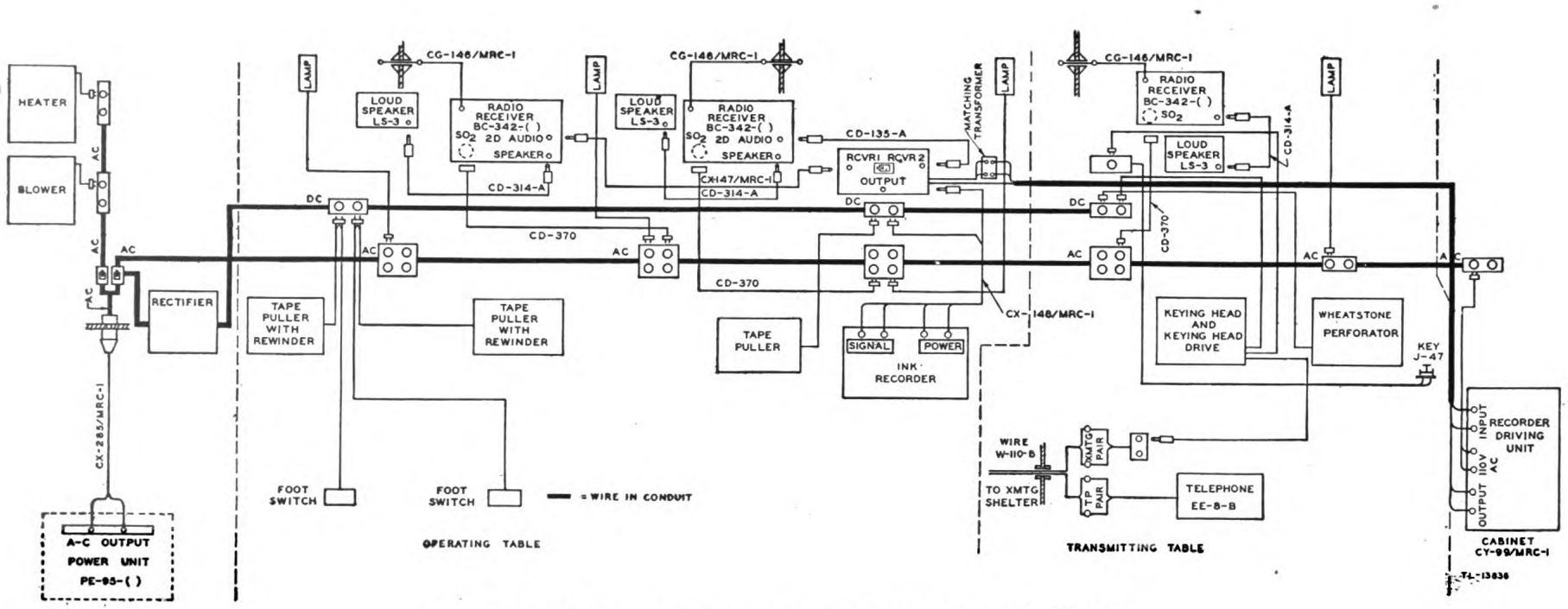


Figure 47. Radio Set AN/MRC-1—operating shelter over-all cording diagram.

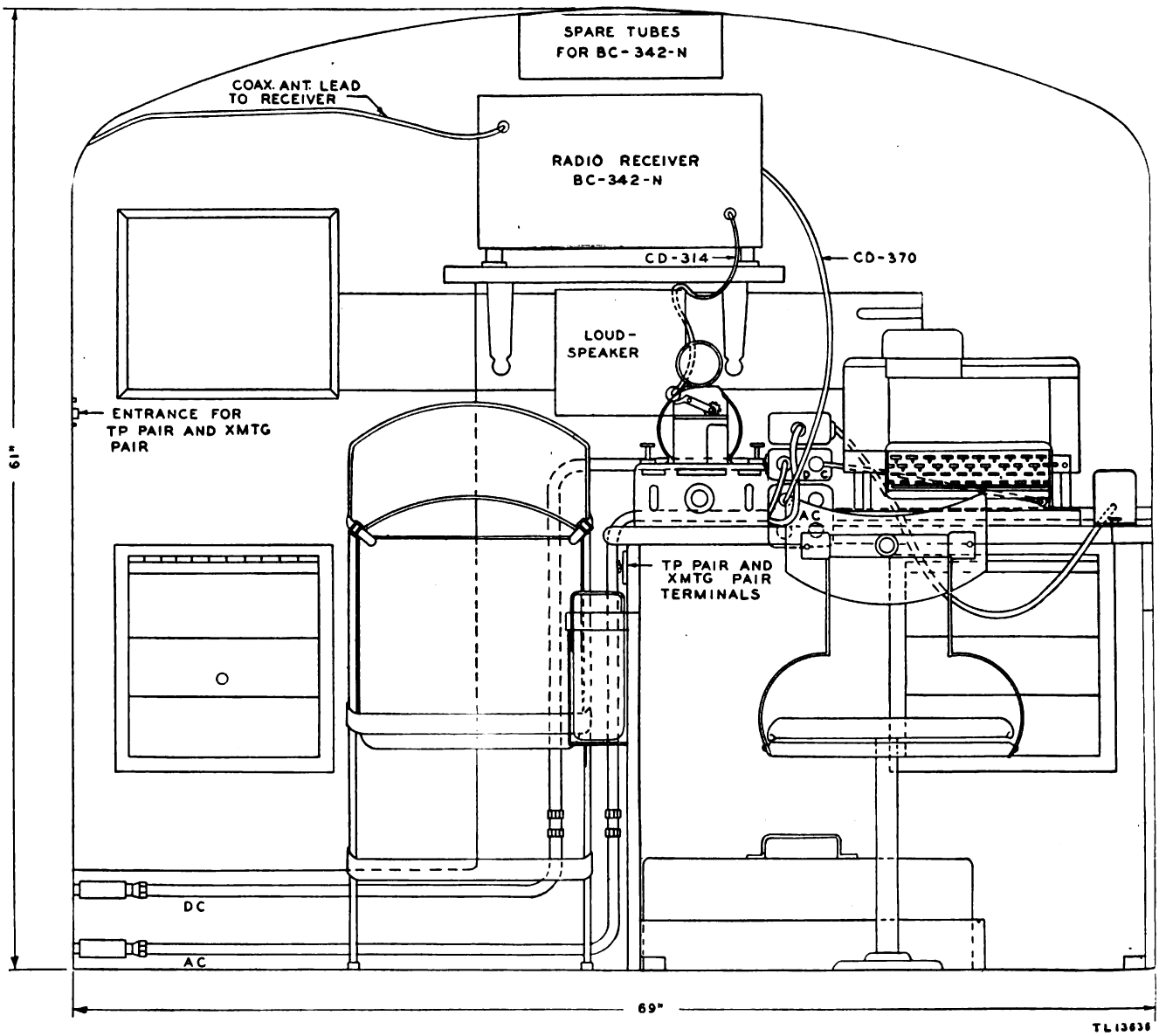


Figure 48. Radio Set AN/MRC–1—operating shelter, transmitting table pictorial cording diagram.

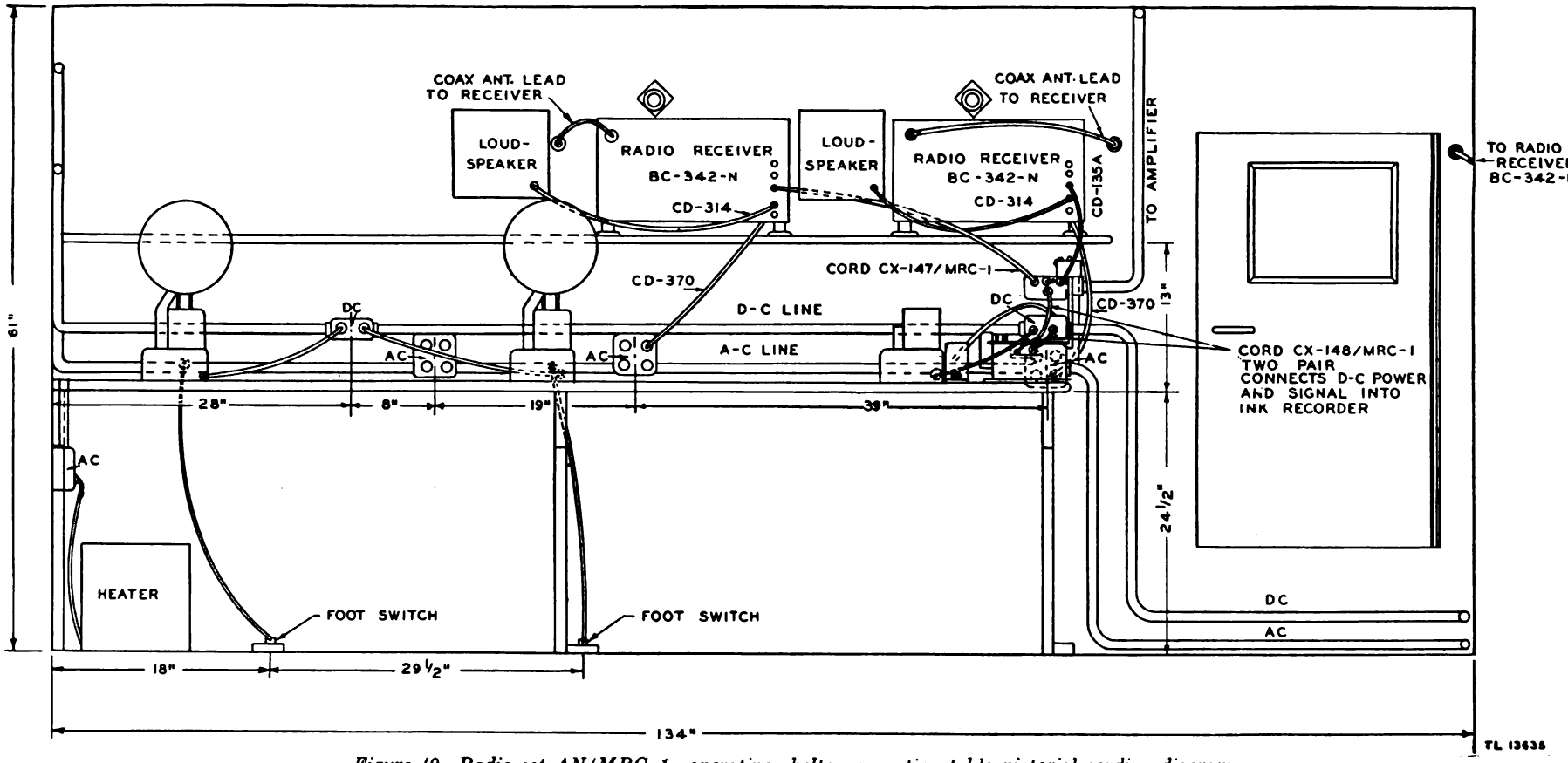


Figure 49. Radio set AN/MRC-1—operating shelter, operating table pictorial cording diagram.

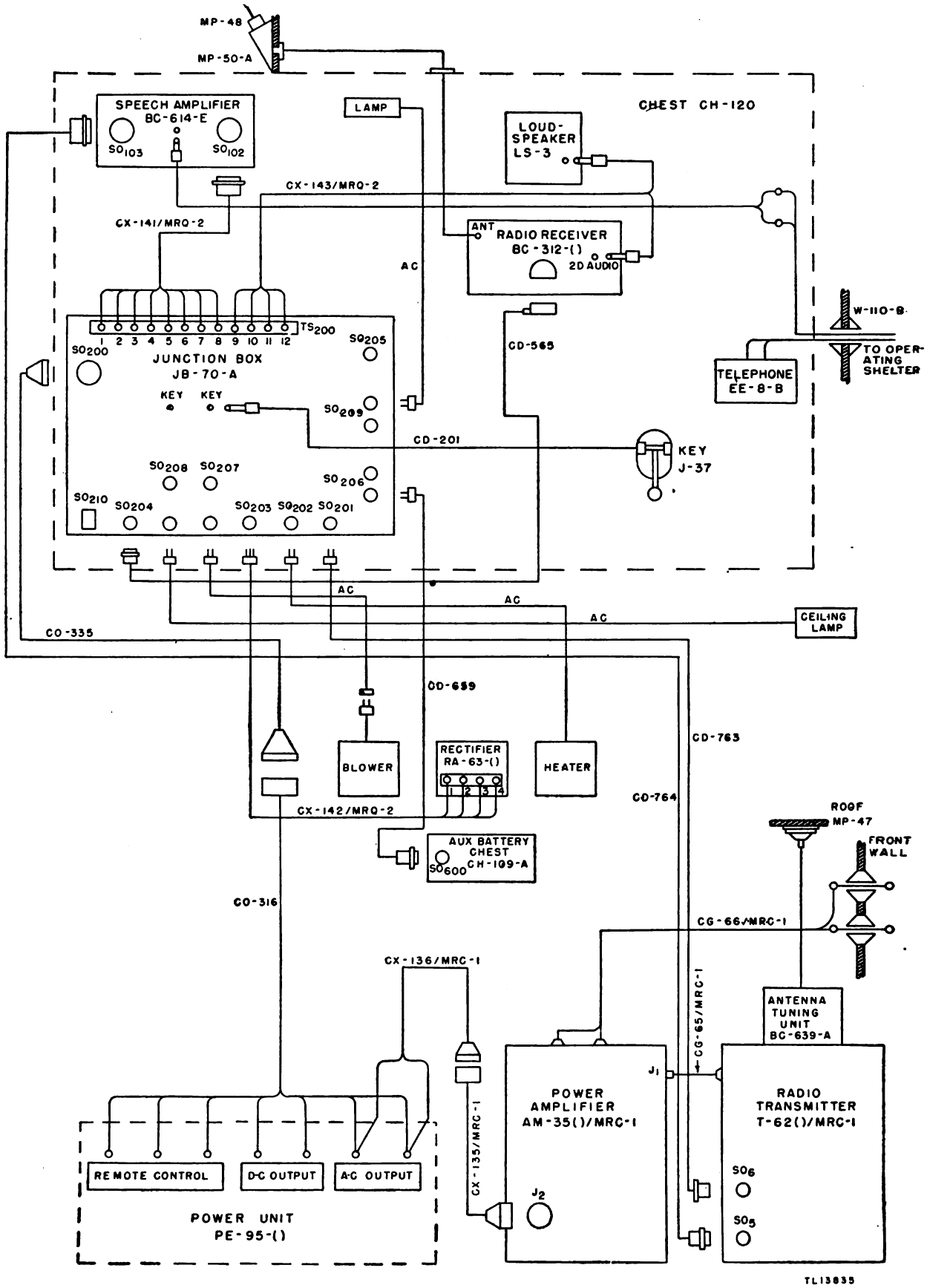


Figure 50. Radio Set AN/MRC–1—transmitting shelter cording diagram. Note: Cord CG–66/MRC–1 and entering bowls have been deleted. Cord CG–145/MRC–1 connects directly from amplifier AM–35( )MRC–1 to antenna.

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