TM 11-618

WAR DEPARTMENT TECHNICAL MANUAL

RADIO SET AN/TRC-8 (XC-3)

RADIO TERMINAL SET AN/TRC-11 (XC-3)

RADIO RELAY SET AN/TRC-12 (XC-3)

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WAR DEPARTMENT • 19 MARCH 1945

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United States Government Printing Office

Washington : 1946

QUICK INDEX

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LIST OF ILLUSTRATIONS

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 — Front panels of sets, tubes, capacitors, meters, carrying cases, etc., castings and spark plugs of power supply.

2. Cut — All cords, cables, wiring, etc.

3. Burn — All smashed parts as well as all books and papers concerning the equipment.

4. Bend — Mast sections, dipole elements, etc.

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

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.

Do not change tubes or make adjustments inside equipment with high-voltage supply on.

FIRST AID FOR ELECTRIC SHOCK

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.

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.

TREATMENT.

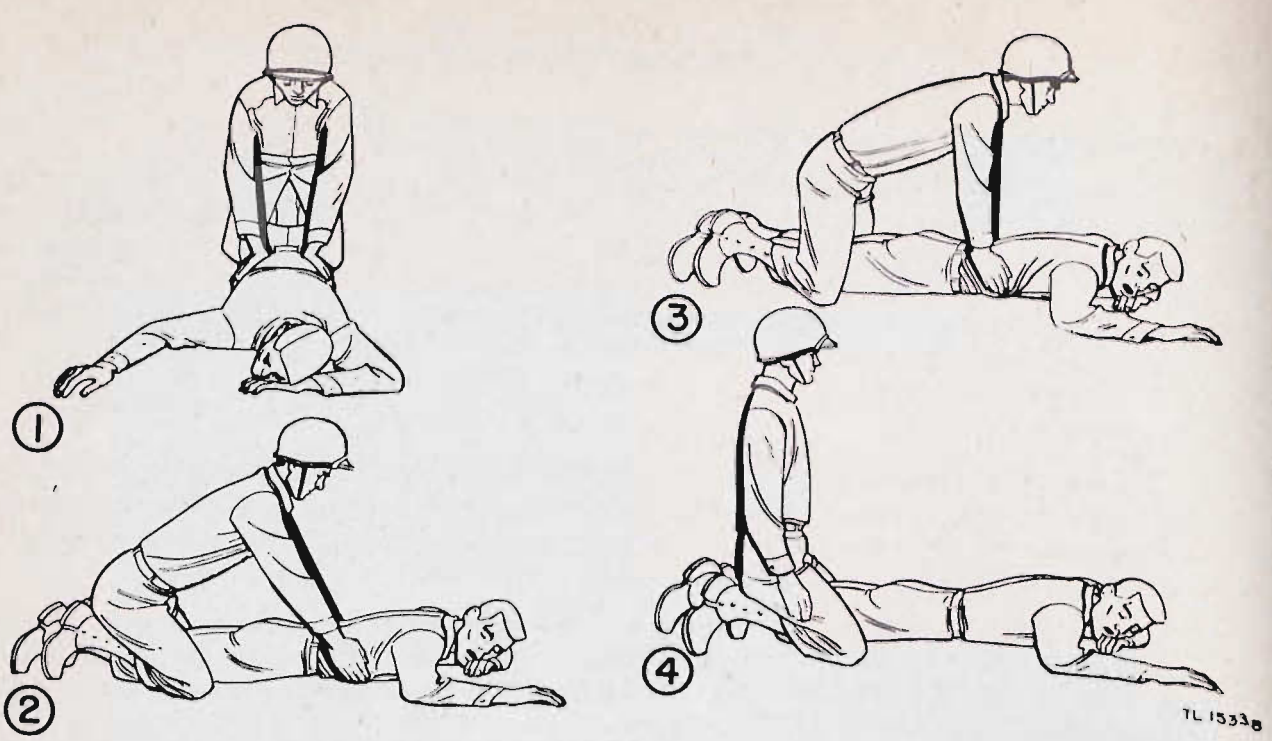
a. Start artificial respiration immediately. At the same time send for a doctor, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only,* remove 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 (figs. 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 are vertical while applying pressure on the small of the victim's back (fig. 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 (fig. 1).

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

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 (fig. 4).

(3) After 2 seconds' rest, swing forward, again positioning the hands, and apply pressure for another second (figs. 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 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 he is 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.

METHOD OF RELIEVING OPERATOR.

The relief operator kneels beside the operator, assuming the same position on an imagi-

nary victim, and follows the operator through three or four complete cycles. When the relief operator is sure that he has the correct rhythm, on the next forward swing of the operator he 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 to make 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.

INHALANT STIMULANTS.

If an inhalant stimulant is used, such as aromatic spirits of ammonia, the person 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.

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 watched carefully. NEVER LEAVE A RESUSCITATED PERSON ALONE UNTIL IT IS *CERTAIN* THAT HE IS FULLY CONSCIOUS AND BREATHING NORMALLY.

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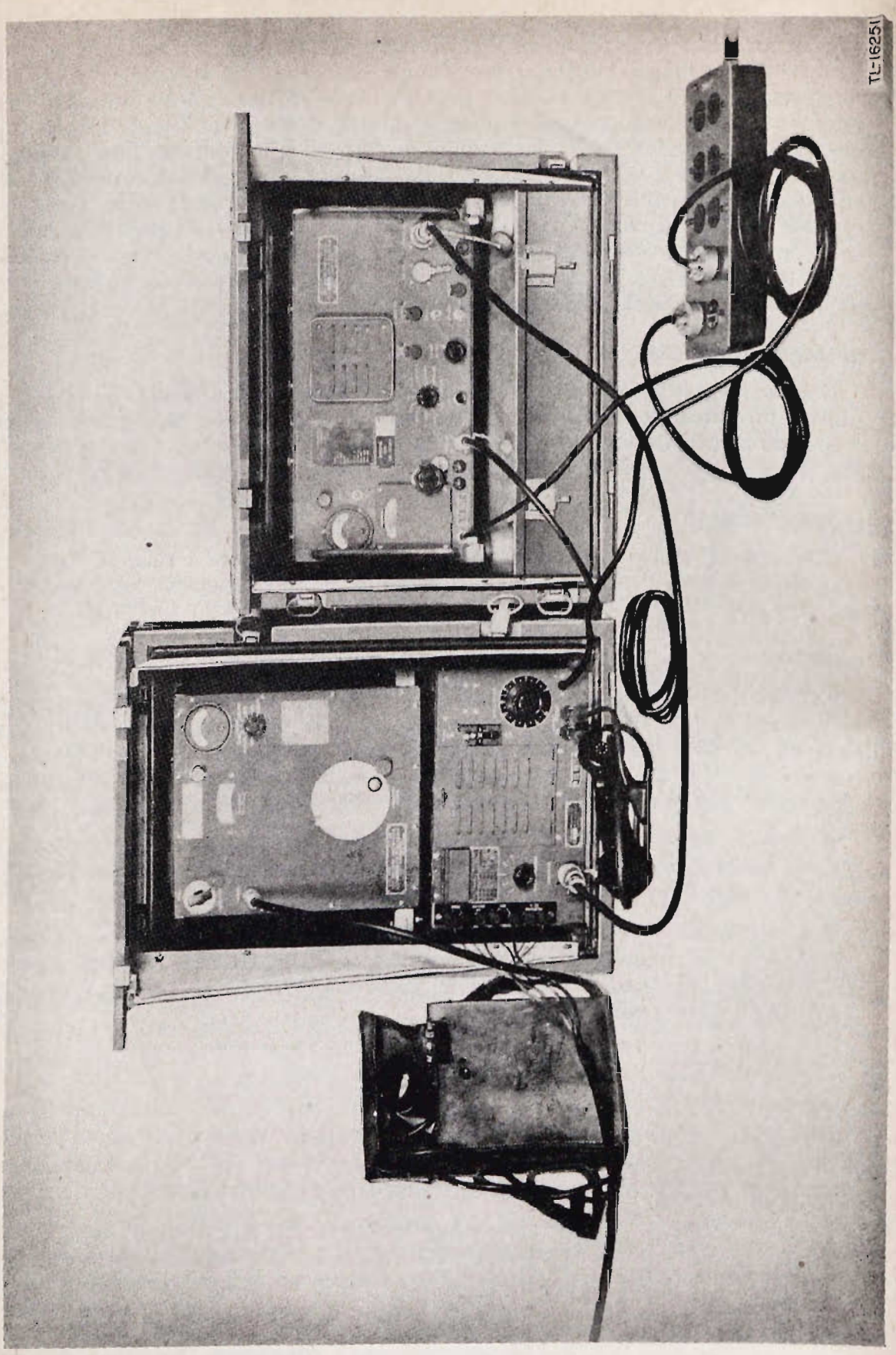


Figure 1. Radio Receiver R-48/TRC-8 (XC-3), Radio Transmitter T-30/TRC-8 (XC-3), and associated equipment.

PART ONE

INTRODUCTION

SECTION I. DESCRIPTION

1. GENERAL.

a. Scope. This manual describes the installation, operation, and maintenance of Radio Set AN/TRC-8 (XC-3), Radio Terminal Set AN/TRC-11 (XC-3), and Radio Relay Set AN/TRC-12 (XC-3) with particular reference to their use in Signal Corps four-channel carrier-telephone systems using Telephone Terminal CF-1-(*) (Carrier) and Telegraph Terminal CF-2-(*) (Carrier). In addition, these sets may be used for single-channel point-to-point and radio-relay communication.

NOTE: Telephone Terminal CF-1-(*) refers to Telephone Terminal CF-1-A or CF-1-B. Telegraph Terminal CF-2-(*) refers to Telegraph Terminal CF-2-A or CF-2-B.

b. Radio Set AN/TRC-8 (XC-3) (fig. 1). Radio Set AN/TRC-8 (XC-3) consists of an f-m (frequency-modulated) Radio Receiver R-48/TRC-8 (XC-3), an f-m Radio Transmitter T-30/TRC-8 (XC-3), Power Pack PP-115/TRC-8 (XC-3), two Antenna Assemblies AS-52/TRC-8 (XC-3), two 40-foot Antenna Supports AB-48/TRC-8 (XC-3), one Power Unit PE-75-( ), and spare parts for maintenance (fig. 2(1)).

NOTE: Throughout the text of this manual, reference to Radio Transmitter T-30/TRC-8 (XC-3) will include both Radio Transmitter T-30/TRC-8 (XC-3) and Power Pack PP-115/TRC-8 (XC-3). Power Unit PE-75-( ) refers to any power unit of the Power Unit PE-75 series supplied with the equipment.

This equipment is intended for point-to-point or radio-relay application to provide either single- or multichannel communication in both directions simultaneously. Spare components are not included in Radio Set AN/TRC-8 (XC-3) as it is not intended for continuous uninterrupted operation. The reliable range is 25 miles over flat terrain. Satisfactory communication can be attained as far as 100 miles when advantage is taken of high points in the terrain and when a line-of-sight path exists between transmitter and receiver. The equipment is solidly built and is intended for use as a fixed field station and not for mobile operation. All components are transportable in a standard military ¾-ton truck or 1-ton trailer. The radio set may be installed by a crew of four men in approximately 1 hour after arrival at the operating site if the equipment has previously been removed from any packing cases. It has been designed with excel-

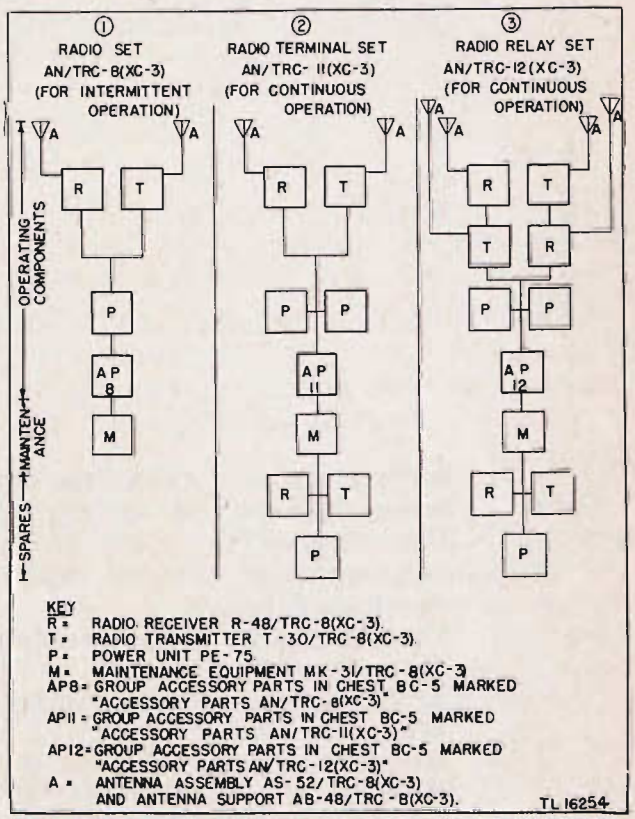
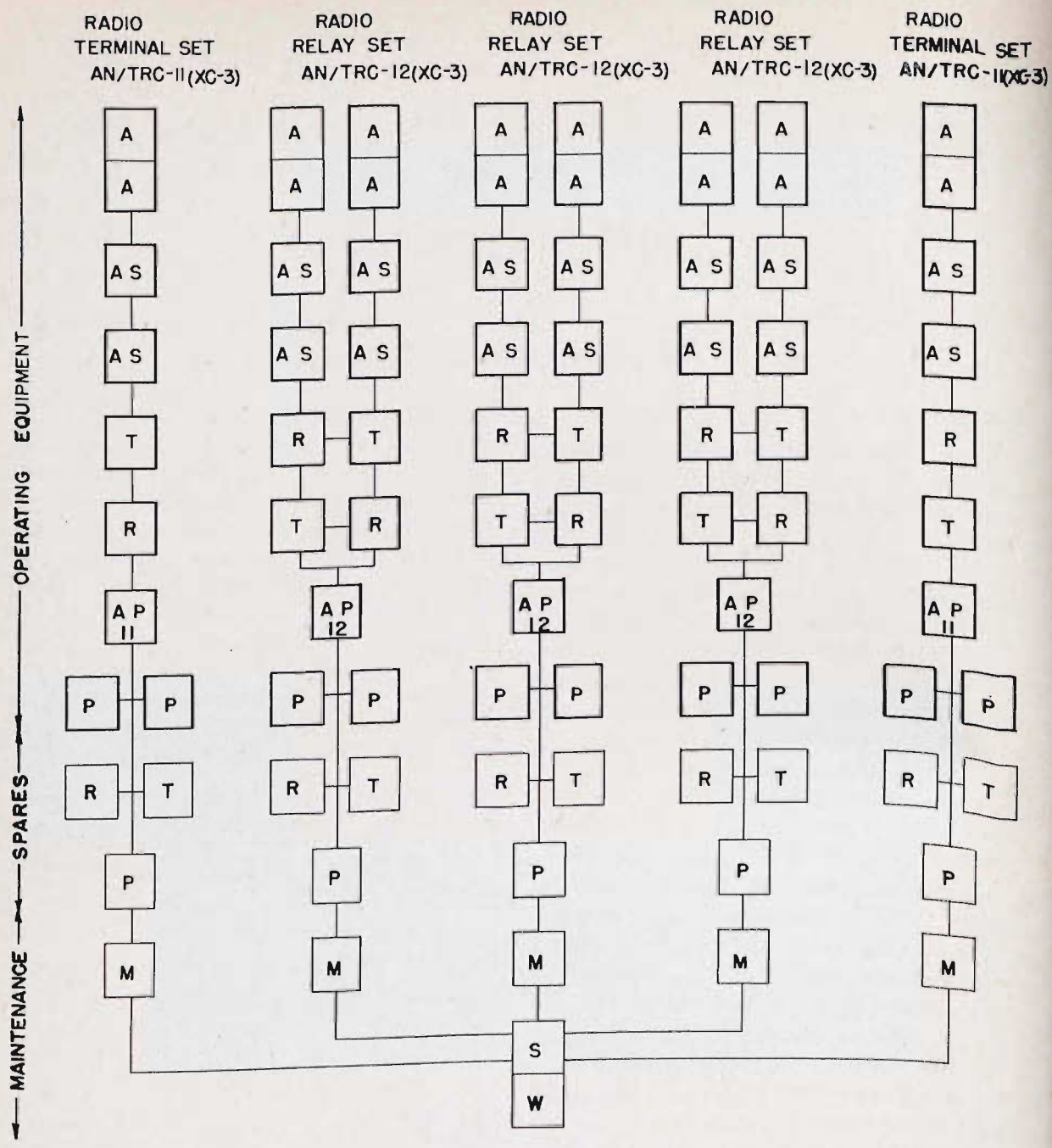


Figure 2. Components of Radio Set AN/TRC-8 (XC-3), Radio Terminal Set AN/TRC-11 (XC-3), and Radio Relay Set AN/TRC-12 (XC-3).



KEY

A = ANTENNA ASSEMBLY AS-52/TRC-8(XC-3), 2 PACKED IN CASE CY-53/TRC-8(XC-3)

A S = ANTENNA SUPPORT AB-48/TRC-8(XC-3), PACKED IN CASE CY-54/TRC-8(XC-3)

T = RADIO TRANSMITTER T-30/TRC-8(XC-3), PACKED IN CASE CY-52/TRC-8(XC-3)

R = RADIO RECEIVER R-48/TRC-8(XC-3), PACKED IN CASE CY-51/TRC-8(XC-3)

P = POWER UNIT PE-75

A P 11 = GROUP ACCESSORY PARTS PACKED IN CHEST BC-5 MARKED "ACCESSORY PARTS, AN/TRC-11(XC-3)."

A P 12 = GROUP ACCESSORY PARTS PACKED IN CHEST BC-5 MARKED "ACCESSORY PARTS, AN/TRC-12(XC-3)."

M = MAINTENANCE EQUIPMENT MK-31/TRC-8(XC-3), PACKED IN CHEST BC-5 MARKED "MAINTENANCE EQUIPMENT, MK-31/TRC-8(XC-3)."

S = SYSTEM SPARES PACKED IN CHEST BC-5 MARKED "SYSTEM SPARES, AN/TRC-8(XC-3)"

W = WIRE W-110-B WOUND ON REEL DR-4 (5 REELS, $\frac{1}{2}$ MILE WIRE PER REEL)

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Figure 3. Components of radio relay system

lent frequency stability, sensitivity, and all operating characteristics necessary for long, reliable service under conditions of relative humidities up to 95 percent and temperature variations from −40° C to +60° C.

c. Radio Terminal Set AN/TRC-11 (XC-3). Radio Terminal Set AN/TRC-11 (XC-3) consists of two Radio Receivers R-48/TRC-8 (XC-3) (one in use, one spare), two Radio Transmitters T-30/TRC-8 (XC-3) (one in use, one spare), two Antenna Assemblies AS-52/TRC-8 (XC-3), two 40-foot Antenna Supports AB-48/TRC-8 (XC-3), three Power Units PE-75-( ) (two in use, one spare), and spare parts for maintenance (fig. 2(2)). The components are identical to those used in Radio Set AN/TRC-8 (XC-3). This equipment is intended for operation at the *terminals* of single- or multichannel radio-relay systems when continuous operation is required. The radio terminal set can be installed in 1 hour by four men. Components not in use are running spares or maintenance equipment supplied to insure uninterrupted service in case of failure of a basic component.

d. Radio Relay Set AN/TRC-12 (XC-3). Radio Relay Set AN/TRC-12 (XC-3) consists of three Radio Receivers R-48/TRC-8 (XC-3) (two in use, one spare), three Radio Transmitters T-30/TRC-8 (XC-3) (two in use, one spare), four Antenna Assemblies AS-52/TRC-8 (XC-3), four Antenna Supports AB-48/TRC-8 (XC-3), three Power Units PE-75-( ) (two in use, one spare), and sufficient spare parts for maintenance (fig. 2(3)). This equipment is intended for operation as a *relay station* of a single- or multichannel radio-relay communication system when continuous operation is important. The radio-relay set can be installed in 2 hours by four men. Running spares and maintenance equipment have been selected to insure uninterrupted service in case of failure of a basic component.

e. Radio-relay System. A complete radio-relay system requires a Radio Terminal Set AN/TRC-11 (XC-3) at both ends and one to seven Radio Relay Sets AN/TRC-12 (XC-3) between them (fig. 3).

2. APPLICATION OF EQUIPMENT.

a. Multichannel Radio-relay Communication System (fig. 4). (1) The radio sets have been designed to replace spiral-four cable and Telephone Repeaters CF-3-A (Carrier) normally used in a multichannel carrier telephone system to connect two Telephone Terminal CF-1-(*) (Carrier) circuits.

(2) A typical multichannel radio-relay communication system consists basically of two Radio Terminal Sets AN/TRC-11 (XC-3), three Radio Relay Sets AN/TRC-12 (XC-3), two Telephone Terminal Sets TC-21, and two Telegraph Terminal Sets TC-22. The two telegraph terminal sets at each terminal with associated telegraph equipment enables four telegraph communication channels to be placed on any one of the voice channels of Telephone Terminal CF-1-(*) (Carrier).

(3) Figure 5 shows the simplified block diagram of the major components in a complete communication system. Terminal A of this system consists essentially of one Radio Terminal Set AN/TRC-11 (XC-3), one Telephone Terminal CF-1-(*) (Carrier) (part of Telephone Terminal Set TC-21), two Ringing Equipments EE-101-A, Telegraph Terminal CF-2-(*) (part of Telegraph Terminal Set TC-22), associated telephone and telegraph facilities, and up to 5 miles of spiral-four cable.

(4) Radio Terminal Set AN/TRC-11 (XC-3), is normally located at any distance up to 5 miles from the carrier equipment on some mountain top or suitable elevated site, and connected to the carrier equipment by the spiral-four cable.

(5) Terminal B at the distant location comprises identical equipment in a similar arrangement as terminal A.

(6) Three Radio Relay Sets AN/TRC-12 (XC-3) are located at approximately 25-mile intervals or are spaced at elevated sites approximately within line of sight of each other.

(7) In this system, four simultaneous messages are carried over a single channel. Telephone Terminal CF-1-(*) (Carrier), located at each terminal of a system, converts the four messages, each in the frequency range from 200 to 2,800 cycles, to a single channel modulated over the frequency range of 200 to 12,000 cycles. This modulated carrier from terminal A is fed to the transmitter at the Terminal A Radio Station by means of the spiral-four cable. The signal from the transmitter at the Terminal A Radio Station is picked up by a receiver at the first relay station. The receiver output modulates its

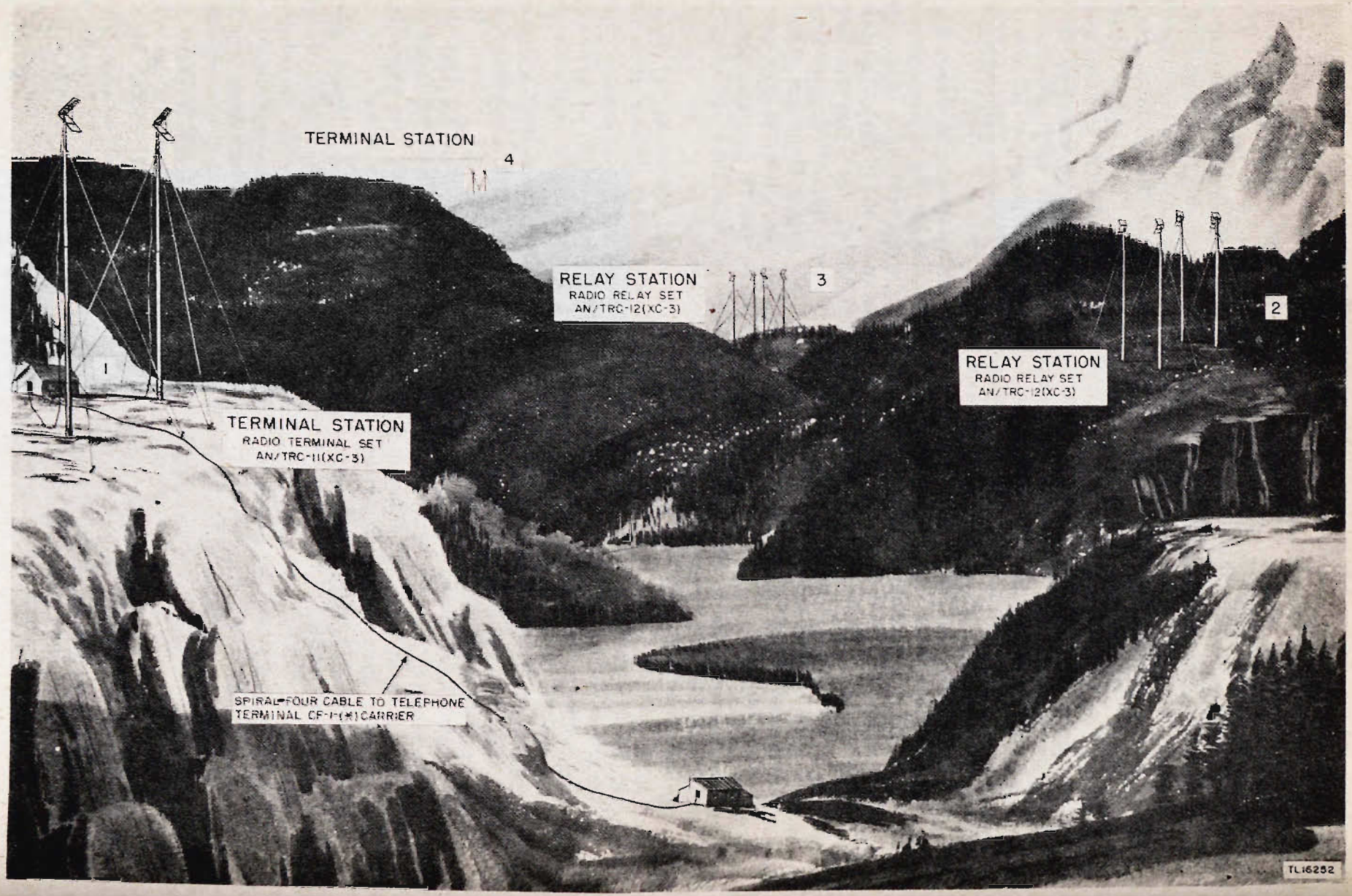

Figure 4. Multichannel radio relay communication system.

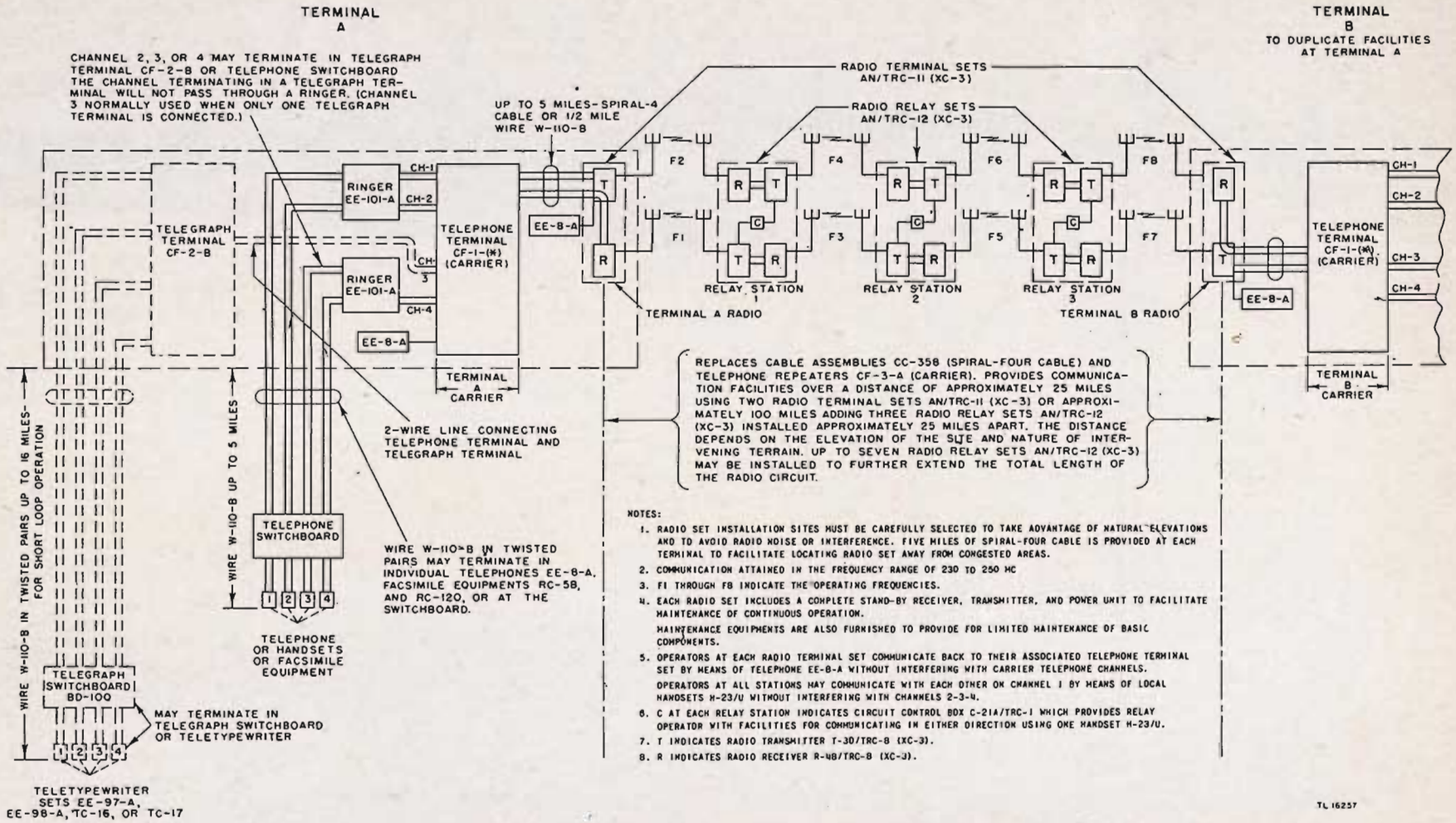

Figure 5. Communication system, block diagram.

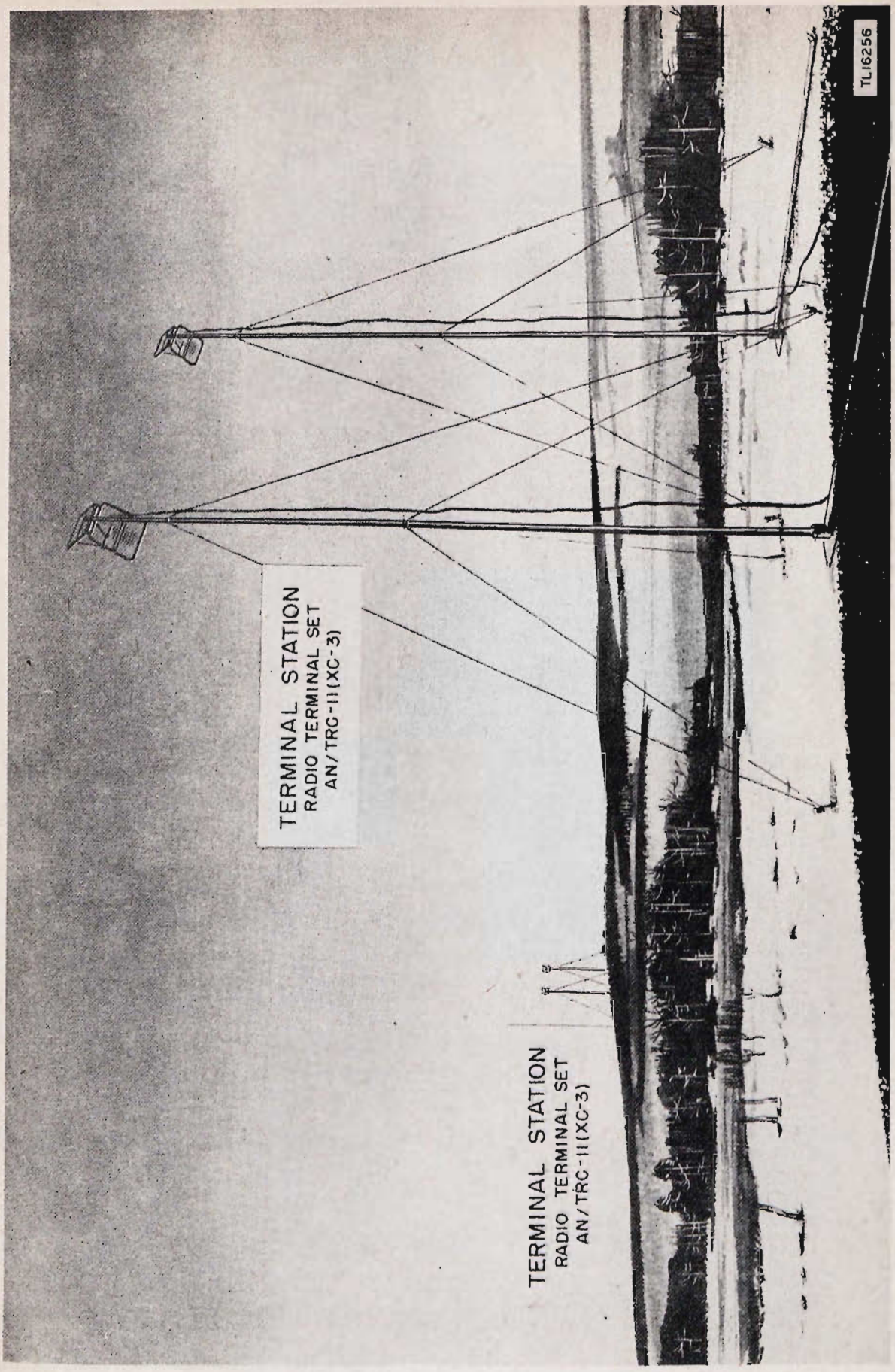

Figure 6. Multichannel point-to-point communication system.

associated transmitter which relays the signal on a different carrier frequency toward the next relay station and finally to Terminal B Radio Station. At terminal B another Telephone Terminal CF-1-(*) (Carrier) converts the 200- to 12,000-cycle signal back to the original four messages. As simultaneous communication in two directions is required, another system of transmitters and receivers operating in the same manner in the other circuit direction is used.

(8) The number of relay stations that can be used is theoretically unlimited. For practical purposes, however, seven relay stations are the maximum number used because of cumulative distortion and the possibility of a component break-down.

(9) Channel 1 (200 to 2,800 cycles) is the only channel of the four that is transmitted as a normal telephone circuit and is intelligible at each radio station. For this reason it is normally used for checking and monitoring purposes only. The other three channels are inverted or scrambled and are not intelligible until unscrambled by Telephone Terminal CF-1-(*) (Carrier) at the other terminal station. These three channels cannot be monitored or intercepted without special equipment since they are evident only as a meaningless jumble of sounds. It must be assumed that the enemy has this special equipment. Therefore no secrecy is assured on any channel.

b. Multichannel Point-to-point Communication System. This system is the same as a multichannel radio-relay communication system except that the radio-relay stations are eliminated, the two terminal stations communicating with each other (fig. 6).

c. Single-channel Communication System. Single-channel communication is similar to multichannel communication except that all telephone terminals are eliminated and only one audio channel of communication is available. This one channel originates at the local handset of the transmitter or at a remote microphone located up to 2 miles from the radio set when Remote Control Equipment AN/TRA-2 is used. Since only a single communicating channel is used, the full modulation capabilities of the transmitter may be concentrated on one channel with a corresponding increase in signal strength on this channel. Single-channel communication is used with or without radio-relay stations.

3. TECHNICAL CHARACTERISTICS.

a. Radio Receiver R-48/TRC-8 (XC-3).

Receiver type...	superheterodyne
Frequency range	230 to 250 mc (megacycles)
Type of modulation received .	fm, ±100-kc deviation
Intermediate frequency ...	30 mc
Audio bandwidth	200 to 12,000 cps
Frequency control	tunable resonant line (no crystal)
Output impedance (high fidelity)	500 ohms
Power input ...	115 or 230 volts, 50-60 cycles, 120 watts
Number of tubes	15
Power supply...	self-contained

b. Radio Transmitter T-30/TRC-8 (XC-3).

Frequency range	230 to 250 mc
Type of modulation ..	fm, ±100-kc deviation (100% modulation)
Power output...	12 watts
Type of transmission	voice or multichannel telephone, telegraph, or facsimile
Operating range	25 to 100 miles
Frequency control	tunable resonant line (no crystal)
Power input ...	115 or 230 volts, 50-60 cycles, 350 watts
Number of tubes	8 (6 in transmitter, 2 in power pack)

c. Antenna Assembly AS-52/TRC-8 (XC-3).

Type of antenna.	half-wave dipole with 90° corner reflector; supported by 40-foot sectional mast
Antenna beam width	80°

d. Tube Types and Uses.

RECEIVER TUBE TYPES

Ref symbol	Tube VT-	Tube JAN-	Function
V1		6AG5	R-f amplifier
V2		6AG5	Mixer
V3	202	9002	Oscillator
V4		6AG5	1st i-f amplifier
V5		6AG5	2d i-f amplifier
V6		6AG5	3d i-f amplifier
V7		6AG5	4th i-f amplifier
V8		6AG5	1st limiter
V9		6AG5	2d limiter
V10	90	6H6	Discriminator
V11	231	6SN7GT	Audio and speaker amplifier
V12	107-A	6V6GT	Speaker output amplifier
V13	96	6N7GT/G	Squelch relay control
V14	139	0D3/VR-150	Voltage regulator
V15	244	5U4-G	Rectifier

TRANSMITTER TUBE TYPES

Ref symbol	Tube VT-	Tube JAN-	Function
V201	259	829-B	Master oscillator
V202	259	829-B	Reactance modulator
V203	259	829-B	Tripler and power amplifier
V204	90	6H6	R-f output rectifier
V205	231	6SN7	Audio amplifier
V206	231	6SN7	Amplifier and rectifier for percent modulation indicator.
V207	244	5U4-G	Rectifier
V208	244	5U4-G	Rectifier

4. TABLE OF COMPONENTS.

Description	Quantity			
	Radio Set AN/TRC-8 (XC-3)	Radio Terminal Set AN/TRC-11 (XC-3)	Radio Relay Set AN/TRC-12 (XC-3)	Radio-relay system*
Radio Receiver R-48/TRC-8 (XC-3).	1	2	3	13
Radio Transmitter T-30/TRC-8 (XC-3).	1	2	3	13
Power Pack PP-115/TRC-8 (XC-3).	1	2	3	13
Antenna Assembly AS-52/TRC-8 (XC-3).	2	2	4	16
Antenna Support AB-48/TRC-8 (XC-3).	2	2	4	16
Power Unit PE-75-( ).	1	3	3	15
Test Oscillator TS-237/TRC-8 (XC-3).	1	1	1	5
Group of accessory parts for Radio Set AN/TRC-8 (XC-3).	1			
Group of accessory parts for Radio Terminal Set AN/TRC-11 (XC-3).		1		2
Group of accessory parts for Radio Relay Set AN/TRC-12 (XC-3).			1	3
Maintenance Equipment MK-31/TRC-8 (XC-3)	1	1	1	5
Test Set I-56-(*)†.	1	1	1	5
Tools and operating components.	1	2	3	13
System spare parts group.				1
Wire W-110-B on Reel DR-4.				5

*A radio-relay system consists of two Radio Terminal Sets AN/TRC-11 (XC-3), three Radio Relay Sets AN/TRC-12 (XC-3), one group of system spare parts, and 5 reels of Wire W-110-B.

† Test Set I-56-(*) refers to Test Sets I-56-C, -D, -H, -J, or -K.

NOTE: Tools and operating components are for initial issue only and are not to be requisitioned as a kit or group as shown on the list of components.

5. PACKAGING DATA.

Item	Radio Set AN/TRC-8 (XC-3)	Radio Terminal Set AN/TRC-11 (XC-3)	Radio Relay Set AN/TRC-12 (XC-3)	Radio Relay System	Length (in.)	Depth (in.)	Height (in.)	Weight (lb)
Case CY-51/TRC-8 (XC-3) containing Radio Receiver R-48/TRC-8 (XC-3), tools, and operating components.	1	2	3	13	23	16	19	126
Case CY-52/TRC-8 (XC-3) containing Radio Transmitter T-30/TRC-8 (XC-3) and Power Pack PP-115/-TRC-8 (XC-3).	1	2	3	13	17½	16	24½	135
Case CY-53/TRC-8 (XC-3) containing two Antenna Assemblies AS-52/TRC-8 (XC-3).	1	1	2	8	33½	14	24	110
Case CY-54/TRC-8 (XC-3) containing Antenna Support AB-48/TRC-8 (XC-3).	2	2	4	16	70	12	13	205
Chest BC-5 containing group of accessory parts.	1	1	1	5	30	19	16	146
Chest BC-5 containing Maintenance Equipment MK-31/TRC-8 (XC-3) and Test Oscillator TS - 237/TRC - 8 (XC-3).	1	1	1	5	30	19	16	130
Chest BC-5 containing system spare parts group.				1	30	19	16	125
Power Unit PE-75-( ).	1	3	3	15	36	19	27	325
Test Set I-56-(*).	1	1	1	5	20	13	9½	60
Wire W-110-B (reels).				5	22	22	7	85
Total number of packages.	9	13	18	86				
Total volume (cu ft).	48	76	101	500				
Total weight (lb).	1,250	2,300	3,150	14,800				

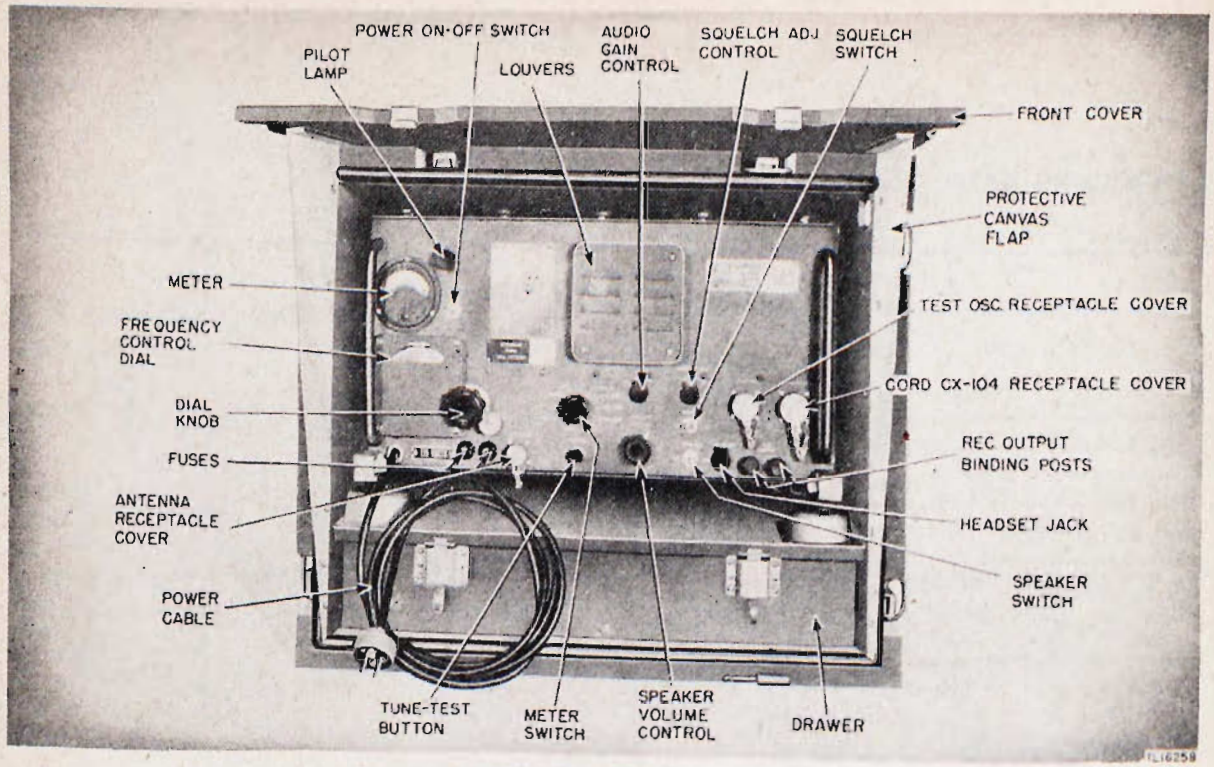

Figure 7. Radio Receiver R-48/TRC-8 (XC-3) in Case CY-51/TRC-8 (XC-3).

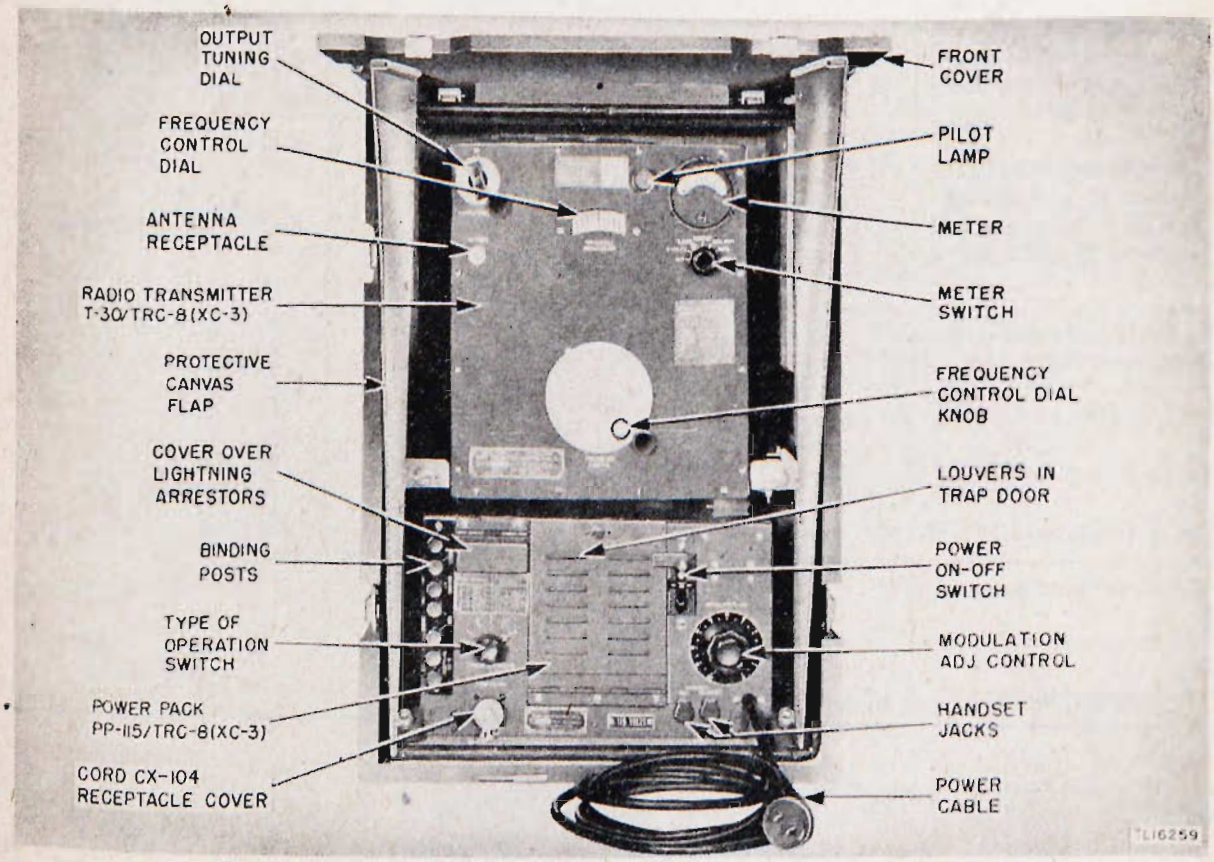

Figure 8. Radio Transmitter T-30/TRC-8 (XC-3) in Case CY-52/TRC-8 (XC-3).

6. RADIO RECEIVER R-48/TRC-8 (XC-3).

Radio Receiver R-48/TRC-8 (XC-3) is a 15-tube superheterodyne receiver designed to operate on any frequency from 230 to 250 mc and to receive f-m signals from Radio Transmitter T-30/TRC-8 (XC-3). The receiver is shock-mounted in Case CY-51/TRC-8 (XC-3) (fig. 7). All operating controls and receptacles for cable connections are on the front panel. A meter and meter switch are also provided on the front panel to indicate proper tuning and to aid in locating trouble. Operation of every stage of the receiver can be checked with this meter.

7. RADIO TRANSMITTER T-30/TRC-8 (XC-3) AND POWER PACK PP-115/TRC-8 (XC-3).

Radio Transmitter T-30/TRC-8 (XC-3) is an eight-tube f-m transmitter capable of operation on any frequency between 230 and 250 mc (megacycles) (fig. 8). The transmitter consists of two sections mounted in Case CY-52/TRC-8 (XC-3). The upper section, Radio Transmitter T-30/TRC-8 (XC-3), contains the r-f (radio-frequency) stages and audio amplifiers; the lower section, Power Pack PP-115/TRC-8 (XC-3), contains the power supply, audio-input circuits, and blower. No crystals are used. The oscillator frequency is stabilized by a temperature-compensated resonant transmission line. A meter and meter switch are provided on the front panel for indicating cathode current of each tube, output tuning, and modulation level. A motor-driven blower circulates air throughout the transmitter.

8. ANTENNA SUPPORT AB-48/TRC-8 (XC-3).

Antenna Support AB-48/TRC-8 (XC-3) is a sectional steel mast designed to support Antenna Assembly AS-52/TRC-8 (XC-3) at a maximum height of 40 feet. The complete mast equipment (fig. 9) is packed in a wooden carrying Case CY-54/TRC-8 (XC-3) which contains:

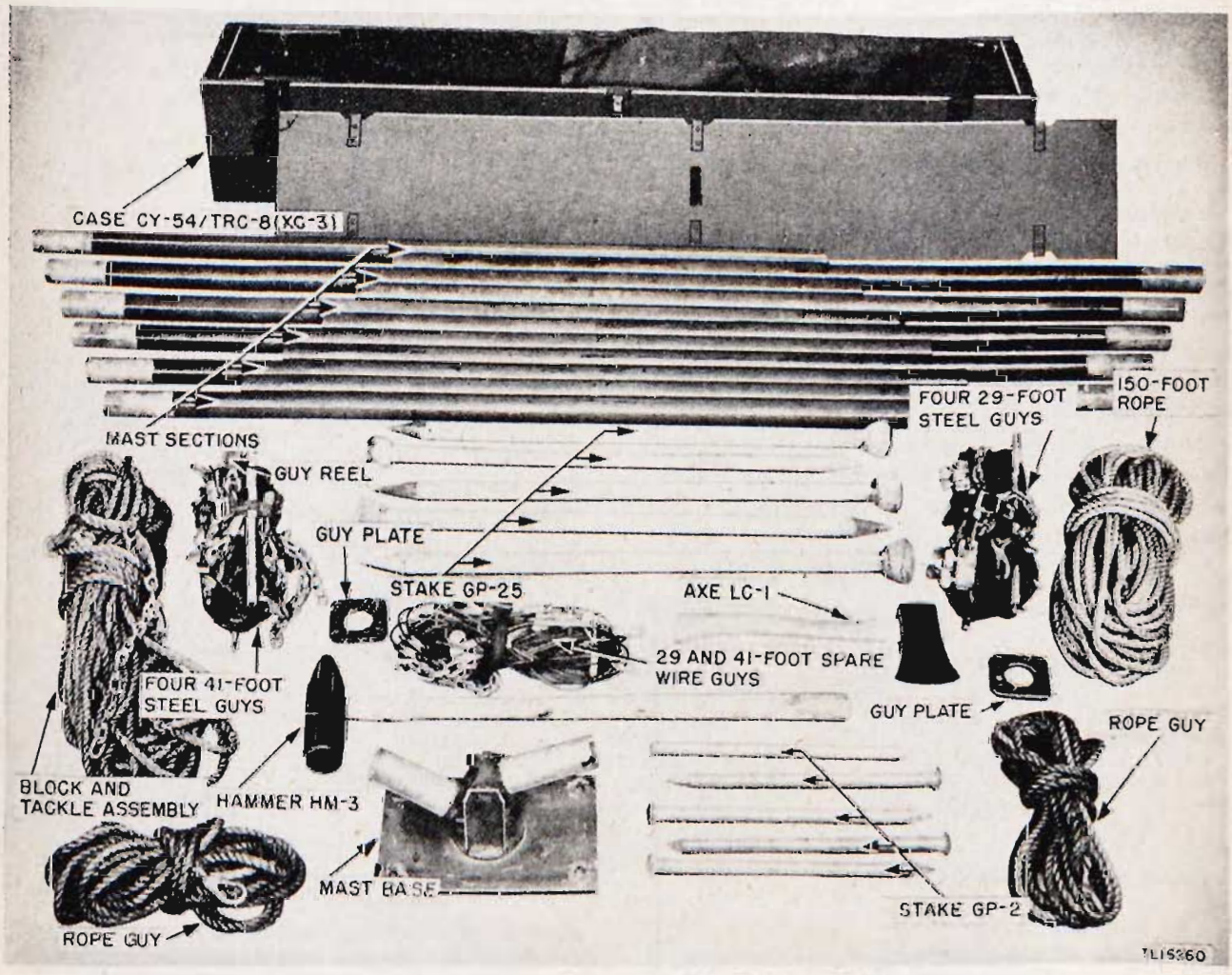

Figure 9. Antenna Support AB-48/TRC-8 (XC-3).

Item	Weight (lb)
1 Axe LC-1.	2.5
1 block and tackle assembly with ⅜-in. rope 150 ft long.	4.5
5 guys (41 ft, 4 in use, 1 spare).	3.0 (ea)
5 guys (29 ft, 4 in use, 1 spare).	3.0 (ea)
2 guys, gin pole (rope).	4.0 (ea)
5 guy plates (3 in use, 2 spare).	0.75 (ea)
1 Hammer HM-3.	9.75
11 mast sections.	6.75 (ea)
1 mast base.	8
3 reels (2 in use, 1 spare).	1 (ea)
150 ft rope, ⅜-in. diam (spare).	2.5
5 Stake GP-2 (4 in use, 1 spare).	2.0 (ea)
5 Stake GP-25 (4 in use, 1 spare).	5 (ea)
Packed weight of Case CY-54/TRC-8 (XC-3): 205 pounds.	

9. ANTENNA ASSEMBLY AS-52/TRC-8 (XC-3).

Antenna Assembly AS-52/TRC-8 (XC-3) consists of a half-wave dipole in front of a 90° corner reflector and requires no adjustment over the frequency range of the transmitter or receiver. Mounting brackets permit erection of the antenna assembly on top of Antenna Support AB-48/TRC-8 (XC-3) to provide either horizontal or vertical polarization. Two arrays may be mounted on one antenna support. Two antenna assemblies (fig. 10) are packed in a wooden carrying Case CY-53/TRC-8 (XC-3). Each antenna assembly contains the following:

Item	Weight (lb)
1 bag, canvas.	0.2
2 clips, with snaphook.	0.1
2 Cords CG-55/U.	7.0
1 corner reflector complete with dipole.	14.0
1 dipole (spare).	1.0
3 Radio Frequency Adaptors UG-29/U.	0.5
2 rolls of Tape TL-94.	0.4
Packed weight of Case CY-53/TRC-8 (XC-3): 110 pounds.	

10. MAINTENANCE EQUIPMENT AND SYSTEM SPARES.

a. Maintenance Equipment MK-31/TRC-8 (XC-3).

Maintenance Equipment MK-31/TRC-8 (XC-3) provides spare parts to operate and maintain Radio Set AN/TRC-8 (XC-3), Radio Terminal Set AN/TRC-11 (XC-3), or Radio Relay Set AN/TRC-12 (XC-3). It consists of the following components packed in Chest BC-5:

1 Test Oscillator TS-237/TRC-8 (XC-3).
1 dummy antenna.
1 Junction Box JB-110.
1 Cord CD-711.
1 lamp, trouble, complete with six 50-watt bulbs.
2 Technical Manuals TM 11-618.
23 Tubes JAN-6AG5.
3 Tubes JAN-9002 (VT-202).
3 Tubes JAN-6H6 (VT-90).
4 Tubes JAN-6SN7GT (VT-231).
2 Tubes JAN-6N7GT (VT-96).
2 Tubes JAN-6V6GT (VT-107).
6 Tubes JAN-5U4 (VT-244).
2 Tubes JAN-OD3/VR-150 (VT-139).
9 Tubes JAN-829B (VT-259).
* 1 connector, cable.
* 1 cable and cord.
*60% capacitors, fixed, mica.
*60% capacitors, fixed, paper.
*100% capacitors, electrolytic.
* 1 choke, r-f.
* 1 coil, i-f.
* 6 clips, tube.
*30 fuses.
* 2 fuse holders.
* 1 jack.
* 1 knob.
* 4 lightning arresters.
* 1 lock, dial.
* 3 lamps, pilot.
* 1 meter.
* 1 pilot lamp assembly.
* 1 relay.
* 3 rings, tube retainer.
*30% resistors, variable.
*30% resistors, fixed.
* 1 socket.
* 1 switch.

Packed weight of Chest BC-5: 130 pounds.

*Indicates the number supplied of each type of component used in one receiver, one transmitter, one power pack, one antenna assembly, and one test oscillator.

b. System Spares. These are a group of the larger replaceable components of the equipment which are less likely to fail in service. A single group of these parts, packed in Chest BC-5 which is marked SYSTEM SPARES AN/TRC-8 (XC-3), is furnished to serve an entire system of five radio stations.

(1) SPARE PARTS FOR RADIO TRANSMITTER T-30/TRC-8 (XC-3).

1 blower with motor.
1 reactor, filter, 3-henry.
1 attenuator, variable, T-pad.
1 transformer, power.
1 transformer, audio-input (two primaries and one push-pull secondary).
1 filter, low-pass.
1 transformer, audio isolation, 500 ohms to 500 ohms.
1 transformer, audio-input, microphone to line.
1 assembly, lightning protector.
1 capacitor, variable tripler tuning.

(2) SPARE PARTS FOR RADIO RECEIVER R-48/TRC-8 (XC-3).

1 transformer, power.
1 transformer, speaker output, and low-pass filter.
1 assembly, reactor, filter, (2 in one case).
1 transformer, high-fidelity output.
1 loudspeaker.

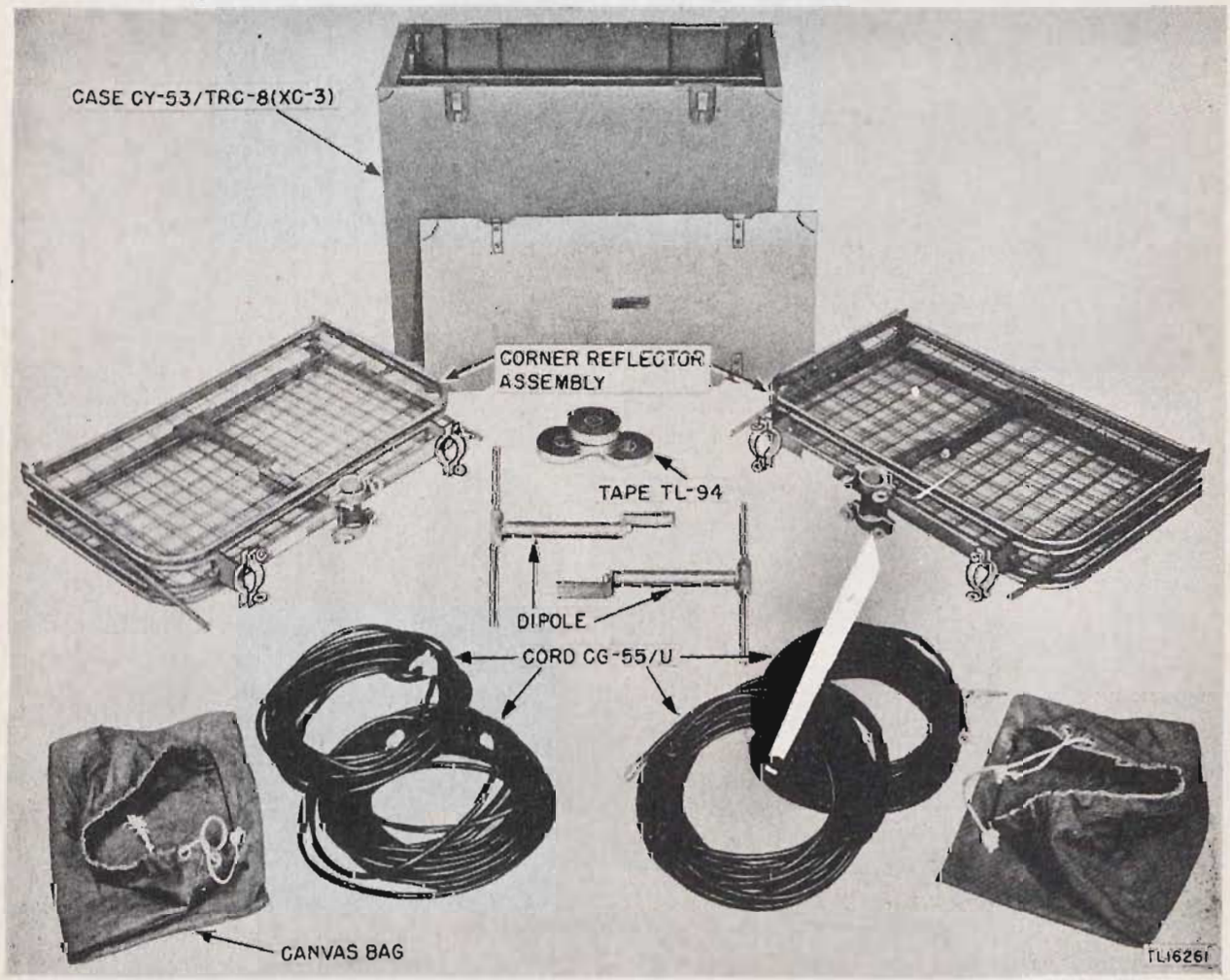

Figure 10, Antenna Assembly AS-52/TRC-8 (XC-3).

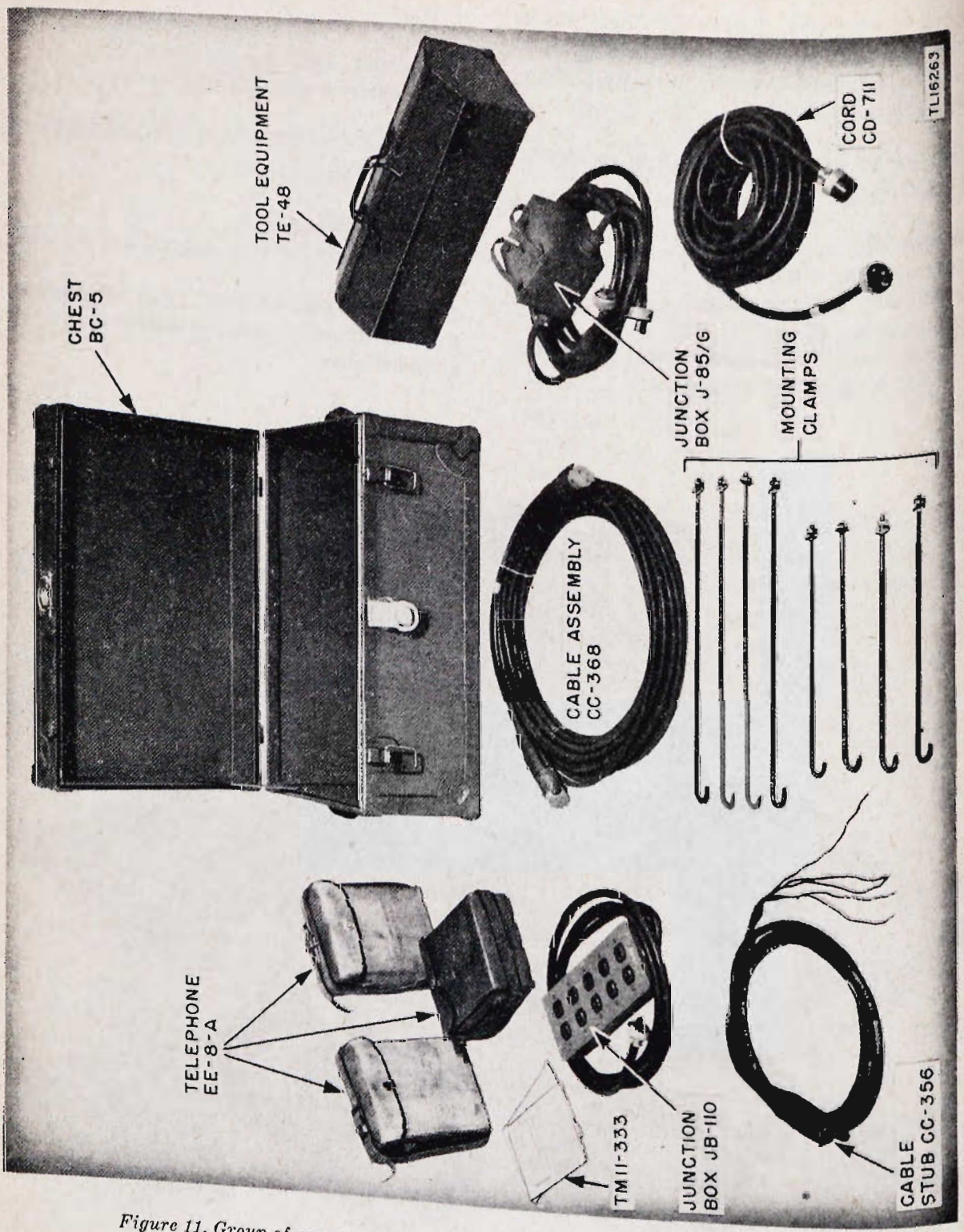

Figure 11. Group of accessory parts for Radio Terminal Set AN/TRC-11 (XC-3).

11. GROUP OF ACCESSORY PARTS FOR RADIO SET AN/TRC-8 (XC-3).

These parts consist of the following items packed in Chest BC-5 which is marked ACCESSORY PARTS AN/TRC-8 (XC-3). The parts are shown in figure 11.

Item	Weight (lb)
1 Cord CD-711.	8.0
1 Junction Box JB-110.	6.0
2 mounting clamps for receiver.	1.0
2 mounting clamps for transmitter.	1.0
1 Tool Equipment TE-48.	28.0
Packed weight of Case BC-5: 89 pounds.	

12. GROUP OF ACCESSORY PARTS FOR RADIO TERMINAL SET AN/TRC-11 (XC-3).

These parts consist of the following items packed in Chest BC-5 which is marked ACCESSORY PARTS AN/TRC-11 (XC-3) (fig. 11):

Item	Weight (lb)
1 Cable Assembly CC-368.	13.0
1 Cable Stub CC-356.	3.0
1 Cord CD-711.	8.0
1 Junction Box JB-110.	6.0
1 Junction Box J-85/G.	9.0
4 mounting clamps for receiver.	2.0
4 mounting clamps for transmitter.	2.0
2 technical manuals for Telephone EE-8-A.	0.2
3 Telephone EE-8-A (2 in use, 1 spare).	10.0 (ea)
1 Tool Equipment TE-48.	28.0
Packed weight of Chest BC-5: 146 pounds.	

These items are necessary for the installation, operation, and maintenance of Radio Terminal Set AN/TRC-11 (XC-3). The components of Tool Equipment TE-48 are shown in figure 12.

13. GROUP OF ACCESSORY PARTS FOR RADIO RELAY SET AN/TRC-12 (XC-3).

These parts consist of the following items packed in Chest BC-5 which is marked ACCESSORY PARTS AN/TRC-12 (XC-3).

Item	Weight (lb)
1 Control Box C-21A/TRC-1.	5.0
1 Cord CD-711.	8.0
1 Junction Box JB-110.	6.0
1 Junction Box J-85/G.	9.0
6 mounting clamps for receiver.	3.0
6 mounting clamps for transmitter.	3.0
2 technical manuals for Telephone EE-8-A.	0.2
3 Telephones EE-8-A (2 in use, 1 spare).	10.0 (ea)
1 Tool Equipment TE-48.	28.0
Packed weight of Chest BC-5: 137 pounds.	

These items are necessary for installation, operation, and maintenance of Radio Relay Set AN/TRC-12 (XC-3).

14. CASE CY-51/TRC-8 (XC-3) (fig. 13).

Case CY-51/TRC-8 (XC-3) is a plywood case, waterproof when closed, designed to house Radio Receiver R-48/TRC-8 (XC-3) when in transit or during field use. It contains a shock mounting into which the receiver slides and locks. The front cover must be open while the receiver is operating (fig. 7). A canvas protective flap, attached to the front cover, is provided as protection against the elements. A drawer below the receiver compartment contains tools and operating components.

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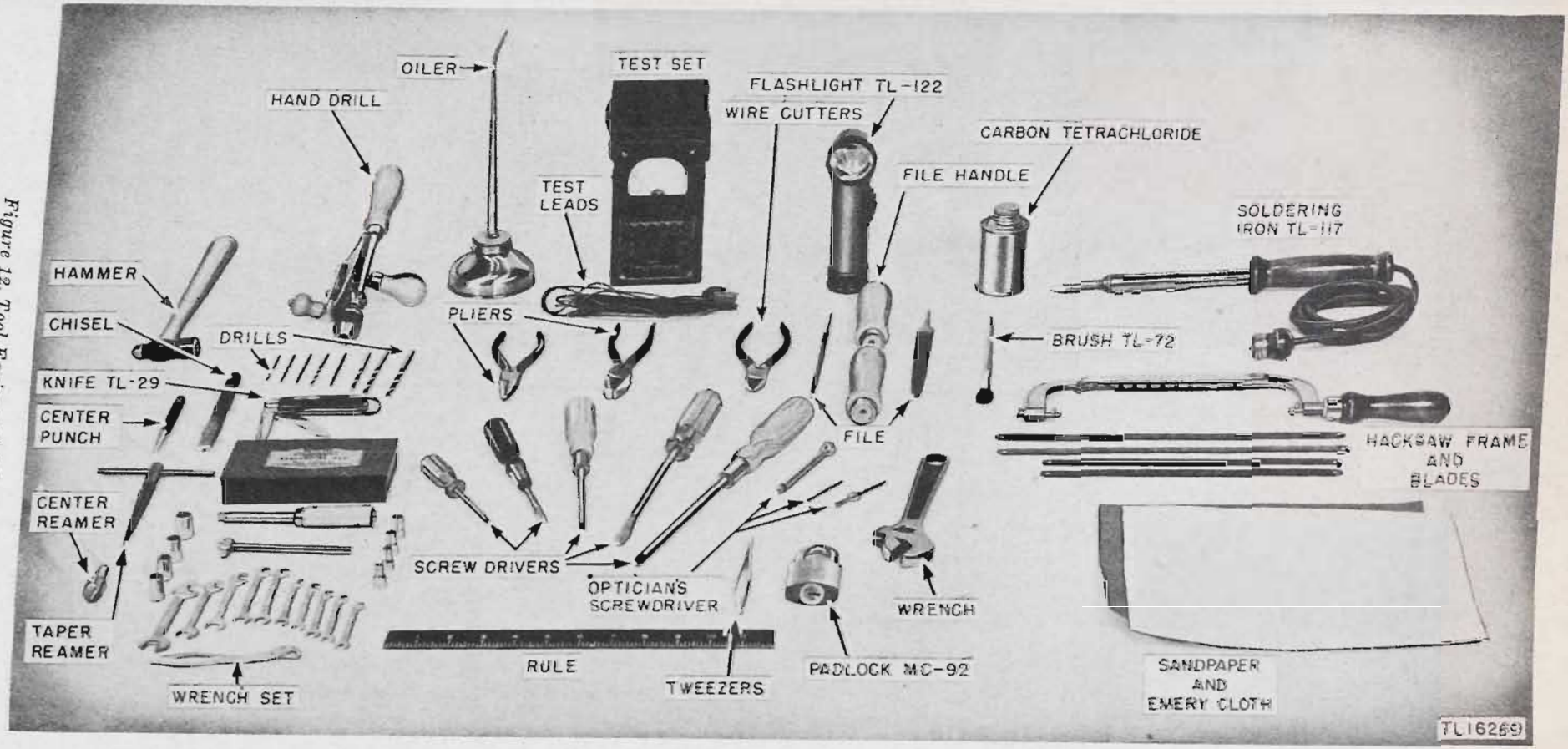


Figure 12. Tool Equipment TE-48.

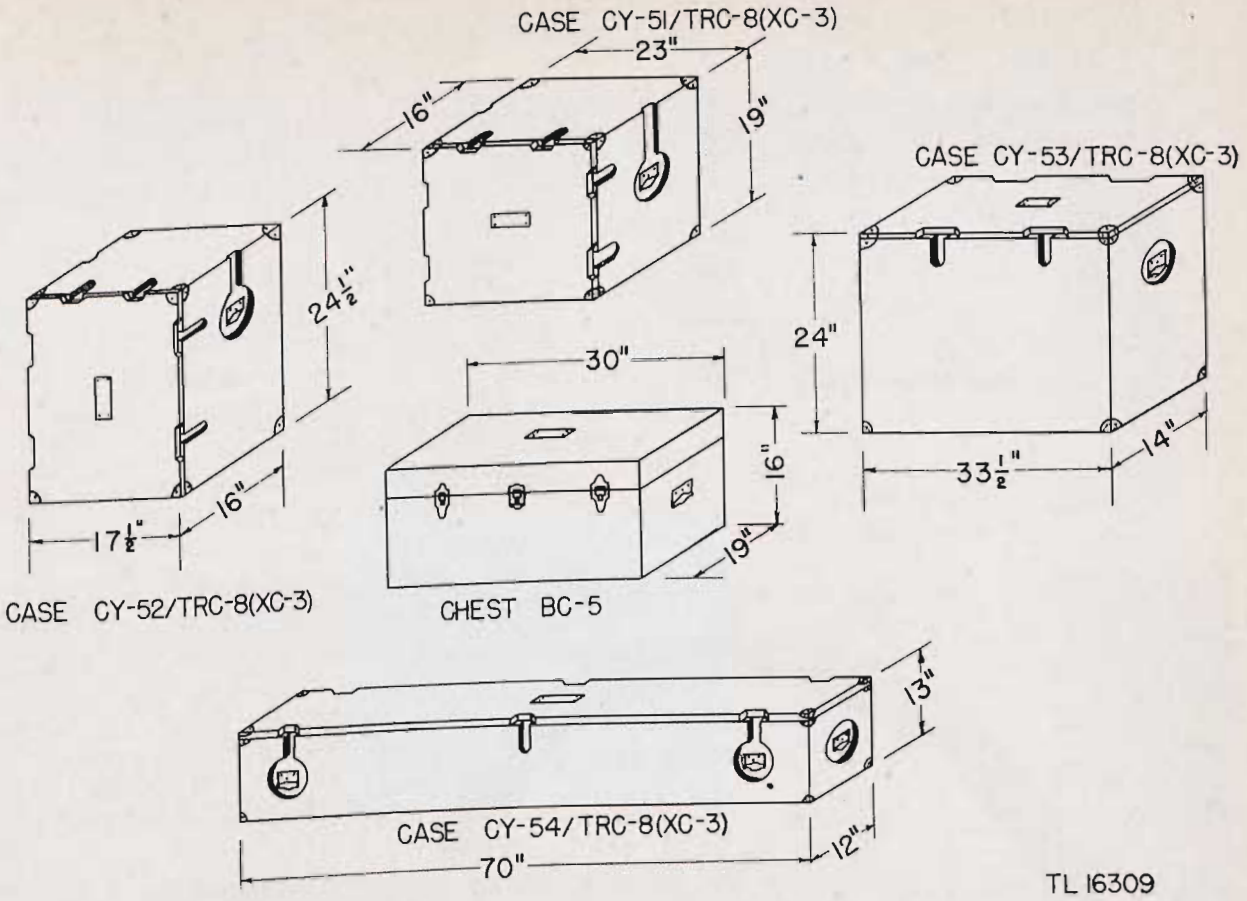


Figure 13. Outline dimensional drawing of cases.

15. CASE CY-52/TRC-8 (XC-3) (fig. 13).

Case CY-52/TRC-8 (XC-3) is a plywood case, waterproof when closed, designed to house Radio Transmitter T-30/TRC-8 (XC-3) when in transit or during field use. It contains a shock mounting into which the upper unit of the transmitter slides and locks. The lower unit is bolted to the case. The front cover must be open while the transmitter is operating. Protective canvas flaps are permanently attached to the inner side of the front cover. When this cover is fastened in position (fig. 8), the snap fasteners at the sides of the flaps are fastened to the case thereby providing protection against the elements.

16. CASE CY-53/TRC-8 (XC-3) (fig. 13).

Case CY-53/TRC-8 (XC-3) is a nonwaterproof plywood case containing two Antenna Assemblies AS-52/TRC-8 (XC-3). It is fitted with brackets and partitions to hold the contents secure. The lid of the case can be removed by unhooking the trunk catches.

17. CASE CY-54/TRC-8 (XC-3) (fig. 13).

Case CY-54/TRC-8 (XC-3) is a nonwaterproof plywood case designed to contain the components of Antenna Support AB-48/TRC-8 (XC-3). It is fitted with brackets to hold the contents secure. The lid of the case can be removed by unhooking the trunk catches.

18. TOOLS AND OPERATING COMPONENTS.

A group of tools and operating components is supplied with each transmitter and receiver, and is stored in the drawer of Case CY-51/-TRC-8 (XC-3) (fig. 14). These components are as follows:

1 Cord CX-104/TRC-1, 10′ 10″.
6 fuses, 2-ampere, type 3AG.
1 screwdriver, Vaco 130.
1 screwdriver, 6-inch blade.
1 wrench, box 9/16 inch and 5/8 inch.
1 Handset H-23/U.
10 pilot lamps, G.E. mazda type 51.
2 Technical Manuals TM 11-618.

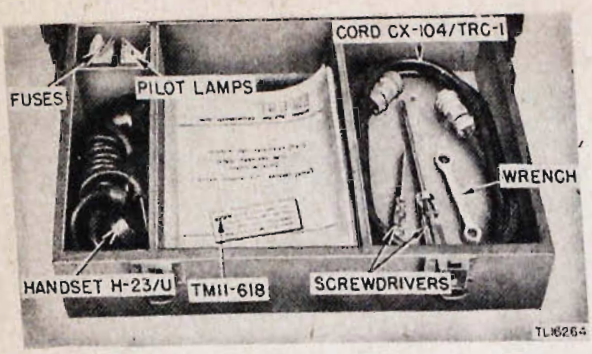


Figure 14. Tools and operating components.

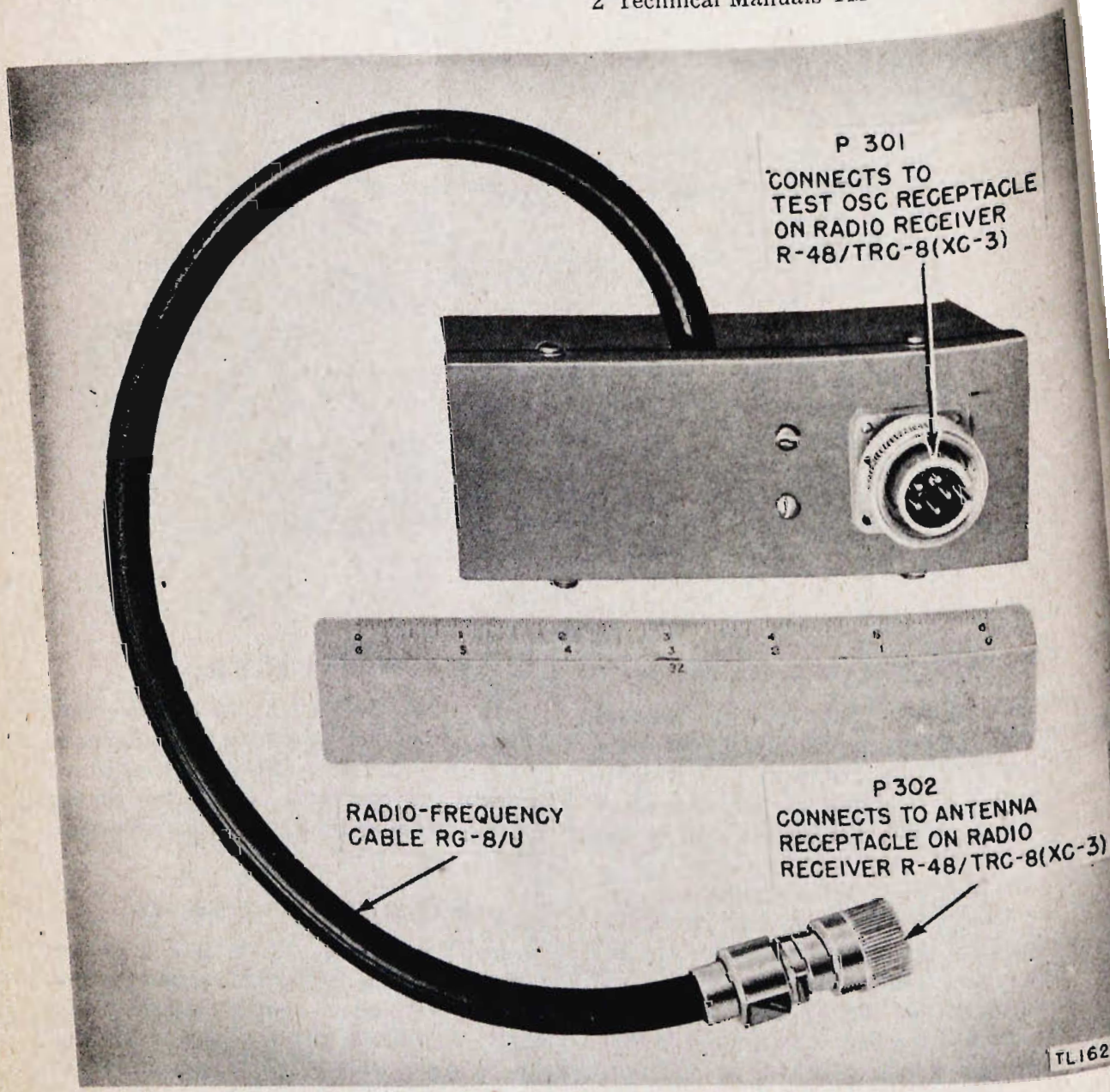


Figure 15. Test Oscillator TS-237/TRC-8 (XC-3).

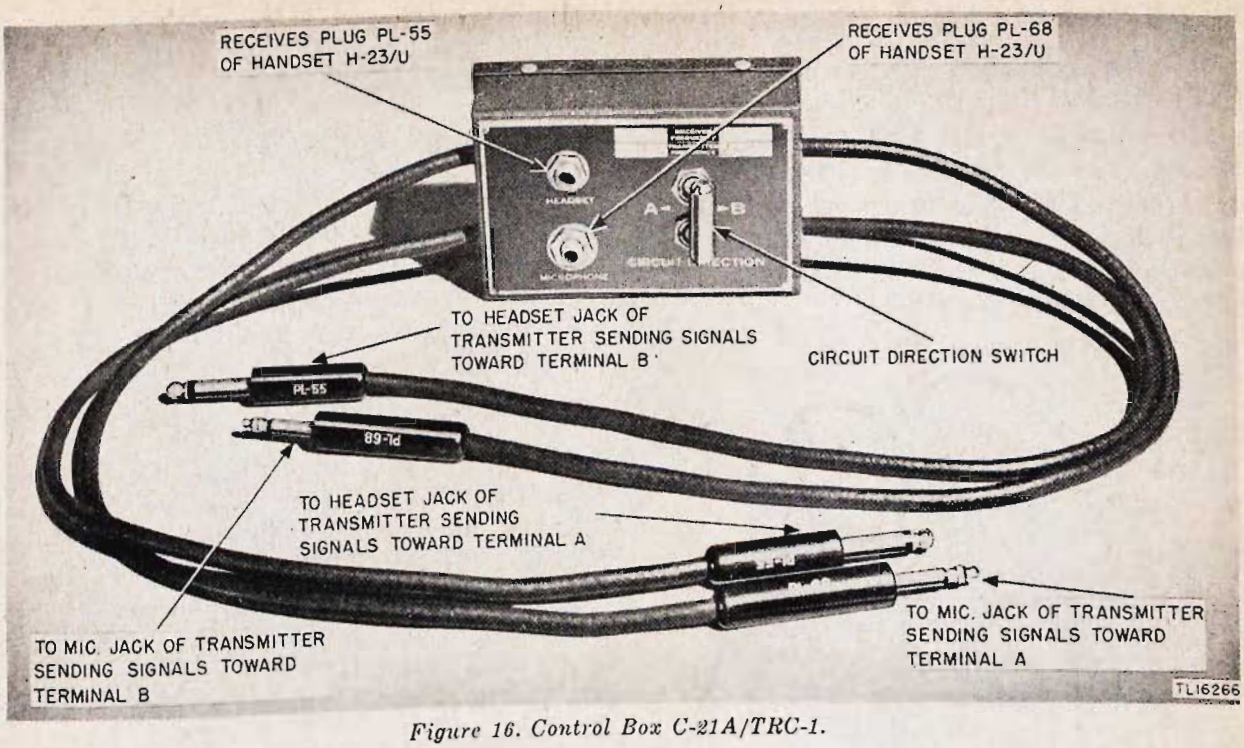


Figure 16. Control Box C-21A/TRC-1.

19. TEST OSCILLATOR TS-237/TRC-8 (XC-3).

Test Oscillator TS-237/TRC-8 (XC-3) is a crystal-controlled signal generator designed to furnish the necessary signals for the alignment of the r-f and i-f (intermediate-frequency) stages of the receiver (fig. 15). A 5-mc crystal provides harmonic output of 30 mc for i-f alignment, and harmonics from 230 to 250 mc in 5-mc steps for r-f alignment. Operating power for the test oscillator is taken from Radio Receiver R-48/TRC-8 (XC-3) by means of a socket provided on the receiver front panel. A single Tube JAN-6AG5 is used in the test oscillator. The test oscillator is packed in Chest BC-5 with Maintenance Equipment MK-31/TRC-8 (XC-3).

20. CONTROL BOX C-21A/TRC-1.

Control Box C-21A/TRC-1 (fig. 16) is used only at a relay station to provide the local operators with facilities for talking in either direction. Two phone cords and two microphone cords from the control box plug into the jacks on the front panels of the two relay transmitters. The operator's handset is plugged into the jacks on the control box. Depending on the position of the circuit direction switch (A or B), the operator may communicate with other operators in either direction on the circuit. Space is provided on the front panel of the control box for recording in pencil the frequencies and stations involved.

21. CORD CX-104/TRC-1.

Cord CX-104/TRC-1 is a shielded, six conductor, rubber- or plastic-jacketed cable used to interconnect Radio Transmitter T-30/TRC-8 (XC-3) with Radio Receiver R-48/TRC-8 (XC-3) (figs. 14 and 143).

22. CORD CG-55/U.

Cord CG-55/U is a 60-foot length of flexible, solid-dielectric, plastic-jacketed coaxial Radio Frequency Cable RG-8/U fitted at each end with a waterproof connector Radio Frequency Plug UG-21/U (fig. 10). This cord is used to connect either a transmitter or a receiver to its corresponding antenna. Its characteristic impedance is 50 ohms.

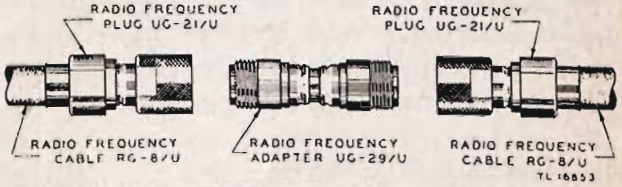


Figure 17. Connecting two Radio Frequency Plugs UG-21/U.

23. RADIO FREQUENCY ADAPTER UG-29/U.

Radio Frequency Adapter UG-29/U is a connector used to join two lengths of Cord CG-55/U when one length is insufficient. The adapter is shown in figure 17.

24. JUNCTION BOX J-85/G.

Junction Box J-85/G (fig. 18) is used to connect two Power Units PE-75-( ) to an extension cord or directly to the load. A switch on the panel permits the selection of either power unit to be used. Two cords are provided which fit into each power unit, and two outlet receptacles are furnished for connection to the load or to engage the plug of Cord CD-711.

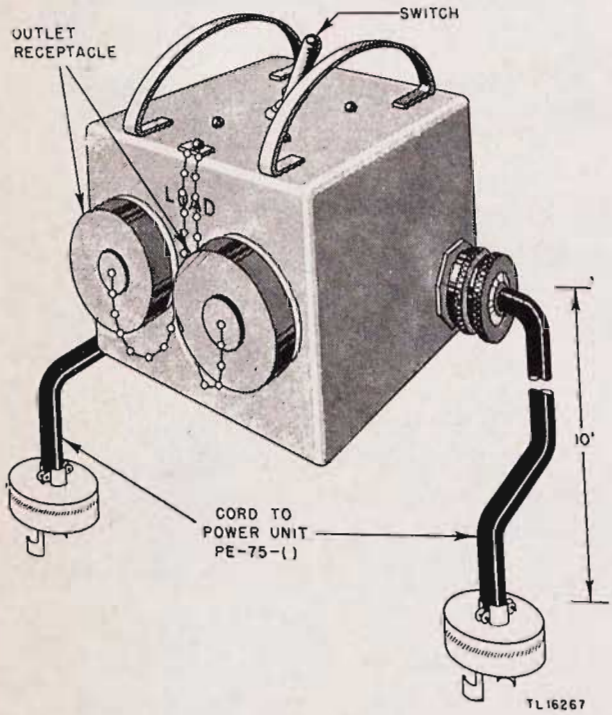


Figure 18. Junction Box J-85/G.

25. CORD CD-711.

Cord CD-711 is a 50-foot, two-conductor, rubber-jacketed cord with a twist-lock plug at one end and a receptacle at the other (fig. 11). It is used to connect Junction Box J-85/G at the power units to the Junction Box JB-110 at the radio station. The cord may be connected directly to a single Power Unit PE-75-( ) where only one power unit is used.

26. JUNCTION BOX JB-110.

Junction Box JB-110 (fig. 19) provides a means for connecting as many as 10 two-conductor power cords to a single power outlet. A 10-foot cord is provided to connect the junction box to the power source. The transmitters, receivers, trouble lamps, shelter lights, etc., are plugged into the box. Over-all dimensions are 12¼ inches long by 4½ inches wide by 2¼ inches deep.

27. TELEPHONE EE-8-A.

Telephone EE-8-A (fig. 11) is a field telephone in a leather case 9½ inches by 7½ inches by 3½ inches containing a Handset TS-9A and a ringer. Terminals are provided for connection to two-conductor wire. Refer to TM 11-333.

28. HANDSET H-23/U.

Handset H-23/U (fig. 14) is a standard issue handset with a butterfly type switch for controlling microphone and transmitter keying circuits. The rubber-covered cord terminates in two plugs: Plug PL-55 for earphone connection, and Plug PL-68 for the microphone and push-switch connection.

29. CABLE STUB CC-356.

Cable Stub CC-356 is used to connect the spiral-four cable to a radio terminal station. The stub consists of 12 feet of Cable WC-548 with a coupler at one end (figs. 11 and 112). One pair of the cable is colored and connects through a loading coil in the coupler to the female terminals. The other pair is white and connects directly to the male terminals of the coupler. At the stub end the conductors are exposed to permit connection to the binding posts on the radio terminal station transmitter. A fifth wire is provided for connecting the steel braid shield of the cable stub to a ground terminal on the transmitter.

30. CABLE ASSEMBLY CC-368.

Cable Assembly CC-368, consisting of 100 feet of spiral-four cable with couplers at both ends, has been provided to permit extension of the spiral-four cable (figs. 11 and 111). When used, Cable Assembly CC-368 connects the ¼-mile spiral-four cable to Cable Stub CC-356, which in turn connects to the radio terminal station transmitter.

31. MOUNTING CLAMPS.

Mounting clamps are furnished in Chests BC 5 marked Part of AN/TRC-8 (XC-3), Part

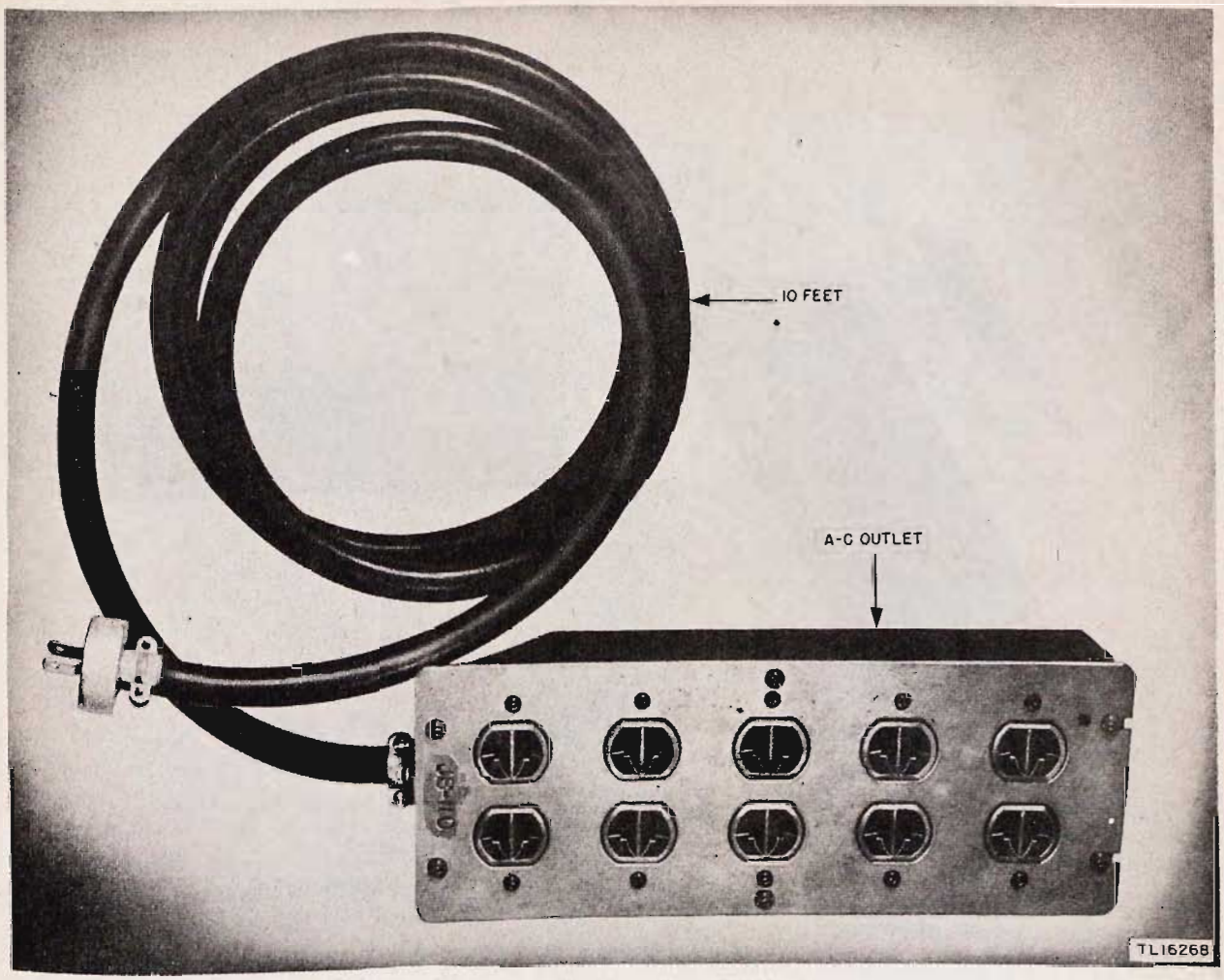


Figure 19. Junction Box JB-110.

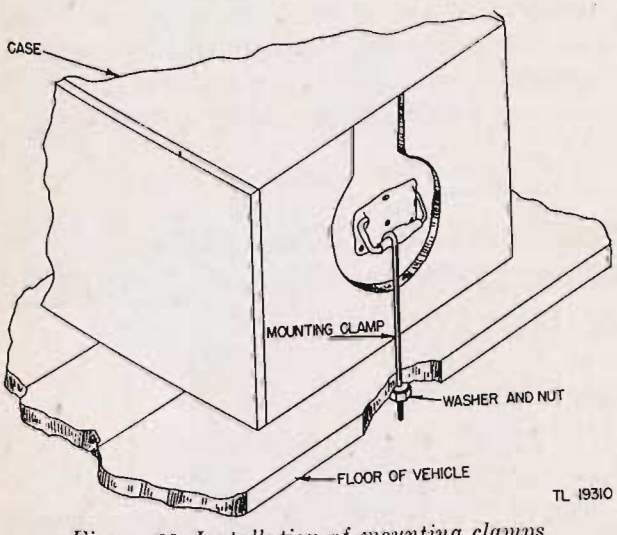


Figure 20. Installation of mounting clamps.

AN/TRC-11 (XC-3), or Part of AN/TRC-12 (XC-3). These clamps are provided to enable Case CY-52/TRC-8 (XC-3) (transmitter) and Case CY-51/TRC-8 (XC-3) (receiver) to be secured to the frame of a motor vehicle while in transit (fig. 20).

32. LIGHTNING ARRESTERS.

a. Four lightning arresters are provided on the front panel of Radio Transmitter T-30/TRC-8 (XC-3) to protect the equipment against lightning discharges picked up by the spiral-four cable (fig. 8). Each arrester consists of two units: a solid carbon block mounted on the ground side of the holder, and a ceramic frame containing a carbon plug held in place with low-temperature fusing cement (fig. 21). When these two blocks are held together, the air gap between them protects against all voltages likely to be encountered. Ordinary lightning discharges picked up by the spiral-four cable will cause an arc across the air gap between the carbon blocks, but will not generate enough heat to melt the cement holding the carbon plug in place. A short

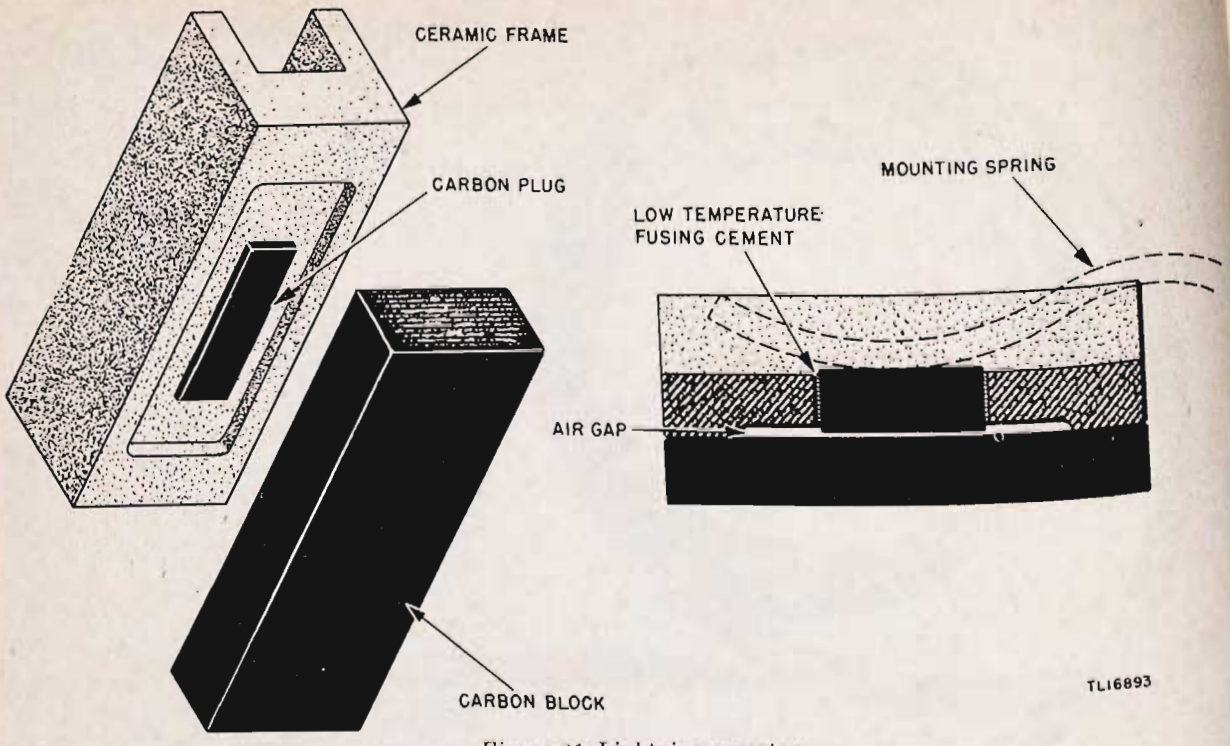


Figure 21. Lightning arrestor.

between the spiral-four cable and a power line, however, will cause repeated discharges of sufficient duration to melt the cement holding the carbon plug in place. Thus, the mounting spring will push the carbon plug into direct contact with the block and permanently ground the line.

b. Do not replace a faulty lightning arrester until the cause of the break-down has been located and corrected. Lightning arresters should be removed from the transmitter at relay stations since no spiral-four cable is used and no protection is therefore necessary.

33. POWER UNIT PE-75-( ).

Power Unit PE-75-( ) (fig. 22) is a 2,500-watt, gasoline engine-driven, a-c (alternating-current) generator of the manual starting type. Engine speed is automatically controlled by a built-in fully enclosed governor. It is designed to generate a 120-volt, single-phase, 60-cycle current. The power unit is mounted on a steel skid base and is supplied with wooden carrying handles. Refer to TM 11-900 series packed with each unit for detailed operating instructions.

SECTION II. INSTALLATION OF RADIO SET AN/TRC-8 (XC-3), RADIO TERMINAL SET AN/TRC-11 (XC-3), AND RADIO RELAY SET AN/TRC-12 (XC-3).

34. SITING (fig. 23).

Installation and operation of these radio sets vary considerably with the type of service required. The principles and considerations outlined below are important for any type of system, and must be followed for satisfactory operation. For purposes of clarity, concealment features are not shown in figure 23. However, all necessary precautions must be taken.

35. LINE OF SIGHT.

a. General. Communication with these radio sets is accomplished in the v-h-f (very-high-frequency) band of 230 to 250 mc. Radio waves at these frequencies tend to travel in straight lines. For this reason, line-of-sight transmission paths are of major importance as signal strength attenuates rapidly over paths which have obstructions between the transmitter and receiver. A

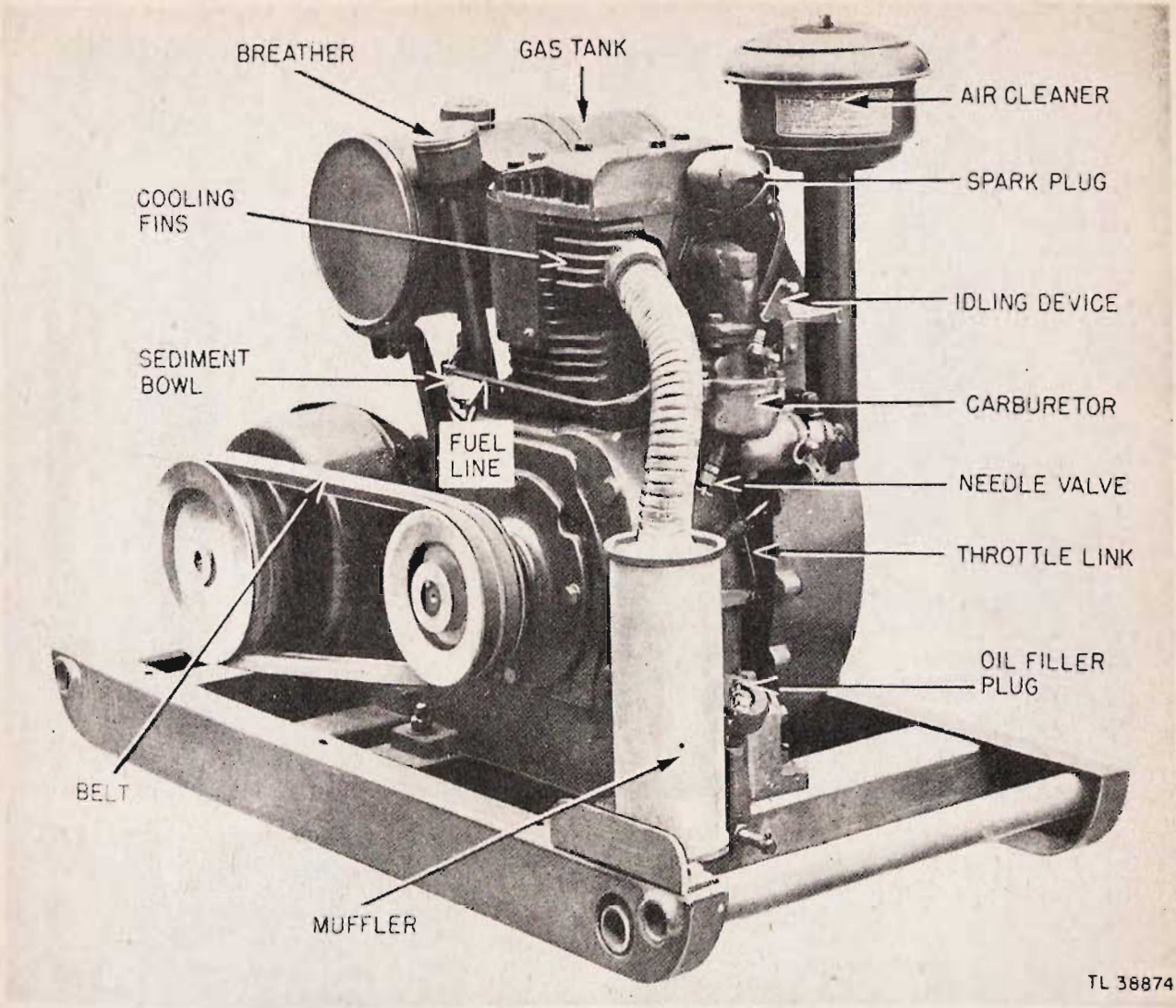


Figure 22. Power Unit PE-75-( ).

though the radio waves bend slightly around these obstructions, reliable communication occurs only when line-of-sight paths exist. Line-of-sight transmission is attained when the transmitter antenna is theoretically within optical range of the receiver antenna. The most important factors limiting line of sight are the curvature of the earth and intervening hills.

b. Curvature of the Earth. The curvature of the earth limits the distance over which line of sight occurs. For example, with both the transmitting and receiving antennas located 40 feet above sea level, the maximum distance that can be spanned before the line of sight is intercepted by the curvature of the earth is approximately 18 miles. This assumes the altitude of the intervening terrain to be also at sea level. In order to obtain a line-of-sight path 50 miles long, the height of both the antennas must be at least 350 feet above sea level and the altitude of the intervening terrain must be at sea level. To determine the maximum distance between two radio stations *with the intervening terrain at sea level,* the following formula is used:

$$D = 1.41\sqrt{X_1} + 1.41\sqrt{X_2}$$

where

D = distance in miles

X_1 = height in feet of one antenna

X_2 = height in feet of the other antenna.

c. Intervening Hills. Intervening hills in a transmission path reduce signal strength when

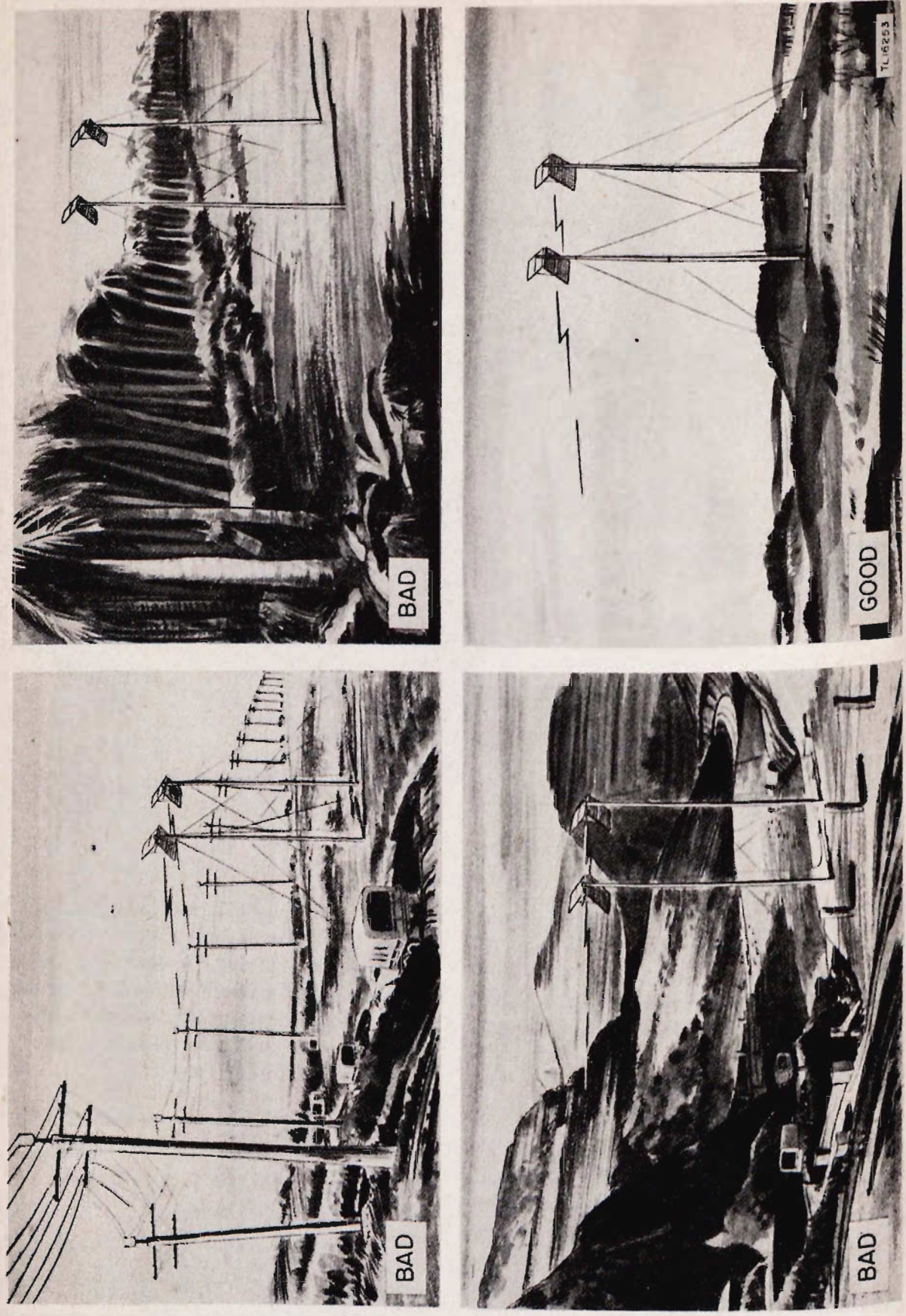
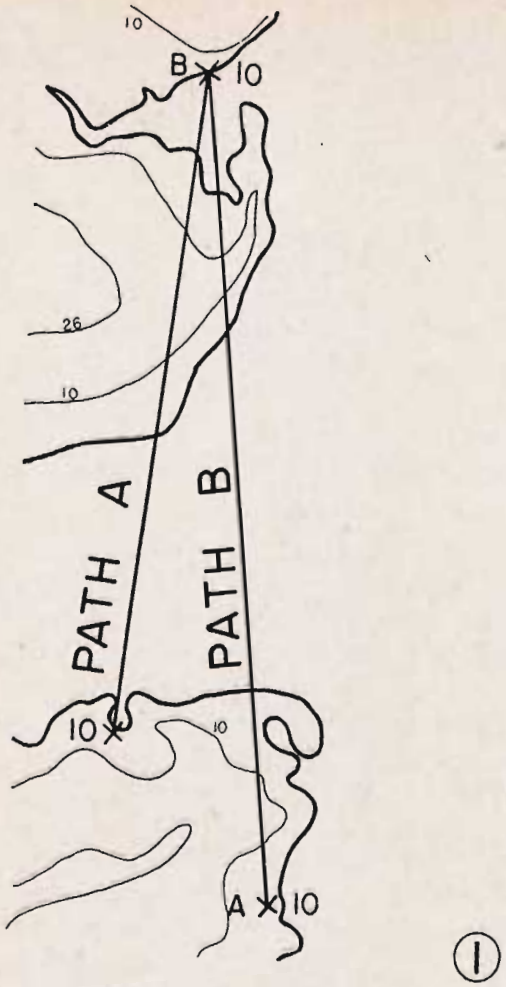
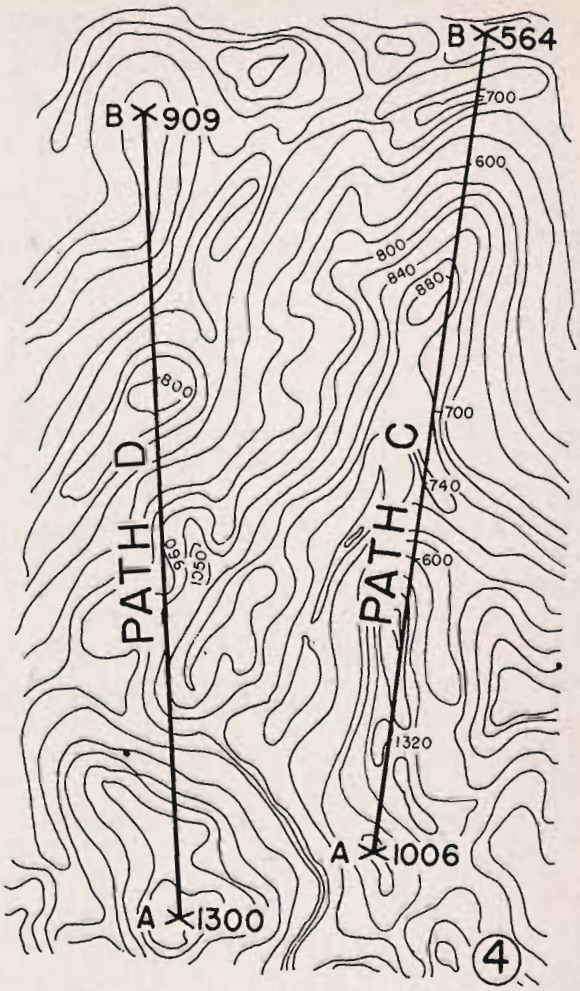


Figure 23. Selecting location for a radio station.



1



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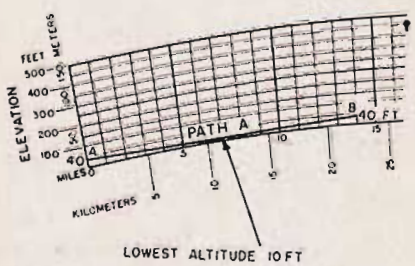

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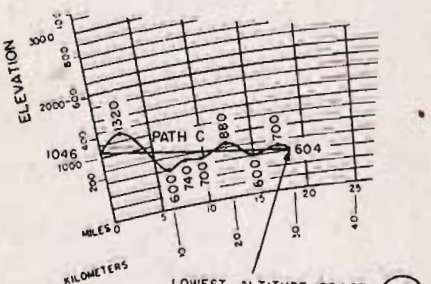

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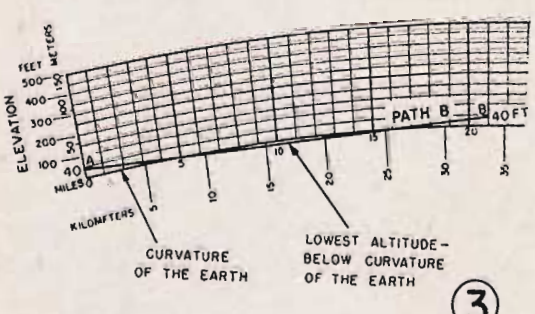

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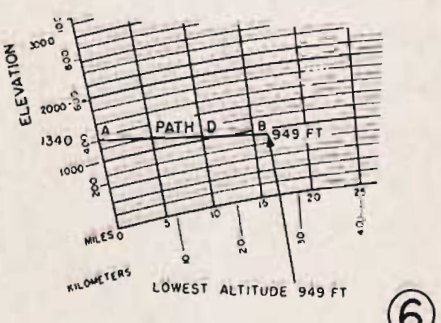

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Figure 24. Plotting profiles.

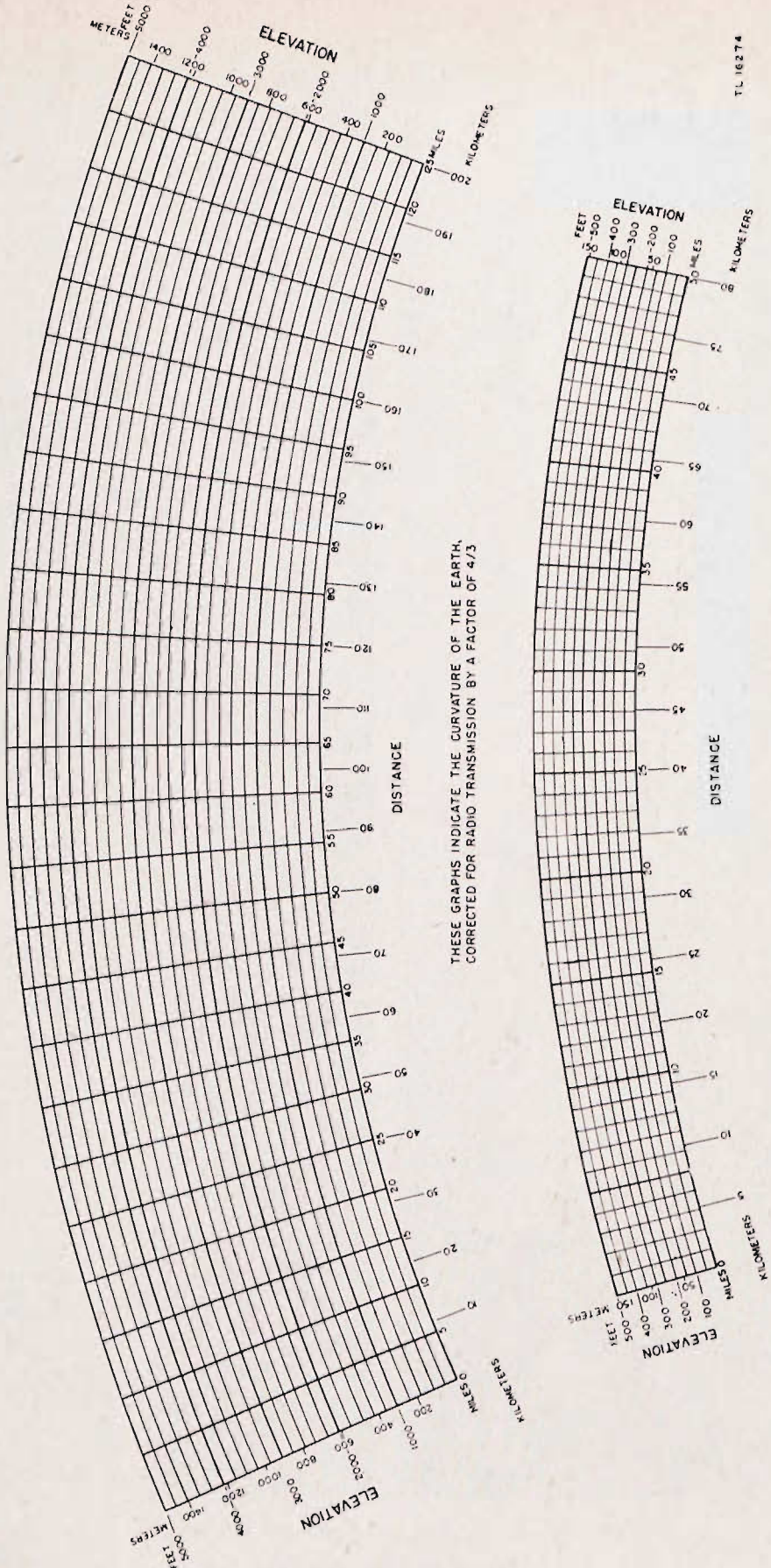


Figure 25. Nonlinear graph paper.

they obstruct the line of sight. Radio waves bend over these obstructions slightly, but bending is accompanied by a loss in signal strength; the greater the bending, the greater the loss. Certain combinations of communication sites and intervening hills may provide satisfactory signals due to reflections, but this condition is realized only by luck, or by calculation with detailed terrain maps. It can be reliably predicted that satisfactory communication will be obtained if line of sight prevails. If line of sight does not exist, the path must be tested first to determine if the site is suitable.

36. PLOTTING PROFILES ON NONLINEAR GRAPH PAPER.

To determine whether a line-of-sight path exists before attempting an installation, a profile should be drawn (fig. 24). The graph paper similar to that in figure 25 is furnished at the rear of this manual for plotting profiles from terrain maps. Either of the two graphs may be used, depending upon the elevations and distances between the two proposed sites. The upper graph is used for elevation up to 5,000 feet and distances up to 125 miles. The lower graph will accommodate elevations up to 500 feet and distances up to 50 miles. This graph paper is used as follows:

a. Determine from the terrain map the scales used for distances and elevations.

b. Draw a line on the terrain map between the two proposed sites (fig. 24(1) and (4)). Measure the length of this line and convert it to the distance between the two points.

c. Determine the elevation at each site as indicated by the contour lines. Add the height of the antenna mast of this figure to arrive at the total elevation. For example, referring to path D (fig. 24(4)), station A is 1,300 feet high. Adding antenna height, in this case 40 feet, brings the total elevation to 1,340 feet. This point is marked off on the vertical scale of the graph above 0 miles (fig. 24(6)). Station B has an indicated elevation of 909 feet. This height plus the antenna height of 40 feet gives a total elevation of 949 feet. This is plotted on the vertical scale (fig. 24(6)) above the 16-mile point, since 16 miles is the distance between the two sites.

d. Draw a straight line between these two points, scan this line, and determine the point of lowest altitude. On path D this is 949 feet; on path A (fig. 24(2)) the lowest altitude is 10 feet and on path B (fig. 24(3)), it is below the curvature of the earth.

e. Scan the terrain map and note if there are any points above the point of lowest altitude. If there are none, as on path D, line of sight exists and no further plotting is necessary.

f. If there are elevations above the point of lowest altitude, as on path C, draw a complete profile. Follow the line drawn on the terrain map and pick out high and low points. Plot these points on the graph paper and join them. All points which project above the straight line on the graph (fig. 24 (5)) represent intervening terrain.

g. If there are intervening hills between the two proposed sites as in path C, or if the site line is below the curvature of the earth as in path B (fig. 24(3)), poor communication may result. Do not use such paths. However, if there are no intervening hills as in paths A and D, good communication will be obtained.

h. If the proposed site is intended for a relay station, the transmission path to each relay or terminal station must be considered. *A line of sight must exist in both directions.*

37. PLOTTING PROFILES ON LINEAR GRAPH PAPER.

If profile graph paper is not available, a profile may be plotted on any linear graph paper and then corrected for the curvature of the earth using the table below.

a. Determine from the terrain map the scales used for distances and elevations. Draw a line on the terrain map between the two proposed sites.

b. Pick out high and low points along the line and plot these on the graph paper. Path C is plotted as a broken line curve on this type of graph paper as an example (fig. 26).

c. Draw a line on the graph paper between the two terminal points A and B.

d. Correction must be made for the earth's curvature to obtain a true picture of the line-

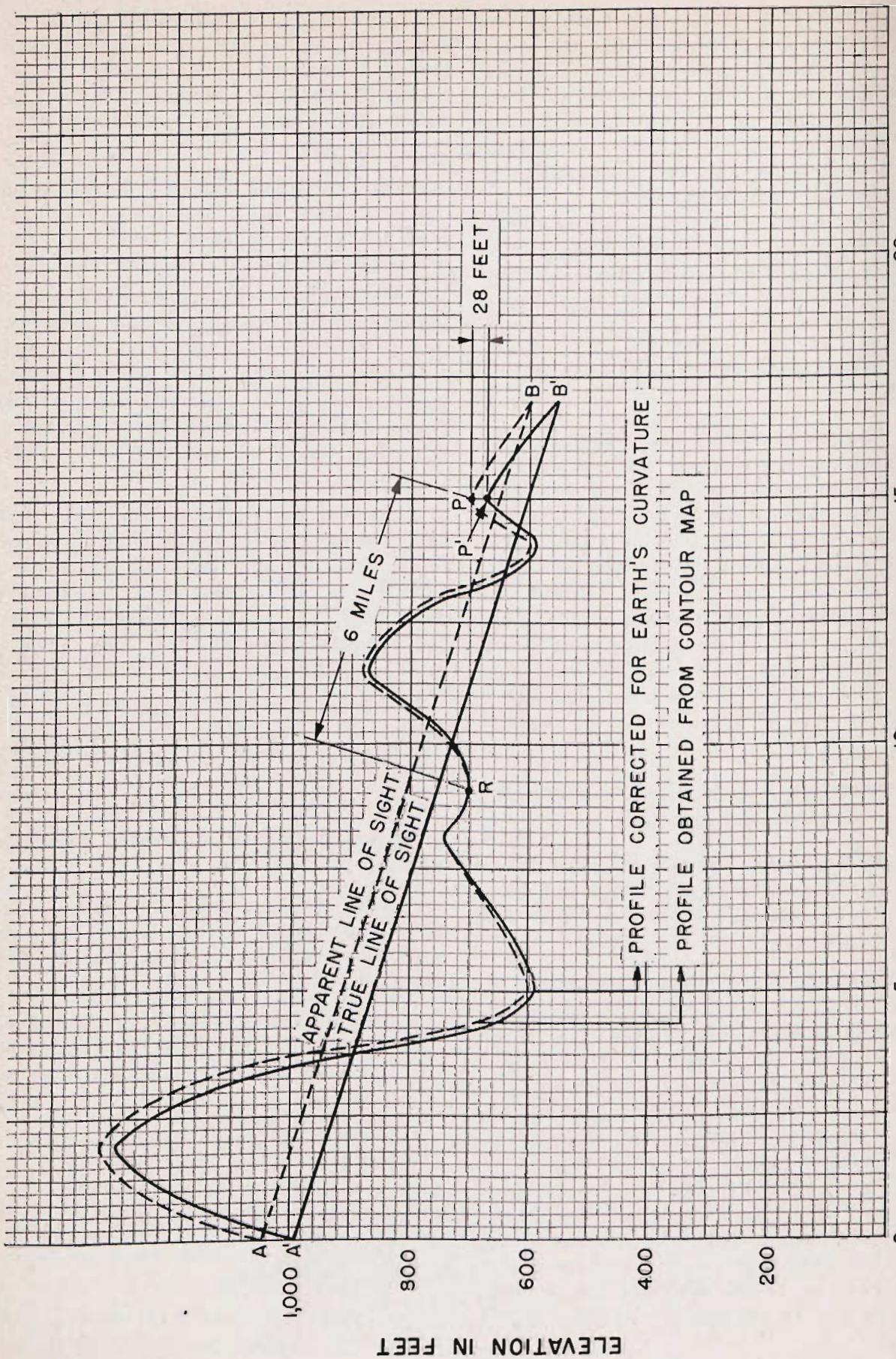


Figure 26. Plotting profiles on linear graph paper.

of-sight path. A high or low point is selected which is as near as possible to the point halfway between the terminals, in this case R. Next, by means of the figures shown in the table below, the heights of all prominent points in both directions from this central point must be corrected (shown as solid line curve). For example, point P shown in figure 26 is 6 miles from the reference point R. After correction, P become P^1, 28 feet lower than the original point.

e. Some profile maps will indicate a line-of-sight path with the drawing uncorrected. With the correction, however, many intervening objects may be apparent.

CONVERSION OF SEA LEVEL ELEVATIONS TO LINE-OF-SIGHT ELEVATIONS

D (miles from reference point)	Elevation correction (ft) (k = 1)
2	3
4	11
6	28
8	43
10	67
12	97
14	130
16	170
18	217
20	266
22	324
24	384
26	455
28	520
30	600
32	680
34	774
36	862

NOTE: The corrected elevation in feet equals $\frac{D^2}{1.5}$ k where k is the ratio of the effective earth's radius to the true earth's radius and D is the distance in miles from the reference point. This formula does not correct for the effect of refraction of the radio wave.

38. NOISE AND INTERFERENCE.

The range of v-h-f communication is inversely related to the amount of noise or interference at the receiver location; the more noise or interference present, the shorter the distance that can be spanned satisfactorily. The most objectionable result of high noise level is reduced intelligibility in telephone circuits and errors in carrier telegraph circuits. Industrial plants using electrical equipment, radio transmitters, power lines, motor vehicle ignition systems, etc., are sources of radio noises. Harmonic radiation from other transmitters may cause considerable interference. The prime requirement for good communication is a high signal-to-noise ratio. SET UP EQUIPMENT AWAY FROM ALL MOTOR TRAFFIC AND DO NOT PERMIT VEHICLES TO COME WITHIN 200 YARDS OF RECEIVER ANTENNAS.

39. ACCESSIBILITY.

Accessibility of a proposed site and a good transmission path are necessary. Reconnaissance is an important part in the planning of proposed communication sites. When choosing a location, access by vehicles to supplies of gasoline, water, oil, food, etc., should be considered, as well as the ability to transport the radio equipment to and from the proposed site.

40. SUMMARY OF SITING.

a. Use line-of-sight paths.

b. Avoid locating too close to motor roads, telephone and power lines, industrial plants, radio transmitters, or gasoline engines (fig. 23).

c. Draw a profile to determine if the proposed path is line of sight.

d. Determine the accessibility of a proposed location by reconnaissance.

e. Erect antennas sufficiently high to clear nearby trees, buildings, etc.

f. Make a test set-up of a proposed circuit.

41. ARRANGEMENT OF EQUIPMENT AT SITE.

a. Arrangement of Antenna Equipment. To choose the proper location for the antenna

equipment, pay careful attention to the following details:

(1) Place the antennas as high as necessary to clear trees, buildings, or any other obstructions in the direction in which transmission or reception is desired.

(2) Do not operate vehicles near antenna sites, particularly near receiver antennas.

(3) Erect the antenna on flat ground, free of rock if possible, so that stakes may be driven. Each antenna will require a rectangle 32 feet by 55 feet.

(4) If line of sight exists between the selected sites and there are no obstructing trees or buildings, it is not necessary to erect the antenna mast to its maximum height in order to obtain satisfactory communication. In such cases, masts made up of four or five mast sections and one set of guy ropes usually provide a satisfactory antenna height.

(5) Set up so that no transmitting antenna at a site transmits directly toward a receiving antenna at the same site.

b. Arrangement of Transmitter and Receiver. Although the radio sets are furnished in weatherproof cases, the equipment should be housed in a suitable shelter. The added protection is especially important when transmitters and receivers are to be aligned or serviced. Locate the receiver and transmitter as close as possible to their respective antennas so that a 60-foot Cord CG-55/U will be adequate. If this is not possible, use two lengths of cord connected by Radio Frequency Adapter UG-29/U. A loss in signal strength of about 2db (decibels) occurs with each added length of cable used. Place all operating receivers and transmitters at one station as close to each other as is convenient. Cord CX-104/TRC-1, connecting the receiver and transmitter, is 10 feet 10 inches long.

c. Arrangement of Power Units. Place the power units as far from the radio set as the 50-foot Cord CD-711 will permit, away from and to the side of the receiving antennas. Power units may be operated in the open, but they should be placed on high ground or on a suitable platform.

CAUTION: If the power units are operated within a building, make certain that all exhaust connections are tight and that the exhaust pipe extends outside the building. Carbon monoxide, contained in exhaust gases, is tasteless and odorless but a DEADLY POISON.

42. UNPACKING, UNCRATING, AND CHECKING.

For domestic shipment, all pieces of equipment are transportable in their own cases and no special unpacking instructions are required. All equipment should be opened, checked, and operated at higher echelons before being issued to field units.

43. INSTALLATION OF ANTENNA EQUIPMENT.

a. Location of Antenna. Assembly and erection of each antenna requires a clearing 30 feet wide and 55 feet long. The site should be chosen so that all the antennas are grouped together and are reasonably close to the receivers and transmitters. During assembly, the antenna lies on the ground in the 55-foot length of clear space. After a suitable site has been decided upon, the ground plan should be studied to select the best location for the antenna mast base.

b. Terminal Station. A terminal station requires two antennas, one for receiving and one for transmitting. The mast bases are spaced at least 32 feet apart to prevent overlapping of the guy wires. If the site permits, antennas pointing in the same direction should be located side by side and not one behind the other (fig. 27).

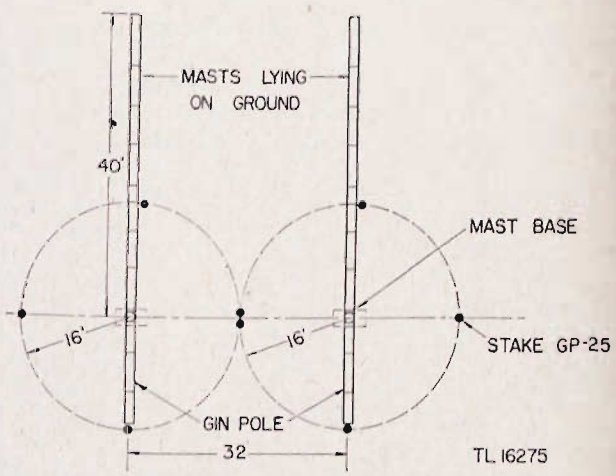


Figure 27. Terminal station layout.

c. Relay Station. A relay station requires four antennas usually arranged to form a square

with the masts spaced about 30 feet from one another. This spacing is necessary to prevent the guy wires from overlapping (fig. 28). The transmitting and receiving antenna must not face each other.

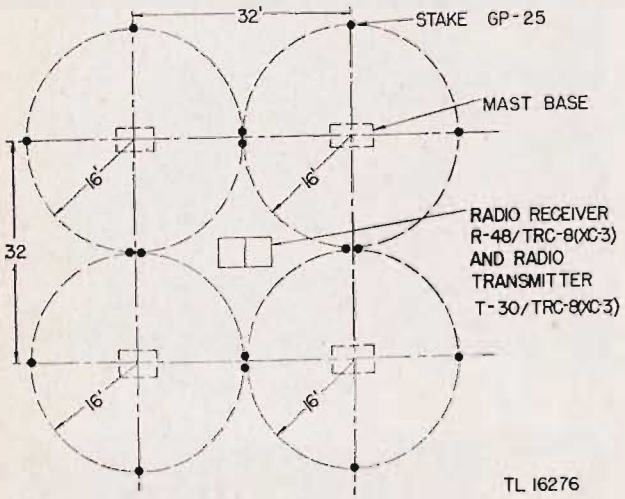


Figure 28. Relay station layout.

44. ASSEMBLY OF ANTENNA SUPPORT AB-48/TRC-8 (XC-3).

a. All components necessary to install a complete antenna support are provided in Case CY-54/TRC-8 (XC-3) (fig. 9).

CAUTION: When unpacking, keep sand and mud from the ends of the mast sections.

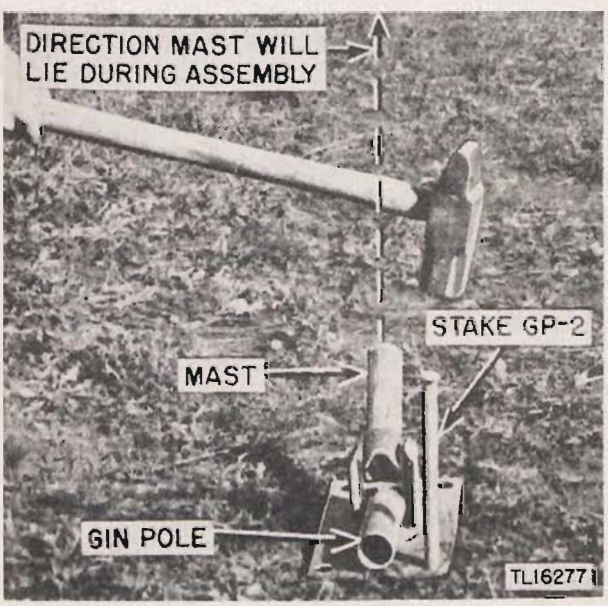


Figure 29. Driving stake in mast base.

b. Place the mast base at the location previousiy chosen, with one side facing the direction in which the mast will be during assembly. Drive four Stakes GP-2 through the holes in the mast base (fig. 29).

c. Turn the mast base tube marked GIN POLE so that it lies parallel with the mast base (fig. 30) and is ready to receive the mast sections.

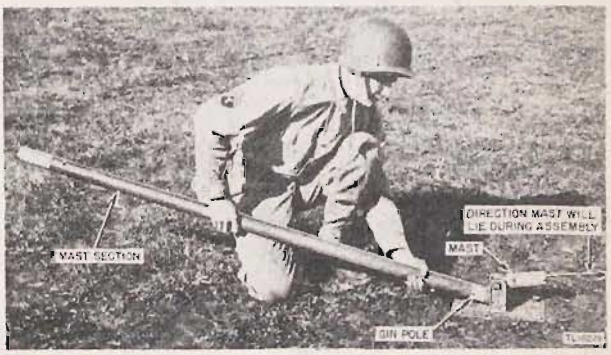


Figure 30. Inserting mast section over GIN POLE tube.

d. Insert the widest end of one mast section firmly over the GIN POLE tube of the mast base (fig. 30). Add two more sections to complete the gin pole.

e. Place the gin pole so that it points in the opposite direction from that in which the mast lies during assembly, and use the pole to measure the distance from the base to the ground stakes. Drive a Stake GP-25 about 3 inches beyond the end of the gin pole and at an angle (as shown in fig. 31).

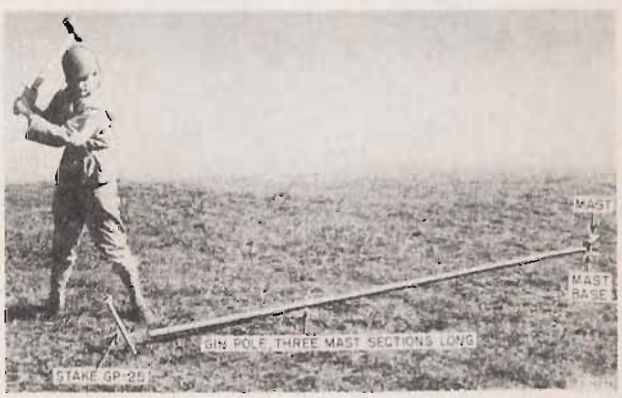


Figure 31. Driving Stake GP-25.

f. Walk around the mast base with the gin pole, and using the first stake as a reference point, drive three more stakes into the ground

spaced 90° from each other (fig. 32). *Make sure that all four stakes form a perfect square with the mast base in the exact center.*

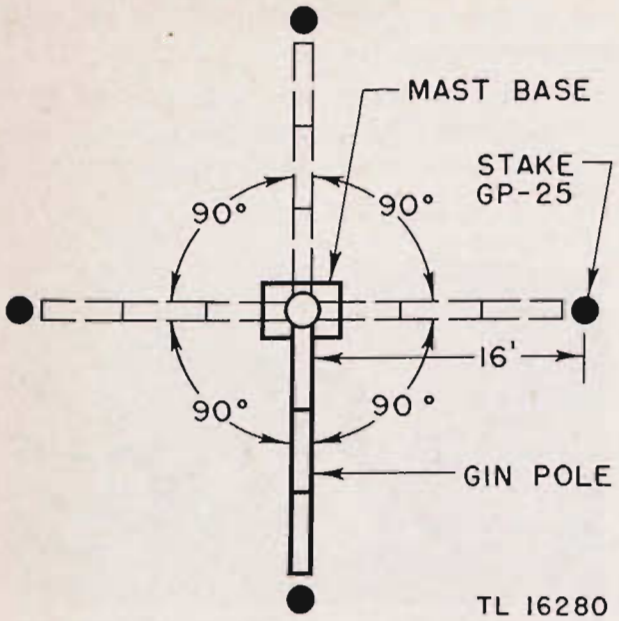


Figure 32. Location of stakes and mast base.

g. Rotate the gin pole until the mast base tube marked MAST is facing the direction in which the mast is to be assembled. Couple four mast sections to the MAST tube.

h. Unwind four 29-foot wire guys simultaneously from the reel and place the guy plate which is attached to these guys over the end of the fourth mast section (fig. 33). Fasten one guy to each of the side ground stakes and fasten the chains around the ground stakes as tightly as possible. Figure 34 shows the respective position of the guy plate and wires.

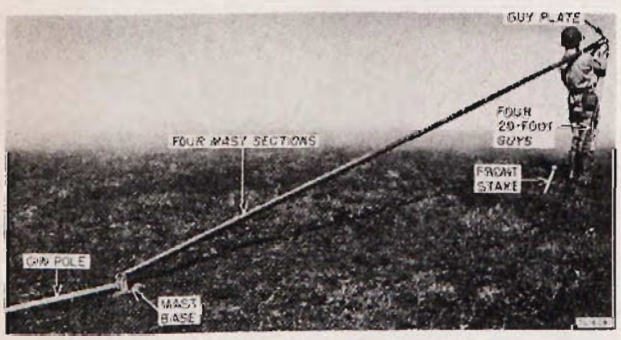


Figure 33. Placing guy plate on mast section.

i. Make certain the mast is lying exactly in line with the mast base and gin pole. Adjust the length of the two side guys by means of the clamp until there is only a little slack (fig. 35).

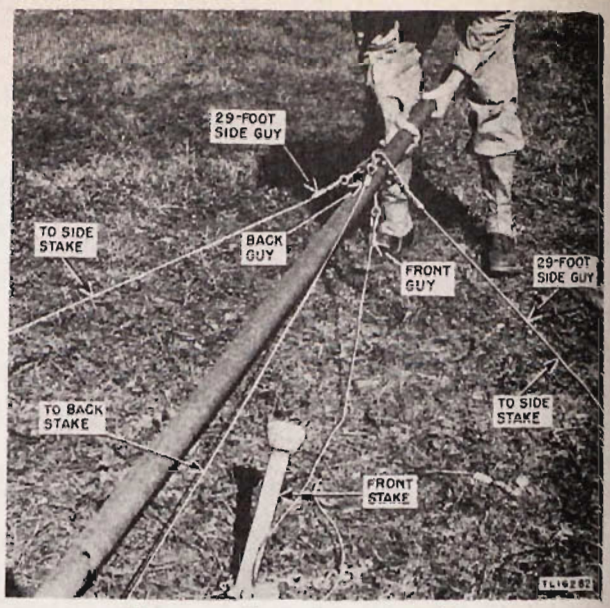


Figure 34. Guy plate connections.

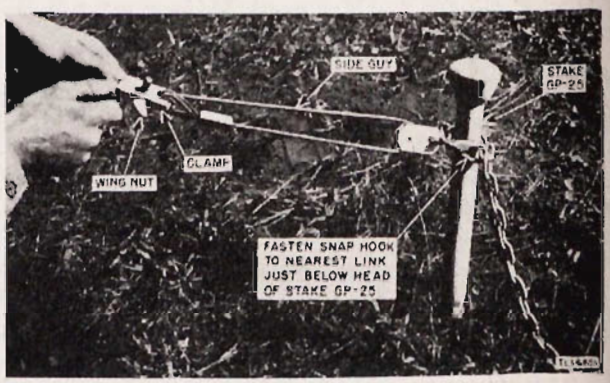


Figure 35. Adjusting length of guy.

Adjust the length of the front and rear guys so that they are the same length as the side guys. To do this, bring these two guys to the side stakes and adjust their length so that there is only a little slack.

j. Fasten the front guy to its ground stake and allow the back guy to lie on the ground in the direction of the back stake.

k. Add three more sections to the mast. Unwind the 41-foot guys from the reel and place the guy plate to which the guys are fastened over the ferrule end of the seventh mast section.

l. Fasten each guy to its ground stake and adjust the length in the same manner that the 29-foot guys were adjusted. The back guy remains unfastened. Be careful to arrange the guys so that they don't cross.

m. Add another mast section to the mast. The completed mast should now consist of eight sections having a total length of 40 feet.

n. Rotate the gin pole to the position shown in figure 36, and place a guy plate over the top of the gin pole.

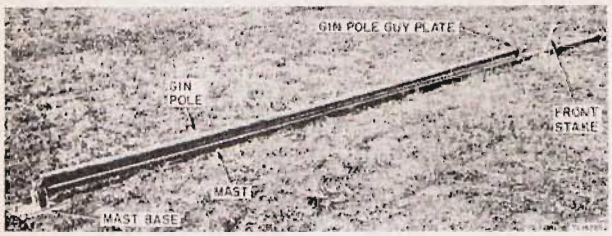


Figure 36. Position of gin pole for block and tackle.

o. Fasten the two back guys to the bottom hole of the guy plate and hook the block and tackle onto the top hole of the guy plate (fig. 37). Chain the other end of the block and tackle to the rear ground stake which has no guys attached. Clip the snap hooks of the two side rope guys to the side holes of the gin pole guy plate and tie the other ends of the ropes to the side stakes, adjusting their length so that there is no slack.

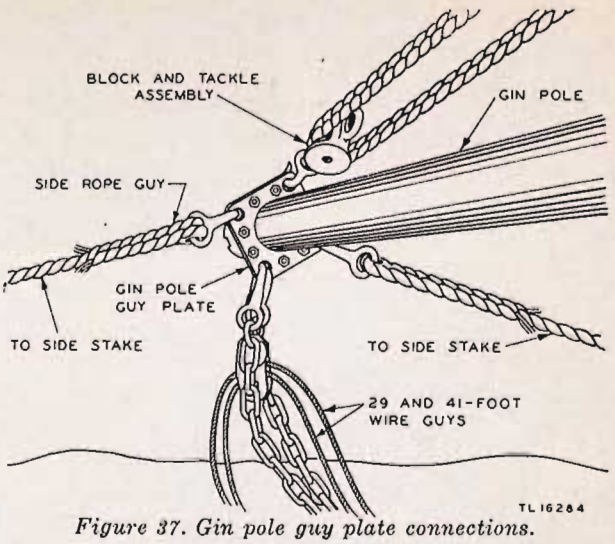


Figure 37. Gin pole guy plate connections.

45. ASSEMBLING ANTENNA ASSEMBLY AS-52/TRC-8 (XC-3).

a. The following components from Case CY-53/TRC-8 (XC-3) are required for installing one complete antenna assembly: one corner

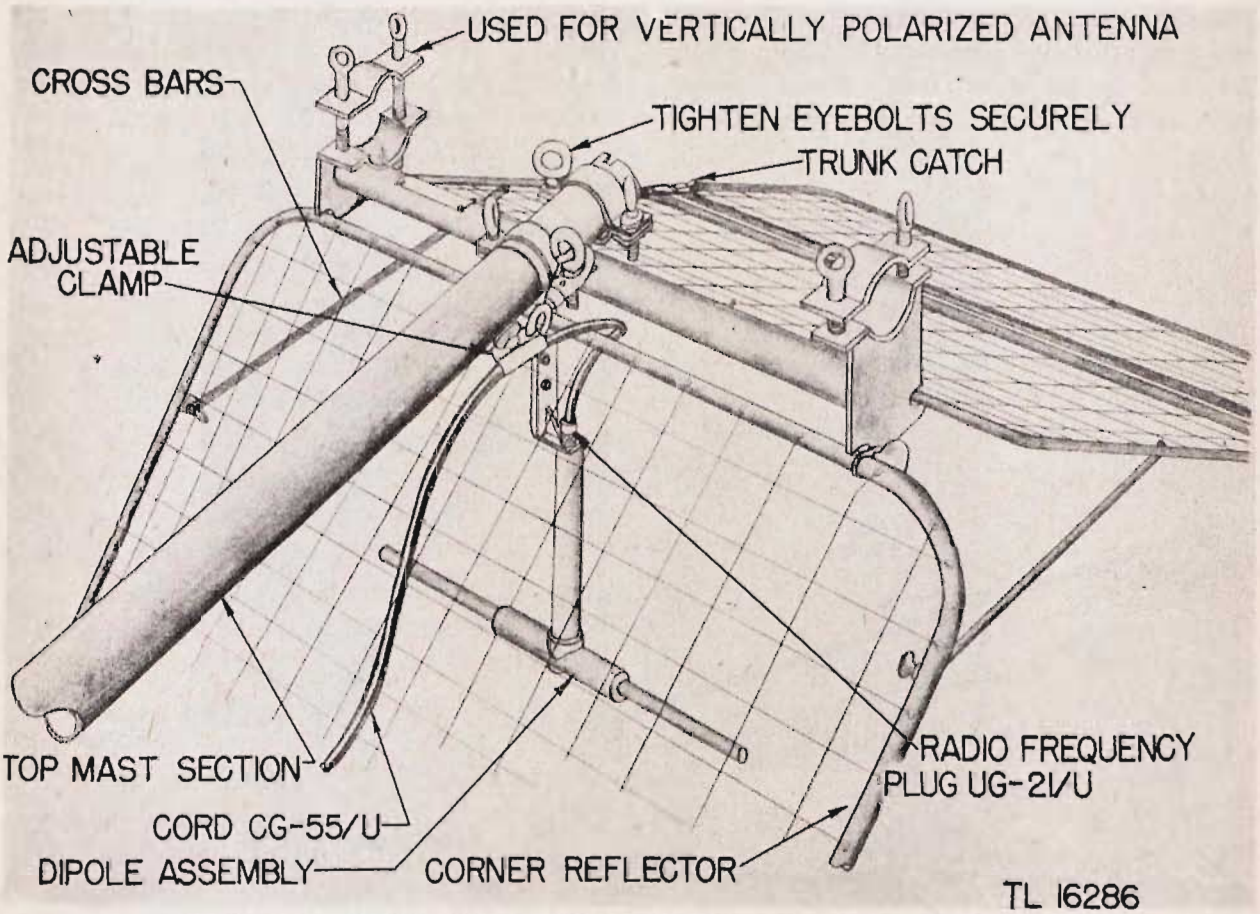


Figure 38. Antenna Assembly AS-52/TRC-8 (XC-3) mounted on antenna support.

reflector assembly with dipole, one Cord CG-55/U, and one clip with snaphook.

b. Unfold the corner reflector and snap the trunk catches and cross bars into place. Mount the antenna assembly on the antenna mast (fig. 38) and fasten securely.

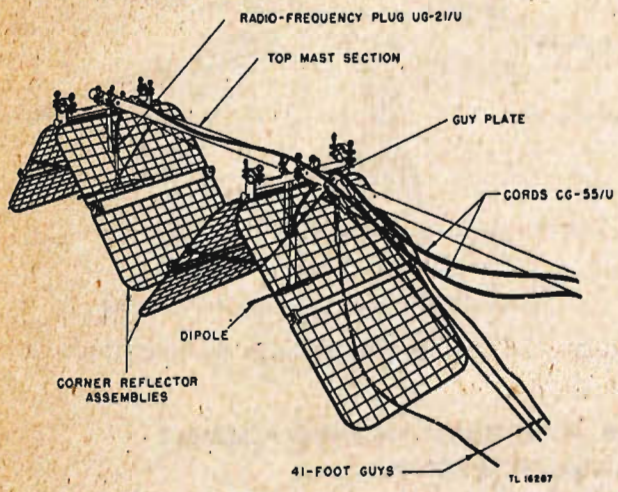


Figure 39. Two Antenna Assemblies AS-32/TRC-8 (XC-8) mounted on one antenna support.

c. The antenna assemblies may be mounted to provide either vertical (dipole vertical) or horizontal (dipole horizontal) polarization. Care must be taken to insure that the companion antennas are similarly polarized or considerable signal attenuation will occur. Do not attempt to transmit to a vertically polarized antenna with a horizontally polarized antenna or vice versa. It is recommended that the same type of polarization be used throughout the system. Two antenna assemblies may be mounted on a single mast if it is necessary; one for transmitting and one for receiving, both pointing in the same direction (fig. 39).

d. Unroll a 60-foot Cord CG-55/U and attach the plug on one end to the receptacle on the base of the dipole (fig. 38).

CAUTION: Avoid kinking of the cord. Do not allow vehicles to drive over it. This is a fragile r-f transmission line and not an electric lighting cable.

Since dents or sharp bends ruin the cord, bury it if possible. If a cord becomes damaged, replace it immediately. The terminals of the cord, Radio Frequency Plugs UG-21/U, must be kept absolutely dry.

e. Secure an adjustable clamp about 12 inches below Radio Frequency Plug UG-21/U of Cord CG-55/U. Hook the adjustable clamps on the cord to one of the eye bolts on the antenna assembly and leave a loop of slack to ease the strain on the dipole.

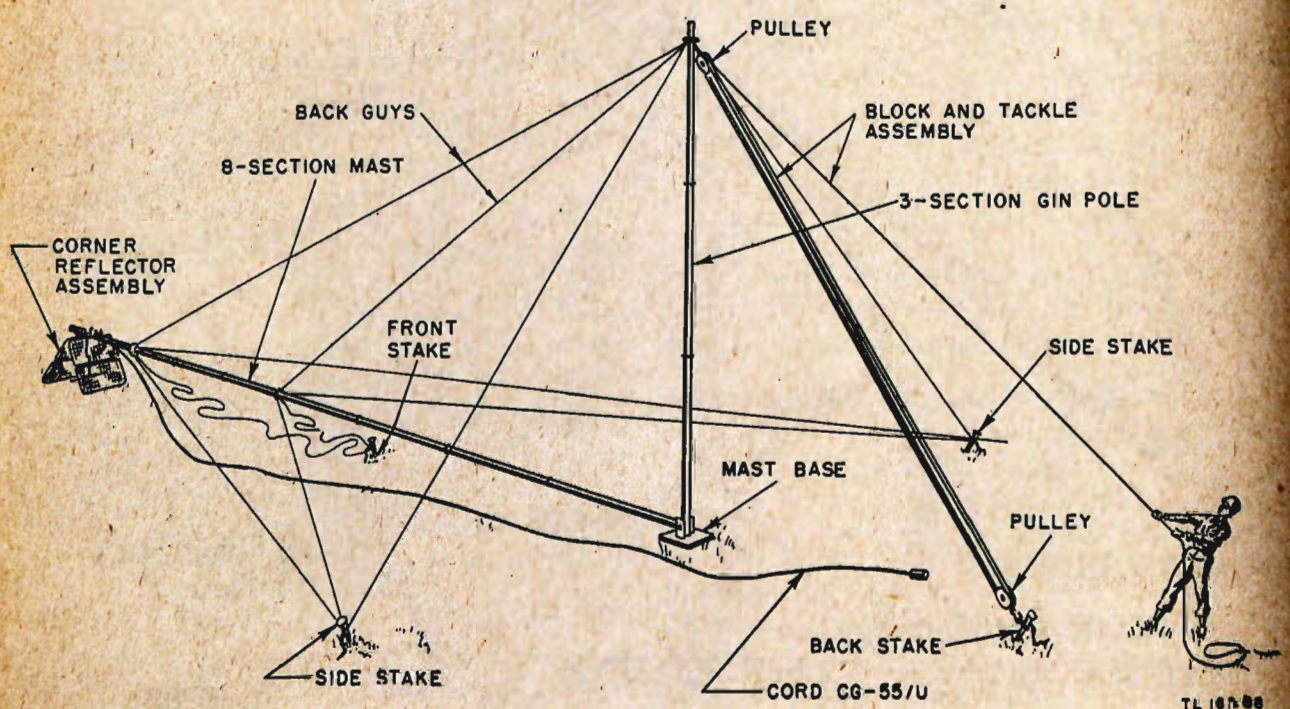


Figure 40. Gin pole erected.

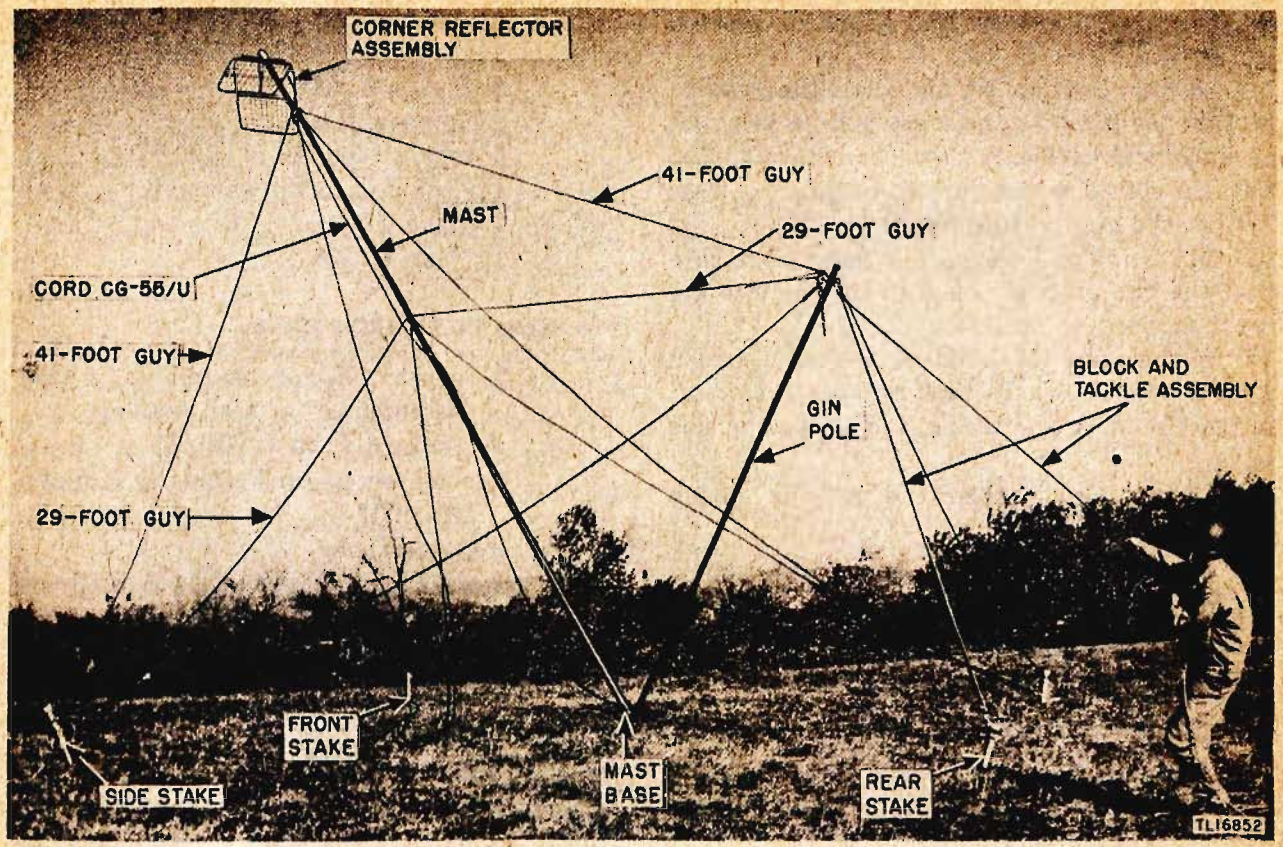


Figure 41. Raising the mast.

46. RAISING THE ANTENNA.

a. Inspect the fastening of all guys, clamps, stakes, and the block and tackle. Raise the gin pole to a vertical position by hand. The two back guys should become taut (fig. 40). Raise the mast slightly with the block and tackle and check for crossing of guys, tautness, etc. If necessary, adjust the two back guys so that the mast is straight when raised.

b. Pull the block and tackle cord to raise the mast (fig. 41). If more than one man is available, raise the top of the mast as high as possible by hand while pulling on the block and tackle.

c. As soon as the mast is upright, unhook the two back guys from the gin pole, keeping them taut and securely fasten them to the rear stake.

d. Adjust the length of all guys to make sure that the mast is vertical and straight. Remove the gin pole rope guys and the block and tackle from the gin pole guy plate. Remove the gin pole guy plate.

e. Rotate the mast by means of the gin pole until the array faces the desired direction (fig. 42).

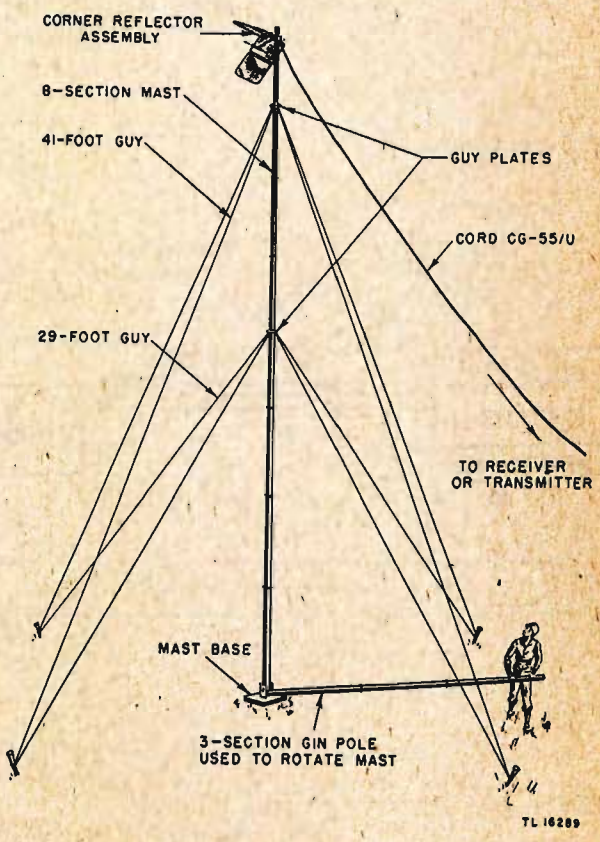


Figure 42. Antenna erected.

f. Be sure to observe the following precautions:

(1) During erection, do not allow the guys to become too tight as the mast will be bent out of shape and buckle.

(2) Do not allow the guys to become too loose so that the mast is unsupported.

(3) In raising or lowering the mast make sure that the two guys attached to the gin pole are both supporting the mast.

(4) If the mast bends during erection, return it to a position where bending does not occur, secure the block and tackle, and adjust the side guys.

(5) Do not stand under the antenna during erection.

47. CARE OF EQUIPMENT.

After the antenna is erected, return the following items to their proper cases:

a. Case CY-54/TRC-8 (XC-3).

1 Axe LC-1
1 guy, 29 ft
1 guy, 41 ft
3 reels
3 guy plates
2 guys, gin pole
1 Hammer HM-3
1 rope, cotton, 3/8 in., 150 ft
1 block and tackle assembly
1 Stake GP-2
1 Stake GP-25

b. Case CY-53/TRC-3 (XC-3).

1 corner reflector assembly (if only one antenna has been erected)
All unused Cord CG-55/U
All unused Radio Frequency Adapter UG-29/U
2 bags, canvas
2 clips, with snaphook (if only one antenna has been erected)
2 dipoles, spare
All unused Tape TL-94

48. GENERAL COMMENTS.

a. Try to locate the antenna near its transmitter or receiver to keep the transmission line

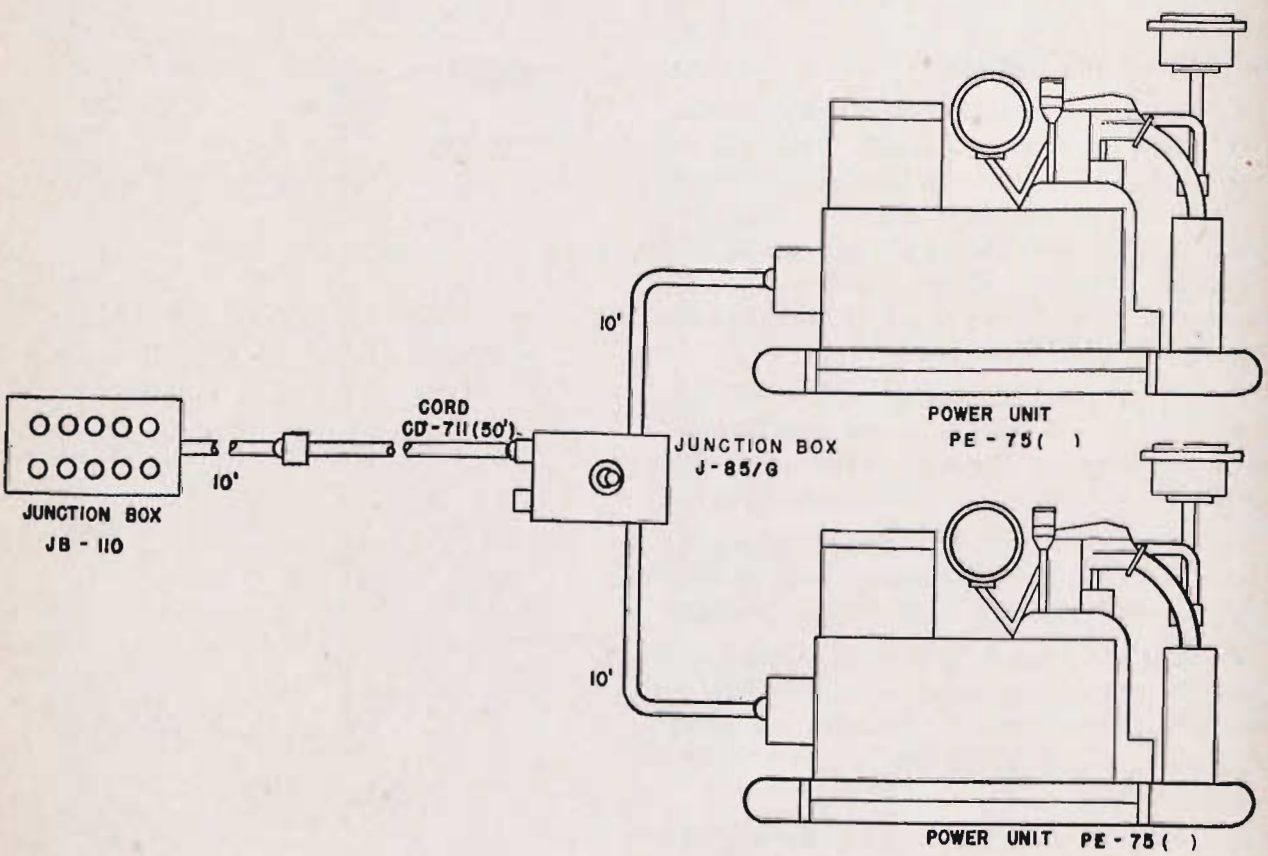


Figure 43. Cording diagram for two Power Units PE-75-( ). TL 16290

as short as possible. If a choice exists, Cord CG-55/U connected to the receiver should be the longer one.

b. When more than one Cord CG-55/U is used between a receiver and the antenna, the cord must be coupled with one of the Radio Frequency Adapters UG-29/U provided in Case CY-53/TRC-8. Be sure the sleeves are screwed on firmly (fig. 17).

c. Often, advantage may be taken of the natural surroundings in erecting an antenna. If there are high trees, buildings, telephone poles, etc., it may be possible to mount the corner reflector assembly directly on top of these or with the added height of two mast sections.

49. INSTALLATION OF POWER UNIT, TRANSMITTER, AND RECEIVER.

a. Power Unit PE-75-( ). Refer to paragraph 41*c*. Connect Power Units PE-75-( ), Junction Box J-85/G, Cord CD-711, and Junction Box JB-110 as shown in figure 43. If only one power unit is to be used, connect Cord CD-711 directly to the power unit and omit Junction Box J-85/G (fig. 44).

b. Radio Transmitter T-30/TRC-8 (XC-3) and Radio Receiver R-48/TRC-8 (XC-3). (1) Refer to paragraph 41. Remove the front covers from Case CY-51/TRC-8 (XC-3) and Case CY-52/TRC-8 (XC-3). Place the covers on top of their cases. If the equipment is to be used in the open, attach the canvas protective flaps (fig. 8).

(2) Check to see that all tubes are firmly seated in their proper sockets (figs. 45 and 46). With the exception of tubes V205 and V206, all the transmitter tubes are accessible through the trap doors. V205 and V206 are made accessible by pulling the transmitter out from its case. Remove dust from the blower screen with the brush supplied in Tool Equipment TE-48. The upper unit of the transmitter is removed by loosening the two fasteners on the lower corners of the r-f section and pulling the handles. To remove the receiver, pull out and turn down the two springs at the lower corners of the receiver. Pull the receiver handles up and out simultaneously.

(3) Plug the a-c cords of the receiver and transmitter into the outlets on Junction Box JB-110.

(4) Connect the receiver and transmitter as shown by the cording diagrams, figures 47, 48, 49, 50, or 51, depending on the type of operation required.

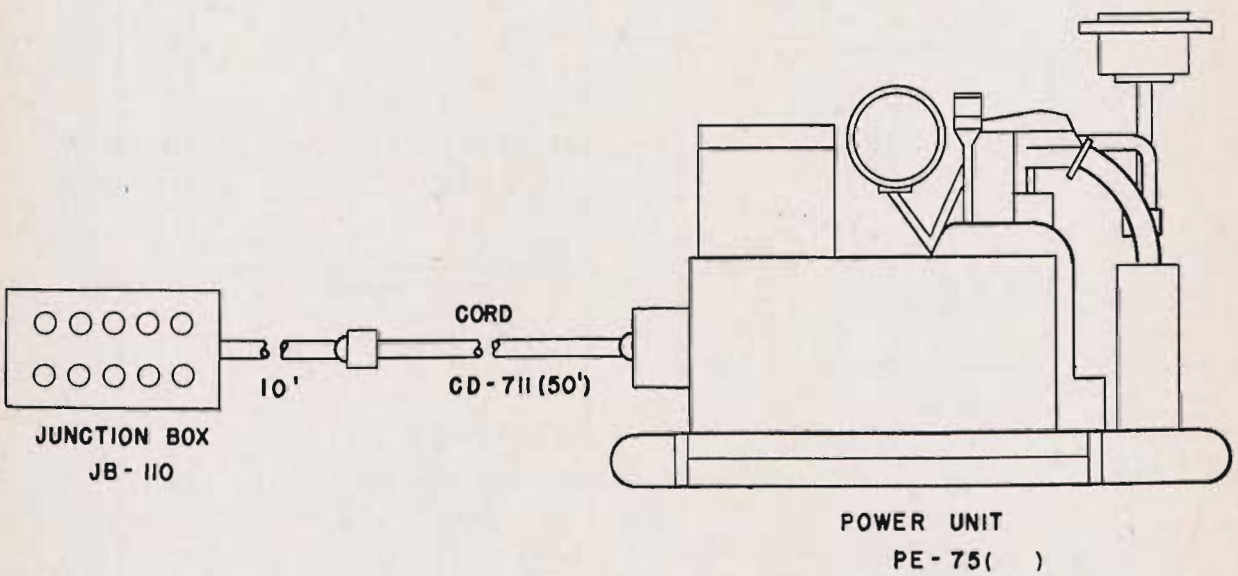


Figure 44. Cording diagram for one Power Unit PE-75-( ).

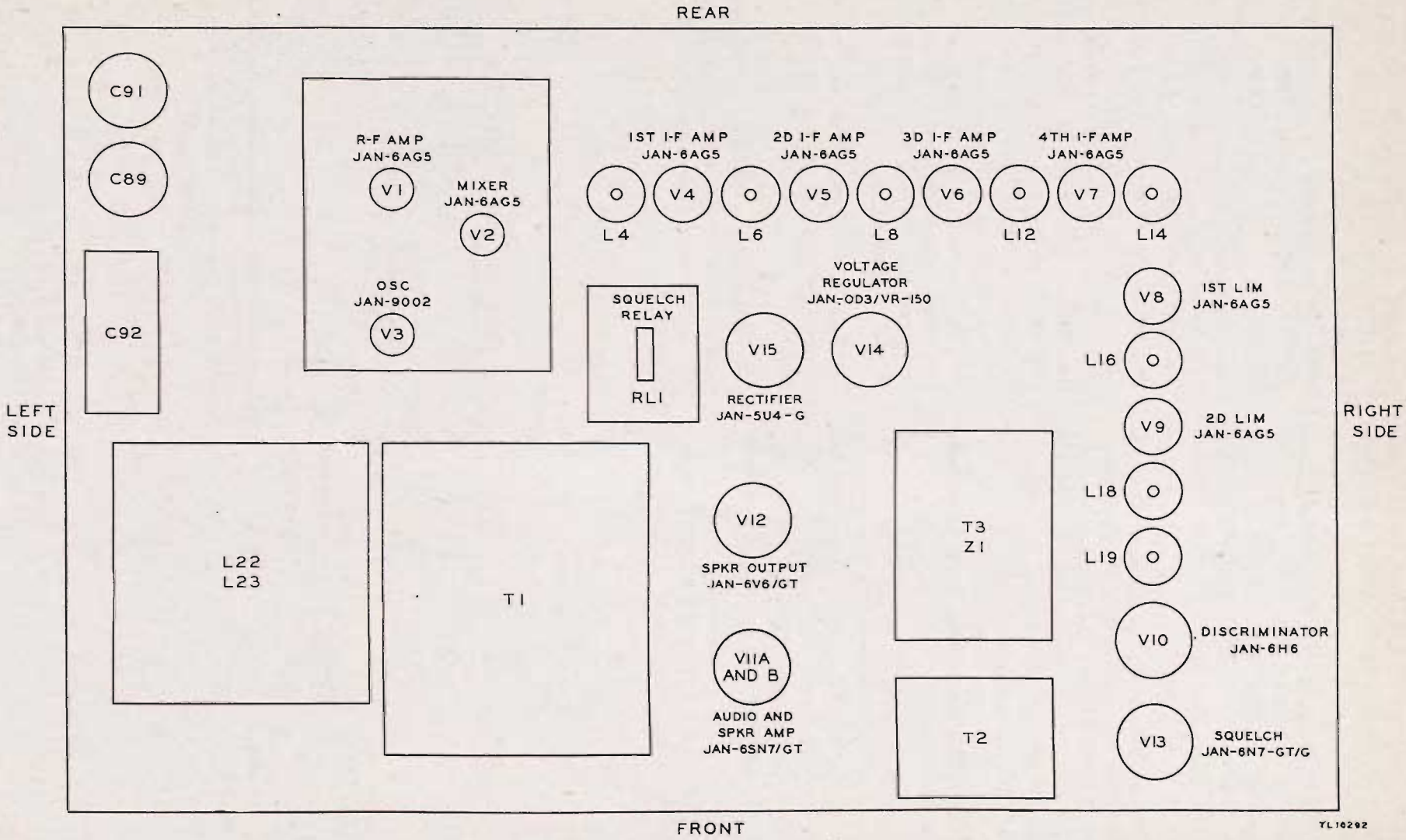


Figure 45. Radio receiver R-48/TRC-8 (XC-2), tube location.

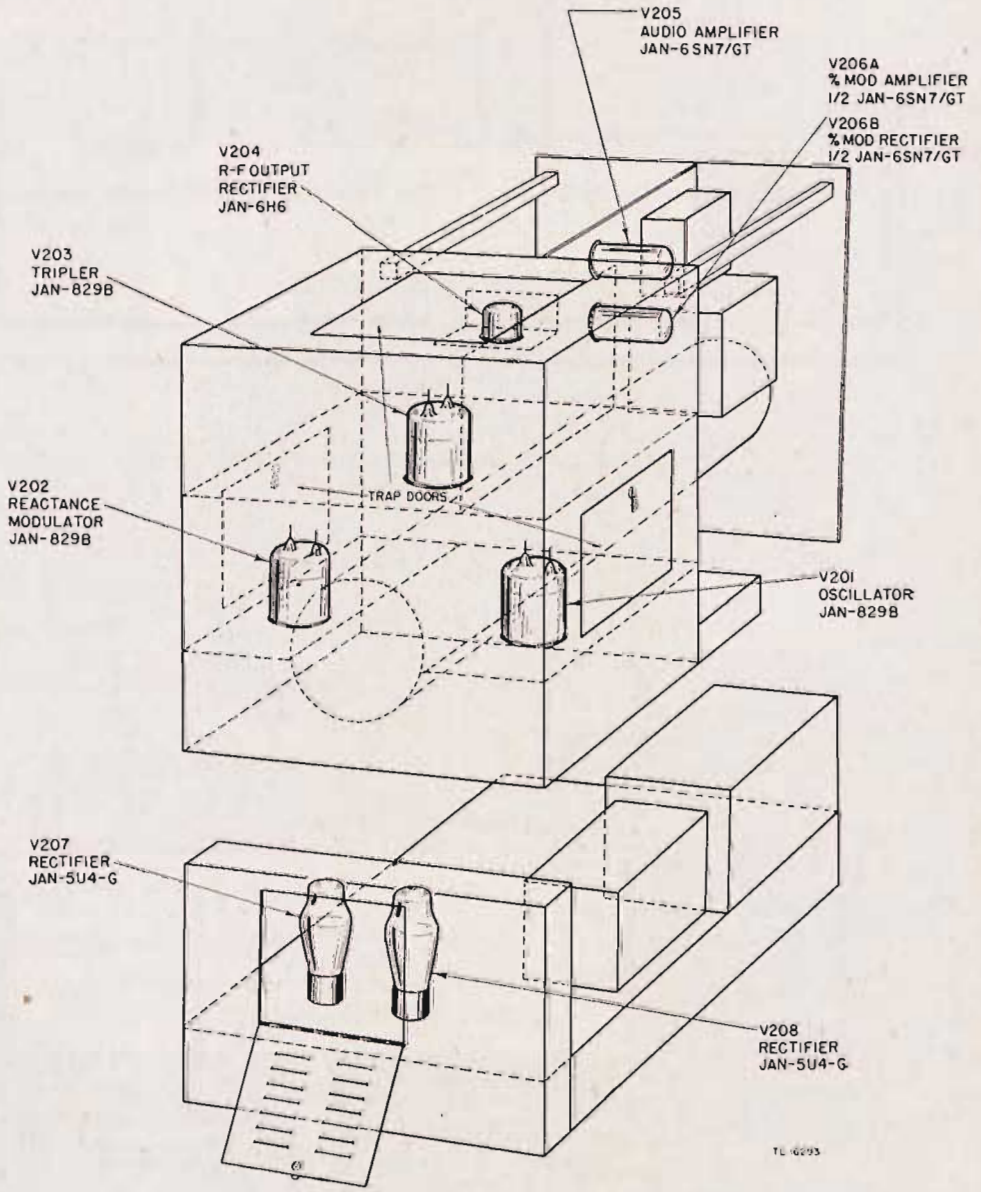


Figure 46. Radio Transmitter T-30/TRC-8 (XC-3), tube location.

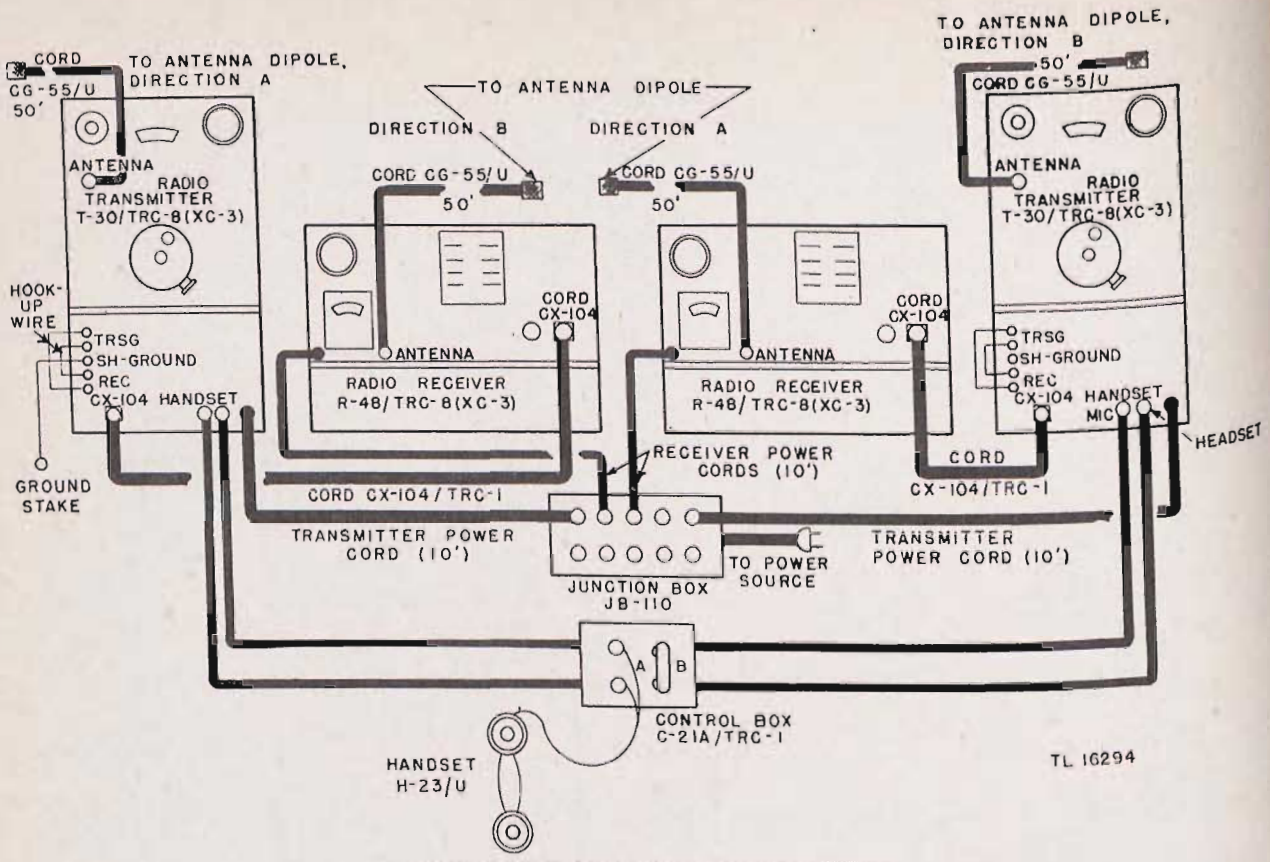


Figure 47. Relay station, cording diagram.

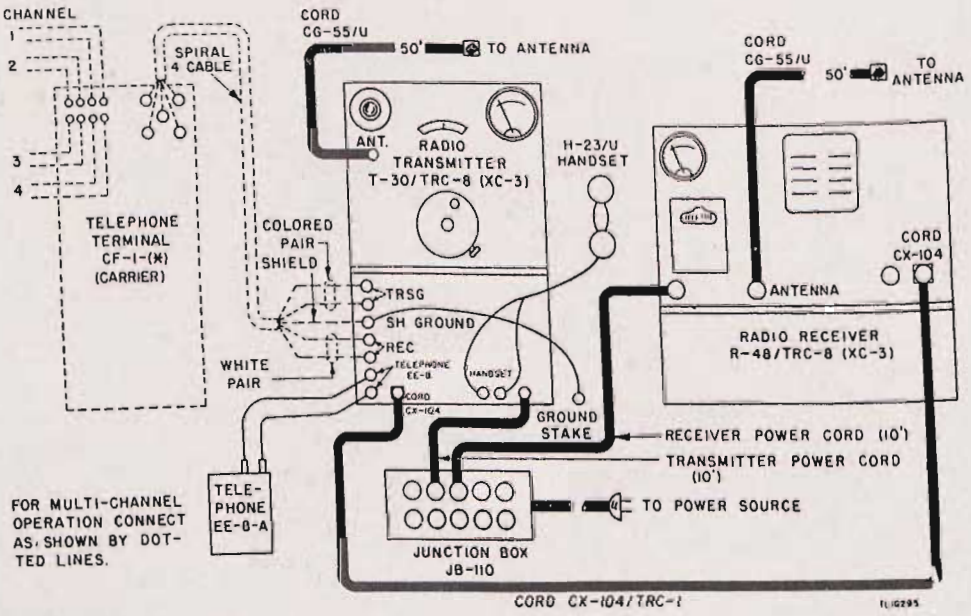


Figure 48. Terminal station, cording diagram.

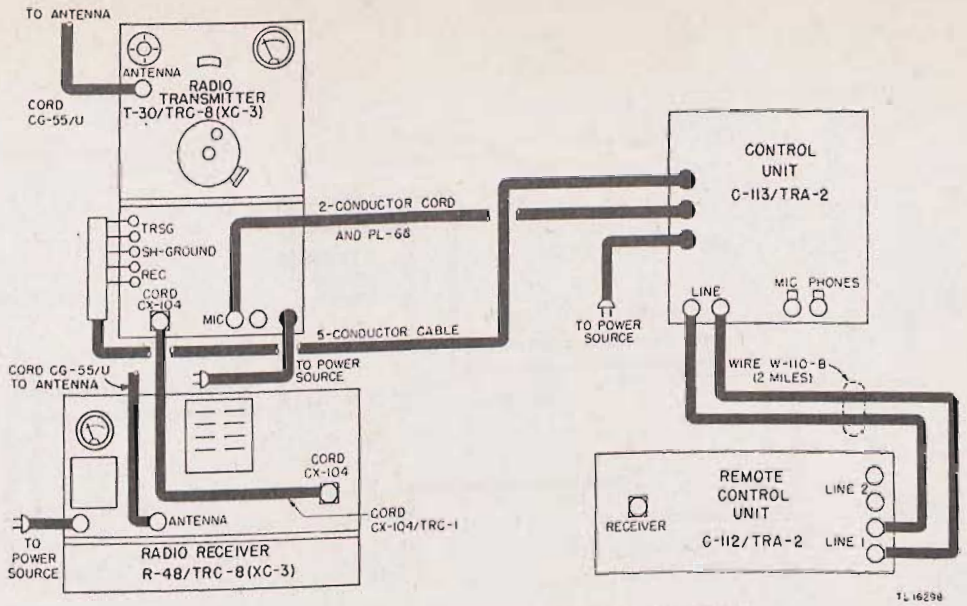


Figure 49. Two-wire radio remote control, cording diagram.

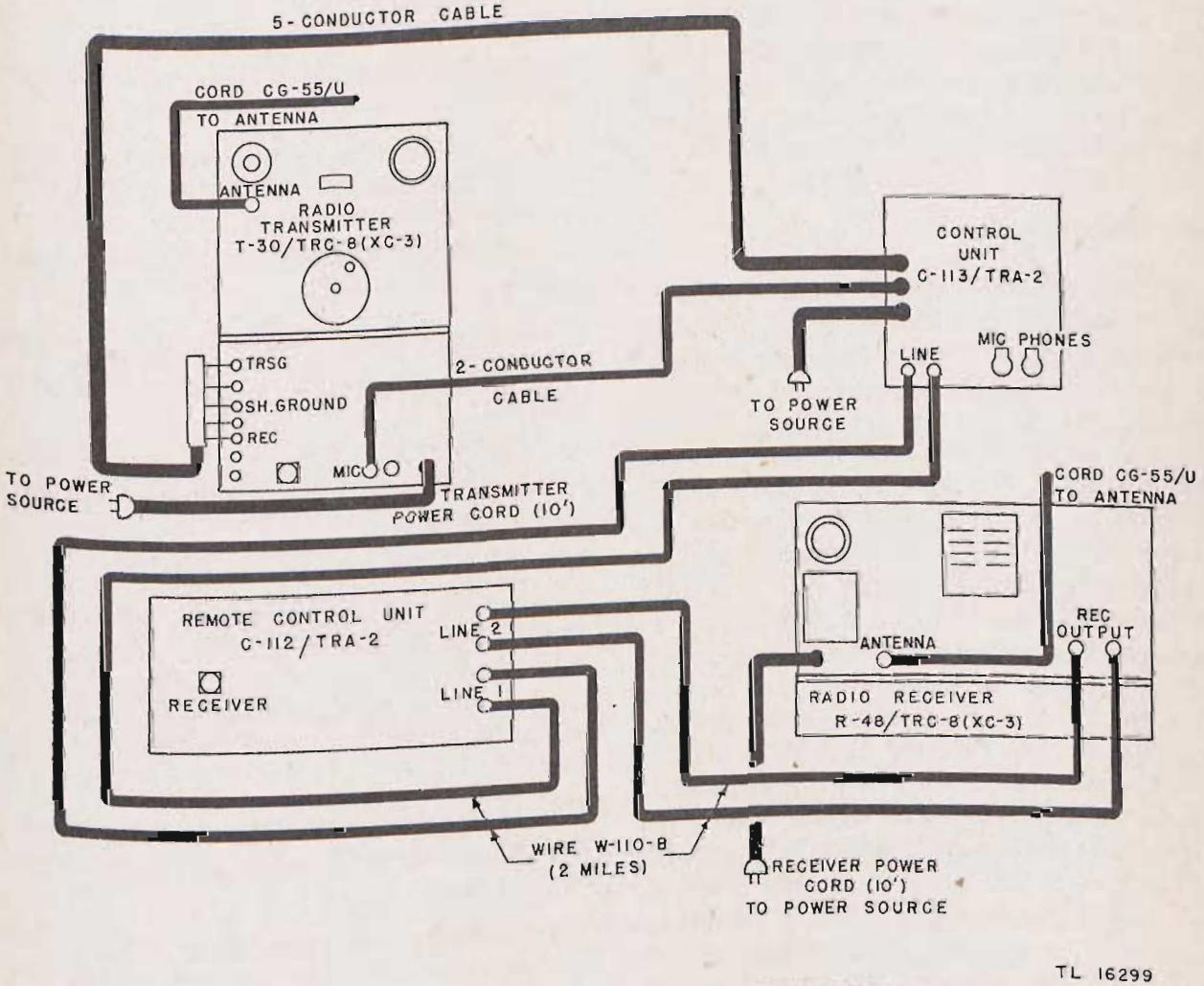


Figure 50. Four-wire radio remote control, cording diagram.

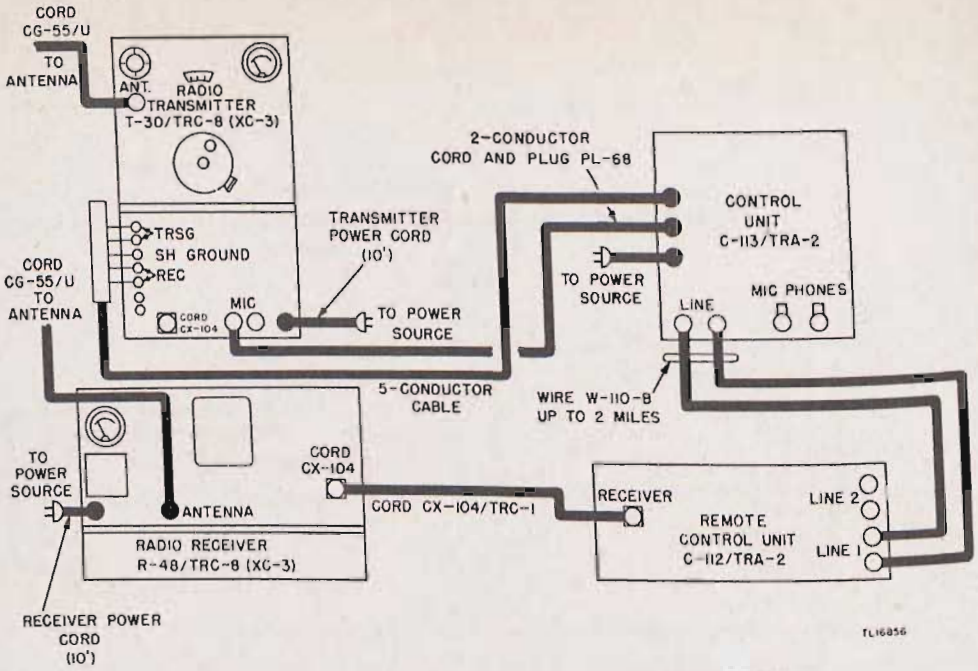


Figure 51. Automatic relay operation, cording diagram.

(5) Ground all transmitters by connecting the binding post marked SH-GROUND to a stake GP-25 driven into moist earth. Remove the lightning arresters at relay stations since spiral-four cable is not used.

50. LINE VOLTAGE.

a. Both the transmitter and the receiver can be operated on either 115-volt or 230-volt alternating current. A primary link plate is located on the underside of the receiver and power pack chassis (figs. 52 and 53). One side of this link plate is marked 115 V and the other side is marked 230 V. The links on this plate and the connections to the primary windings of the power transformers are so arranged that when the plate is bolted in position with the 115 V marking showing, the primary windings are automatically hooked up for 115-volt operation. When this plate is removed and then replaced with the 230 V marking showing, the primary windings are automatically hooked up for 230-volt operation. A separate line voltage plate on the front panel of the receiver, and on the front panel of the power pack, indicates in which position (115 V or 230 V), the link plate is bolted, and thus the line voltage at which the equipment will operate. This plate is marked 115 VOLTS on one side, and 230 VOLTS on the other, and is reversed each time the link plate is reversed. It must read the same as the link plate.

b. To change the receiver from 115-volt to 230-volt operation, or from 230-volt to 115-volt operation proceed as follows:

(1) Throw POWER ON-OFF switch, to OFF position.

(2) Remove bottom plate on receiver housing.

(3) Loosen five screws on primary link plate (fig. 52).

(4) Slide out the primary link plate, turn it over, and replace it with the desired primary voltage showing.

(5) Tighten the five screws securely.

(6) Remove the two screws and nuts holding the 115 VOLTS—230 VOLTS line voltage plate to the front panel, and replace the plate, so that the line voltage showing is the same as that on the primary link plate. Bolt the plate in position securely.

(7) Replace the bottom of the receiver housing. The unit is now ready for the line voltage operation indicated.

c. To change transmitter from 115- to 230-volt operation, or from 230-volt to 115-volt operation proceed as follows:

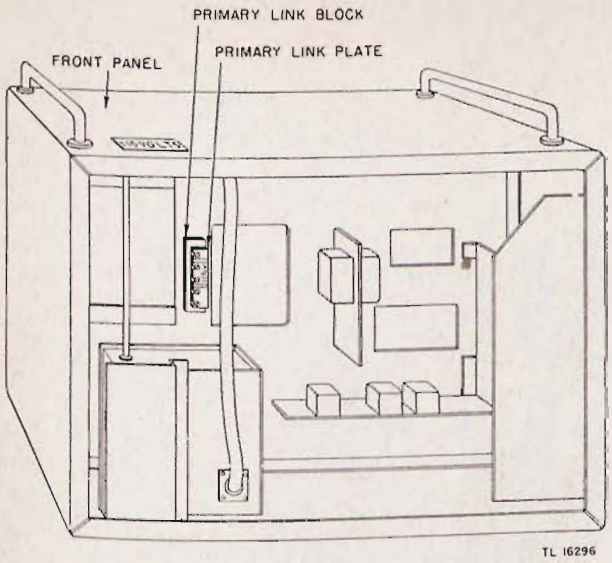


Figure 52. Radio Receiver R-48/TRC-8 (XC-3), primary link plate.

(1) Throw POWER ON-OFF switch to OFF position.

(2) Remove Power Pack PP-115/TRC-8 (XC-3) from Case CY-52/TRC-8 (XC-3).

(3) Loosen five screws on primary link plate (fig. 53).

(4) Repeat steps (4), (5), and (6) above.

(5) Replace power pack in case. Equipment is now ready for the line-voltage operation indicated.

51. LOWERING AND DISASSEMBLING THE ANTENNA.

To lower the antenna, proceed as follows:

a. Place the guy plate on the gin pole.

b. Attach the block and tackle and the side guy ropes to the guy plate.

c. Chain the other end of the block and tackle assembly to the rear ground stake.

d. Adjust the length of the block and tackle assembly until it is taut.

e. Remove the rear guys from the ground stake and connect them to the gin pole guy plate.

f. Gently lower the mast by means of the block and tackle assembly.

g. Loosen all guys from their stakes and the gin pole guy plates. Remove the block and tackle from the rear stake. Remove Cord CG-55/U from the antenna dipole.

h. Remove the corner reflector assembly from the mast.

i. Remove the top mast section.

j. Remove the guy plate containing the 41-foot guys and wind them on a reel.

k. Remove three more mast sections.

l. Remove the guy plate containing the 29-foot guys and wind them on a reel.

m. Remove the last three mast sections.

n. Remove all ground stakes and mast pins.

o. Pack all components in their respective chests.

52. REPACKING.

a. Carrying cases for all components have been designed to furnish adequate protection for their contents under all conditions of domestic shipment. This protection is not sufficient, however, if the equipment is to be exported. Additional packing is required for overseas shipment and reference should be made to U. S. Army Specification No. 100-14A for specific export packing instructions. In preparing equipment for overseas shipment, all tubes in transmitters and receivers not equipped with tube clamps should be held in place with masking tape to prevent damage.

b. The method of packing Antenna Support AB-48/TRC-8 (XC-3) in Case CY-54/TRC-8 (XC-3) is shown in figure 54. Figure 55 shows the method of packing two Antenna Assemblies AS-52 TRC-8 (XC-3) in Case CY-53/TRC-8 (XC-3).

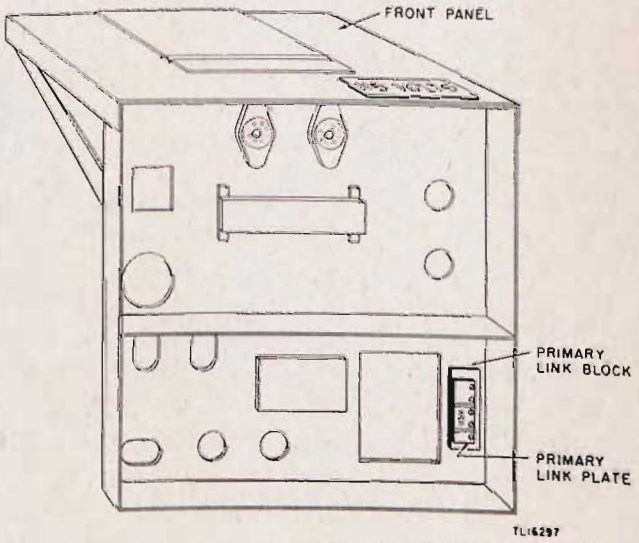


Figure 53. Radio Transmitter T-30/TRC-8 (XC-3), primary link plate.

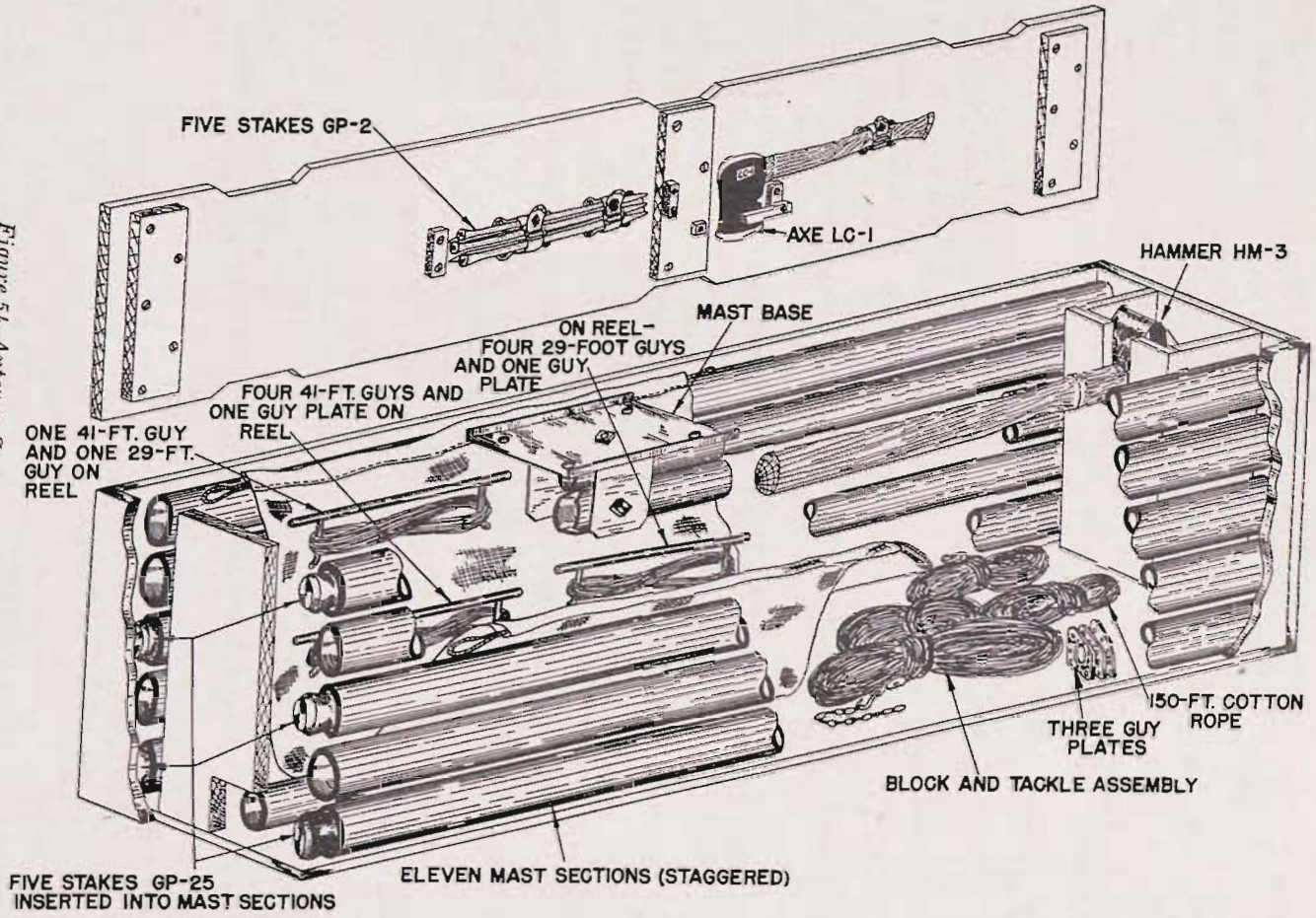


Figure 54. Antenna Support AB-48/TRC-8 (XC-3) packed in Case CY-54/TRC-8 (XC-3).

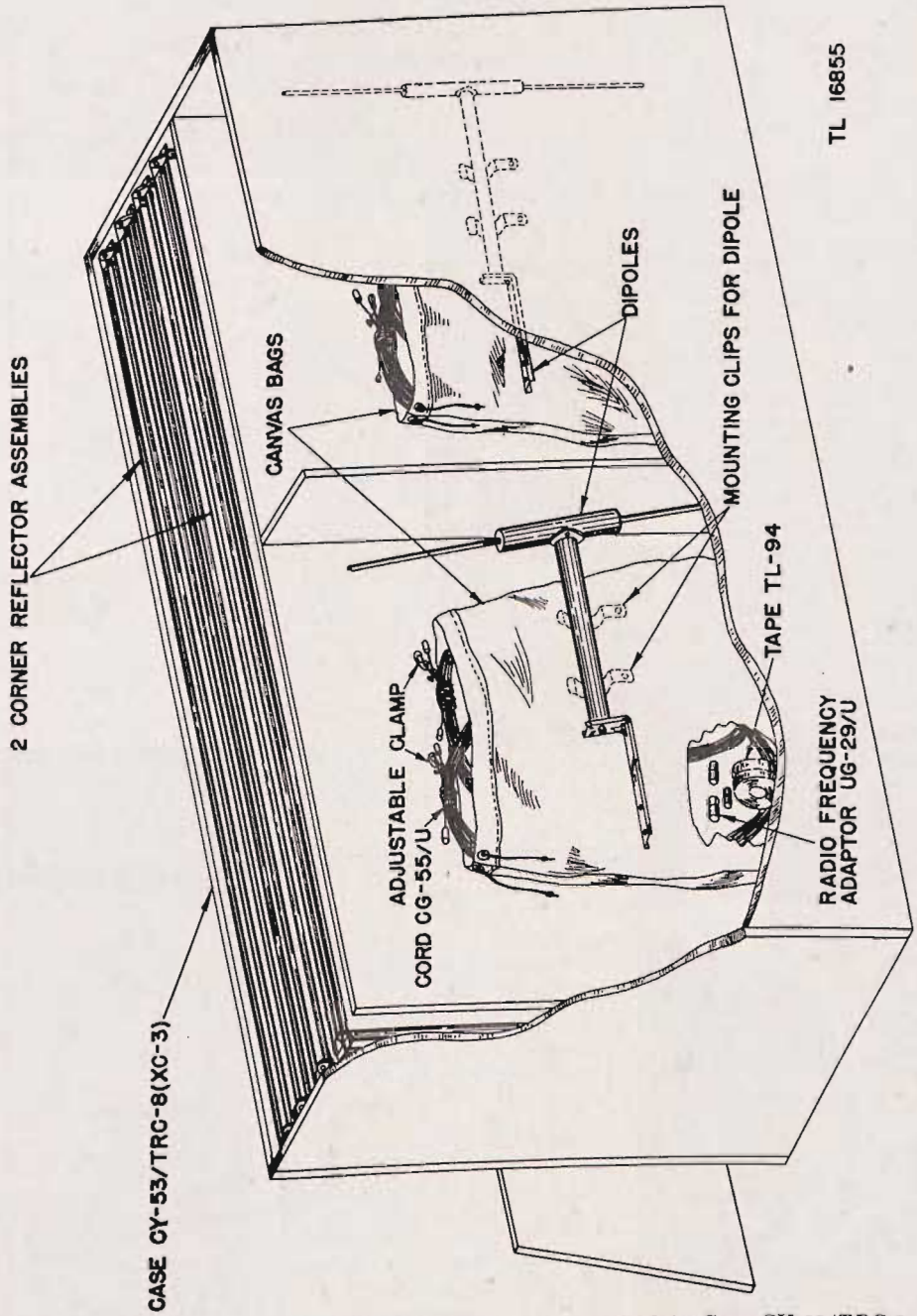


Figure 55. Two Antenna Assemblies AS-52/TRC-8 (XC-3) packed in Case CY-53/TRC-8 (XC-3).

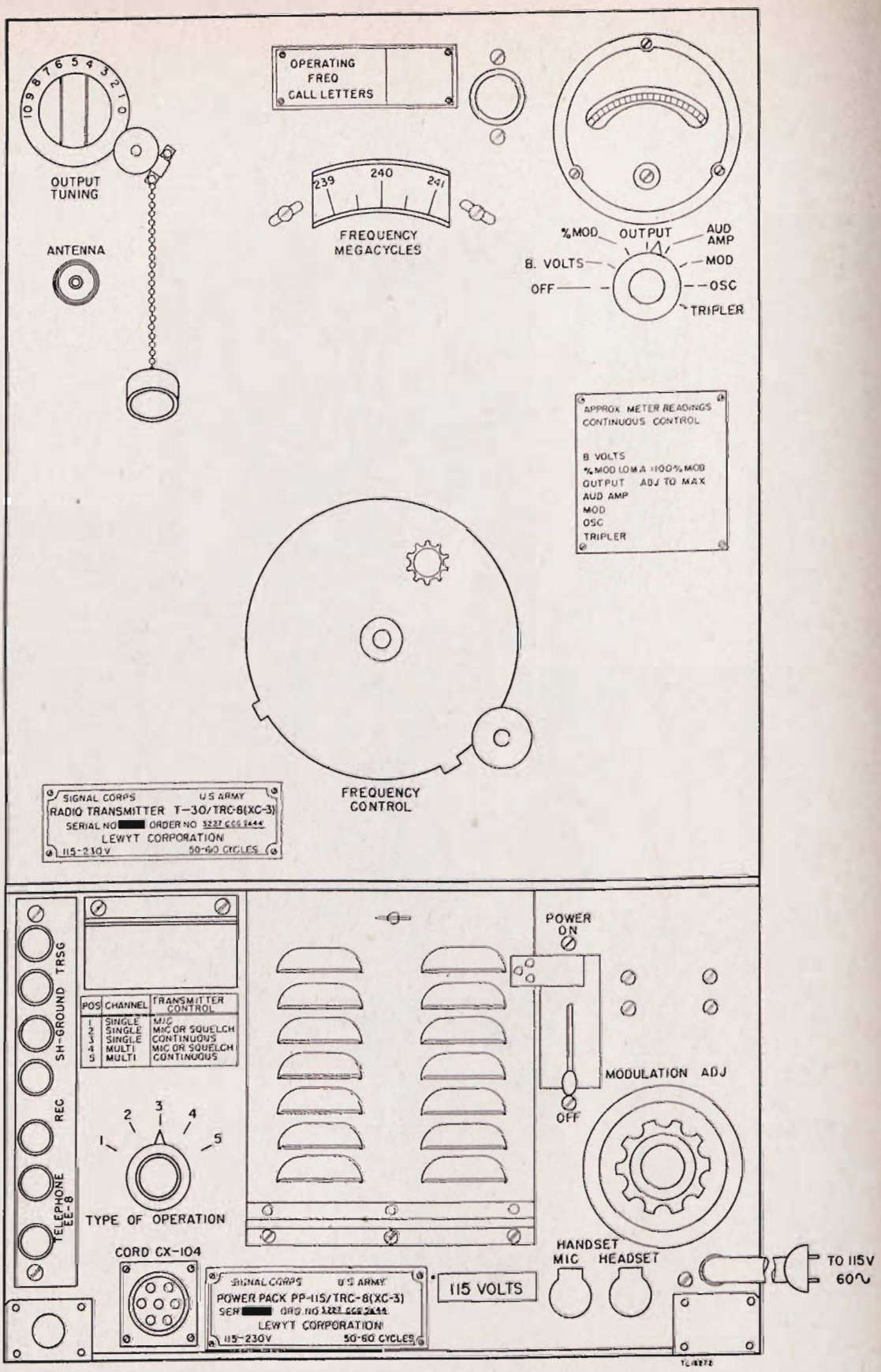


Figure 56. Radio Transmitter T-30/TRC-8 (XC-3), front panel.

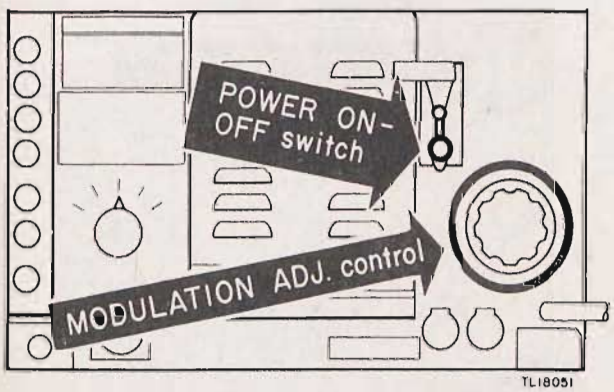
PART TWO

OPERATING INSTRUCTIONS

NOTE: For information on destroying the equipment to prevent enemy use, refer to the destruction notice at the front of the manual.

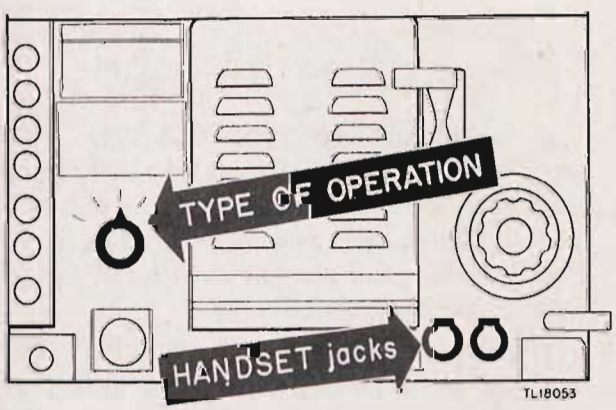
SECTION III. CONTROLS AND THEIR USE

53. TRANSMITTER CONTROLS (fig. 56).



a. POWER ON-OFF Switch. In the ON position, the power switch connects the transmitter to the primary a-c power (115 or 230 volts, 50 to 60 cycles).

b. MODULATION ADJ. Control. The MODULATION ADJ. control is an attenuator which adjusts the percentage of modulation of the transmitter high-fidelity channel only in 1-db steps.



c. TYPE OF OPERATION Switch. The TYPE OF OPERATION switch is a five-position switch which adjusts the transmitter for any one of five possible types of operation.

(1) POSITION 1. SINGLE CHANNEL MIC. enables the r-f carrier of the transmitter to be fully modulated by the local handset. The transmitter carrier is turned on by pressing the push-to-talk switch on the handset. No modulation adjustment is provided; normal speech modulates the carrier 100 percent.

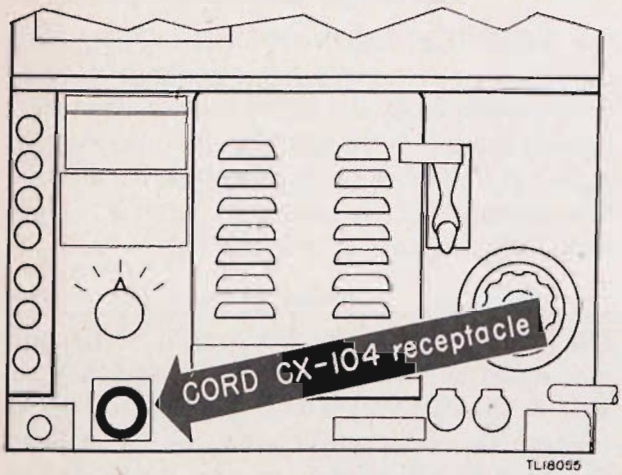
(2) POSITION 2. SINGLE CHANNEL MIC. OR SQUELCH enables the carrier to be fully modulated by either the high-fidelity input circuit or the local handset. The r-f carrier of the transmitter is put on the air by either pressing the push-to-talk switch on the local handset, or by operation of the squelch relay of the associated receiver when used in a single-channel relay system. This relay is operated when a signal is received. Thus the transmitter is off the air until a received signal operates the squelch relay.

(3) POSITION 3. SINGLE CHANNEL CONTINUOUS position enables the r-f carrier of the transmitter to be on continuously, even when unmodulated. It may be fully modulated by either the high-fidelity input circuit or the local handset.

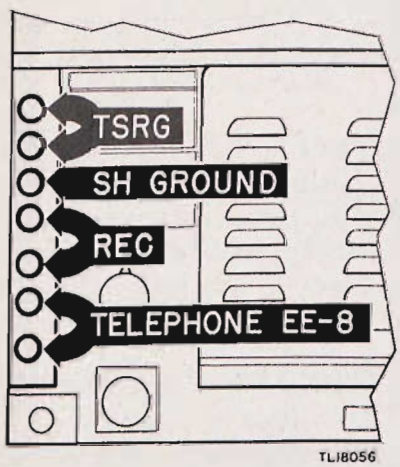
(4) POSITION 4. MULTICHANNEL MIC. OR SQUELCH position enables the r-f carrier of the transmitter in a relay set of a multichannel system to be modulated 25 percent per channel on all four channels by the high-fidelity input circuit and to be put on the air by operation of the squelch relay of the associated receiver. The local handset also controls the r-f carrier of the transmitter and modulates the transmitter 25 percent when the push-to-talk switch on the handset is depressed.

(5) POSITION 5. MULTICHANNEL CONTINUOUS enables the r-f carrier of the transmitter to be on continuously and to be modulated 25 percent per channel on all four channels by the high-fidelity circuit. The local handset also modulates the transmitter carrier 25 percent when the button on the handset is depressed.

d. HANDSET Jacks. These jacks provide for connection to Handset H-23/U or Control Box C-21A/TRC-1. The MIC. jack receives Plug PL-68. The HEADSET jacks accommodate Plug PL-55.



e. Cord CX-104 Receptacle. The receptacle engages the plug of Cord CX-104/TRC-1 used to interconnect the receiver and transmitter.



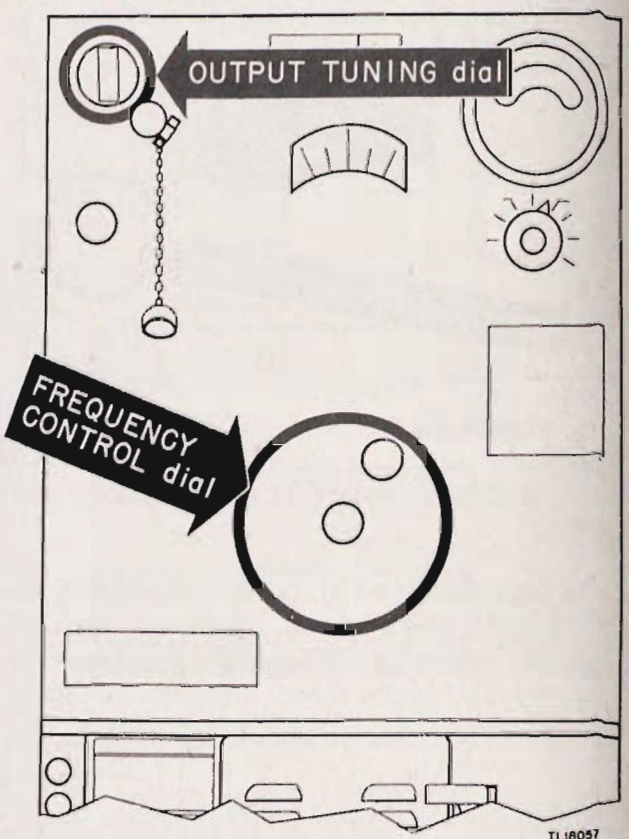
f. Binding Posts.

(1) TRSG. At a terminal station, this pair of binding posts receives the transmitting pair of spiral-four cable from telephone Terminal CF-1-(*) (Carrier). At a relay station, this pair of binding posts are connected to the REC pair of binding posts by hook-up wire so that the receiver can modulate its associated transmitter.

(2) REC. At a terminal station, the REC binding posts connect to the receiving pair of spiral-four cable from Telephone Terminal (CF-1-(*) (Carrier). At a relay station the REC binding posts are connected by hook-up wire to the TRSG binding posts.

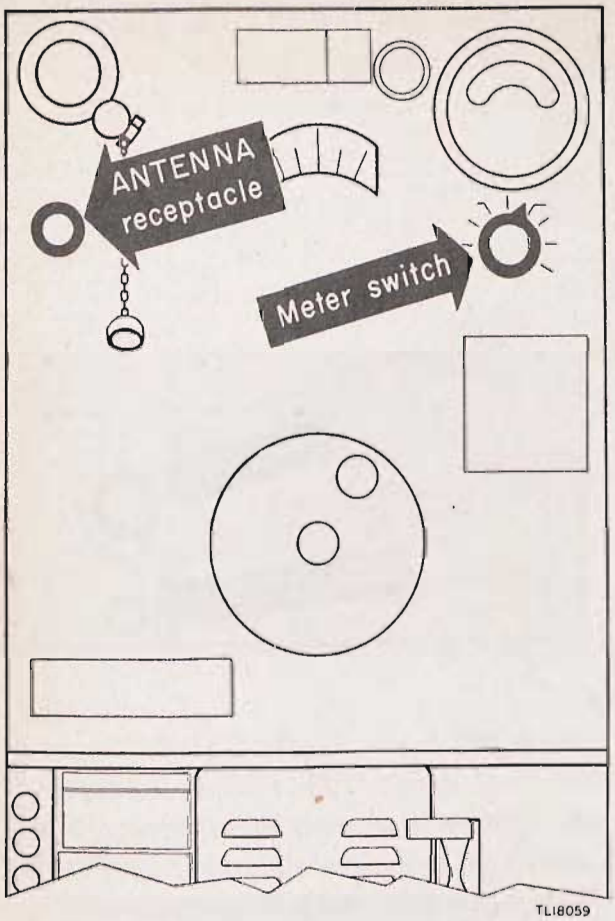
(3) SH-GROUND. This post connects to the shield of the spiral-four cable and also to a ground stake.

(4) TELEPHONE EE-8. These posts connect to Telephone EE-8-A and enable communication between the terminal station and the telephone terminal.



g. FREQUENCY CONTROL Dial. The FREQUENCY CONTROL dial is calibrated directly in megacycles. Rotating the dial knob places the transmitter on the desired frequency. A dial lock is provided to prevent shifting of the dial after it has been set.

h. OUTPUT TUNING Dial. The OUTPUT TUNING dial turns a variable capacitor used to resonate the tripler tank circuit. It is used with the transmitter meter for final adjustment of r-f output. This control is also provided with a dial lock.



i. ANTENNA Receptacle. The receptacle receives Radio Frequency Plug UG-21/U of Cord CG-55/U connecting the antenna to the transmitter.

j. Meter Switch. An eight-position selector switch is provided to enable the meter to check the various stages of the transmitter. These positions and their functions are as follows:

Switch position	Function
OFF	Shorts the meter to restrict its movement when the transmitter is shipped or otherwise handled.
B. VOLTS	Meter reading is proportional to the output voltage of the power supply.
% MOD.	Indicates percent modulation; 1.0 ma (full scale deflection) is equal to 100 percent modulation.
OUTPUT	Meter reading is proportional to the voltage applied to the antenna.
AUD. AMP.	Meter reading is proportional to the cathode current of audio amplifier tube V205.
MOD.	Meter reading is proportional to the cathode current of modulator tube V202.
OSC.	Meter reading is proportional to the cathode current of oscillator tube V201.
TRIPLER	Meter reading is proportional to the cathode current of tripler tube V203.

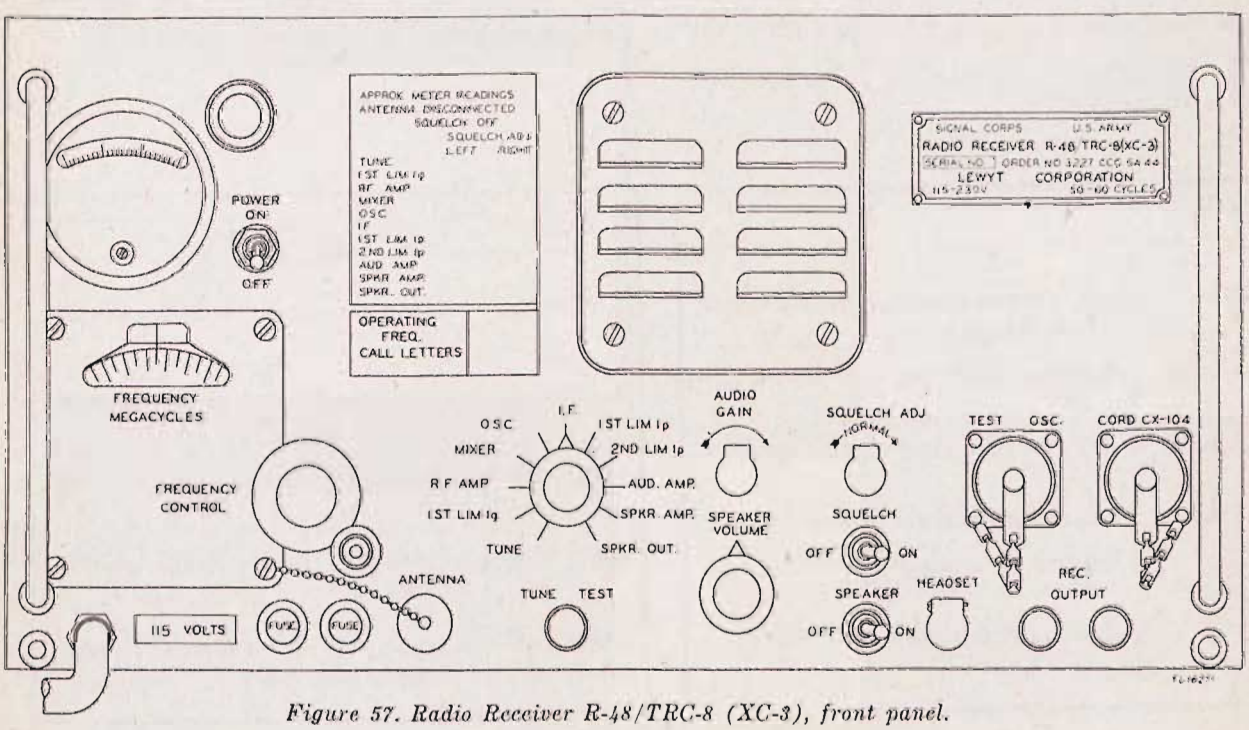
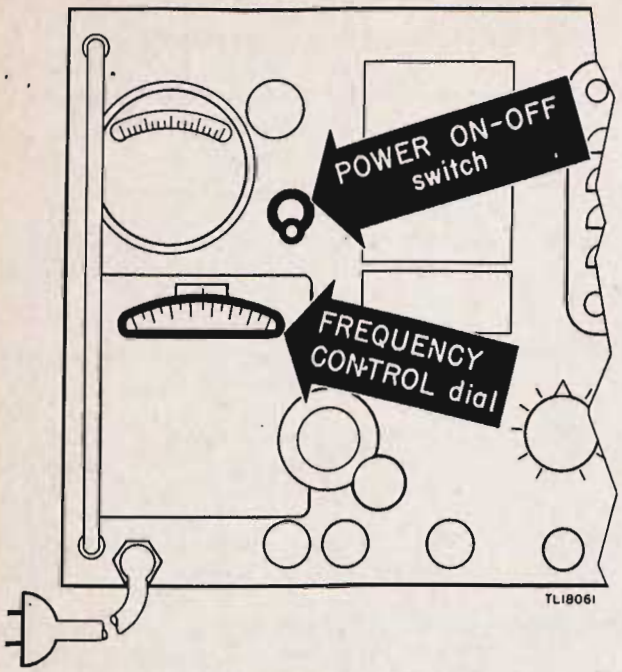


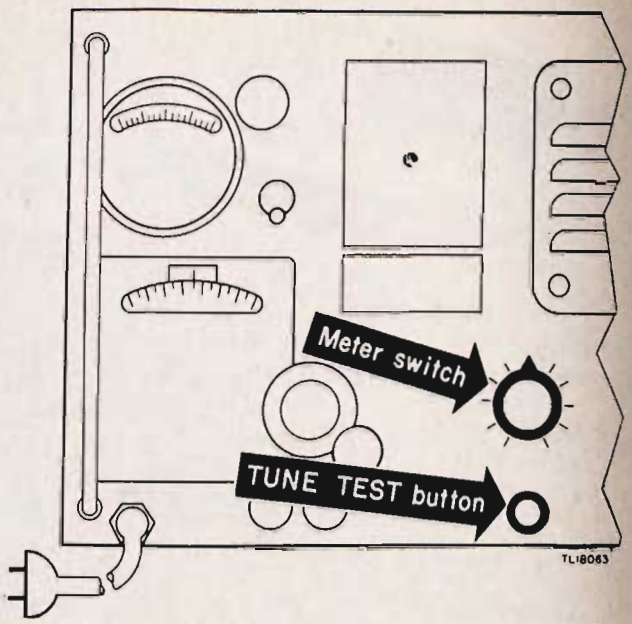
Figure 57. Radio Receiver R-48/TRC-8 (XC-3), front panel.

54. RECEIVER CONTROLS (fig. 57).



a. POWER ON-OFF Switch. In the ON position, the POWER switch connects the receiver to the a-c power source.

b. FREQUENCY CONTROL Dial. The FREQUENCY CONTROL dial controls the operating frequency of the receiver. Rotation of the dial knob tunes the receiver to the desired frequency. A dial lock is provided to prevent the dial from shifting after it has been set.

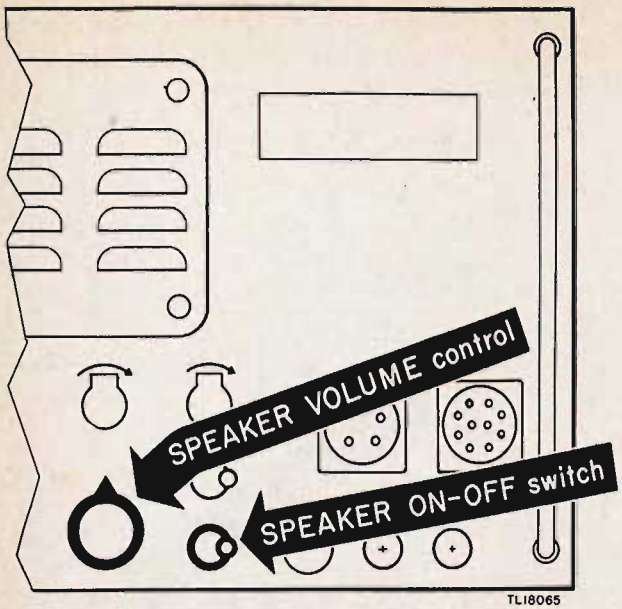


c. TUNE TEST Button. The TUNE TEST button is used to determine if the receiver is properly tuned. If the set is properly tuned, there will be no change in meter reading when the TUNE TEST button is depressed with the meter switch in the TUNE position.

d. Meter Switch. The meter switch is an 11-position wafer switch which connects the meter to various circuits in the receiver. The positions and functions are as follows:

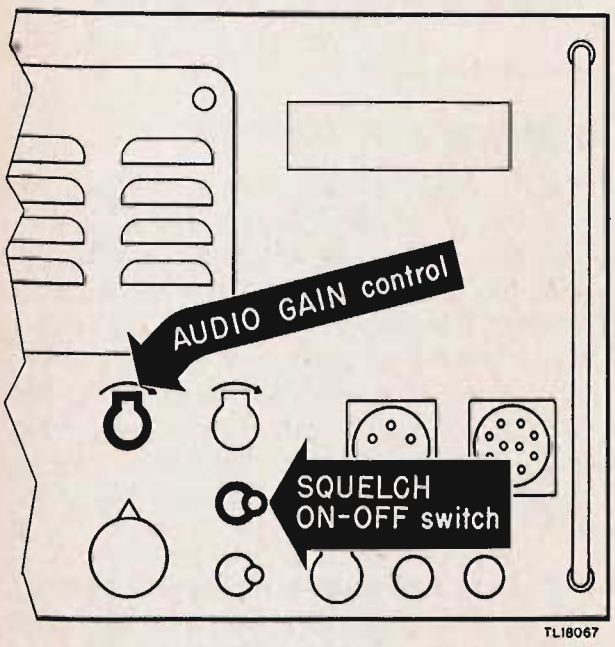
Position	Function
TUNE	Indicates discriminator current and is used in tuning the receiver.
1st LIM Ig	Indicates grid current of 1st limiter tube V8.
R. F. AMP.	Indicates plate current of r-f amplifier tube V1.
MIXER	Indicates plate current of mixer tube V2.
OSC.	Indicates plate current of oscillator tube V3.
I.F.	Indicates plate current of i-f stages V4, V5, V6, and V7.

Position	Function
1st LIM. Ip	Indicates plate current of first limiter tube V8.
2nd LIM. Ip	Indicates plate current of second limiter tube V9.
AUD. AMP.	Indicates plate current of audio amplifier tube V11a.
SPKR. AMP.	Indicates plate current of speaker amplifier tube V11b.
SPKR. OUT	Indicates plate current of speaker output amplifier tube V12.



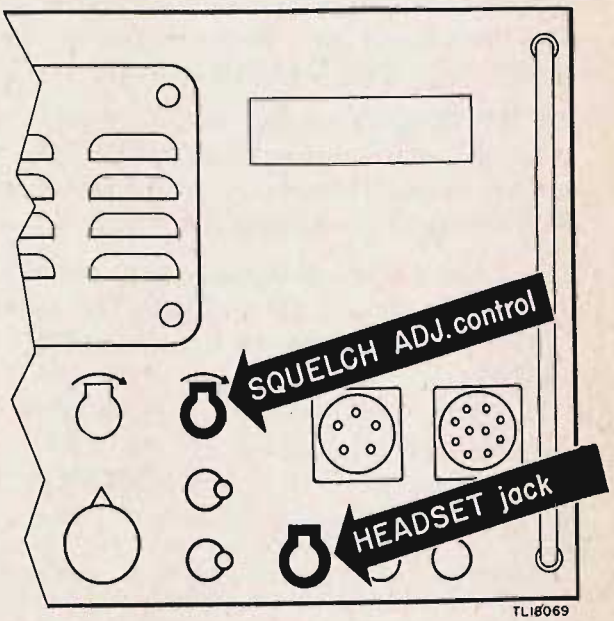
e. SPEAKER ON-OFF Switch. The switch is placed in the ON position to put the loudspeaker into operation.

f. SPEAKER VOLUME Control. The SPEAKER VOLUME control is a potentiometer which adjusts the audio level to the monitoring speaker (low-fidelity circuit).



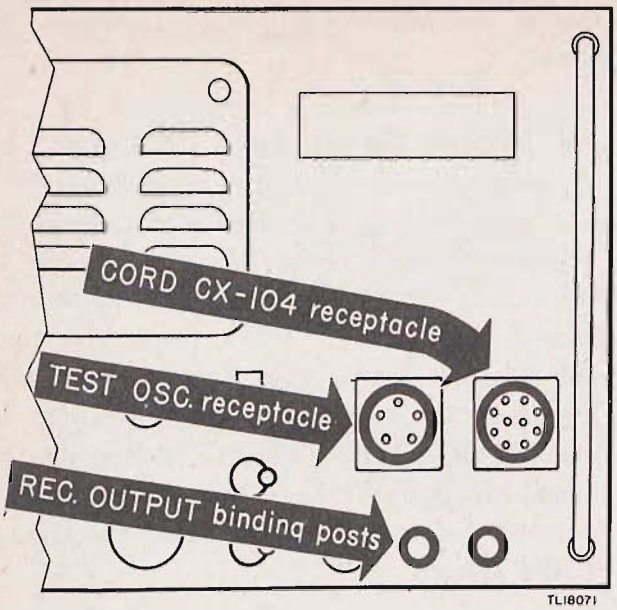
g. AUDIO GAIN Control. The AUDIO GAIN screwdriver control is a potentiometer which adjusts the audio output of the high-fidelity circuit.

h. SQUELCH ON-OFF Switch. This switch is used to remove the squelch relay from the circuit when squelch operation is not required. When the switch is in the ON position, it allows the SQUELCH ADJ. control to set the sensitivity of the receiver so that it responds to signals above a desired level. Signals below this level mute the receiver output. In positions 2 and 4 of the TYPE OF OPERATION switch, a signal above the level to which the receiver is adjusted will turn on and modulate the transmitter carrier.



i. SQUELCH ADJ. Control. The sensitivity of the receiver may be varied by adjusting this control. This adjustment is used together with the SQUELCH ON-OFF switch when squelch operation of the radio set is desired.

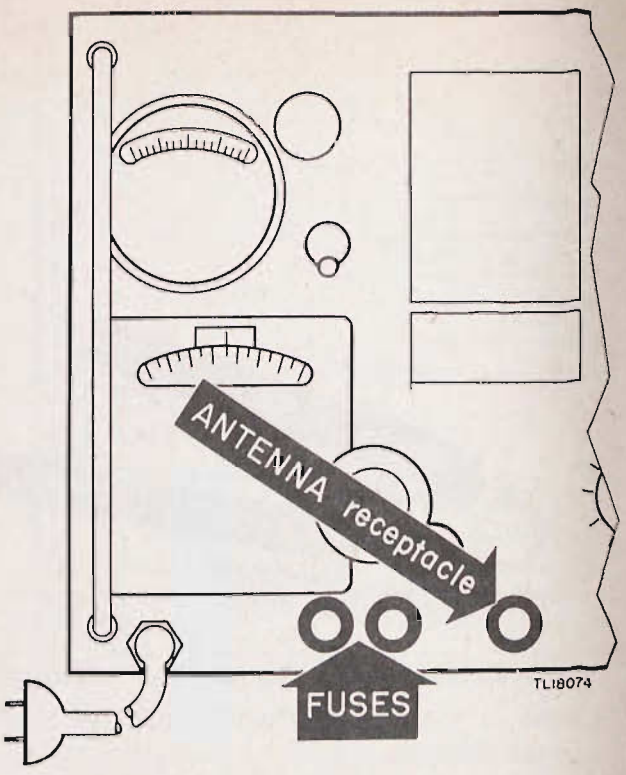
j. HEADSET Jack. The jack receives Plug PL-55 of a headset and enables the receiver output to be monitored.



k. REC. OUTPUT Binding Posts. These posts are used in four-wire radio remote control to connect the receiver high-fidelity output to line 2 of Remote Control Unit C-112/TRA-2.

l. TEST OSC. Receptacle. The receptacle connects to Test Oscillator TS-237/TRC-8 (XC-3) and allows the receiver to furnish heater and plate power to the test oscillator.

m. CORD CX-104 Receptacle. This receptacle engages the plug of Cord CX-104/TRC-1 used to interconnect the receiver and transmitter.



n. ANTENNA Receptacle. The receptacle engages the Radio Frequency Plug UG-21/U of Cord CG-55/U connecting the antenna to the receiver.

o. FUSES. Two 2-ampere fuses are provided, one in each leg of the a-c power input. The fuse holders are mounted on the front panel.

SECTION IV. OPERATION

55. SYSTEM CONTROL.

NOTE: The information contained in paragraphs 55 to 57 is a suggested method for system operation and can be used if other instructions are not issued by the proper authorities.

a. In a multichannel radio-relay system, Telephone Terminal CF-1-(*) (Carrier) station of the senior unit (fig. 5) is designated as Terminal A Carrier and the radio station as Terminal A Radio. At the opposite terminal they are called Terminal B Carrier and Terminal B Radio. Terminal A Carrier is a'so designated the System Control Station and is responsible for the satisfactory operation of the over-all system. Any changes or adjustments, except those of an emergency nature, must be referred to the System Control Station for clearance.

b. Terminal A Radio, designated Radio Control Station, is responsible to the System Control Station for the satisfactory operation of the radio portion of the circuit and supervises all changes or adjustments therein. This includes scheduling periodic tests, and taking necessary action on reports of trouble. The Radio Control Station obtains permission from the over-all System Control Station to make any changes which may affect service over the system.

c. In a single-channel radio-relay system, the Radio Control Station has complete charge. Stations other than the Radio Control Station should not make changes in the radio equipment which are likely to affect the operation of the over-all circuit without first obtaining

permission from the Radio Control Station. In emergencies the Radio Control Station should be given complete information as soon as practicable.

d. Terminal B Radio and Terminal B Carrier, designated as the Alternate Radio Control Station and Alternate System Control Station, assume control of the stations adjacent to them following a system break of any nature. The alternate control stations exercise all the functions of the control station in such cases.

56. STATION ROUTINES.

a. The satisfactory operation of a station requires strict attention to all details of station routine. Care should be exercised at all stations to reduce to a minimum the possible causes of interruptions to service.

b. A record should be kept at each station of pertinent data on the operating settings, etc., of the equipment. This will be a useful reference if the office personnel is changed, and will aid in localizing trouble. A unit of equipment that is varying in performance, or is repeatedly found to be outside of limits, is an indication of a potential source of trouble. Any change in settings made during emergency servicing should be returned to the normal settings after the trouble has been cleared.

57. MULTICHANNEL SYSTEM INSTALLATION.

a. All telephone and radio equipment in any installation are turned on and adjusted for operation immediately after installation is completed, following the preliminary adjustments outlined in paragraph 62. Communication is established between the adjacent radio stations by means of the handset.

b. As soon as possible, each radio station operator advises the Radio Control Station that his station is in operation. Since the TYPE OF OPERATION switch of all transmitters is in position 5, voice modulation of the handset is relayed to other stations in the circuit.

c. When all stations have reported to the Radio Control Station the Radio Control Station will advise them to adjust their equipment for the type of operating system to be used (pars. 64 and 65). The Radio Control Station then advises the System Control Station over Telephone EE-8-A or the local handset that the system is ready for line-up. It is recommended that no unnecessary communication between stations be made during the above proceedings.

58. CONTINUOUSLY OPERATED SYSTEMS.

a. In a continuously operated system (position 3 or 5 of TYPE OF OPERATION switch) the transmitter carrier is on the air at all times even when there is no modulation on the system. Therefore the associated receiver is always receiving a carrier signal and is quiet, that is, there is no rushing noise.

b. Both single and multichannel continuously operated systems are available.

c. A continuously operated system recommended since trouble in this type of system is more easily detected than in a squelch operated system.

59. SQUELCH-OPERATED SYSTEMS.

a. Relay Station. (1) It sometimes is desirable for a transmitter to be on the air only when transmitting intelligence through a system. For this reason a squelch circuit in the receiver is provided to operate the transmitter. A signal picked up by a receiver at a relay station automatically turns on the associated transmitter which relays the signal to the next station. When the received signal stops, the transmitter is automatically turned off to stand by for the next message.

(2) When the transmitter is off the air, the receiver output is normally a loud rushing noise. To quiet this noise, the receiver is adjusted so that its audio output circuit is automatically short-circuited to ground by means of the squelch circuit when it is not receiving a signal, thus muting the loudspeaker. Squelch operatior is obtained by placing the TYPE OF OPERATION switch at a relay station on position 2 (SINGLE CHANNEL MIC. OR SQUELCH) or position 4 (MULTICHANNEL MIC. OR SQUELCH) and adjusting the squelch as shown in paragraph 63.

b. Terminal Station. At a terminal station the receiver squelch controls are adjusted to mute the rushing noise but the transmitter carrier will not be turned on since the transmitter TYPE OF OPERATION switch is in position 1. Normally, the method of turning on and modulating the transmitter at a terminal station is to operate the local handset or to place the transmitter TYPE OF OPERATION switch in a continuously operated position (position 3 or 5).

c. Channels Available. Both single channel squelch and multichannel squelch operated systems are available.

60. MONITORING.

a. General. Normal operation of the equipment is automatic and intercommunication between stations should be kept at a minimum. When required, intercommunication between radio stations is accomplished by means of the local handset over the same frequency band as channel 1 of the telephone terminal. In a multichannel system intercommunication is obtained without interfering with communication on channels 2, 3, and 4. These latter three channels are inverted by the Telephone Terminal CF-1-(*) (Carrier) and are not intelligible at the radio stations. They are reconverted to the original modulation by the telephone terminal at the other end of the circuit. If the telephone terminal operator desires to contact a radio station other than the adjacent radio terminal station he does so on channel 1. Only channel 1 can be understood at a radio station. Telephone EE-8-A provides communication between the telephone terminal and the adjacent radio terminal station only.

b. Procedure. To communicate with another radio station use the following procedure:

(1) Listen to the receiver to be sure no one else is using channel 1.

(2) Press the push-to-talk switch on the handset and talk in a normal tone of voice directly into the microphone.

c. Control Box C-21A/TRC-1. Control Box C-21A/TRC-1 is provided at all relay stations to facilitate communication between the relay operators and other operators on the circuit (fig. 16). By using this control box, it is possible to communicate in either direction with one handset. When the CIRCUIT DIRECTION switch is thrown to direction A, the handset is connected so that communication is obtained with the operator at terminal A or any operator between the relay station and terminal A. With the CIRCUIT DIRECTION switch in direction B, communication may be obtained with the operator at terminal B or any operator between the relay station and terminal B.

61. SELECTION OF OPERATING FREQUENCIES.

a. Requirements. There are three requirements that must be observed in selecting operating frequencies for a standard radio-relay system.

(1) At any one site, receiving frequencies must be at least 3 mc away from transmitting frequencies. This is necessary because radiation from a transmitting antenna placed about 50 feet from a receiving antenna will interfere with reception unless the receiver is tuned at least 3 mc away from any adjacent transmitter.

(2) At any one site, the receiver frequencies must be at least 3 mc apart. This separation is sufficient to cover the worst operating conditions and is therefore recommended.

(3) Two receivers at any one site, *receiving signals of equal signal strength,* may use frequencies spaced 500 kc apart if their antennas are directed 90° or more from each other, or use frequencies spaced 1 mc apart if their antennas are directed less than 90° from each other. The 500-kc separation is not recommended unless the frequencies chosen are first field tested for objectionable interference.

b. Method of Selecting Frequencies. In assigning frequencies in a radio-relay system, the following procedure is used:

(1) Use the following table as an example:

System	Terminal A	Relay stations						Terminal B
		No. 1		No. 2		No. 3		
1	230.5 T →	230.5 R	233.5 T →	233.5 R	236.5 T →	236.5 R	239.5 T →	239.5 R
	241.0 R ←	241.0 T	244.0 R ←	244.0 T	247.0 R ←	247.0 T	250.0 R ←	250.0 T
2	f1 T →	f1 R	f3 T →	f3 R	f1 T →	f1 R	f3 T →	f3 R
	f2 R ←	f2 T	f4 R ←	f4 T	f2 R ←	f2 T	f4 R ←	f4 T
3	235.0 T →	235.0 R	241.0 T →	241.0 R	235.0 T →	235.0 R	241.0 T →	241.0 R
	238.0 R ←	238.0 T	244.0 R ←	244.0 T	238.0 R ←	238.0 T	244.0 R ←	244.0 T

(2) Set up an outline as follows:

Terminal A	Relay stations						Terminal B
	No. 1		No. 2		No. 3		
T →	R	T →	R	T →	R	T →	R
R ←	T	R ←	T	R ←	T	R ←	T

T represents the transmitting frequency.
R represents the receiving frequency.
The arrows indicate the direction of transmission.

(3) Starting with terminal A, choose two frequencies keeping in mind the three limitations discussed above (subpar. *a* above). For system No. 1 of the above example, these frequencies are 230.5 mc transmitting and 241 mc receiving.

(4) Repeat the two frequencies chosen for terminal A at the appropriate receiver and transmitter of relay station No. 1.

(5) Choose another receiving frequency (244 mc in the example) keeping in mind the limitations noted in subparagraph *a* above.

(6) Determine a second transmitting frequency for relay station No. 1 remembering that it must be 3 mc apart from any receiving frequency at that station. In the above example 233.5 mc is chosen.

(7) Check the frequencies at relay station No. 1 for the three limitations noted in subparagraph *a* above.

(8) Repeat the last two frequencies chosen for relay station No. 1 (244 mc and 233.5 mc) at the appropriate receiver and transmitter of relay station No. 2.

(9) Using the same procedure, determine two more frequencies for relay station No. 2. In the example, these are 236.5 mc transmitting and 247 mc receiving.

(10) Repeat these frequencies at the appropriate receiver and transmitter of relay station No. 3, and continue in this manner until frequencies have been assigned for a whole system.

c. Radio-relay System Utilizing Four Frequencies. A radio-relay system consisting of three relay stations may use four instead of eight frequencies (system 2 of the example). In this case any two of the four frequencies used are represented by f1 and f2 and appear at terminal A. These are repeated at relay station No. 1. The two other frequencies represented by f3 and f4 are chosen. At relay station No. 2, f3 and f4 are repeated and f1 and f2 are again used. At relay station No. 3, f1 and f2 are repeated, and f3 and f4 used once more. System 3 is a radio-relay system using four frequencies.

62. PRELIMINARY ADJUSTMENTS.

a. Power Unit.

Step 1

1. Install the power units as indicated in paragraph 49.

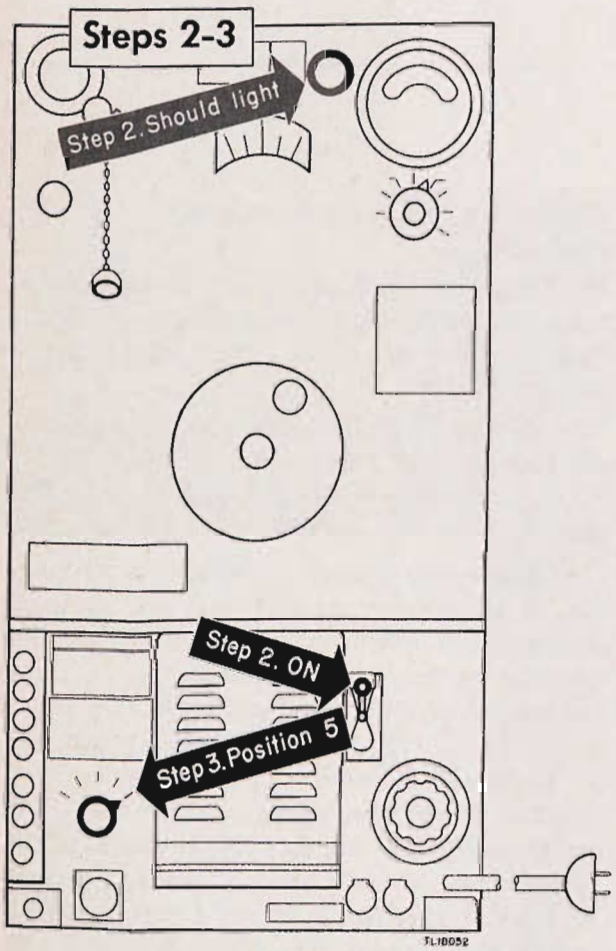
Step 2

2. Start the power unit according to the instructions given in the TM 11-900 series. Test the output voltage by measuring the a-c voltage across one socket of Junction Box JB-110 with the voltmeter in Test Set I-56-(*). Regulate the voltage so that it reads between 115 and 120 volts.

b. Transmitter.

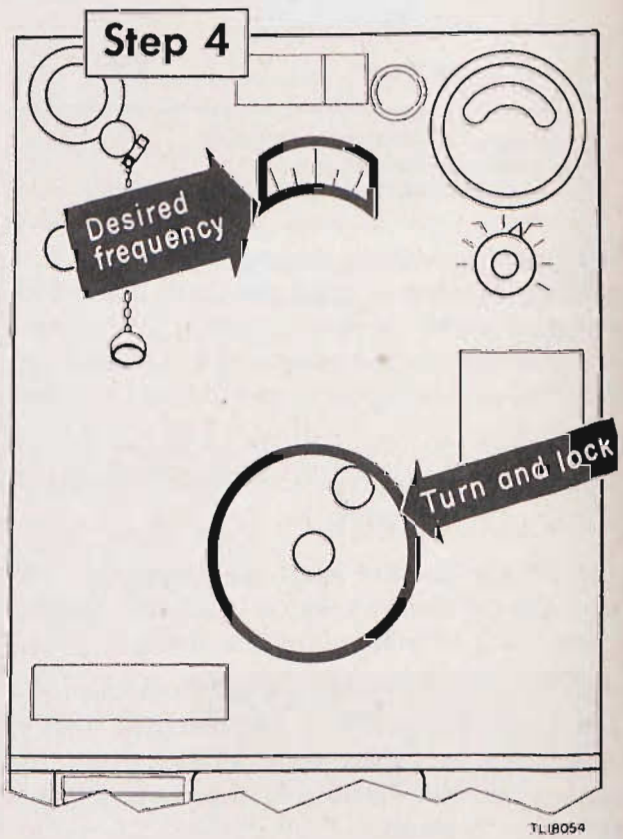
Step 1

1. Install the transmitter following the instructions given in paragraphs 41 and 49.

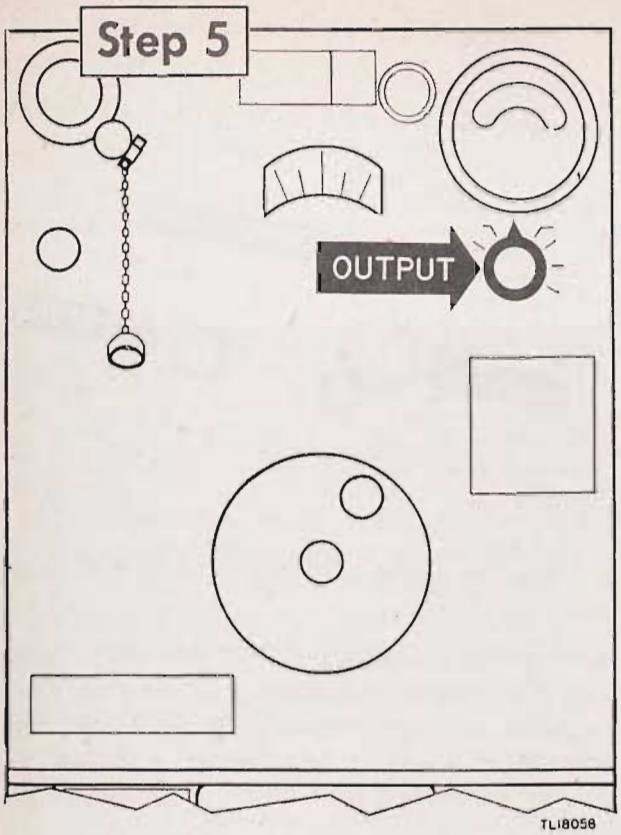


2. Throw the POWER switch to the ON position. The pilot lamp should light and the blower start. If this switch fails to stay up, push it up slowly until it catches. The power switch is also a closely adjusted circuit breaker and in the event of an overload, will automatically click OFF. If after several attempts the switch fails to hold, trouble is indicated in one of the components.

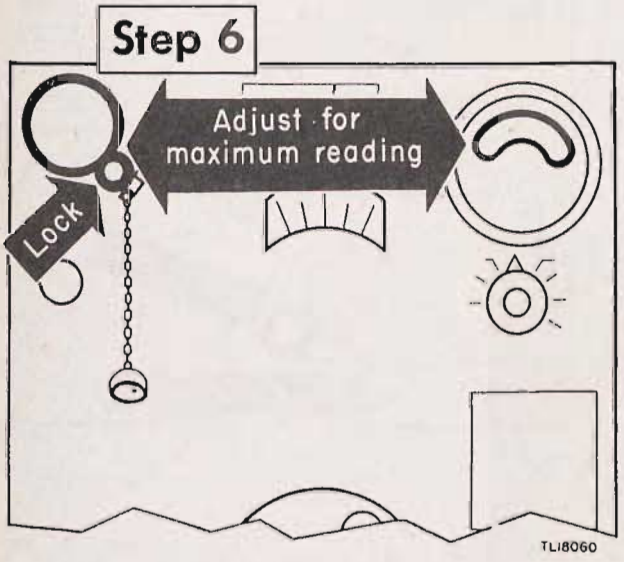
3. Place the TYPE OF OPERATION switch in position 5 (MULTICHANNEL CONTINUOUS). This position of the TYPE OF OPERATION switch causes the r-f carrier of the transmitter to be on continuously.



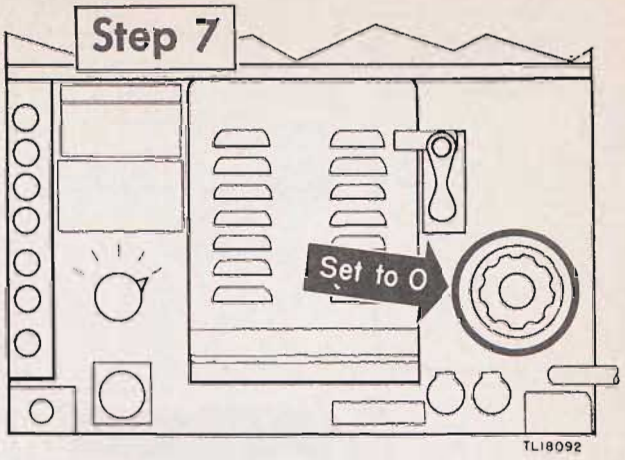
4. Turn the FREQUENCY CONTROL knob until the desired operating frequency is indicated on the dial. Lock the dial with the dial lock.



5. Turn the meter switch to the OUTPUT position.



6. Adjust the OUTPUT TUNING dial for maximum reading on the meter. After the transmitter has been in operation for about 20 minutes, readjust this dial for maximum reading and lock the dial in place.

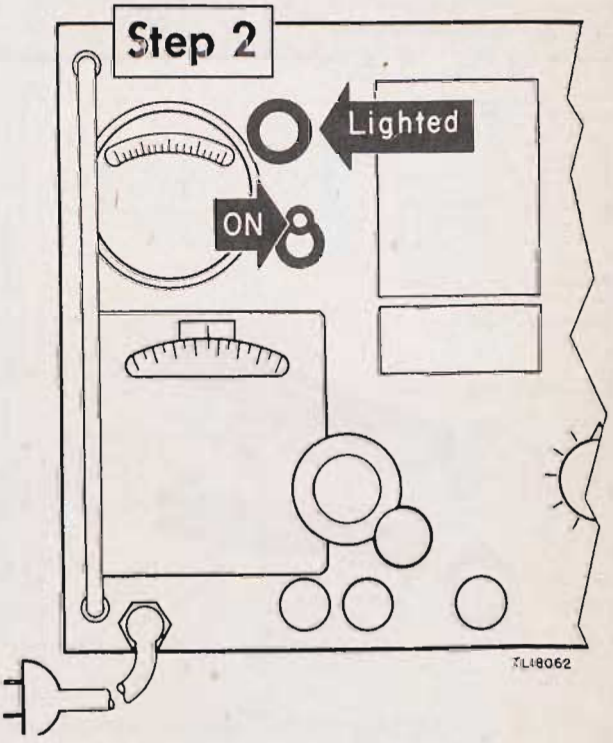


7. Set the MODULATION ADJ. control to O.

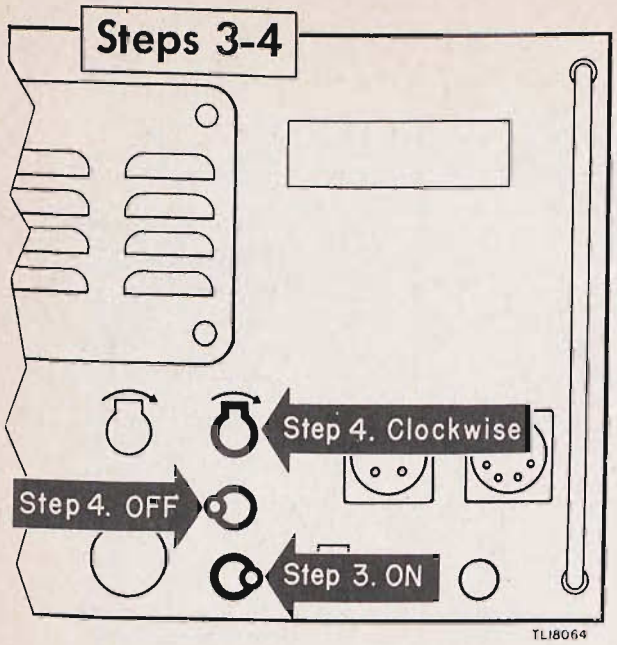
c. Receiver.

Step 1

1. Install the receiver following the instructions given in paragraphs 41 and 49.

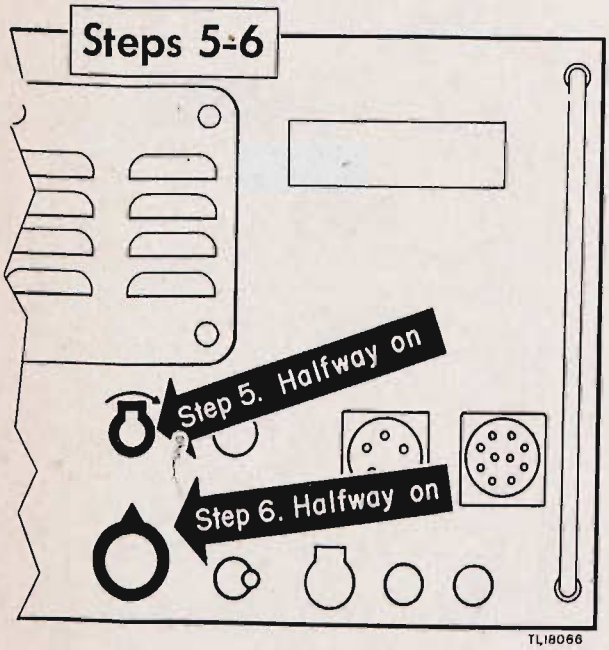


2. Throw the POWER switch to the ON position. The pilot lamp should light.



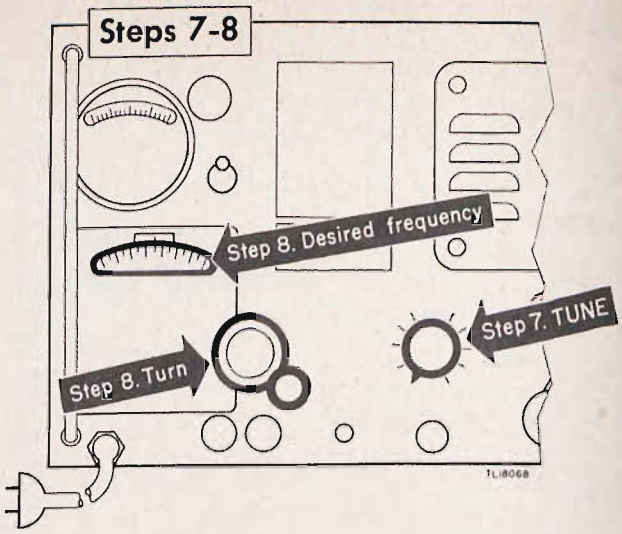
3. Turn the SPEAKER switch ON.

4. Turn the SQUELCH ON-OFF switch to OFF and SQUELCH ADJ. control full clockwise.



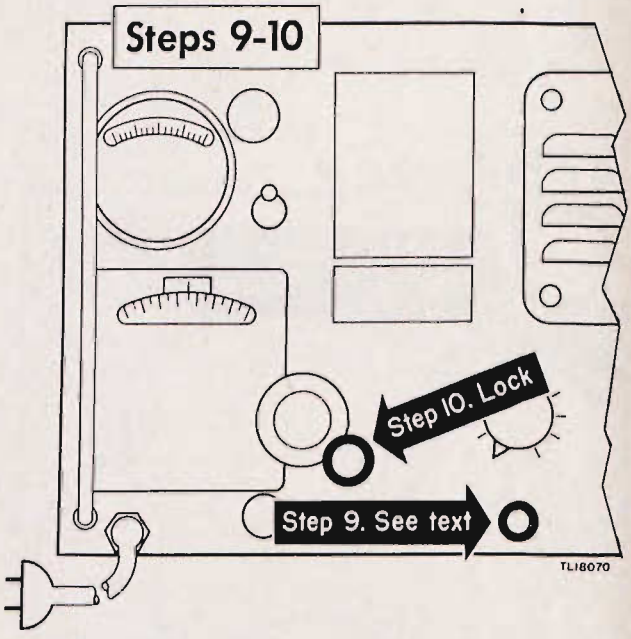
5. Turn the AUDIO GAIN control half way on.

6. Turn the SPEAKER VOLUME control half way on.



7. Place the meter switch in the TUNE position.

8. Turn the FREQUENCY CONTROL knob until the desired frequency is indicated. The cessation of background noise indicates the presence of a carrier. If a carrier is not picked up, the associated transmitter may not be on the air.



9. Press and then release the TUNE TEST button. If the meter needle deflects, readjust the FREQUENCY CONTROL dial until there is no deflection of the meter needle when the TUNE TEST button is operated.

10. Secure the FREQUENCY CONTROL dial by means of the dial lock.

Step 11

11. Check the receiver tuning periodically. Occasional adjustments are necessary especially during the first 2 hours of operation.

d. Antenna Direction. This adjustment is made after the transmitter and receiver are installed and operating.

Step 1

1. Place the meter switch in the 1st LIM Ip position.

Step 2

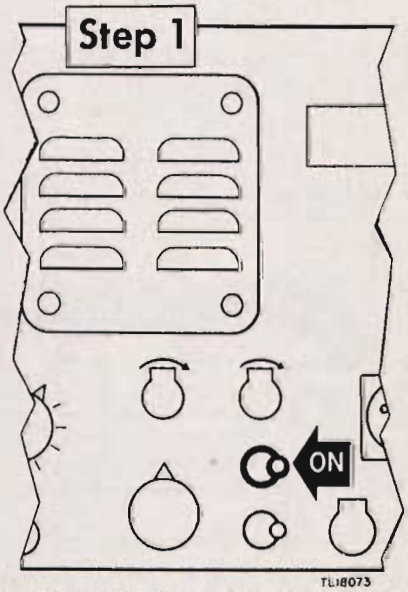
2. Rotate the receiving antenna slowly by means of the gin pole until a maximum reading on the meter occurs. The antenna is now facing the distant station. If the received signal is too strong, a more critical adjustment may be obtained by rotating the SQUELCH ADJ. control counterclockwise. Return the SQUELCH ADJ. control to its original position after the antenna has been properly directed.

Step 3

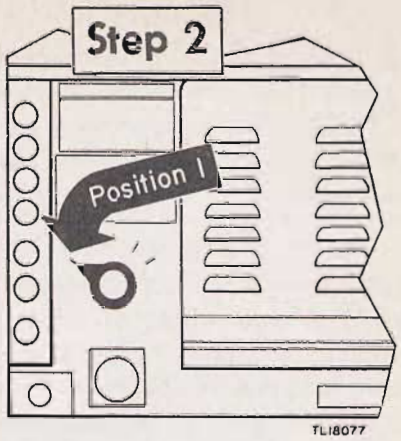
3. At a terminal station, point the transmitting antenna in the same direction as the receiving antenna. At a relay station, point the antennas of the receiver and transmitter, not connected together by Cord CX-104/TRC-1, in the same direction.

63. SQUELCH ADJUSTMENT OF RECEIVER.

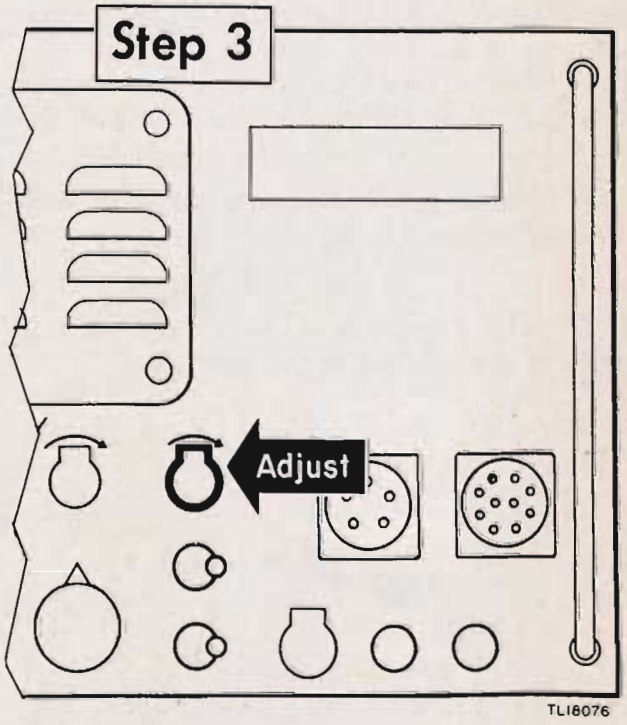
When squelch adjustment of the receiver is desired, the procedure is as follows:



1. Set the SQUELCH switch to the ON position.



2. By means of the handset, instruct the operator at the preceding station to keep his carrier off the air. He can do this by temporarily placing the TYPE OF OPERATION switch of the transmitter (which is transmitting to the receiver that is being adjusted) to position 1. Under these conditions he should not press the push-to-talk switch on the local Handset H-23/U.



3. Make sure that no signal is being received and adjust the SQUELCH ADJ. control counterclockwise until the receiver output noise just disappears.

Step 4

4. Instruct the operator at the preceding station to press the push-to-talk button of the handset. The received signal should actuate the squelch relay, and signals from the transmitter should be heard.

Step 5

5. Instruct the operator at the preceding station to key the transmitter on and off several times by pressing and releasing the button on the handset. The receiver that is being adjusted should mute and receive the signals as the signal from the transmitter goes off and on, respectively. If the set does not mute when the signal goes off the air, turn the SQUELCH ADJ. slightly more to the left.

64. TERMINAL STATION ADJUSTMENTS.

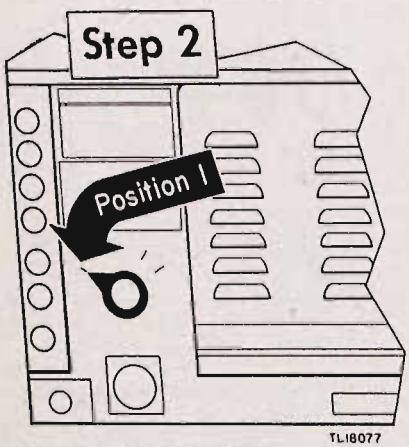
In point-to-point communication, *each* station is a terminal station. In radio-relay communication, the stations at the *ends* of the circuit are terminal stations. The type of operation used depends in general upon the mission of the system.

The settings and adjustments of the various controls of the transmitter and receiver at a radio terminal station for the operating systems described in paragraphs 58 and 59 are as follows:

a. Terminal-station, Single-channel, or Squelch-operated System (fig. 48).

Step 1

1. Adjust the controls of the transmitter and receiver as described in paragraph 62.



2. Set the TYPE OF OPERATION switch to position 1 (SINGLE CHANNEL MIC.).

Step 3

3. Adjust the receiver for squelch operation in the manner described in paragraph 63.

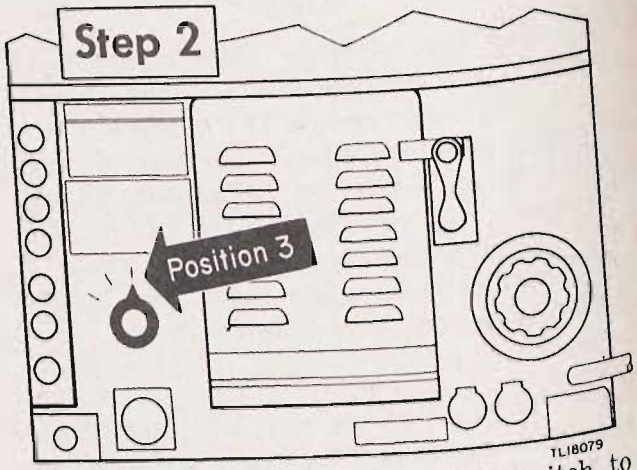
Step 4

4. Adjust the AUDIO GAIN control as described in paragraph 67.

b. Terminal-station, Single-channel, Continuously Operated System (fig. 48).

Step 1

1. Adjust the controls of the transmitter and receiver as described in paragraph 62.



2. Set the TYPE OF OPERATION switch to position 3 (SINGLE CHANNEL CONTINUOUS). The meter will indicate in the OUTPUT position since the carrier is on continuously.

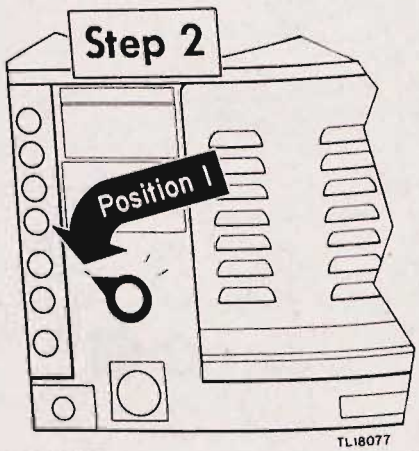
Step 3

3. Adjust the AUDIO GAIN control as described in paragraph 67.

c. Terminal-station, Multichannel Squelch-operated System (fig. 48).

Step 1

1. Adjust the receiver and transmitter controls as described in paragraph 62.



2. Set the TYPE OF OPERATION switch to position 1 (SINGLE CHANNEL MIC.).

Step 3

3. Adjust the receiver for squelch operation as described in paragraph 63.

Step 4

4. The terminal stations are each connected to a Telephone Terminal CF-1-(*) (Carrier). When there is no traffic, the TYPE OF OPERATION switch at the terminal stations is in position 1; at relay stations it must be in position 4 (MULTICHANNEL SQUELCH). All receivers are adjusted for squelch operation and the transmitter carriers are not on the air. When communication is desired, the operator at Telephone Terminal CF-1-(*) (Carrier) calls the terminal station operator by means of Telephone EE-8-A and instructs him to place *his* TYPE OF OPERATION switch to position 5, thus switching on his transmitter carrier as well as the carriers of all transmitters on the circuit.

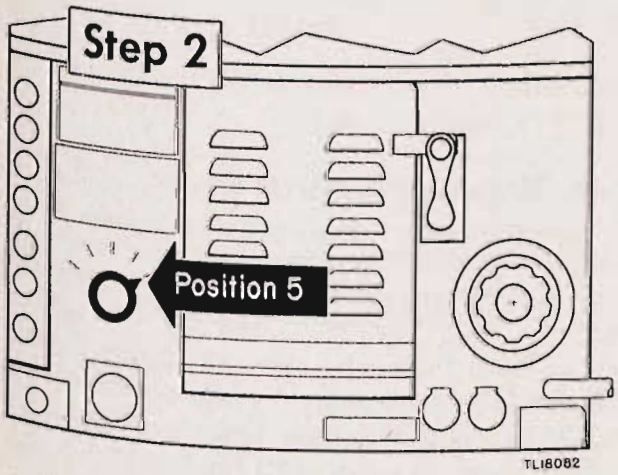
Step 5

5. Adjust the MODULATION ADJ. and AUDIO GAIN controls as described in paragraph 66.

d. Terminal-station, Multichannel, Continuously Operated System (fig. 48).

Step 1

1. Adjust the receiver and transmitter controls as described in paragraph 62.



2. Set the TYPE OF OPERATION switch to position 5 (MULTICHANNEL CONTINUOUS).

Step 3

3. Adjust the MODULATION ADJ. and AUDIO GAIN controls as described in paragraph 66.

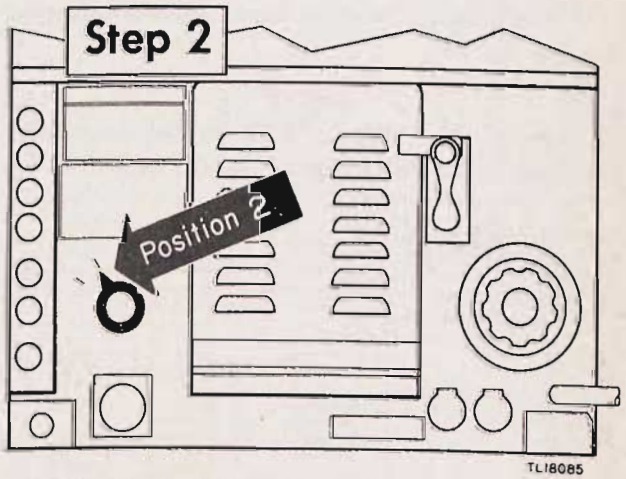
65. RELAY STATION ADJUSTMENTS.

At a relay station, one transmitter and receiver is used to communicate in one circuit direction, and another transmitter and receiver is used simultaneously in the other circuit direction. Each transmitter and receiver operates on a different frequency and four antennas are required. The primary purpose of a relay station is to extend the operating range of communication by repeating the transmission from a terminal station or another relay station. The settings and adjustments of the various controls of the transmitters and receivers at a radio relay station for the operating systems described in paragraphs 58 and 59 are as follows:

a. Radio-relay, Single-channel, Squelch-operated System (fig. 47).

Step 1

1. Adjust the controls of both receivers and transmitters as described in paragraph 62.



2. Set the TYPE OF OPERATION switch on both transmitters to position 2.

Step 3

3. Adjust both receivers for squelch operation in the manner described in paragraph 63.

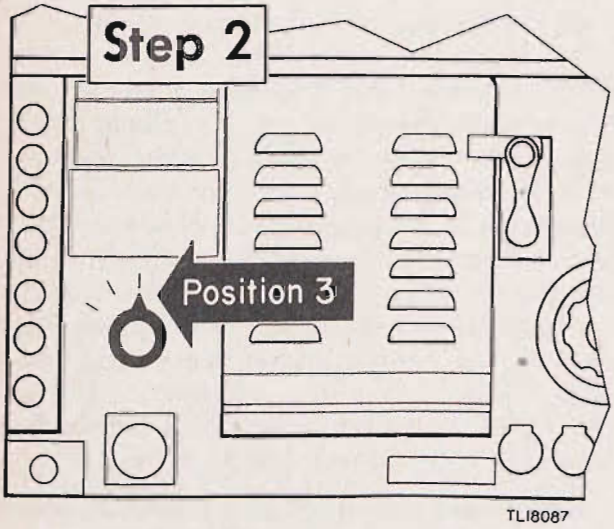
Step 4

4. Adjust the AUDIO GAIN control as described in paragraph 67.

b. Radio-relay, Single-channel, Continuously Operated System (fig. 47).

Step 1

1. Adjust the receiver and transmitter as described in paragraph 62.



2. Set the TYPE OF OPERATION switches of both transmitters to position 3.

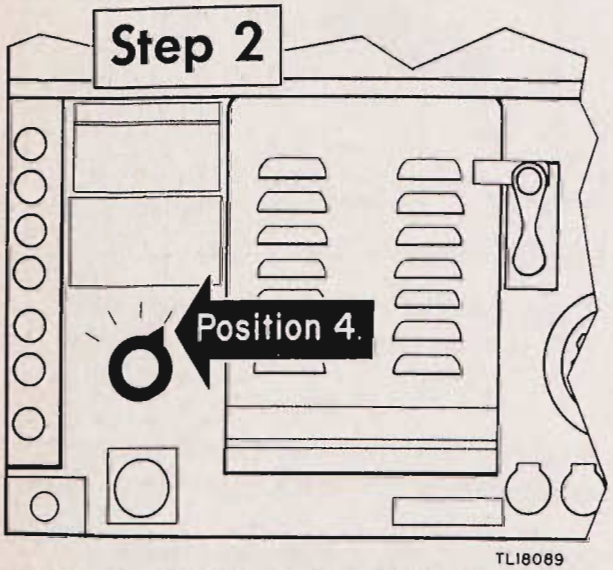
Step 3

3. Adjust the AUDIO GAIN control as described in paragraph 67.

c. Radio-relay, Multichannel Squelch-operated System (fig. 47).

Step 1

1. Adjust the controls of both receivers and transmitters as described in paragraph 62.



2. Set the TYPE OF OPERATION switches of both transmitters to position 4.

Step 3

3. Adjust both receivers for squelch operation as described in paragraph 63.

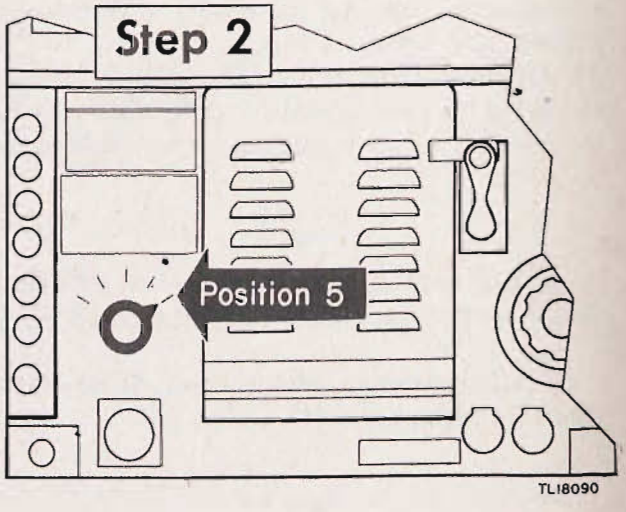
Step 4

4. Adjust the AUDIO GAIN controls as described in paragraph 66.

d. Relay-station, Multichannel, Continuously Operated System (fig. 47).

Step 1

1. Adjust the receiver and transmitter controls as described in paragraph 62.



2. Set the TYPE OF OPERATION switches of both transmitters to position 5.

Step 3

3. Adjust the AUDIO GAIN control as described in paragraph 66.

66. MULTICHANNEL SYSTEM LINE-UP.

NOTE: The information contained in paragraphs 66, 67, and 68 is a suggested method of system operation and can be used if other instructions are not issued by the proper authorities.

a. Upon the advice from the Radio Control Station that the system is ready for line-up, the System Control Station takes control of the system, and proceeds with the line-up.

b. The line-up of the system is made from terminal A to terminal B and then from terminal B to terminal A.

NOTE: Each radio station should check to see that the transmitter meter switch is on % MOD. and that the MODULATION ADJ. control is set at 0.

c. A test tone is sent on channel 2 of Terminal A Carrier. By means of Telephone EE-8-A Terminal A Radio is told to GO AHEAD.

d. The MODULATION ADJ. control on the transmitter of Terminal A Radio is adjusted until the meter reads 0.25 ma (¼ of full scale).

e. Terminal A Radio then instructs relay station No. 1 to GO AHEAD.

f. At relay station No. 1 the receiver AUDIO GAIN control is adjusted until the meter reads 0.25 ma on the transmitter sending out signals toward terminal B.

g. Relay station No. 1 instructs relay station No. 2 to GO AHEAD. The AUDIO GAIN control of the receiver at relay station No. 2 receiving from Terminal A is adjusted similarly and so on until the final relay station has been adjusted.

h. The final relay station instructs Terminal B Radio to GO AHEAD.

(1) At Terminal B Radio, connect the a-c output terminals of Voltohmmeter I-166 to the REC OUTPUT binding posts on the receiver. *Do not disconnect the spiral-four cable from the transmitter.* Set the voltohmmeter on the 1.5-volt, 4,000-ohm, a-c scale. Adjust the receiver AUDIO GAIN control for a reading of 0.125 on the voltohmmeter. This is equivalent to -5 dbm.

(2) If the Voltohmmeter I-166 is not available, the following procedure is used. At Terminal B Radio the TYPE OF OPERATION switch is placed in position 1, the spiral-four cable is removed from the transmitter, and the REC and TRSG binding posts connected with hook-up wire. The AUDIO GAIN control is then adjusted until the transmitter meter reads about 0.6. The hook-up wire is removed and the spiral-four cable is again replaced. The TYPE OF OPERATION switch is reset to its original position.

i. Terminal B Radio then instructs Terminal A Carrier to take the tone off the air.

j. The same procedure is followed to adjust the receivers and transmitters directed toward terminal A, Terminal B Carrier sending the tone.

k. After the radio circuit line-up is completed, test tones on all four channels are transmitted by Terminal A Carrier. Equalization and gain adjustments are made at Terminal B Carrier.

l. The same procedure is repeated in the other direction. No adjustments should be made to the radio circuit while the telephone terminals are being adjusted.

67. SINGLE-CHANNEL SYSTEM LINE-UP.

a. This line-up is very similar to multichannel system line-up (par. 65d) except that no Telephone Terminal CF-1-(*) (Carrier) is involved and the Radio Control Station has complete charge.

b. After all the radio stations have reported to the Radio Control Station and have adjusted their equipment for the type of system being used, the system is ready for line-up.

NOTE: Each radio station should check to see that the transmitter meter switch is on % MOD. and that the MODULATION ADJ. control is set at 0.

c. Terminal A Radio then speaks into the handset in a normal level voice and continues speaking until Terminal B Radio tells him to stop.

d. The operator at relay station No. 1 rotates the AUDIO GAIN control until the meter of the transmitter which is transmitting toward terminal B reads full scale.

e. Relay station No. 1 instructs relay station No. 2 to GO AHEAD. Relay station No. 2 adjusts the AUDIO GAIN control until the meter of the transmitter which is transmitting toward terminal B reads full scale. This same procedure is followed until the final relay station has been adjusted.

f. The final relay station instructs Terminal B Radio to GO AHEAD. At Terminal B Radio the TYPE OF OPERATION switch is placed in position 1, and the REC and TRSG binding posts connected with hook-up wire. The AUDIO GAIN is then adjusted until the transmitter meter reads full scale. The hook-up wire is removed and the TYPE OF OPERATION switch is reset to its original position.

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g. Terminal B Radio then instructs Terminal A Radio to stop modulating.

h. The operator at Terminal B Radio speaks into the handset and each station adjusts the other receiver AUDIO GAIN in the manner described above.

68. LINE-UP CHECK.

The line-up of the system is checked:

a. Whenever a transmitter or receiver is replaced.

b. Whenever any component is repaired or replaced.

c. Whenever a change is made in the operating frequency of any radio set.

d. Whenever unsatisfactory or impaired operation of the system is indicated.

69. STOPPING PROCEDURE.

Upon receiving instructions from the control station:

a. Turn the POWER ON-OFF switch to OFF in both receiver and transmitter. Lock the receiver and transmitter controls.

b. Turn off Power Unit PE-75-( ) as instructed in the TM 11-900 series.

70. OPERATION CHART.

The following chart summarizes the setting of the receiver and transmitter controls for various types of operating systems.

Type of system	Transmitter control settings			Receiver control settings		
	TYPE OF OPERATION switch		MODULATION ADJ.	SQUELCH ON-OFF	SQUELCH ADJ.	AUDIO GAIN
	Terminal station	Relay station				
Single channel, squelch operated.	1	2	0.	ON	See par. 63.	See par. 67.
Single channel, continuously operated.	3	3	0.	OFF	Full clockwise.	See par. 67.
Multichannel, squelch operated (no traffic).	1	4	See par. 66.	ON	See par. 63.	See par. 66.
Multichannel, squelch operated (with traffic).	5	4	See par. 66.	ON	See par. 63.	See par. 66.
Multichannel, continuously operated.	5	5	See par. 66.	OFF	Full clockwise.	See par. 66.

NOTE: For remote control operation adjustments refer to paragraph 102.

SECTION V. EQUIPMENT PERFORMANCE CHECK LIST

71. PURPOSE AND USE OF CHECK LIST.

a. General. The equipment performance check list (par. 72) will help the operator to determine whether the radio equipment is functioning properly. The check list gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures that the operator can take. Items 1 to 11 are checked before starting, items 12 to 28 during operation, and items 29 to 33 when stopping. Items 17 to 28 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.

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 item is 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. Reference to part five in the table indicates that the correction of the trouble cannot be effected during operation and that trouble shooting by an experienced repairman is necessary. 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. Spare transmitters and receivers are available at terminal and relay stations, and in the event of a break-down, substitution of a serviceable component can be quickly made.

e. Items 1 to 11. Items 1 to 11 should be checked each time the equipment is put into operation.

f. Items 12 to 28. Items 12 to 28 are the normal conditions occurring during operation. Meter readings are correct for input voltages of 115 or 230 volts. If input voltage exceeds these values, slightly higher readings may be expected. Meter readings should be recorded daily and any change in normal readings is an indication of a fault which may develop into a break-down. The operator must become familiar with the characteristics of the equipment during normal operation; he must use that knowledge as a basis for recognizing changes in audible and visible indications, such as relay clicks, meter readings, etc., when the set is not operating properly.

g. Items 29 to 33. Items 29 to 33 are checked whenever the station is taken out of operation. Any abnormal indications at this time are symptoms of trouble in the equipment and should be corrected before the next expected period of operation.

72. EQUIPMENT PERFORMANCE CHECK LIST.

Power Unit PE-75-( ).

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Power Unit PE-75-( ).	Running.	Output 115 v ac.	See TM 11-900 series.

Radio Transmitter T-30/TRC-8 (XC-3).

PREPARATORY	2	A-c cord.	Plugged into Junction Box JB-110.		
	3	Cord CG-55/U.	Plugged into ANTENNA receptacle.		
	4	Cord CX-104/TRC-1.	Connected between transmitter and receiver receptacles Cord CX-104.		

Radio Transmitter T30/TRC-8 (XC-3) (contd).

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	5	REC and TRSG binding posts.	Interconnected at a relay station. Connected to spiral-four cable at a terminal station of a multichannel system.		
	6	Handset H-23-U.	Plugged into HANDSET jacks on transmitter or Control Box C-21A/TRC-1.		
	7	Antenna Assembly AS-52/TRC-8 (XC-3).	Assembled and properly directed.		

Radio Receiver R-48/TRC-8 (XC-3).

PREPARATORY	8	A-c cord.	Plugged into Junction Box JB-110.		
	9	Cord CG-55/U.	Plugged into ANTENNA receptacle.		
	10	Cord CX-104/TRC-1.	Connected between transmitter and receiver.		
	11	Antenna Assembly AS-52/TRC-8 (XC-3).	Assembled and properly directed.		

Radio Transmitter T-30/TRC-8 (XC-3).

START	12	POWER ON-OFF switch.	Turn ON.	Pilot lamp lights. Blower operates.	Check power cords. Check circuit breaker.
	13	TYPE OF OPERATION switch.	Set to desired position.		
	14	FREQUENCY CONTROL dial.	Set to desired operating frequency.		
	15	Meter switch.	Turn to OUTPUT position.	Meter indicates whether TYPE OF OPERATION switch is in position 3 or 5. (For position 1, 2, and 4, press the handset to make the meter indicate.)	Check tube V204.
	16	OUTPUT control.	Tune for maximum reading on meter.	Meter peaks sharply (0.4 to 0.8 ma).	Check tube V203.
	17	MODULATION ADJ. control.	See pars. 66 and 67.	See pars. 66 and 67.	Check tubes V205 and V206.

Radio Receiver R-48/TRC-8 (XC-3).

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	18	POWER ON-OFF switch.	Turn ON.	Pilot lamp lights.	Check power cords and fuses.
	19	SPEAKER ON-OFF switch.	Turn ON.	Noise in speaker.	Refer to part five.
	20	SPEAKER VOLUME control.	Turn clockwise.	Noise increases.	Refer to part five.
	21	AUDIO GAIN control.	See par. 66.	See par. 67.	Refer to part five.
	22	FREQUENCY CONTROL dial.	Set to desired frequency.	Dial moves freely.	Loosen dial lock.
	23	Meter switch.	Turn to TUNE.	Meter reads 0. Meter indicates if receiver is off frequency.	Retune receiver. Check tube V10.
	24	SQUELCH ON-OFF switch.	Set to desired position.		
	25	SQUELCH ADJ. control.	See par. 63.		

Radio Transmitter T-30/TRC-8 (XC-3).

EQUIPMENT PERFORMANCE	26	Meter readings.	Meter switch position:		
			B. VOLTS.	0.3–0.45	Check tubes V207 and V208.
			AUD. AMP.	0.65–0.95	Check tube V205.
			MOD.	0.2–0.3	Check tube V202.
			OSC.	0.2–0.3	Check tube V201.
			OUTPUT (TYPE OF OPERATION switch in position 3 or 5. Press handset switch for positions 1, 2, or 4).	0.4–0.5	Check tube V204.
			TRIPLER (condition same as for OUTPUT).	0.3–0.4	Check tube V203.
			% MOD.		
			TYPE OF OPERATION switch in position 1, 2, or 3. Handset switch pressed and spoken into.	1.0	Check tube V206.
			TYPE OF OPERATION switch in position 4 or 5. Handset pressed and spoken into.	0.25	Check tube V206.
	27	OUTPUT control.	Meter in OUTPUT position.	0.4–0.5	Retune OUTPUT control. Refer to part five.

Radio Receiver R-48/TRC-8 (XC-3).

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	28	TUNE–TEST button.	Press in. Meter in TUNE position.	No change in meter reading.	Retune.
	29	Meter readings.	Meter switch positions:		
			TUNE	0	Retune FREQUENCY CONTROL.
			1st LIM. Ig	70-200	Check tube V8. Refer to part five.
			R.F. AMP.	50-100	Check tube V1. Refer to part five.
			MIXER	90-110	Check tube V2. Refer to part five.
			OSC	90-110	Check tube V3. Refer to part five.
			I.F	70-95	Check tubes V4, V5, V6, V7. Refer to part five.
			1st LIM. Ip	70-85	Check tube V8. Refer to part five.
			2nd LIM. Ip	65-110	Check tube V9. Refer to part five.
			AUD. AMP.	80-90	Check tube V11A. Refer to part five.
			SPKR. AMP.	100-120	Check tube V11B. Refer to part five.
			SPKR. OUT	180-200	Check tube V12. Refer to part five.

Radio Transmitter T-30/TRC-8 (XC-3).

STOP	30	POWER ON–OFF switch.	Turn OFF.	Pilot lamp goes out. Blower stops.	
	31	FREQUENCY CONTROL dial.	Lock in position to prevent detuning.		

Radio Receiver R-48/TRC-8 (XC-3).

STOP	32	POWER ON–OFF switch.	Turn OFF.	Pilot lamp goes out.	
	33	FREQUENCY CONTROL dial.	Lock in position to prevent detuning.		

Power Unit PE-75-( ).

STOP	34	Power Unit PE-75-( ).	Turn OFF.		

NOTE: For continuous operation of radio stations, make sure that the idle Power Unit PE-75-( ) is fueled and ready to operate in order to avoid power interruptions. Switch to the stand-by power unit before fuel is exhausted in the operating unit.

PART THREE

PREVENTIVE MAINTENANCE

SECTION VI. PREVENTIVE MAINTENANCE TECHNIQUES

73. 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 vitally important that radio operators and repairmen maintain their radio sets properly.

NOTE: The operations in sections VI and VII are first and second echelon (organization operators and repairmen) maintenance. Some operations in sections VIII and X are higher echelon maintenance.

74. DESCRIPTION OF PREVENTIVE MAINTENANCE TECHNIQUES.

CAUTION: Before performing any preventive maintenance, discharge high-voltage capacitors with the shorting stick (par. 93) or similar tool.

a. General. Most of the electrical parts used in transmitters and receivers 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 instructions 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 on a general knowledge of field needs. For example, the dust encountered on dirt roads during cross-country travel filters into the 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 of exposed surfaces and parts. Without frequent inspections and the necessary performance of tightening, cleaning, and lubrication operations, equipment becomes undependable and subject to break-down when it 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 operat-

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

(4) Tightness, by testing any connections 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 part three.

> **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 X 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 the light oil to door hinges or other sliding surfaces on the equipment.

75. VACUUM TUBES.

> NOTE: Avoid working on the 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 caps or envelopes are found, replace the tubes if possible.

(2) Examine the spring clips that make contact with the plate caps of transmitter tubes for corrosion and for loss of tension with resulting looseness. Also, check the condition of the wires soldered to the spring clips.

(3) Inspect the firmness of tubes in their sockets. Make the inspection by pressing the tubes down in the sockets and testing them in that position *not* by partially withdrawing the tubes and jiggling them from side to side. Sidewise movement of a 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; the elements may be displaced. Connections to the 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.

c. Clean (C). (1) Clean the tubes, but only if inspection shows cleaning to be necessary. Tubes operated at high voltage and with exposed plate connections, such as in the transmitter, must be kept free of dirt and dust because of possible leakage between plate terminals. In contrast, tubes operating at low voltages and not having exposed plate caps do not require frequent cleaning.

(2) Remove dust and dirt from the glass or metal envelopes with a clean lint-free, dry cloth. If proper care is exercised, the 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 caps with a clean dry cloth.

76. CAPACITORS.

a. Inspect (I). (1) Inspect the terminals of large fixed capacitors for corrosion and loose connections. Observe the mountings carefully to discover loose mounting screws 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 friction tape. The terminals of the capacitors should not be cracked or broken.

(2) Inspect the case of each large fixed capacitor thoroughly for leaks, bulges, and discoloration. Whenever an oil-filled capacitor is found to be leaking oil, remove it and replace it if a replacement is available. Equipment may operate with a leaking capacitor; however, replacement should be made as soon as possible to avoid break-down.

(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 thus check for proper operation of the capacitor.

b. Tighten (T). (1) Tighten loose terminals, mountings, and connections on the capacitor.

(2) Carefully tighten the retaining nuts on the insulation bushings, if leakage occurs around the gasket of oil-filled capacitors. When tightening a nut, be careful not to break the bushing or damage the gasket.

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

77. RESISTORS.

a. Inspect (I). Inspect the coating of the vitreous-enameled resistors for signs of cracks and chipping, especially at the ends. Examine the bodies of all types of resistors for blistering, discoloration, and other indications of overheating and replace them only after the cause of the overheating has been located and corrected. Inspect leads and all other connections for corrosion, dirt, dust, looseness, and broken strands in the connecting wires. Check the security of all mountings. Do not attempt to move resistors with pigtail connections, because there is danger of breaking the connections at the point where they enter the body of the resistor. Such defects cannot be repaired.

b. Tighten (T). Tighten resistor connections and mountings whenever they are found loose. If a resistor is allowed to remain loose, vibration may break the connection or damage the body.

c. Clean (C). (1) Clean all carbon resistors with a small brush.

(2) The vitreous-enameled resistors must be kept clean to avoid leakage between the terminals. They will ordinarily be wiped with a dry cloth. However, if the dirt deposit is unusually hard to remove, use a dry-cleaning solvent.

(3) Resistors with discolored bodies cannot be cleaned. Discoloration indicates that there has been overloading and overheating at some time prior to the inspection. The discoloration is probably due to circuit trouble which requires analysis and correction. Trouble-shooting procedures are described in part five.

NOTE: When fungiproofed resistors are heated, a harmless brown stain may appear.

78. SWITCHES.

a. Inspect (I). (1) Inspect the mechanical action of each switch and, while so doing, look for signs of dirt or corrosion on all exposed elements. In some cases, it will be necessary to examine the elements of the switch visually; in others, the action of the switch is checked by flipping the control knob or toggle, or by pressing the switch button and noting the freedom of the movement and the amount of spring tension.

(2) Examine the ganged switches to see if the contacts are clean. The inspection is visual. Do not pry the leaves of the switch apart. The rotary members should make good contact with the stationary members, and as the former slides into the latter, a spreading of the stationary contact leaves should be noticeable. The switch action should be free. The wiping action of the contacts usually removes any dirt at the point of contact.

b. Tighten (T). Tighten the mounting nuts on all switches. Loose mounting nuts cause unnecessary strain on switch wiring when the switch is rotated.

c. Clean (C). The exterior surfaces of switches are cleaned with a stiff brush moistened with dry-cleaning solvent.

d. Adjust (A). Stationary contacts of rotary switches should be adjusted only if poor or no contact is indicated. Adjustment should be done carefully until a noticeable spreading of the stationary contact occurs when it is engaged by a rotary contact. Use long-nose pliers for this adjustment.

e. Lubricate (L). If necessary, lubricate the wiping contacts with a light oil.

79. RELAYS.

Relays are considered normal if the exterior is free from dirt or dust; the contacts are not burned, pitted, or corroded; the contacts are parallel and correctly spaced; the moving parts travel freely and function in a satisfactory manner; the connections to the relay are tight; the wire insulation is not frayed or torn; the relay assembly is securely mounted; and the field coil shows no signs of overheating.

a. Inspect (I). (1) Inspect the relay to detect defects. The contacts may be examined with the aid of a flashlight and mirror.

(2) Check the mechanical action of the relays to make certain that when the moving and stationary contacts come together they make positive contact and are directly in line with each other.

b. Tighten (T). Tighten all loose connections and mounting screws, but do not apply enough force to damage the screw or to break the parts it holds.

c. Clean (C). (1) RELAY EXTERIOR. Brush the exterior of the relay with a soft brush. If it is very dirty, clean it with a brush dipped in dry-cleaning solvent. If loose connections are found, they should be tightened. If they are dirty or corroded, remove, clean, and replace them carefully.

(2) RELAY CONTACTS. Contacts are cleaned by drawing a strip of thin clean cloth or paper between them while holding them together. In some cases, it may be necessary to moisten the cloth with dry-cleaning solvent. Use a dry cloth or paper strip for polishing. Corroded, burned, or pitted contacts must be cleaned with a point file, burnishing tool, or crocus cloth.

d. Adjust (A). Adjust carefully all relay contacts, if necessary, so that a definite make and break occurs when the armature is moved by hand. Poor contact in the make position causes arcing and erratic operation and insufficient travel in the break position causes arcing that may permanently damage the contacts. Use long-nose pliers and bend contacts at the point nearest the mounting screws so that contact will not be out of parallel after adjustment.

80. BLOWER.

a. Feel (F). The transmitter blower should have the feel operation performed as soon as possible after shut-down so that overheated bearings can be detected.

b. Inspect (I). Check the rotation of the vane to see that it turns freely by hand. Inspect motor connections for loose or frayed wires.

c. Tighten (T). Tighten all assembly and mounting screws on blower.

d. Clean (C). Remove all accumulated dust and foreign matter from blower openings. Use a stiff brush for this purpose.

81. POTENTIOMETERS.

a. Inspect (I). (1) Inspect the mechanical condition of the potentiometers. The moving arm should be keyed tightly to the shaft, and the shaft should turn easily in the bushing.

(2) Inspect the assembly and mounting screws, setscrews, and mounting nuts.

(3) Examine the insulating body of the po-

tentiometer for dust, dirt, cracks, and chipped places.

(4) Examine all metallic parts for dust, dirt, and corrosion.

b. Tighten (T). Tighten loose assembly or mounting screws and mounting nuts.

c. Clean (C). Clean the body of the potentiometer and the connections whenever they are found in a dirty or corroded condition.

82. CORDS AND CABLES.

The cables can be regarded as the life lines of the equipment. The condition of the cabling must be closely observed. Equipment operated in all kinds of weather and moved on all kinds of roads subjects cabling to a great deal of punishment.

a. Inspect (I). Inspect the cables for cracked or deteriorated insulation, frayed or cut insulation at the connecting and supporting points, and improper placement which places the cables or connections under strain. Also watch for kinks and improper supports.

b. Tighten (T). Tighten loose cable clamps, coupling rings, cable connections, and strain reliefs.

c. Clean (C). Clean connections on cables when they are dirty or corroded. Corroded connectors are cleaned with #0000 sandpaper. It is important that the entire surface of the connector be cleaned. No attempt should be made to remove individual prongs from cable plugs.

83. METERS.

Meters are extremely delicate instruments and must be handled very carefully. They require very little maintenance. They are precision instruments and ordinarily cannot be repaired in the field.

a. Inspect (I). Inspect the leads and connections to the meters. Look for loose, dirty, and corroded connections. Look for cracked or broken cover glasses. Since the movement of a meter is extremely delicate, its accuracy will be seriously affected if the glass is broken and dirt and water filter through.

b. Tighten (T). Tighten all connections found loose. Any loose meter wires should be inspected for dirt or corrosion before they are tightened. The tightening of meter connections requires a special technique because careless handling can easily crack the meter case.

c. Clean (C). Meter cases can usually be cleaned with a dry cloth. If cleaning is difficult, the cloth should be dampened with a dry-cleaning solvent. Dirty connections may be cleaned with a small brush dipped in dry-cleaning solvent or with a small piece of cloth dipped in the solvent.

d. Adjust (A). Normally, meters in transmitters and receivers should indicate zero when the equipment is turned off. Before deciding whether a meter needs readjusting, tap the meter case *lightly* with the tip of the finger. This helps the needle to overcome the slight friction which sometimes exists at the bearings and prevents an otherwise normal unit from coming to rest at zero. If adjustment is needed, insert the tip of a very thin screwdriver in the slotted screw head located below the meter glass and slowly turn the adjusting screw until the pointer is at zero. Lightly tap the meter case again and view the meter face and pointer full on and not from either side. Avoid turning the screw too far, because the needle may be bent or the hairspring damaged.

84. CABINETS, CHASSIS, AND MOUNTINGS.

a. Inspect (I). Inspect the outside and inside of each cabinet thoroughly, paying strict attention to every detail. Check the ventilator mountings, the panel screws, and the zero settings of the meters (par. 83). Examine the pilot-light covers for cracks and breaks. Inspect the panels for loose knobs, switches, and jacks. Examine air filters for dirt.

b. Clean (C). Clean each cabinet, outside and in, with a clean dry cloth. Use dry compressed air to blow out all accumulated dirt and dust. If air filters cannot be cleaned with compressed air, replace them with clean filters. Repaint any surface that is found scratched, rusted, or chipped.

c. Tighten (T). Tighten all mounting bolts, panel screws, plugs, and control knobs found loose.

85. PILOT LIGHTS.

Pilot lights are used to indicate when power has been applied to a circuit. They are easily removed and replaced.

a. Inspect (I). Inspect the pilot-light assemblies for loose lamps, loose mounting screws, and loose, dirty, or corroded connections.

b. Tighten (T). (1) Tighten loose mounting screws and resolder any loose connections. If the connections are dirty or corroded, they should be cleaned before soldering.

(2) Loose lamps should be screwed tightly into the sockets.

86. JACKS AND PLUGS.

a. Jacks. Jacks require very little attention at infrequent intervals. Occasionally, it is necessary to tighten the mounting nut, clean the contacts, or increase the spring tension. Remove dirt with a brush and dry-cleaning solvent. Remove corrosion with a piece of crocus cloth followed by a clean cloth. Increase spring tension when necessary. Try the action of the jack after each adjustment. Be careful to keep all soldered connections intact.

b. Plugs.

(1) INSPECT (I). Inspect all handset, headset, and mike plugs for loose connections with the cover removed. Observe that strain cords are in order so that no stress is placed on the connections whenever the plug is pulled out.

(2) TIGHTEN (T). Tighten all plug connections as frequently as necessary.

(3) CLEAN (C). Clean the contact portions of all plugs whenever they show signs of corrosion or oxidation. Fine sandpaper or crocus cloth may be used for this purpose.

87. HANDSETS AND SWITCH BOXES.

These items of equipment are essential to operation, hence the operator must give them the same care as the actual communication equipment.

a. Inspect (I). Inspect all external surfaces for dirt and corrosion. See that all cable connections are tight and that plugs and jacks fit together properly. Inspect the switches for proper operation.

b. Clean (C). Clean all items of equipment in accordance with the instructions outlined previously for relays, cords, jacks, etc.

SECTION VII. ITEMIZED PREVENTIVE MAINTENANCE

88. INTRODUCTION.

For ease and efficiency of performance, preventive maintenance will 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 radio set 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 VI. All work is to be performed with the power removed from the equipment.

89. COMMON MATERIALS NEEDED.

The following materials, most of which are included in Tool Equipment TE-48 or TE-113, will be needed in performing preventive maintenance:

Common hand tools.

Clean cloth.

#0000 sandpaper.

Crocus cloth.

Point file or relay burnishing tool.

Solvent, Dry-cleaning, Federal Specification P-S-661a.

NOTE: Gasoline will not be used 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 Specification 2-102B, may be used for cleaning purposes when dry-cleaning solvent is not at hand. Carbon tetrachloride, or fire-extinguishing liquid (carbon tetrachloride base) will be used, if necessary, only on contact parts of electronic equipment.

90. SPECIFIC PREVENTIVE MAINTENANCE.

The location of parts requiring preventive maintenance is shown in figures 58 through 65.

ITEM 1, EXTERIOR OF RADIO SETS.

OPERATIONS.

ITC	Cabinets.
ITC	Jacks.
IT	Control knobs.
ITC	Pilot lamps.
IC	Meters.
ITCAL	Switches.

ITEM 2, ANTENNAS.

OPERATIONS.

I	Mast sections.
IT	Stakes.
ITA	Guy wires.
IA	Mast base.

ITEM 3, CORDS AND CABLES.

OPERATIONS.

IC	Cords.
ITC	Connectors.

ITEM 4, HANDSET.

OPERATIONS.

ITCA Handset.

ITEM 5, CABINETS OF COMPONENTS.

OPERATIONS.

ITC Transmitter and receiver cabinets.

ITEM 6, RADIO RECEIVER R-48/TRC-8 (XC-3)

PRELIMINARY STEPS. Remove receiver from case. Remove shield cover from r-f unit.

OPERATIONS.

ITCA	Tubes and sockets.
ITC	Capacitors.
ITC	Resistors.
ITCAL	Switches.
ITCA	Meter.
ITCA	Relay.
ITC	Potentiometers.
ITCA	Jacks.

ITEM 7, RADIO TRANSMITTER T-30/TRC-8 (XC-3).

PRELIMINARY STEP. Remove transmitter and power pack from cases.

OPERATIONS.

ITCA	Tubes, tube clamps, and sockets.
ITC	Capacitors.
ITC	Resistors.
ITCAL	Switches and attenuator.
ITCA	Meter.
ITCA	Relay.
ITC	Potentiometers.
ITCA	Jacks.
FITCA	Blower.

ITEM 8, TEST OSCILLATOR TS-237/TRC-8 (XC-3).

OPERATIONS.

ITCA	Tube and socket.
I	Crystal and socket.
ITC	Capacitors.
ITC	Resistors.
ITC	Cords and connectors.

ITEM 9, CONTROL BOX C-21A/TRC-1.

OPERATIONS.

ITCA	Plugs and jacks.
IC	Cords.
I	Switches.

ITEM 10, TUNING CONTROLS.

OPERATIONS.

ITCAL Tuning controls of transmitter and receiver.

ITEM 11, POWER UNIT PE-75-( ).

OPERATIONS.

ITCAL Power units. See TM 11-900 series.

91. PREVENTIVE MAINTENANCE CHECK LIST.

a. The following check list is a summary of the preventive maintenance operations to be performed. Time intervals shown on the check list may be reduced at any time by the local commander. For best performance of the equipment, perform operations at least as frequently as called for in the check list. The echelon column indicates which operations are first echelon maintenance and which operations are second echelon maintenance.

b. The senior operator with each set is responsible for the first echelon maintenance. This comprises the following:

(1) Keep all parts of the set and associated equipment clean.

(2) Keep all external wires and plugs bright and tight.

(3) Check antenna for loose joints and connections.

(4) Check ground connections.

(5) Replace burned-out fuses and tubes, and maintain a supply of spares.

(6) Keep all external screws, bolts, snap fasteners, and snubbers tight.

(7) Report immediately any failure or abnormal operation of the set.

(8) Obtain replacements for any defective unit.

(9) See that spare antenna sections, microphones, and authorized spare parts are on hand and properly stowed.

c. Operators will make no repairs requiring soldering connections nor repair any parts which cannot be reached by removing covers or panels held only by snap fasteners or thumb screws. No adjustments are made to trimmer or variable capacitors, permeability tuned inductors, or to adjustable or variable resistors. Second echelon repairs within the limitations of tools available may be performed under emergency conditions by qualified chief operators in order to keep their sets working.

d. Operations are indicated by the letters of the word FITCAL. For example, if the letters ITCA appear in the "Operations" column, the item to be treated must be inspected (I), tightened (T), cleaned (C), and adjusted (A).

Preventive Maintenance Check List

Item No.	Operations	Item	When performed					Echelon
			Before operation	After operation	Daily	Weekly	Monthly	
1	ITC	Exterior of radio sets.	X		X			1st
2	ITC	Antennas.	X		X			1st
3	ITC	Cords and cables.	X		X			1st
4	ITCA	Handset.	X		X			1st
5	ITC	Cabinets of components.				X		1st
6	ITCA	Radio Receiver R-48/TRC-8 (XC-3).	X				X	2d
7	ITCAL	Radio Transmitter T-30/TRC-8 (XC-3).	X				X	2d
8	ITC	Test Oscillator TS-237/TRC-8 (XC-3).	X				X	2d
9	ITCA	Control Box C-21A/TRC-1.	X				X	1st
10	ITCAL	Tuning controls.	X				X	2d
11	ITCAL	Power Unit PE-75-( ).	X	X	X			1st

NOTE: Meter readings on transmitter and receiver should be logged daily to furnish an indication of minor faults before an actual break-down occurs.

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

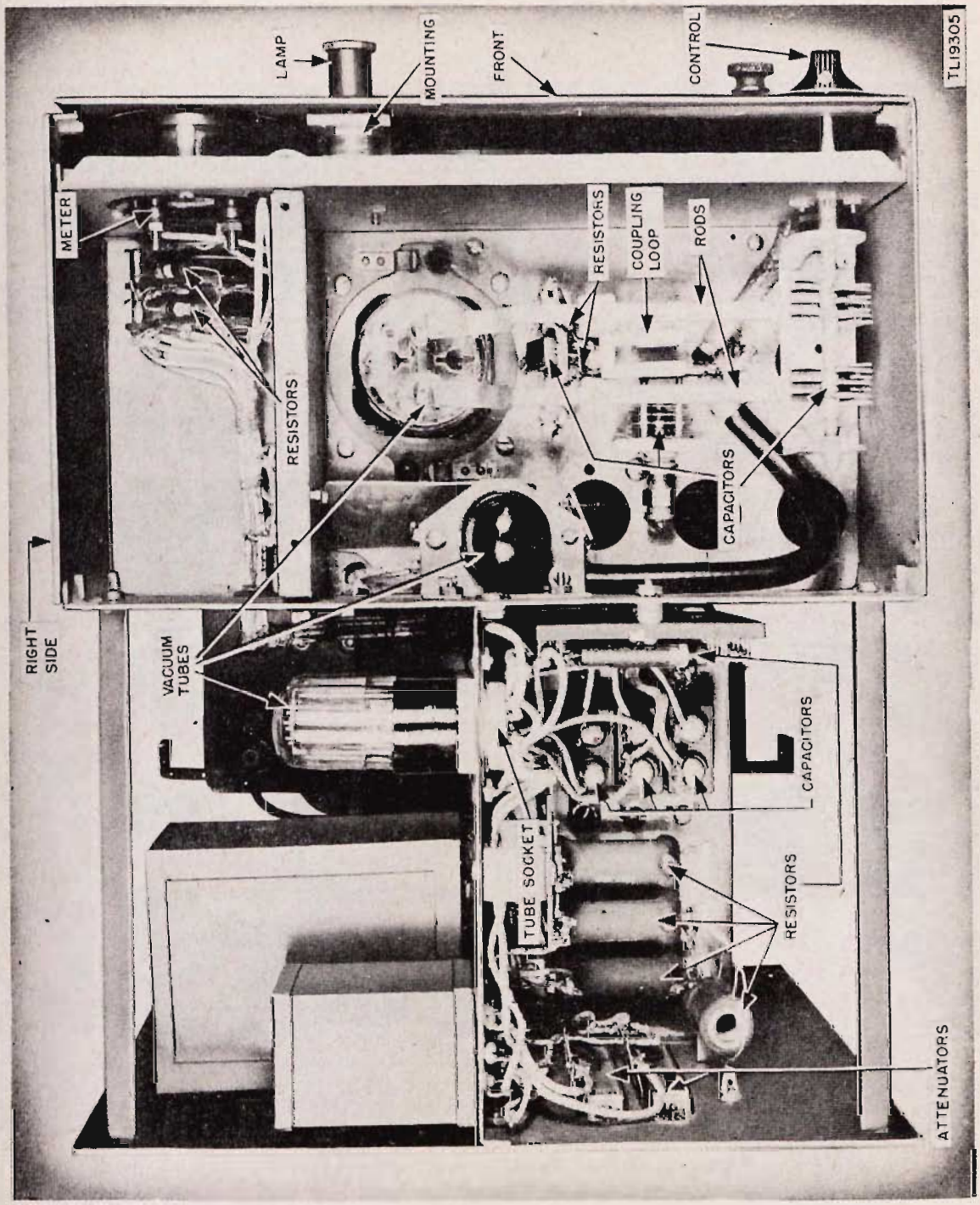

Figure 58. Radio Transmitter T-30/TRC-8 (XC-3), typical preventive maintenance, top panel removed.

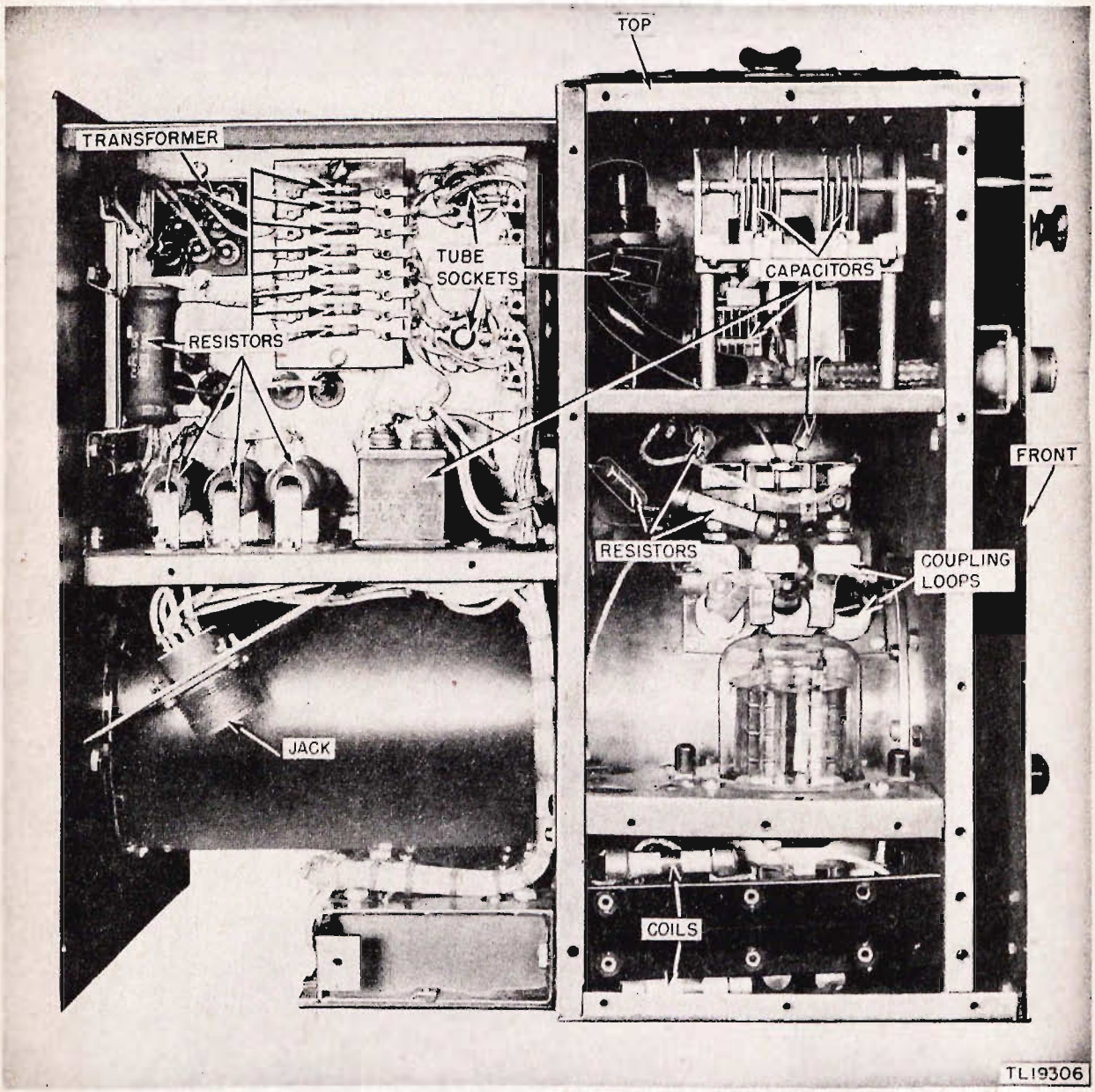

Figure 59. Radio Transmitter T-30/TRC-8 (XC-3), typical preventive maintenance, left side panel removed.

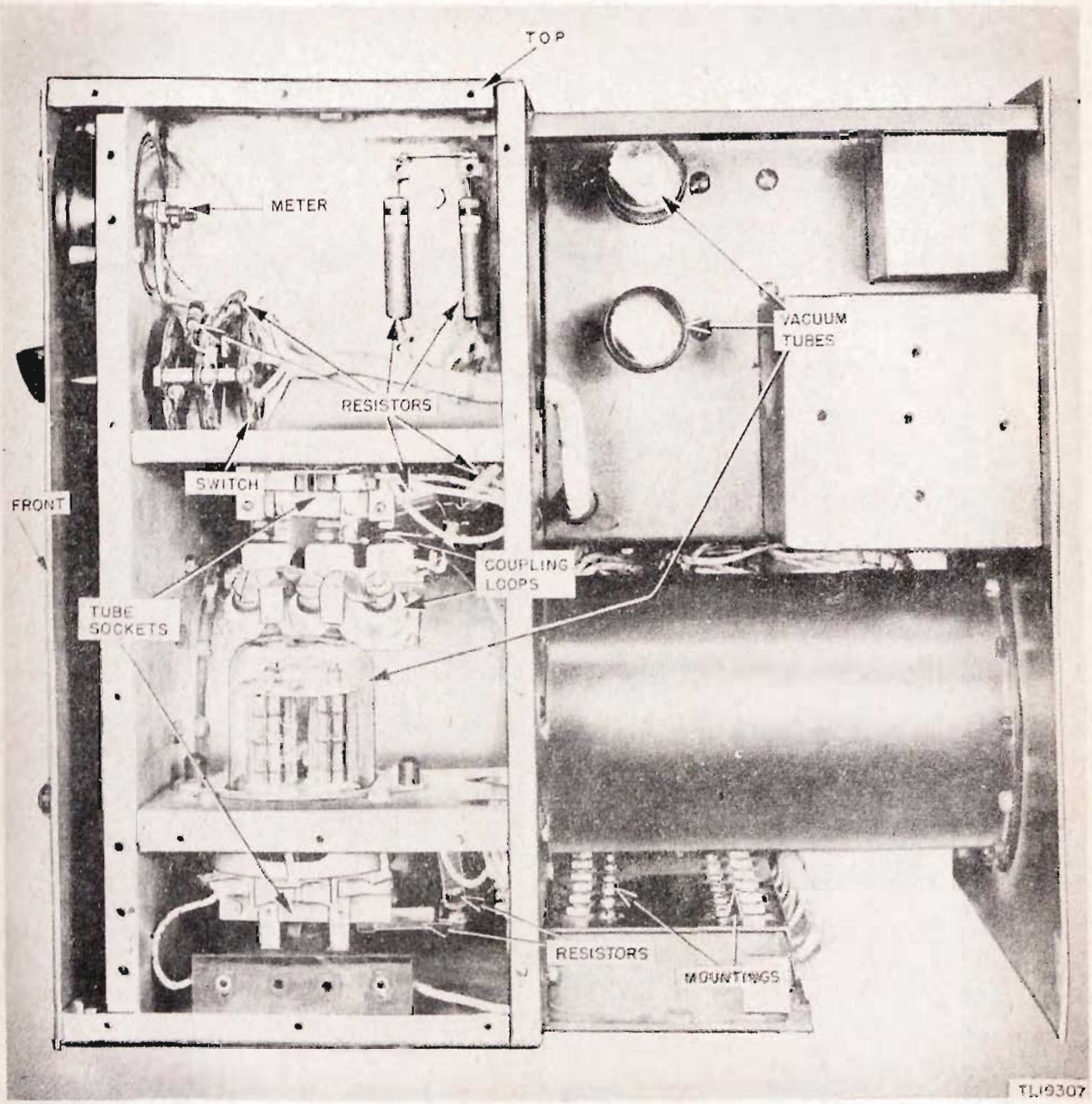

Figure 60. Radio Transmitter T-30/TRC-8 (XC-3), typical preventive maintenance, right side panel removed.

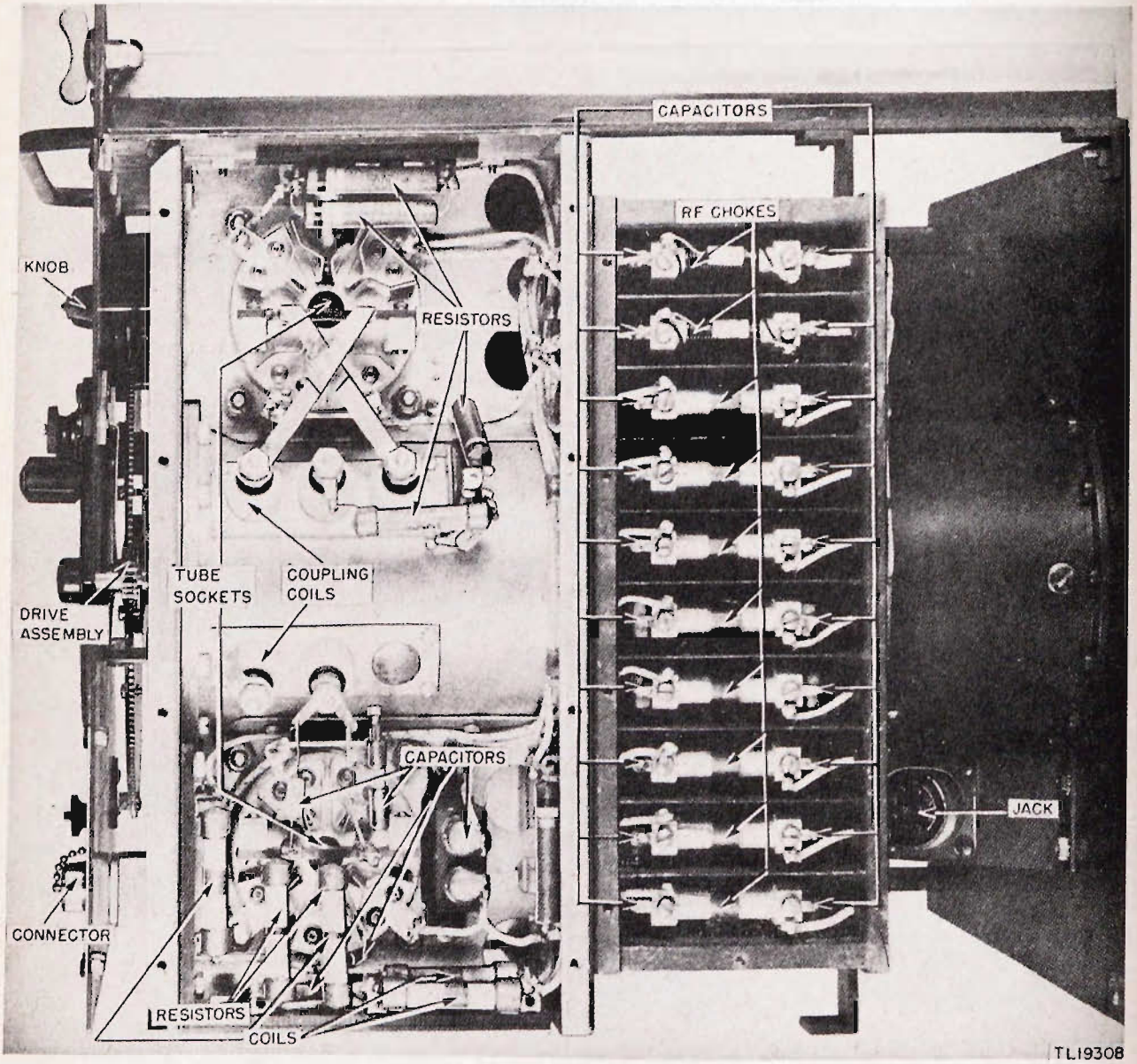

Figure 61. Radio Transmitter T-30/TRC-8 (XC-3), typical preventive maintenance, bottom panel removed.

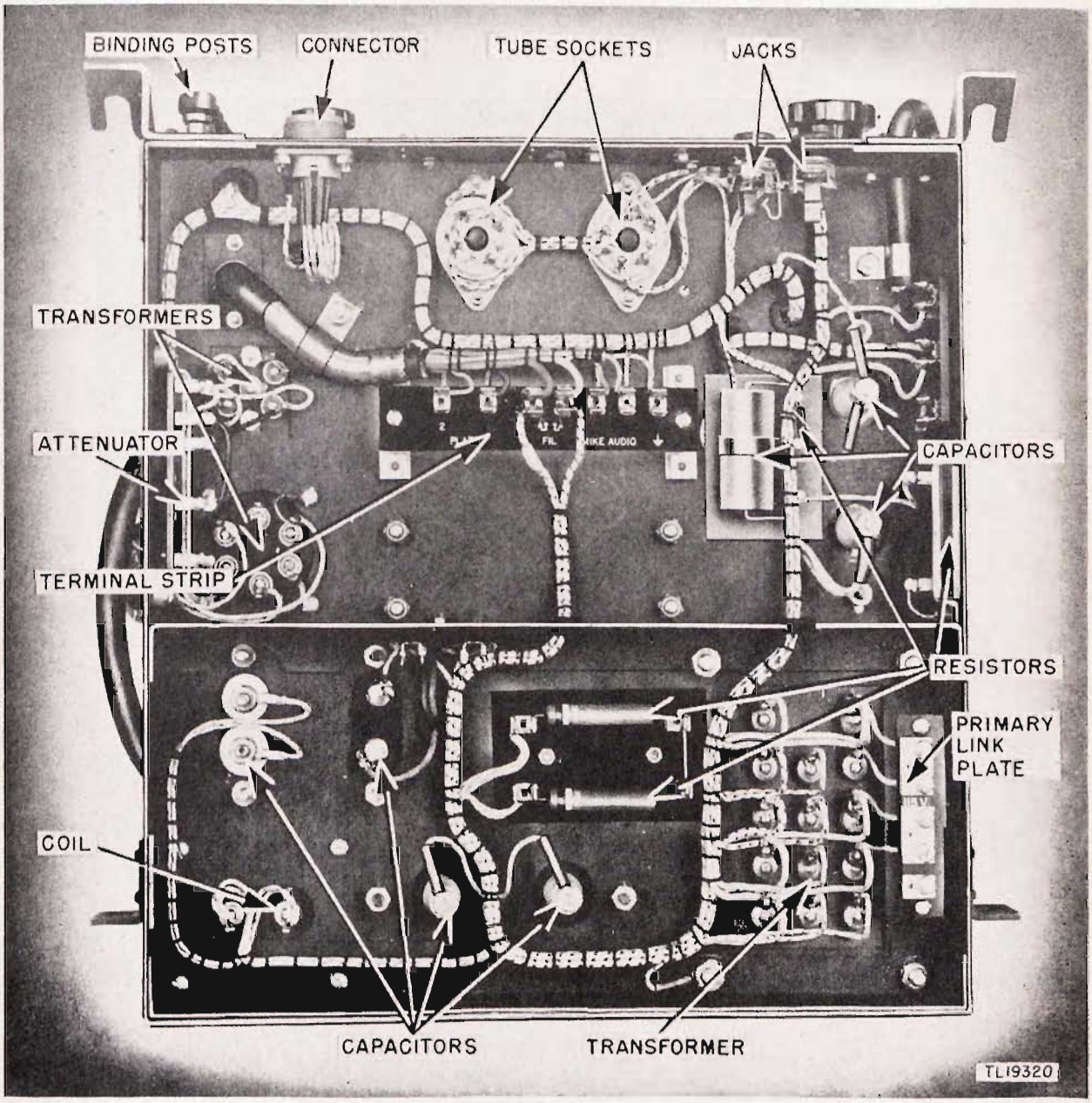

Figure 62. Power Pack PP-115/TRC-8 (XC-3), typical preventive maintenance, bottom view.

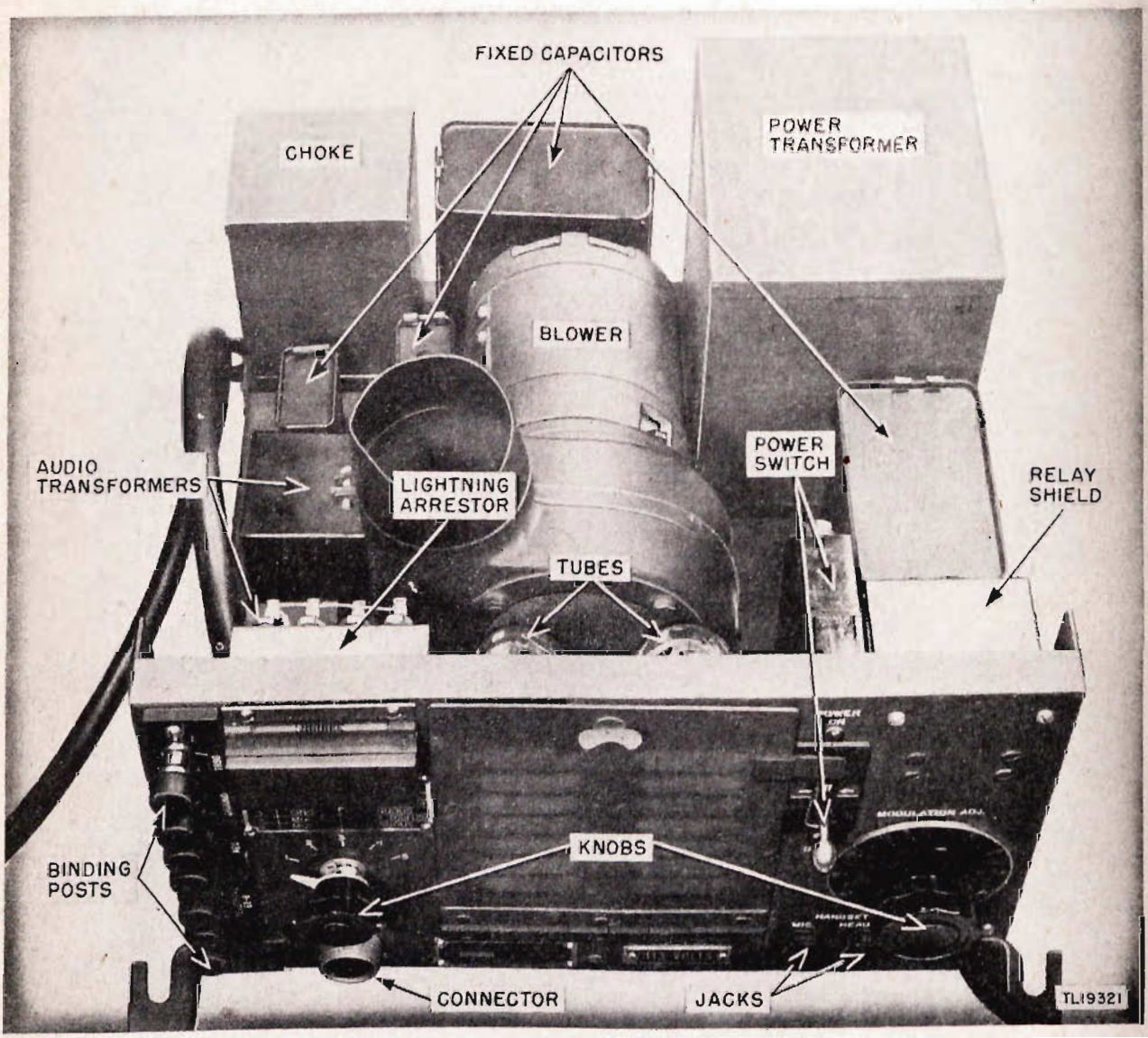

Figure 63. Power Pack PP-115/TRC-8 (XC-3), typical preventive maintenance, front and top view.

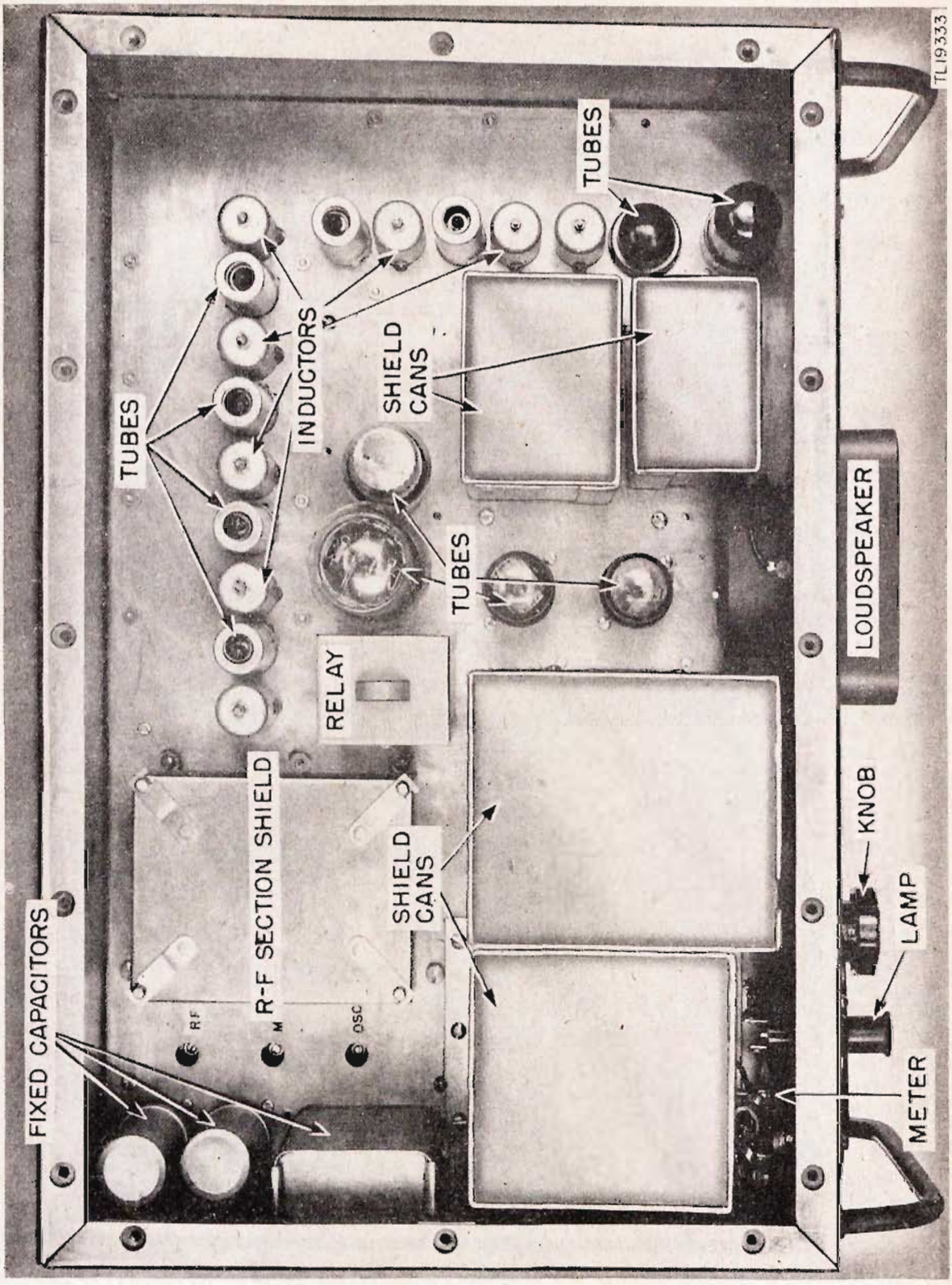

Figure 64. Radio Receiver R-48/TRC-8 (XC-3), typical preventive maintenance, top view.

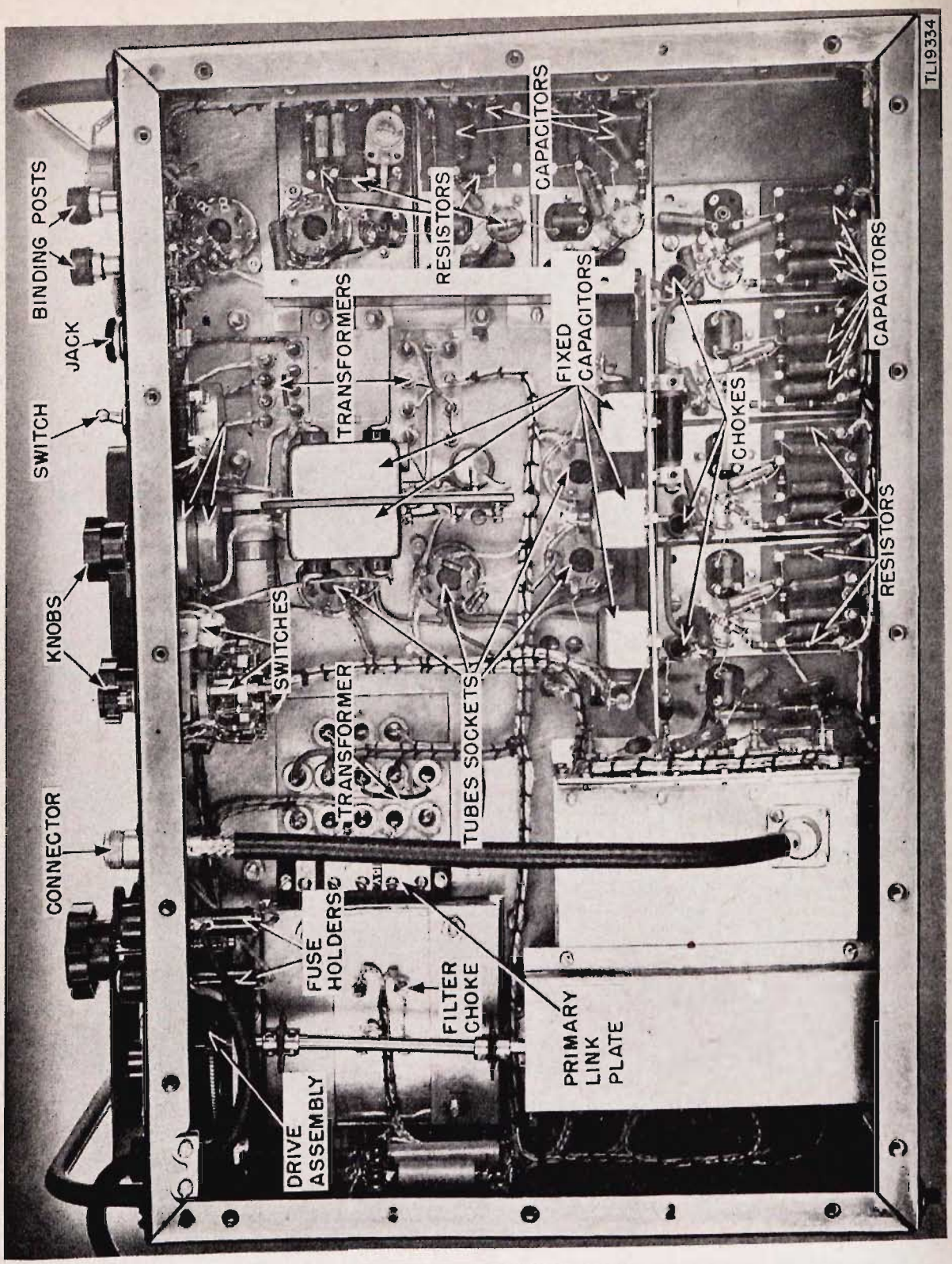

Figure 65. Radio Receiver R-48/TRC-8 (XC-3), typical preventive maintenance, bottom view.

SECTION VIII. LUBRICATION

92. LUBRICATION.

There is no lubrication order furnished with this equipment. No lubrication is required for the blower motor. For lubrication of Power Unit PE-75-( ), see the TM 11-900 series.

SECTION IX. SPECIAL TOOLS

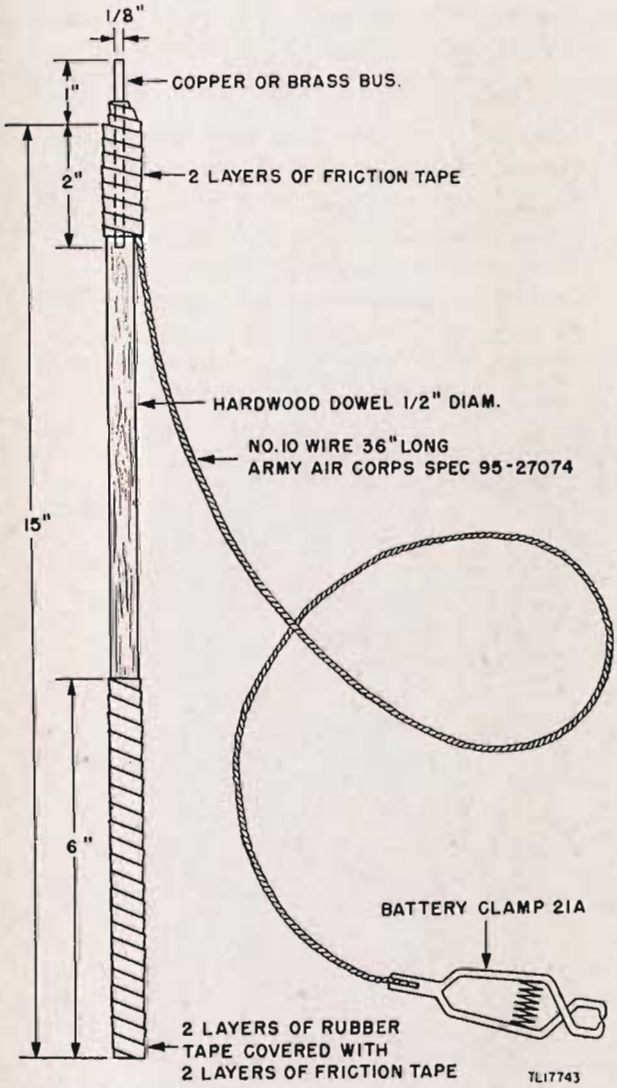

Figure 66. Shorting stick.

93. SHORTING STICK.

a. General. When the power is shut off on most radio equipment, the capacitors will normally discharge through bleeder resistors or the voltage divider to ground. Occasionally, a failure occurs in a bleeder or voltage divider network, and the capacitors remain charged. If contact is made to a charged capacitor with any part of the human body, severe burns may result. Therefore, as a precautionary measure, discharge capacitors before performing any preventive maintenance or trouble shooting.

b. Manufacture of Shorting Stick. Obtain a hardwood dowel, ½ inch in diameter and 15 inches long. Drill a ⅛-inch hole in the end of the dowel, extending 2 inches from the end (fig. 66). Press fit a piece of copper or brass bus wire into the hole, leaving approximately 1 inch of bus wire extending beyond the limits of the dowel. Solder one end of a 36-inch length of flexible, stranded No. 10 Wire, Air Corps Specification 95-27074 (or equal) to the bus wire, as close to the dowel as possible. Attach a battery clamp No. 21A to the other end of the flexible wire. Apply several layers of friction tape over the soldered connection of the flexible wire and the bus wire, leaving approximately ½ inch of the bus wire extended untaped. Continue the tape from the soldered connection down over the dowel and the insulated wire, firmly attaching the wire to the dowel for a distance of 2 inches from the soldered joint. Apply two layers of rubber tape and two layers of friction tape to the opposite end of the dowel, extending the tape upward 6 inches to form an insulated handle for the shorting stick.

c. Use of Shorting Stick. Connect the battery clamp to any known chassis ground that may be conveniently located near the capacitor to be discharged. Holding the shorting stick by the insulated handle, touch the exposed bus wire to the capacitor terminals.

SECTION X. MOISTUREPROOFING AND FUNGIPROOFING

94. GENERAL.

When operated in tropical areas where temperature and relative humidity are extremely high, Signal Corps equipment requires special attention. These are some of the problems met:

a. Resistors, capacitors, coil, chokes, transformer windings, etc., fail because of the effects of fungus growth and excessive moisture.

b. Electrolytic action, often visible in the form of corrosion, takes place in resistors, coils, chokes, transformer windings, etc., causing eventual break-down.

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

d. Moisture forms electrical leakage paths on terminal boards and insulating strips, causing flash-overs.

95. TREATMENT.

A moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection against fungus growth, 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. Refer to 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 poisonous effects if inhaled. To avoid inhaling spray, use respirator if available; otherwise, fasten cheesecloth or other cloth material over nose and mouth. Never spray varnish or lacquer near an open flame. Do not smoke in a room where varnish or lacquer

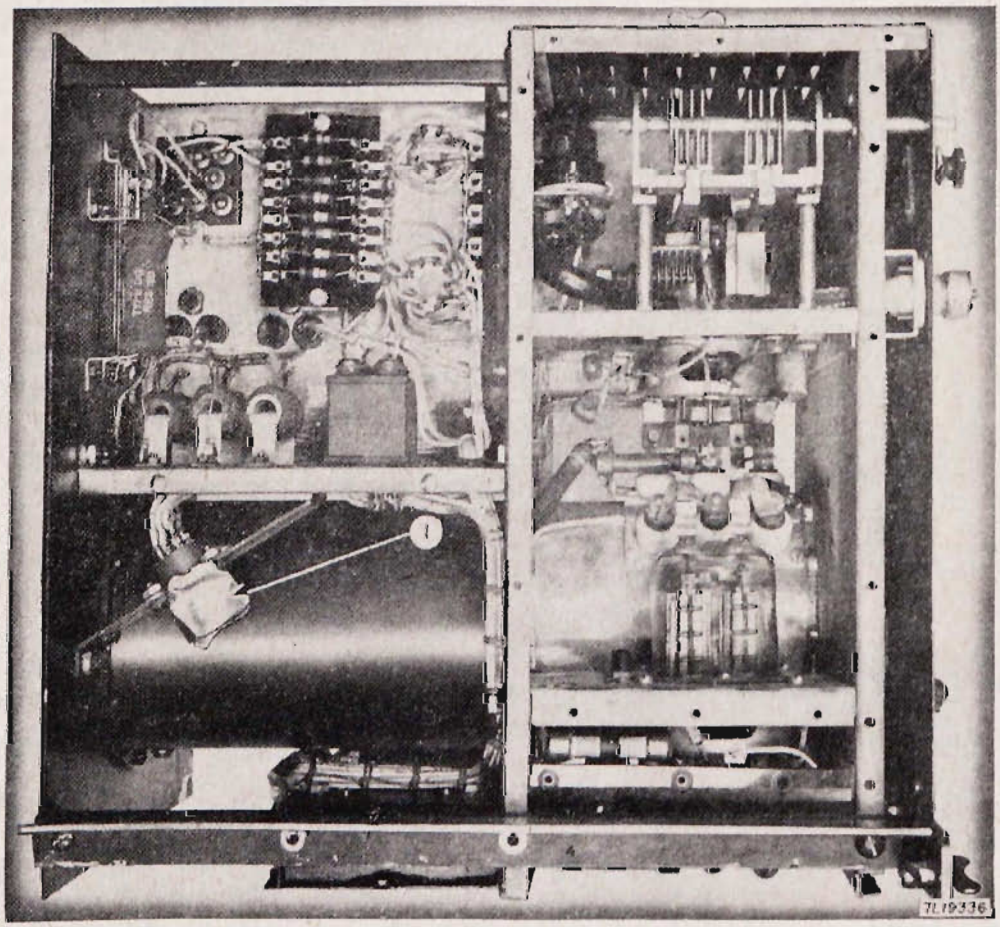

Figure 67. Radio Transmitter T-30/TRC-8 (XC-3), masking details, left side view.

is being sprayed. The spray may be highly explosive.

96. RADIO TRANSMITTER T-30/TRC-8 (XC-3).

a. Preparation. Make all repairs and adjustments necessary for proper operation of the equipment.

b. Disassembly.

(1) Remove unit from chest.

(2) Remove side, top, and bottom plates, exposing components.

(3) Remove modulator, oscillator, and tripler tubes (fig. 46).

NOTE: When replacing tubes, return them to proper socket.

c. Cleaning. Clean all dirt, dust, rust, and fungus from the equipment to be processed. Clean all oil and grease from surfaces to be varnished.

d. Masking.

(1) Mask connector plug (item 1, fig. 67).

(2) Mask meter switch (item 1, fig. 68).

e. Drying. Place equipment in oven under heat lamps and dry for 2 or 3 hours at 160° F.

f. Varnishing.

(1) Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, Spec No. 71-2202 (Stock No. 6G1005.3), or equal). Allow each coat to air-dry for 15 or 20 minutes before applying the next coat.

(2) Apply varnish immediately after the equipment is dried. If varnish is not applied immediately, moisture condenses on the equipment. Varnish applied over the moisture peels off readily after the varnish has dried.

(3) Spray varnish on equipment. Do not spray varnish into oscillator, modulator, and tripler compartments. Brush coat all wires and components.

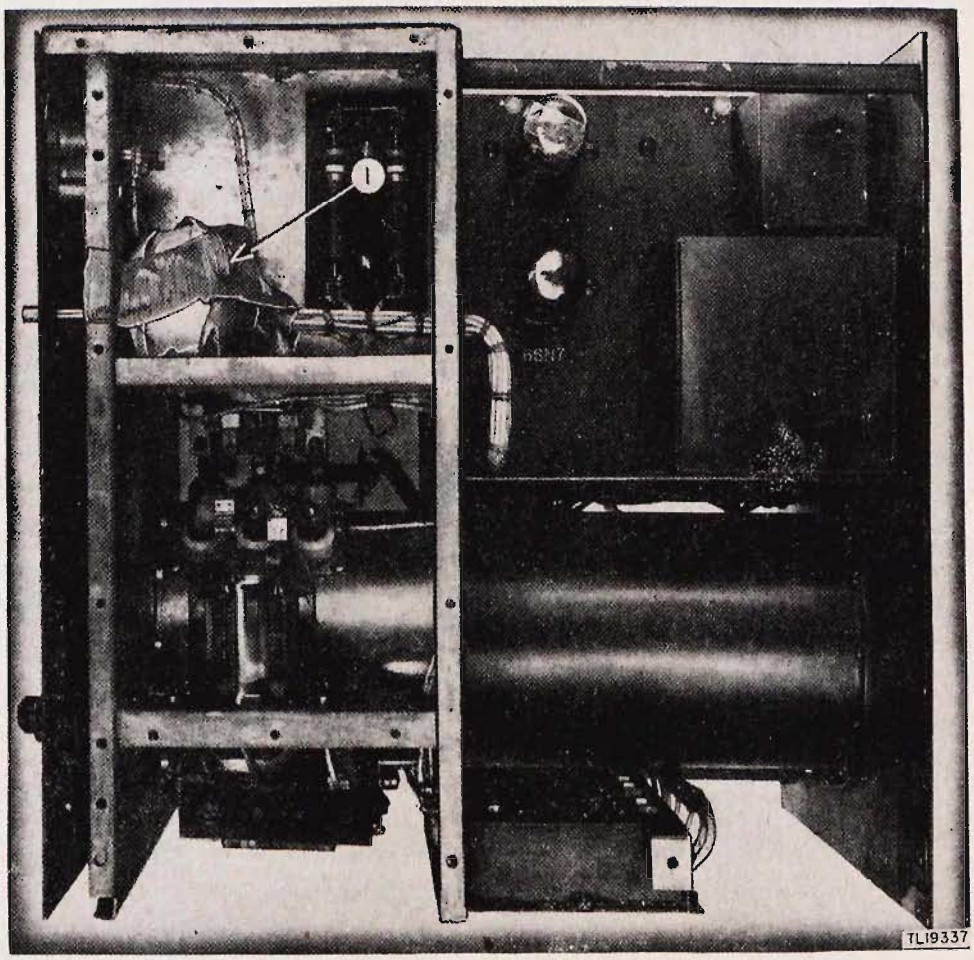

Figure 68. Radio Transmitter T-30/TRC-8 (XC-3), masking details, right side view.

g. Reassembly.

(1) Remove all masking tape, being careful not to peel varnish from nearby areas.

(2) Reassemble the set and test its operation.

h. Marking. Mark the letters MFP and the date of treatment near the nameplate.

EXAMPLE: MFP—8 Dec 44.

97. POWER PACK PP-115/TRC-8 (XC-3).

a. Preparation. Make all repairs and adjustments necessary for proper operation of the equipment.

b. Disassembly.

(1) Remove unit from chest.

(2) Remove rectifier tubes.

c. Cleaning. Clean all dirt, dust, rust, and fungus from the equipment to be processed. Clean all oil and grease from surfaces to be varnished.

d. Masking.

(1) Mask microphone and headset jacks (item 1, fig. 69).

(2) Mask relay (item 1, fig. 70).

(3) Mask TYPE OF OPERATION switch (item 2, fig. 70).

(4) Mask sockets of rectifier tubes.

e. Drying. Place equipment in oven under heat lamps and dry for 2 or 3 hours at 160° F.

f. Varnishing.

(1) Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, Spec No. 71-2202 (Stock No. 6G1005.3), or equal). Allow each coat to air-dry for 15 or 20 minutes before applying the next coat.

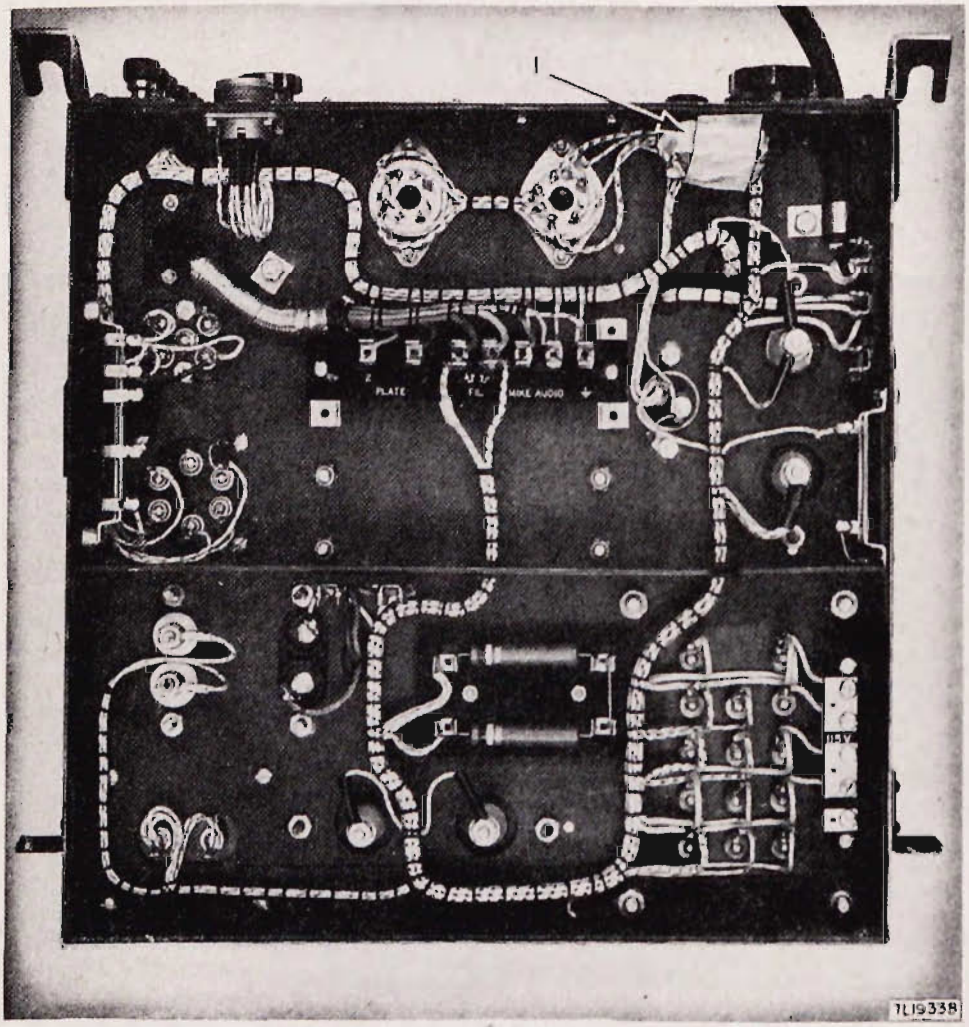

Figure 69. Power Supply PP-115/TRC-8 (XC-3), masking details, bottom view.

(2) Apply varnish immediately after the equipment is dried. If the varnish is not applied immediately, moisture condenses on the equipment. Varnish applied over the moisture peels off readily after the varnish has dried.

(3) The spray method of varnishing is used.

g. Reassembly.

(1) Remove all masking tape, being careful not to peel varnish from nearby areas.

(2) Reassemble the set and test its operation.

h. Marking. Mark the letters MFP and the date of treatment near the nameplate.

EXAMPLE: MFP—8 Dec 44.

98. RADIO RECEIVER R-48/TRC-8 (XC-3).

a. Preparation. Make all repairs and adjustments necessary for proper operation of the equipment.

b. Disassembly.

(1) Remove unit from chest.

(2) Remove bottom cover.

(3) Remove shield covering mixer, oscillator, and r-f section (fig. 45).

(4) Remove rectifier and voltage regulator tubes (fig. 45).

(5) Remove cover of loudspeaker.

c. Cleaning. Clean all dirt, dust, rust, and fungus from the equipment to be processed. Clean all oil and grease from surfaces to be varnished.

d. Masking.

(1) Cover and mask mechanical drive (item 1, fig. 71).

(2) Cover and mask meter switch (item 2, fig. 71).

(3) Mask TUNE TEST switch (item 3, fig. 71).

(4) Mask jacks (item 4, fig. 71).

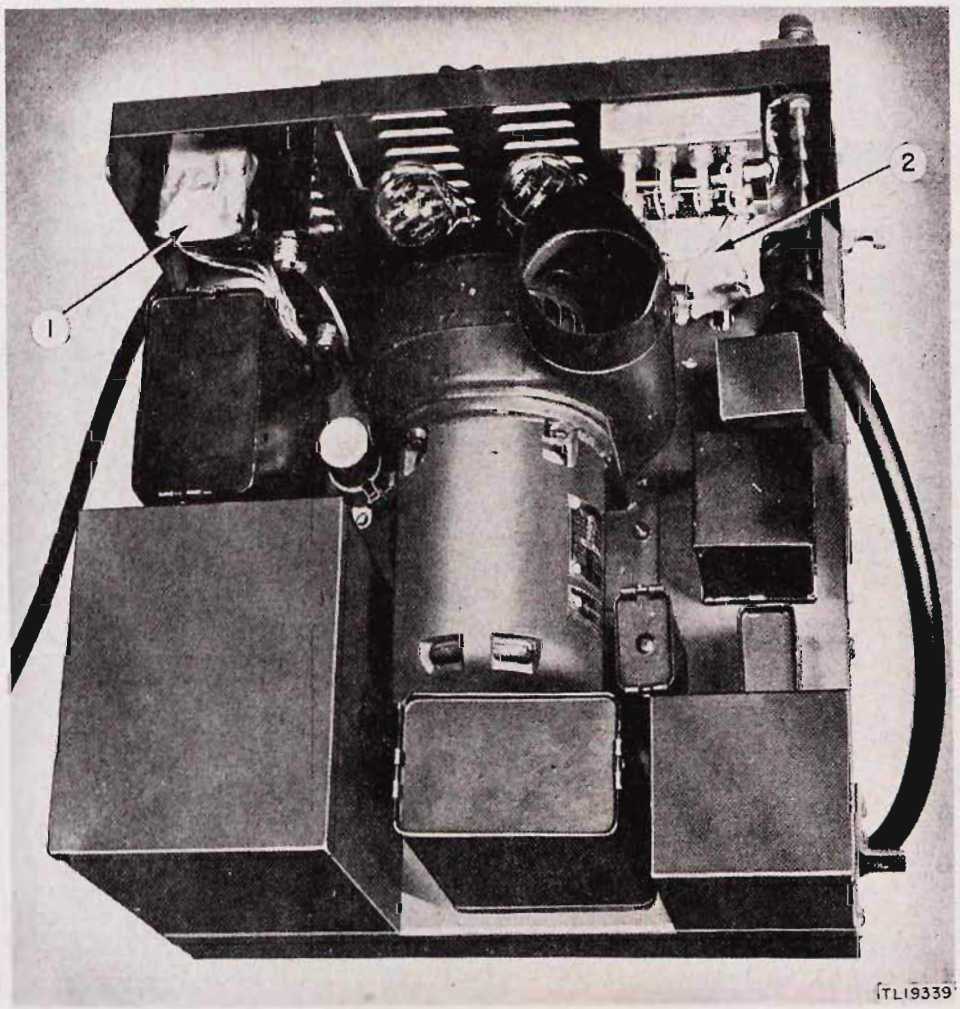

Figure 70. Power Supply PP-115/TRC-8 (XC-3), masking details, top view.

(5) Mask ceramic trimmer (item 5, fig. 71).

(6) Mask opening through chassis to prevent varnish from flowing on relay controls (item 6, fig. 71).

(7) Mask rectifier and voltage regulator tube sockets (on top side of chassis).

e. Drying. Place equipment in oven under heat lamps and dry for 2 or 3 hours at 160° F.

f. Varnishing.

(1) Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, Spec No. 71-2202 (Stock No. 6G1005.3), or equal). Allow each coat to air-dry for 15 or 20 minutes before applying the next coat.

(2) Apply varnish immediately after the equipment is dried. If varnish is not applied immediately, moisture condenses on the equipment. Varnish applied over the moisture peels off readily after the varnish has dried.

(3) Spray all components except the loudspeaker cone. Use the brush method on the latter.

g. Reassembly.

(1) Remove all masking tape, being careful not to peel varnish from nearby areas.

(2) Reassemble the set and test its operation.

h. Marking. Mark the letters MFP and the date of treatment near the nameplate.

EXAMPLE: MFP—8 Dec 44.

99. TEST OSCILLATOR TS-237/TRC-8 (XC-3).

a. Preparation. Make all repairs and adjustments necessary for proper operation of the equipment.

b. Disassembly. Remove four screws holding top cover to box and remove test unit.

c. Cleaning. Clean all dirt, dust, rust, and fungus from the equipment to be processed. Clean all oil and grease from surfaces to be varnished.

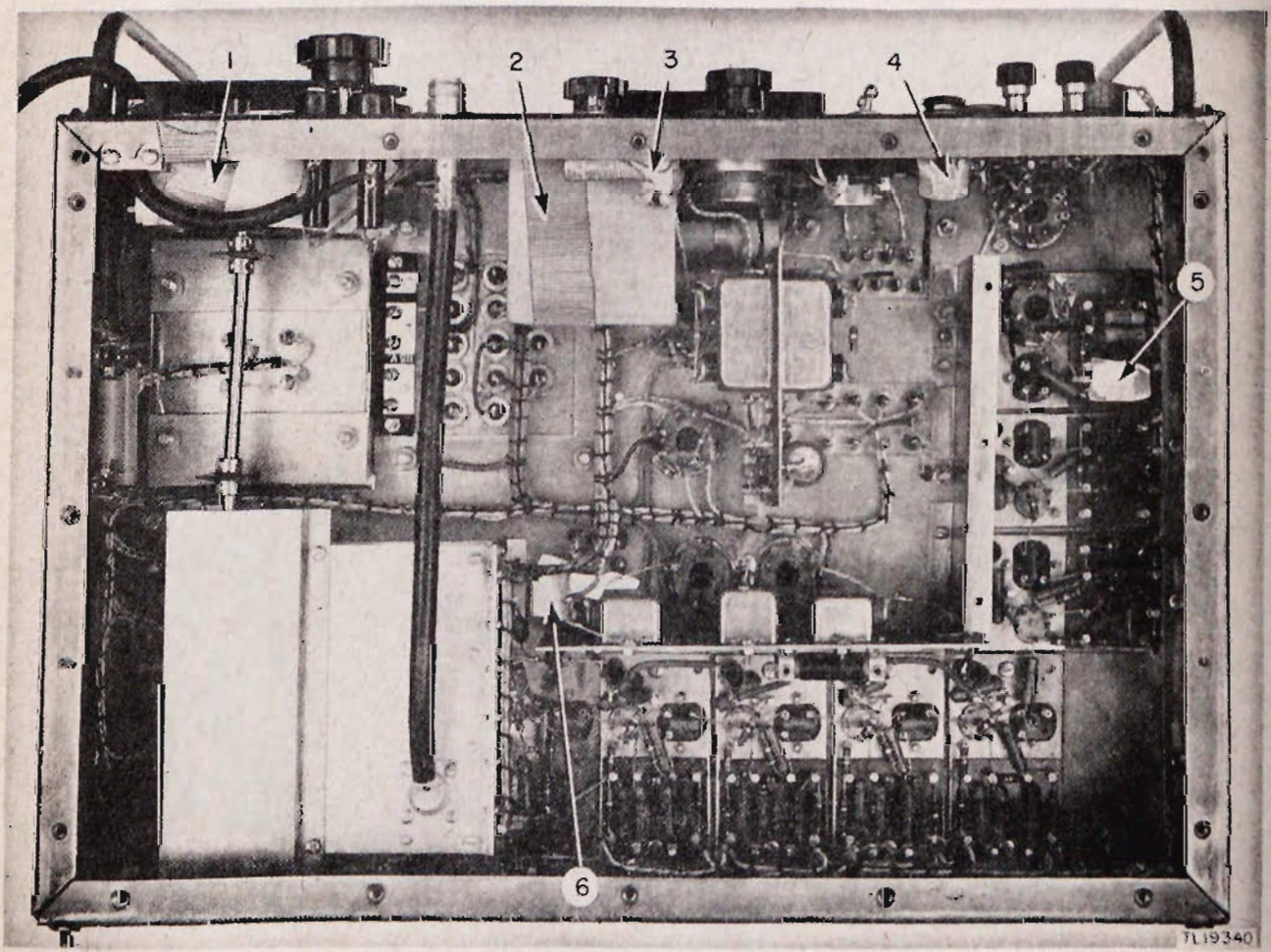

Figure 71. Radio Receiver R-48/TRC-8 (XC-3), masking details, bottom view.

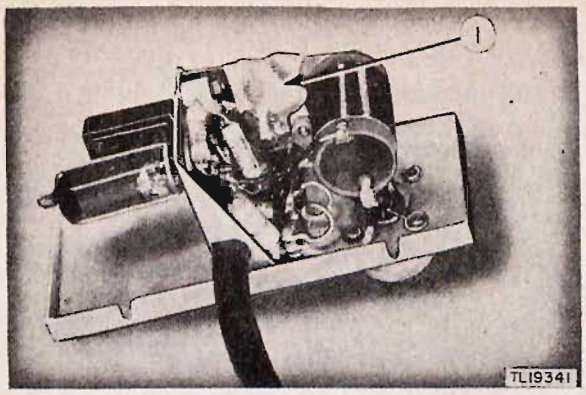

Figure 72. Test Oscillator TS-237/TRC-8 (XC-8), masking details.

d. Masking. Mask ceramic trimmer (item 1, fig. 72).

e. Drying. Place equipment in oven under heat lamps and dry for 2 or 3 hours at 160° F.

f. Varnishing.

(1) Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, Spec No. 71-2202 (Stock No. 6G1005.3), or equal. Allow each coat to air-dry for 15 or 20 minutes before applying the next coat.

(2) Apply varnish immediately after the equipment is dried. If varnish is not applied immediately, moisture condenses on the equipment. Varnish applied over the moisture peels off readily after the varnish has dried.

(3) Spray all components except crystal. Treat crystal by dipping into varnish, up to but not on pins.

g. Reassembly.

(1) Remove all masking tape, being careful not to peel varnish from nearby areas.

(2) Reassemble the test oscillator and test its operation.

h. Marking. Mark the letters MFP and the date of treatment near the nameplate.

EXAMPLE: MFP—8 Dec 44.

100. CONTROL BOX C-21A/TRC-1.

a. Preparation. Make all repairs and adjustments necessary for proper operation of the equipment.

b. Disassembly.

(1) Remove bottom cover plate by loosening screws holding cover to side of chassis.

(2) Unscrew bakelite molding on Plugs PL-55 and PL-68 and push molding back approximately 4 inches from end of plug .

c. Cleaning. Clean all dirt, dust, rust, and fungus from the equipment to be processed.

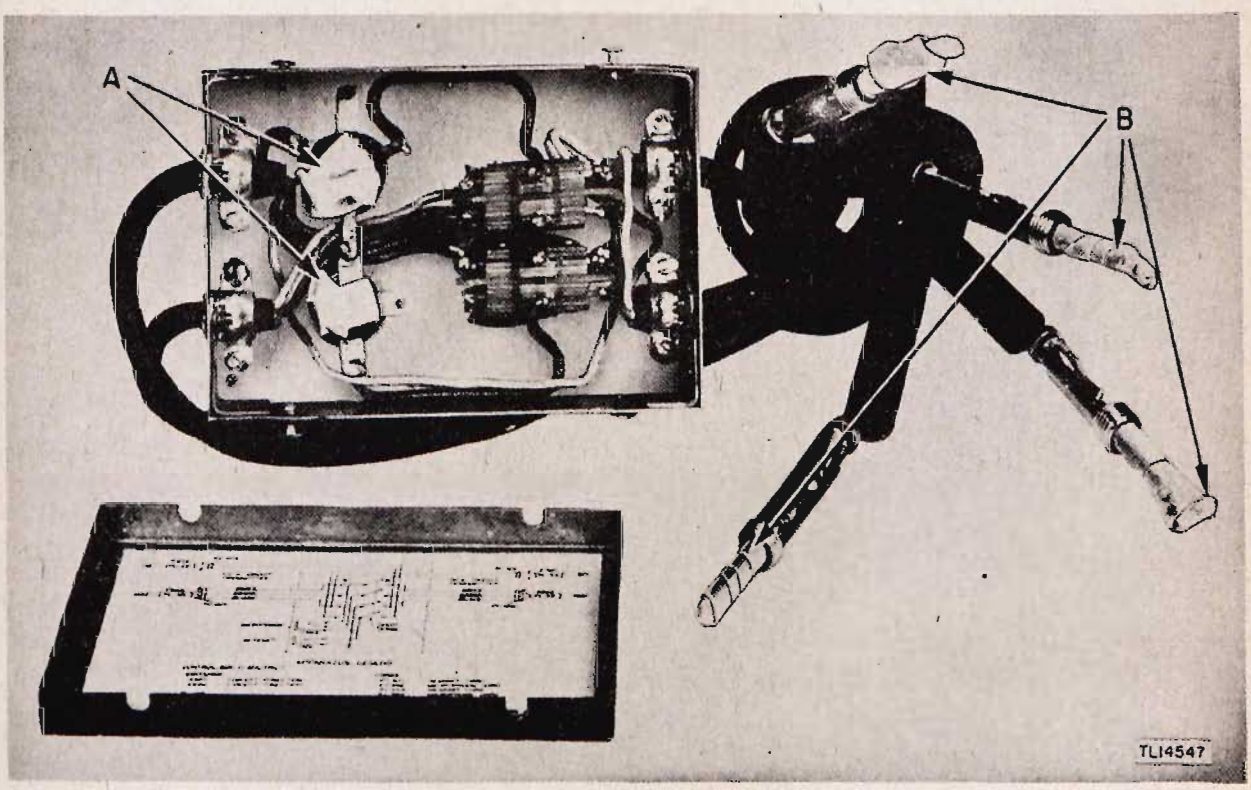

Figure 73. Control Box C-21A/TRC-1, masking details.

Clean all oil and grease from surfaces to be varnished.

d. Masking.

(1) Mask contacts of microphone headset jacks (item A, fig. 73).

(2) Mask sleeve and tips of Plugs PL-55 and PL-68 (item B, fig. 73).

e. Drying. Place equipment in oven under heat lamps and dry for 2 or 3 hours at 160° F.

f. Varnishing.

(1) Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, Spec No. 71-2202 (Stock No. 6G1005.3), or equal). Allow each coat to air-dry for 15 or 20 minutes before applying the next coat.

(2) Apply varnish immediately after the equipment is dried. If varnish is not applied immediately, moisture condenses on the equipment. Varnish applied over the moisture peels off readily after the varnish has dried.

(3) Use the spray method of varnishing.

g. Reassembly.

(1) Remove all masking tape, being careful not to peel varnish from nearby areas.

(2) Reassemble the control box and test its operation.

h. Marking. Mark the letters MFP and the date of treatment near the nameplate.

EXAMPLE: MFP—8 Dec 44.

101. MOISTUREPROOFING AND FUNGIPROOFING AFTER REPAIRS.

If, during repair, the coating of protective varnish has been punctured or broken, and if complete treatment is not needed to reseal the equipment, apply a brush coat to the affected part. Be sure the break is completely sealed.

PART FOUR

AUXILIARY EQUIPMENT

SECTION XI. REMOTE CONTROL EQUIPMENT AN/TRC-2, TELEPHONE TERMINAL CF-1-(*) (CARRIER), AND TELEGRAPH TERMINAL CF-2-(*) (CARRIER)

102. REMOTE CONTROL EQUIPMENT AN/TRA-2.

Remote control of Radio Set AN/TRC-8 (XC-3) is provided when the radio set is used in conjunction with Remote Control Equipment AN/TRA-2 (fig. 74). A detailed discussion of the operation of this auxiliary equipment is found in TM 11-2621. The manual describes the operation of Remote Control Equipment AN/TRA-2 with Radio Set AN/TRC-1. Minor changes in installation and operation are necessary when used with Radio Set AN/TRC-8 (XC-3). The equipment is used with Radio Set AN/TRC-8 in three basic applications: *radio remote control, two-wire; radio remote control, four-wire; and automatic relay operation.* Ra-

Figures 74. Remote Control Equipment AN/TRA-2.

dio remote control, two-wire and four-wire are used with a terminal station. Automatic relay operation is used at a relay station. Before the equipment can be put into operation, the setting of the controls on the receiver-transmitter and remote control equipment must be adjusted as follows.

a. Radio Remote Control, Two-wire.

(1) Connect the equipment as shown in figure 49.

(2) Set LINE SWITCH of Remote Control Unit C-112/TRA-2 to the TWO WIRE position.

(3) Adjust the controls of the transmitter and receiver in the manner described in paragraph 62.

(4) Set TYPE OF OPERATION switch to position 1.

(5) Adjust the receiver controls for squelch operation in the manner described in paragraph 63.

(6) Adjust AUDIO GAIN until the received signal is of sufficient volume at Remote Control Unit C-112/TRA-2.

The HEADSET VOLUME control is at the MED. position.

(7) While the operator at Remote Control Unit C-112/TRA-2 speaks into his microphone, adjust the MODULATION ADJ. at the terminal transmitter so that the meter reads 1.0 on voice peaks. Proceed with system line-up as described in paragraph 67, except that the voice modulation originates at Remote Control Unit C-112/TRA-2.

b. Radio Remote Control, Four-wire.

(1) Connect as shown in figure 50.

(2) Set LINE SWITCH of Remote Control Unit C-112/TRA-2 to FOUR WIRE position.

(3) Adjust the controls of the transmitter and receiver in the manner described in paragraph 62.

(4) Set TYPE OF OPERATION switch to position 1.

(5) Adjust the receiver for squelch operation in the manner described in paragraph 63.

(6) Adjust AUDIO GAIN until the received signal is of sufficient volume at Remote Control Unit C-112/TRA-2.

(7) Adjust the MODULATION ADJ. control as for radio remote control, two-wire.

c. Automatic Relay Operation.

(1) Connect the equipment as shown in figure 51.

(2) Set LINE SWITCH of Remote Control Unit C-112/TRA-2 to TWO WIRE position.

(3) Adjust the controls of the receiver and transmitter as described in paragraph 62.

(4) Set TYPE OF OPERATION switch to position 2.

(5) Set SQUELCH switch to ON position and adjust SQUELCH ADJ. in the manner described in paragraph 63.

(6) Adjust AUDIO GAIN as described in paragraph 67.

103. TELEPHONE TERMINAL CF-1-(*) (CARRIER).

This telephone terminal provides four channels of communication which are fed to the radio terminal station over a single spiral-four cable. The radio terminal station transmits these four messages over a single radio carrier towards another radio terminal station, the output of which is then fed to a second telephone terminal whose output is the original four messages. Further information regarding the telephone terminal is available in TM 11-341.

104. TELEGRAPH TERMINAL CF-2-(*) (CARRIER).

The telegraph terminal provides four telegraph channels of communication when connected to any one channel of Telephone Terminal CF-1-(*) (Carrier). The four telegraph channels may terminate in teleprinters or teletypewriters. Telegraph Terminal CF-2-A (Carrier) is similar to and performs the same functions as Telegraph Terminal CF-2-B (Carrier). Telegraph Terminal CF-2-A (Carrier) is mechanically constructed as two components or bays whereas Telegraph Terminal CF-2-B (Carrier) is constructed as one unit. Refer to TM 11-355 and TM 11-355B for further information.

105. REFERENCES.

For information on the auxiliary equipment discussed herein, consult the following publications:

a. TM 11-341, Telegraph Terminal CF-1-A (Carrier) and Repeater CF-3-A (Carrier).

b. TM 11-342, Ringing Equipment EE-100-T1, EE-100-A (Voice Frequency) and EE-101-A (Voice Frequency).

c. TM 11-354, Telegraph Printer Sets (Teletypewriter) EE-97 and EE-98, Teletypewriter Sets EE-97-A, EE-98-A, and EE-102.

d. TM 11-355, Telegraph Terminal CF-2-A (Carrier).

e. TM 11-355B, Telegraph Terminal CF-2-B (Carrier).

f. TM 11-358, Telegraph Central Office Set TC-3.

g. TM 11-369, Spiral-Four Cable.

h. TM 11-2201, Reperforator Teletypewriter Sets TC-16 and TC-17.

i. TM 11-2621, Remote Control Equipment AN/TRA-2.

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PART FIVE

REPAIR INSTRUCTIONS

NOTE: Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on W.D., A.G.O. Form No. 468 (Unsatisfactory Equipment Report); by Army Air Forces, on Army Air Forces Form No. 54 (unsatisfactory report). If either form is not available, prepare the data according to the sample form reproduced in figure 134.

SECTION XII. SYSTEM FUNCTIONING

106. GENERAL.

a. Radio Set AN/TRC-8 (XC-3), Radio Terminal Set AN/TRC-11 (XC-3), and Radio Relay Set AN/TRC-12 (XC-3) are designed to provide point-to-point radio communication circuits over relatively short distances (about 25 miles). The range is extended 100 miles or more by using automatic relay stations spaced at intervals of approximately 25 miles (fig. 5).

b. The equipment has been designed with a high-fidelity audio-frequency characteristic to permit the radio relaying of multichannel carrier telephone circuits, such as those developed for use with the spiral-four cable. In this system, four conversations can be held at the same time. The four channels occupy an audio-frequency spectrum of 200 to 11,600 cycles. Channel 1, occupying the frequency range of 200 to 2,800 cycles, is a normal telephone circuit. The three remaining channels occupy the frequencies between 3,000 and 11,600 cycles and are single sideband, suppressed-carrier circuits. (Refer to TM 11-341, TM 11-335, TM 11-355B, and TM 11-342 for complete information on Telephone Terminal CF-1-A (Carrier), Telegraph Terminal CF-2-A (Carrier), Telegraph Terminal CF-2-B (Carrier), and Ringing Equipment EE-101-A, respectively.) These four channels are simultaneously applied to the transmitter as though they were a single audio signal. This audio signal is then transmitted over the radio circuits on a single radio channel. At the distant end the output signal of the receiver is fed to another carrier telephone terminal, over spiral-four cable, where the signal is separated into the original four channels.

c. The transmission over channel 1 of this system is normally used only for purposes of servicing and checking the system. Signals on channels 2, 3, and 4, are not intelligible to any party, friendly or hostile, unless they have special receiving equipment similar to Telephone Terminal CF-1-(*) (Carrier). It must be assumed that the enemy has the special equipment. Therefore, the security of the communication circuit is limited and no secrecy is assured on any channel.

d. At a relay station, the signals from the distant transmitter are received, amplified, demodulated, and applied to the audio-frequency input of another transmitter which relays the same multichannel a-f signals to a further station without change other than the use of a different radio frequency. At the radio terminal stations or at the radio relay stations, only channel 1 can be monitored by the operators. In cases where only one audio channel is in use and no carrier telephone circuits are applied, the full modulation capabilities of the radio equipment may be concentrated on the single speech channel with an attendant increase in signal strength.

e. Under certain conditions it is desirable to have the transmitters off the air except when actually transmitting intelligence. To make this possible, all equipment is so designed that, when desired, the relay stations may be squelch-operated. In this type of operation, a signal picked up by a receiver automatically turns on the associated transmitter which relays the signal to the next station. When there is no received signal, the transmitter is automatically turned off to stand by for the next

message. In all modes of operation the operator at any terminal or relay station can plug in and talk to other stations on the circuit on channel 1 without interfering with the other three channels.

107. MULTICHANNEL RADIO-RELAY SYSTEM.

a. The block diagram of the multichannel relay system (fig. 5) shows Telephone Terminal CF-1-(*) (Carrier) connected to Radio Transmitter T-30/TRC-8 (XC-3) and Radio Receiver R-48/TRC-8 (XC-3) by a length of spiral-four cable or, for short distances, by two pairs of Wire W-110-B. The cording diagram (fig. 48) for the terminal station of this system shows how the spiral-four cable is connected to the radio equipment and Telephone Terminal CF-1-(*) (Carrier).

b. The four channels leave the TRSG terminals of Telephone Terminal CF-1-(*) (Carrier) as audio frequencies which range between 200 and 11,600 cycles. These signals are carried over two conductors of the spiral-four cable to the TRSG binding posts on Radio Transmitter T-30/TRC-8 (XC-3) located at the radio terminal station (fig. 48). These modulated signals are transmitted through successive relay stations (fig. 5) to the receiver of the opposite radio terminal station. The audio output from this radio receiver goes over two conductors of the interconnecting cable, Cord CX-104/TRC-1, to the REC. binding posts on the transmitter and is then sent through the spiral-four cable to the REC. binding posts on Telephone Terminal CF-1-(*) (Carrier). The telephone terminal divides the signals into the proper channels (CH-1, CH-2. CH-3, and CH-4).

c. Any radio operator using Handset H-23/U, plugged into the HEADSET and MIC. jacks on the transmitter, can monitor channel 1 and communicate with any other station on the same frequency band as channel 1 (200 to 2,800 cycles per second) without interfering with transmission on any of the other three channels.

d. Telephone EE-8-A, connected to the radio transmitting binding posts labeled TELEPHONE EE-8, can be used by the radio terminal operator to call the telephone terminal operator over a phantom circuit of the spiral-four cable. This circuit may be used without interfering with the four carrier channels of communication and is useful only between telephone and radio terminals.

108. FOUR-CHANNEL RADIO-RELAY TELEPHONE COMMUNICATION.

Telephone Terminal CF-1-(*) (Carrier), at each of the two terminal stations A and B, has four input circuits labeled CH-1, CH-2, CH-3, and CH-4, as indicated in the block diagram, figure 5. Each input channel may be supplied by a Telephone EE-8-A located at any distance up to 5 miles from the telephone terminal unit, or each channel may terminate in a telephone switchboard. Normally, when a channel is used for telephone communication, it is fed to Telephone Terminal CF-1-(*) (Carrier) through Ringing Equipment EE-101-A (Voice Frequency). The ringing equipment at terminal A, for example, converts the ringing current generated in each of the field telephones (or in the switchboard) into a 1,000-cycle tone, modulated at 20 cycles, which passes through the communication system to Telephone Terminal CF-1-(*) (Carrier) at the opposite terminal and then passes into the channel corresponding to the ringing channel. The 1,000-cycle tone is then converted back into a ringing current by Ringing Equipment EE-101-A installed in a similar manner at terminal B.

109. FOUR-CHANNEL RADIOTELEGRAPH AND FACSIMILE COMMUNICATION.

a. Any one of channels CH-2, CH-3, or CH-4 may be used for telegraph or facsimile transmission instead of telephone. Channel 1 is not ordinarily used for telegraph or facsimile since it is useful as a maintenance channel.

b. The channels which are used for telegraph or facsimile do not go through Ringing Equipment EE-101-A (Voice Frequency).

110. TELEPHONE TERMINAL CF-1-(*) (CARRIER).

a. Communications originating at the telephone of CH-1 of Telephone Terminal CF-1-(*) (Carrier) enter channel 1 and are passed

through a filter which confines the frequencies of channel 1 to a band of from 200 to 2,800 cycles. The signal leaves the TRSG terminals of the telephone terminal set at a level of 0 dbm (dbm = decibels above 1 milliwatt; 0 dbm = 1 milliwatt).

b. Communications originating at the telephone of CH-2 enter channel 2 input, and are mixed with an oscillator. The inverted lower side band, produced as a result of the mixing, passes through a band-pass filter which confines the intelligence on channel 2 to a frequency band of 3,100 to 5,700 cycles. The signal leaves the TRSG terminals of the telephone terminal set at a level of 0 dbm.

c. Communications originating at the telephone of CH-3 or CH-4 are converted into side bands in a similar manner except that their respective side-band frequencies are between 6,050 and 8,650 cycles for CH-3, and between 9,000 and 11,600 cycles for CH-4. All four channel outputs are combined and applied to the TRSG terminals of the telephone set.

d. Thus, even though communications enter each of the four channels at ordinary telephone frequencies (200 to 2,800 cycles per second), they leave the TRSG terminals of Telephone Terminal CF-1-(*) (Carrier) as follows:

Channel 1	200 to 2,800 cycles at 0 dbm
Channel 2	3,100 to 5,700 cycles at 0 dbm
Channel 3	6,050 to 8,650 cycles at 0 dbm
Channel 4	9,000 to 11,600 cycles at 0 dbm

Channel 1 enters and leaves at the same frequency. All other channels are elevated in frequency and inverted.

e. These audio frequencies ranging from 200 cycles to 11,600 cycles, depending upon the channel concerned, leave the TRSG binding post of Telephone Terminal CF-1-(*) (Carrier) at a level ranging from 0 dbm to +6 dbm, depending upon the number of channels being used and the level of the signals feeding these channels. The telephone terminal set has a built-in test oscillator which provides a signal for line-up and test purposes. This test signal leaves the TRSG terminals as follows:

Any one of the four channels	0 dbm (1 milliwatt)
Any two of the four channels	+3 dbm (2 milliwatts)
Any three of the four channels	+4.8 dbm (3 milliwatts)
All four channels	+6.0 dbm (4 milliwatts)

111. TRANSMITTER OF RADIO TERMINAL SET AN/TRC-11 (XC-3).

a. From the TRSG terminals of Telephone Terminal CF-1-(*) (Carrier), the audio frequencies go over one pair of the spiral-four cable to the TRSG binding posts on the radio transmitter of Radio Terminal Set AN/TRC-11 (XC-3). The signal is amplified, imposed on a carrier and sent on to the distant terminal station or adjacent radio relay station.

b. The MODULATION ADJ. control provides control for the incoming signal in 1-db steps to compensate for loss of level over the spiral-four cable between Telephone Terminal CF-1-(*) (Carrier) and the radio transmitter at the radio terminal station. There is a loss of 0.8 db per mile of spiral-four cable. It is necessary to compensate for this loss since the transmitter is designed so that it is modulated 100 percent when 1 milliwatt is provided at the TRSG terminals. Thus, any loss along the cable must be made up so that the signal arriving at the transmitter terminals TRSG appears at the modulator of the transmitter at the proper level to modulate the carrier 25 percent of each of the four channels, or 100 percent for all four channels. This adjustment is made at the transmitter of the radio terminal set by rotating the MODULATION ADJ. control for a reading of 0.25 with the meter set on the % MOD. position and with a single test tone sent from the telephone terminal. A reading of 0.25 indicates 25 percent modulation.

112. RADIO RECEIVER OF RADIO TERMINAL STATION.

a. Any communication originating at one station is received at the receiver of the opposite radio terminal station. The audio (high-fidelity) output of the receiver is connected to the REC binding posts on the transmitter

through Cord CX-104/TRC-1 and then over the conductors of the spiral-four cable to the REC. binding posts on Telephone Terminal CF-1-(*) (Carrier).

b. The audio output is also fed to the loudspeaker (low fidelity) of the radio receiver through a filter which eliminates all frequencies above those of channel 1 and prevents them from entering the loudspeaker. This makes it possible to monitor channel 1 only. The output of the loudspeaker amplifier is also connected through Cord CX-104/TRC-1 to Handset H-23/U plugged into the transmitter.

SECTION XIII. THEORY OF RADIO TRANSMITTER T-30/TRC-8 (XC-3) AND POWER PACK PP-115/TRC-8 (XC-3)

113. SIMPLIFIED BLOCK DIAGRAM.

The transmitter is a resonant-line reactance-modulated oscillator operating at one-third of the desired frequency, driving a power amplifier which operates as a frequency tripler (fig. 75). The carrier is frequency-modulated and the power output is approximately 12 watts. Both high-fidelity and low-fidelity speech frequencies are fed into audio amplifier stage V205. The amplified audio signal is coupled into reactance modulator stage V202. Oscillator tube V201 is controlled by the frequency control line (a temperature-compensated transmission line) providing the required frequency stability. Coupling loops from the reactance modulator and tripler tubes also terminate in this line. The output of the reactance modulator tube shifts the oscillator frequency from its nominal value by changing the reactive current present in the

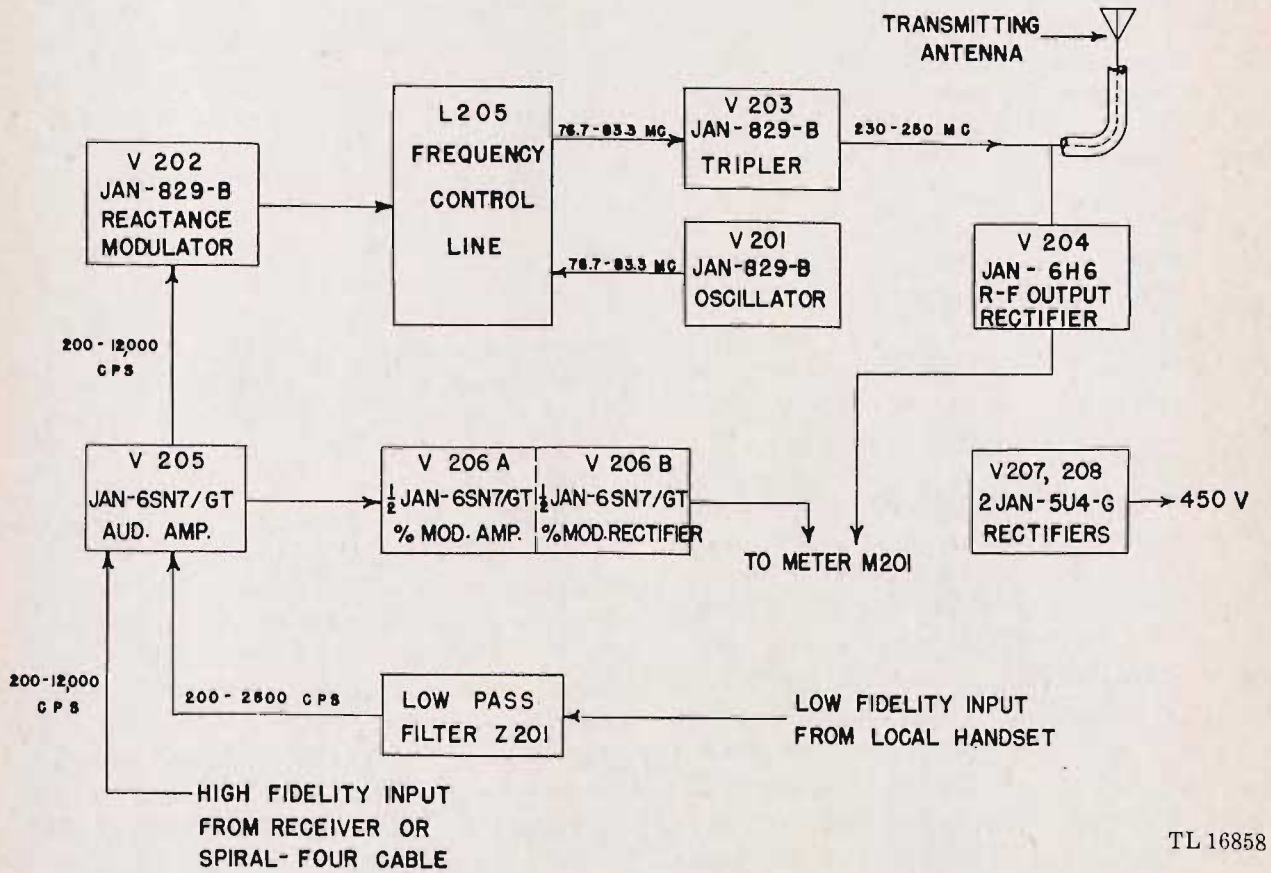


Figure 75. Radio Transmitter T-30/TRC-8 (XC-3), block diagram.

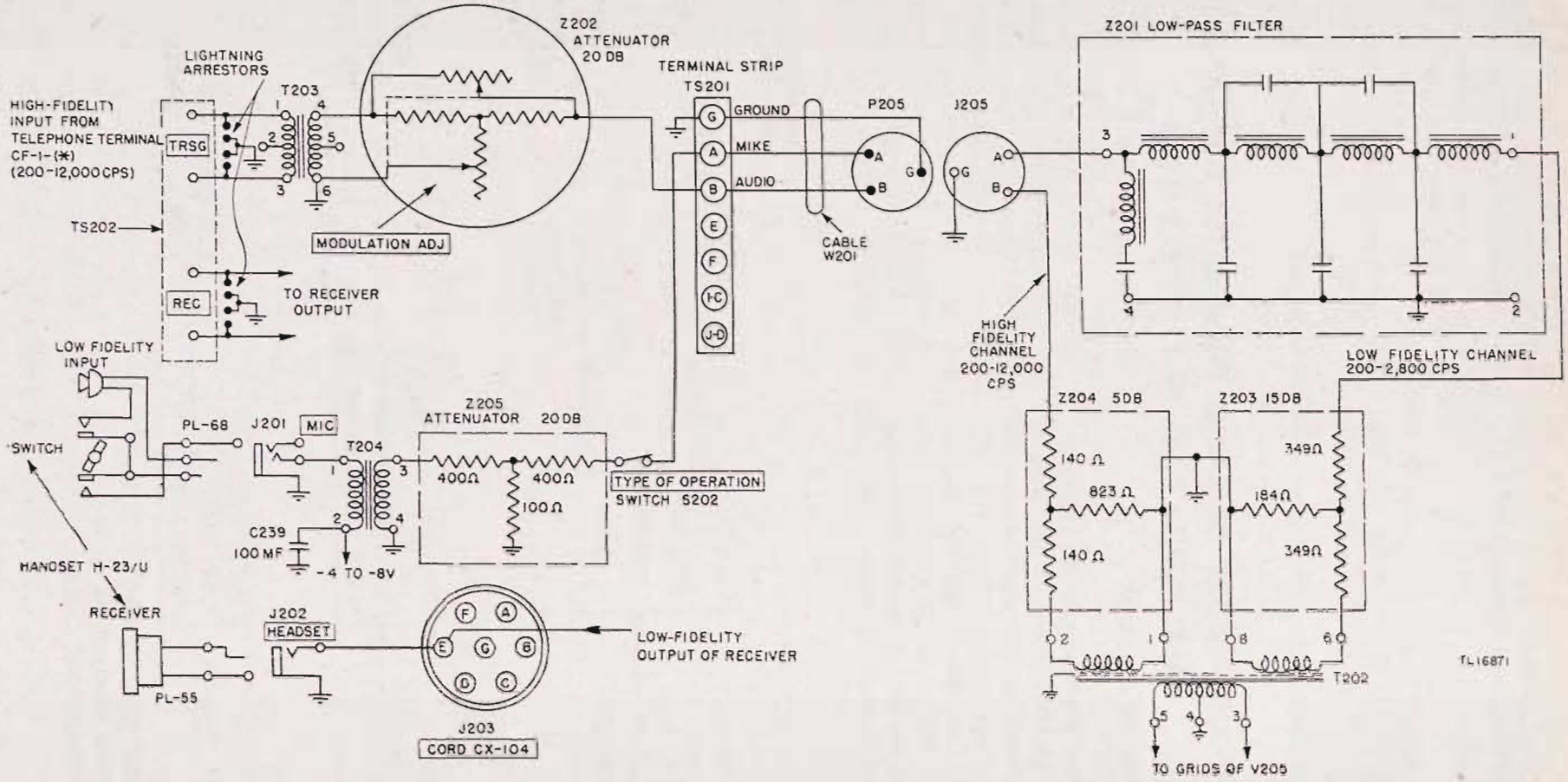


Figure 76. Radio Transmitter T-30/TRC-8 (XC-8), functional diagram of modulation channels.

frequency control line. The oscillator frequency is adjustable from 76.7 to 83.3 mc by the FREQUENCY CONTROL dial. Tripler stage V203 operates at the third harmonic of the oscillator frequency and delivers a final frequency of 230 to 250 megacycles. R-f output rectifier tube V204 and meter M201 in the OUTPUT position are connected across the transmitter output circuit. The meter indicates proper tuning since its reading is proportional to the r-f output. Tube V206 is used as a percent modulation indicator. One half of the tube amplifies a portion of the speech frequencies which are then rectified by the other half. The rectified output is measured by meter M201 which, in the % MOD. position, is calibrated to indicate percentage of modulation. Tubes V207 and V208 are rectifier tubes furnishing 450 v dc. The schematic diagram is shown in figure 136.

114. MODULATION CHANNELS.

a. General. The audio circuits consist of audio components which provide for the adjustment, amplification, and measurement of the audio-frequency signals. There are two audio channels available (fig. 76), a high-fidelity channel (200 to 12,000 cycles) whose input is applied at the binding posts marked TRSG, and a low-fidelity channel (200 to 2,800 cycles) operated by the local handset. The high-fidelity input at a terminal station is Telephone Terminal CF-1-(*). At a relay station, the high-fidelity input is Radio Receiver R-48/TRC-8 (XC-3) connected to the transmitter by Cord CX-104/TRC-1. Lightning arresters are connected to ground from the binding posts marked TRSG and REC to provide a ground path for lightning when spiral-four cable is used.

b. High-fidelity Channel. From the TRSG terminals the high-fidelity signal is fed to the primary of transformer T203. The secondary of transformer T203 is connected to an adjustable 20-db T-pad Z202. At a terminal station this pad provides adjustment of the incoming audio level for different lengths of spiral-four cable between Telephone Terminal CF-1-(*) and a transmitter. The pad is adjusted by a front panel control marked MODULATION ADJ. At a relay station the MODULATION ADJ. is set at 0 and the AUDIO GAIN control of the receiver used to adjust the incoming audio level. A 1-mw (milliwatt) signal from the receiver modulates the transmitter 100 percent when the MODULATION ADJ. is at 0. Both controls are set at correct level during system line-up and normally need not be changed during operation. The output of Z202 is fed to terminal B marked AUDIO on terminal strip TS201, then through cable W201, plug P205, jack J205 to fixed 5-db pad Z204 and then to the primary of line-to-grid transformer T202. Transformer T202 has two primary windings, 550 ohms for high-fidelity signals and 50 ohms for the low-fidelity (handset) channel.

c. Low-fidelity Channel. The low-fidelity channel (200 to 2,800 cycles) is operated by the local handset which is plugged into jack J201. The receiver part of the handset is supplied from the radio receiver through interconnecting Cord CX-104/TRC-1, jack J203, and HEADSET jack J202. Microphone output from the handset is fed to transformer T204 (50 to 500 ohms). One side of the 50-ohm primary is connected to a low-voltage point in the power supply (—4 to —8 volts direct current) filtered by 100-mf (microfarad) capacitor C239 to furnish microphone current. The 500-ohm secondary winding of the mike transformer is connected to 20-db T-pad Z205, which is removed from the circuit when the TYPE OF OPERATION switch, S202, is in position 1, 2, or 3. From fixed pad Z205 the audio signal is fed through switch S202 to the terminal marked MIKE on terminal strip TS201, through cable W201 to terminal A of P205. The signal circuit is completed through the ground connection G of receptacle P205. From terminal A the signal is fed to low-pass filter Z201, which removes all signal components above 2,800 cycles. The output terminals of the filter are connected to fixed 15-db pad Z203, and the output terminals of the pad are connected to the low-fidelity primary of transformer T202 (terminals 6 and 8). The low-pass filter, by removing frequencies above 2,800 cyles, prevents the low-fidelity mike channel from interfering with the high-fidelity channel (2,800 to 12,000 cycles) and allows talking-in on high-fidelity channel No. 1. The fixed 15-db pad provides correct impedance match, terminates the low-pass filter, and also keeps the load on transformer T202 constant.

115. AUDIO AMPLIFIER.

a. The secondary winding of T202 is center-tapped and is terminated by 50,000-ohm resistors R218 and R219, and then connects to the grids of Tube JAN-6SN7/GT (V205) which is operated as a push-pull audio amplifier (fig. 77). The cathodes of the amplifier are tied together and connected through 1,000-ohm resistor R224 to ground, and also connected to the AUDIO AMP. position of the meter switch where the cathode voltage is indicated on the panel meter. The cathode current flowing through R224 produces a voltage drop which makes the cathodes 10 volts positive and provides cathode bias for the tube.

b. The output of V205 is across two pairs of 100,000-ohm resistors in parallel: resistors R225 and R242, and R226 and R243, or 50,000 ohms from each plate to the high-voltage supply. The 0.1-mf capacitors C234 and C235 couple the audio voltage to the grids of the reactance modulator V202 through r-f filters L215 and L216. The grid resistors for the reactance tube modulator V202 are 100,000-ohm resistors R227 and R228. The 50-mmf (micromicrofarad) capacitors C214, C215, C222, and C223 are filters.

116. PERCENT MODULATION AMPLIFIER.

From capacitor C235 the audio signal is also coupled to a grid of Tube JAN-6SN7/GT (V206A), percent modulation amplifier (fig. 77). One half of the dual triode serves as an audio amplifier and the other half of the tube is a half-wave rectifier. The rectified output is indicated on meter M201 when meter switch S201 is in the % MOD. position. The amplifier section of tube V206A is a conventional resistance-coupled amplifier. The 2,000-ohm resistor R229 furnishes cathode bias. The high voltage is fed through resistors R231 and R244, two 100,000-ohm resistors in parallel, making the total plate resistor 50,000 ohms. The 0.1-mf capacitor C237 couples the signal from the output of the amplifier section to the diode (plate and grid tied together) section, V206B. The 10,000-ohm resistors R230 and R217 are diode load resistors. A connection is made from the cathode to meter M201 through the meter switch so that percentage of modulation is indicated when the switch is in the % MOD. position.

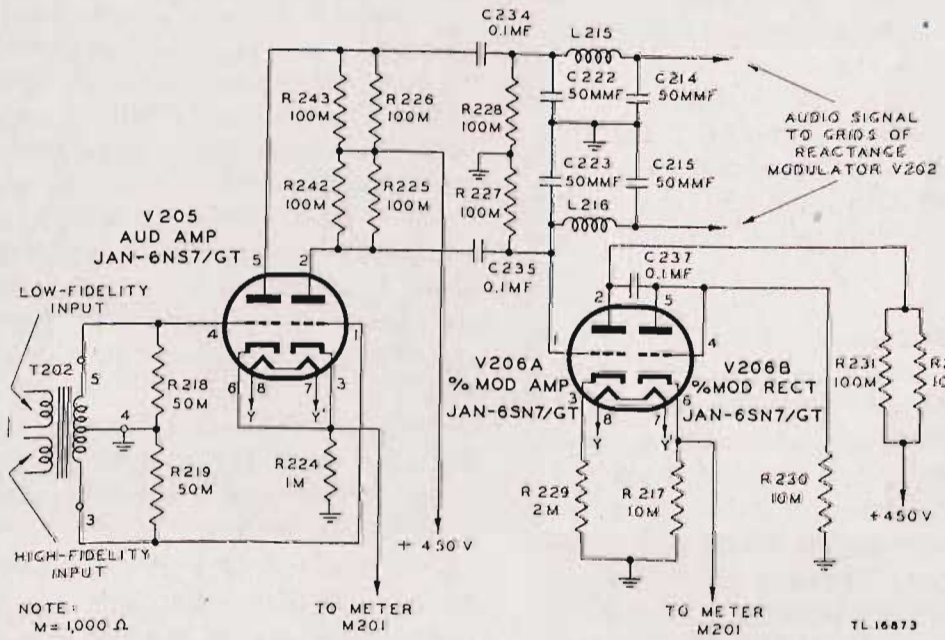


Figure 77. Radio Transmitter T-30/TRC-8 (XC-3), functional diagram of audio and percent modulation amplifier.

117. FREQUENCY CONTROL LINE.

a. General. (1) The application of transmission lines in frequency control circuits of high-frequency oscillators provides stability of frequency comparable with that of well designed crystal-controlled oscillators at lower frequencies. Such lines have the advantages of high Q, low losses, and efficient operation at frequencies above those readily obtainable with ordinary coil and capacitor tank circuits. The high Q provides good control of frequency stability, which is further improved by temperature compensation of the line.

(2) In the circuit used in this transmitter, the high Q temperature-compensated tank circuit L205 is made in the form of concentric transmission lines (fig. 78). The equivalent circuit is shown in figure 79(1). Coupling loop L210 is shown in figure 79(3). The remaining coupling loops are indicated in figure 79(2).

(3) The small diameter inner conductor may be considered as the tank inductance L (fig. 79 (3)); and the large diameter inner conductor, the tank capacitance Cx. The movable end plug forms an adjustable capacitor Cy in parallel with the fixed capacitor formed by the large diameter inner conductor to tune over the required frequency band of 76.7 to 83.3 megacycles by means of the FREQUENCY CONTROL.

b. Mechanical Description. (1) The frequency control line consists of an outer conductor cylinder A, on which coupling loops L206 to L210 are mounted; an inner conductor assembly, which incorporates the tuning mechanism; and the dial drive assembly which indicates the frequency to which the unit is set (fig. 79(3) and (4)).

(2) Cylinder A comprises the outer conductor. Loops L206 to L210, are mounted on feed-through insulators B, which extend through plate C. Cutouts are provided in cylinder A, through which the loops are extended into the tuning unit, and plates C are then bolted to cylinder A.

(3) The inner conductor assembly is welded to flange D, which is bolted to cylinder A, along circumference E. The fixed portion of the inner conductor comprises tube F and cup G. These parts are also welded together. Tuning is accomplished by moving the assembly associated with cup H, into or out of cup G. This movable as-

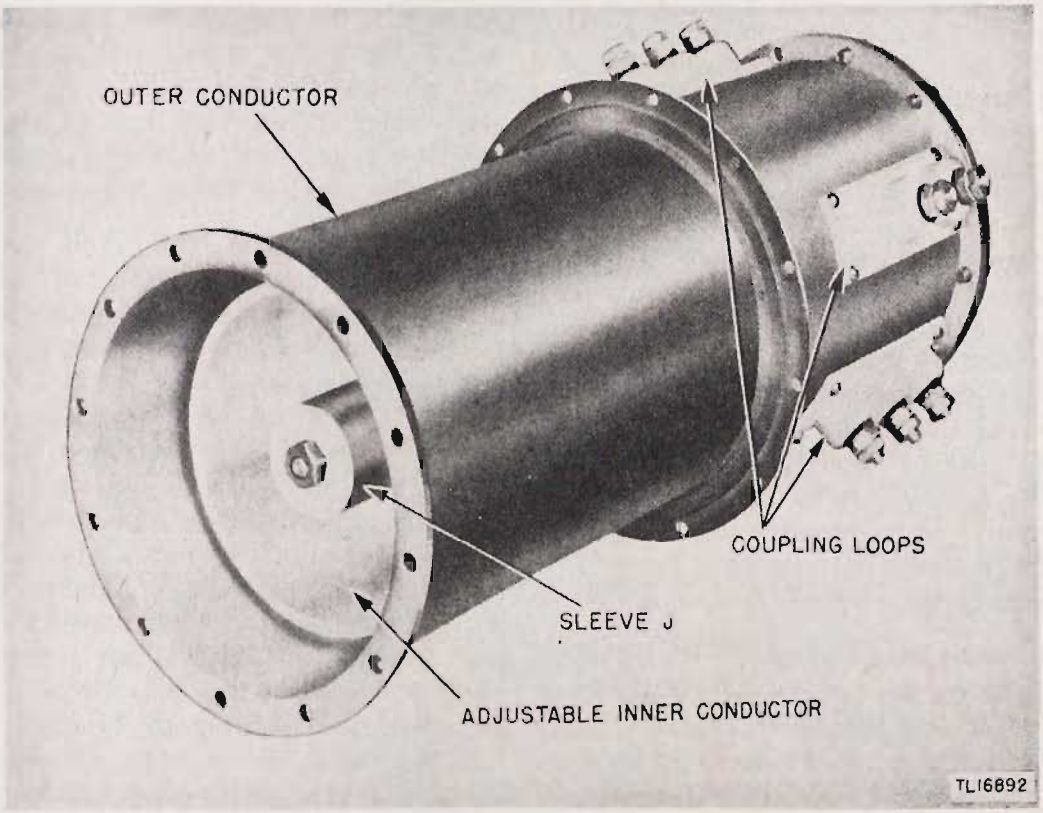


Figure 78. Radio Transmitter T-30/TRC-8 (XC-3), frequency control line.

sembly consists of cup H, brazed to sleeve J, which is bolted to tube K. One end of this tube has a threaded portion L, to engage lead screw M. A spline U on the inside of tube F, engages a keyway V in part L, to prevent any rotation of the movable assembly, permitting only a sliding movement. Compression spring N bears against the inner end of tube J, and shoulder P of tube F, forcing the movable section into its outermost position, thus taking up any backlash in the drive members L and M. Accuracy of resetting is thereby assured.

(4) Drive disk Q, located on the front panel, turns lead screw M which, in turn, moves the tuning section H into or out of section G. Gear R drives gear S, on which the frequency indicating dial is mounted. Ball bearing T provides smooth, accurate functioning of the lead screw. Drain hole screw W is removable to permit the draining out of any moisture which may collect within the unit through breathing or other means.

c. Electrical Description. (1) The frequency control line as a unit is the equivalent of a conventional resonant circuit, having a lumped inductance and a lumped capacity. These elements are in the form of concentric transmission line components. Inner conductor F serves as the inductance portion of the circuit, while sections G and H constitute the capacitive part of the resonant circuit. This capacitance exists between cups G and H, and the outer conductor A, which may be considered as the grounded plate of the capacitor.

(2) The spacing between outer conductor A and inner fixed cup G, is small, and the capacity per unit of its length is, therefore, large. Movable inner cup H is of smaller diameter. Hence its spacing from the outer conductor is greater. It, therefore, has a relatively smaller capacity per unit length. The variation in capacity provided by movable cup H, permits changing the resonant frequency of the control line to any value within the required frequency band from 76.7 to 83.3 megacycles.

d. Temperature Compensation. (1) As the temperatures change, the various parts of the frequency control line expand or contract, thus varying the inductance and capacity in the circuit, and hence the frequency of the transmitter. A high degree of frequency stability, with temperature change, is obtained by making the various parts of Invar, steel, and brass. Invar has an extremely low temperature coefficient of expansion, steel has a medium expansion coefficient; brass has a relatively high expansion.

(2) As the temperature increases, the tube F increases in length, thereby increasing the inductance of the unit. Steel sections G and H, expand in length and thus the capacity in the circuit is increased also. Tube K and lead screw M are made of Invar, and remain substantially constant in length. Tube J is made of brass and expands considerably more than the steel parts. In expanding, it pushes section H into section G, a correspondingly greater amount, thus decreasing the total capacity in the circuit sufficiently to offset the increases in size of both the capacitive and inductive elements H, G, and F. Proper proportioning of the elements thereby maintains a constant resonant frequency for wide variations in temperature.

118. OSCILLATOR.

a. The oscillator circuit of tube V201 is somewhat similar to the Meissner type. In the Meissner circuit, the grid and plate are inductively coupled into a tank circuit. As indicated in paragraph 117, the frequency of the tank circuit, and therefore that of the oscillator, is 76.7 to 83.3 mc. Since this stage is followed by a tripler stage which operates at the third harmonic of oscillator output, the final frequency will be in the desired range of 230 to 250 megacycles.

b. The plates of oscillator Tube JAN-829-B (V201), are coupled into the tank circuit by means of coupling loop L206 (fig. 80). Plate voltage is supplied through the center tap of the loop and is bypassed to ground by 50-mmf capacitor C202 which prevents radio frequency from feeding back into the power supply and places the center tap at r-f ground potential. The grids of the oscillator tube are also coupled into the tank circuit by means of coupling loop L207, with the center tap of the loop returned to ground through 1,000-ohm parasitic damping resistor R201 and 20,000-ohm resistor R202 which provides grid leak bias for the oscillator. Capacitor C201, 100 mmf, bypasses resistor R202 to ground. The center tap of coupling loop L207 is at ground r-f potential, thus meeting the requirements for a push-pull circuit. Cathode

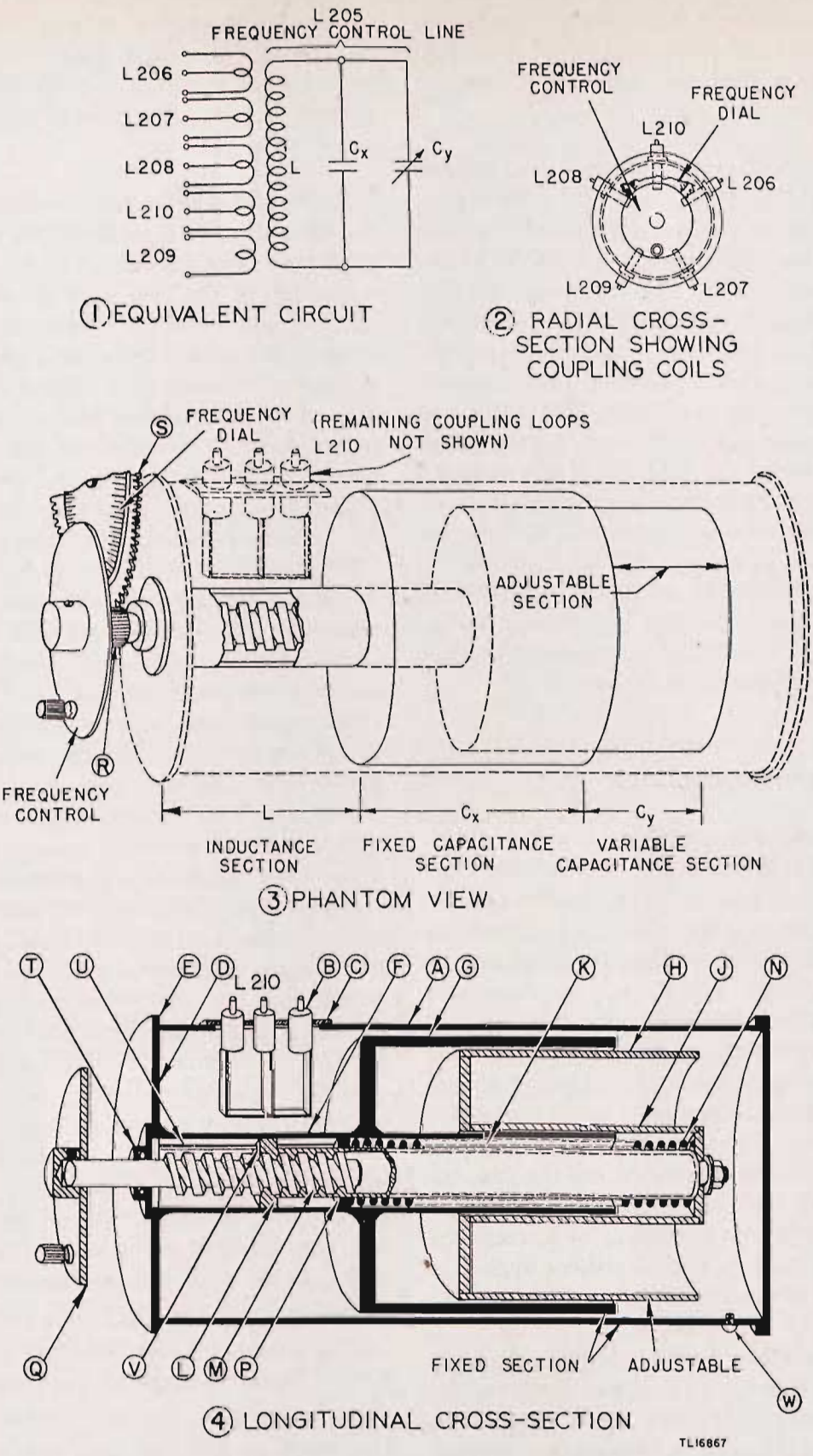


Figure 79. Frequency control line, mechanical and electrical equivalent.

bias is furnished by 200-ohm resistor R213. Both grid leak and cathode bias are used to provide self-adjusting grid bias. The tube is operated class C.

c. Heater voltage, plate voltage, and cathode bias are supplied through r-f filters which keep the oscillator output from causing undesirable radiation, and also keep r-f voltage out of the audio, power supply, and metering circuits. Screen voltage is supplied through 50,000-ohm resistors R203 and R240 in parallel. Heater filters consist of chokes L223 and L224 bypassed to ground by capacitors C230, C231, C232, and C233. All capacitors are 50 mmf. The plate filter comprises choke L218 bypassed to ground by capacitors C217 and C225, 50 mmf each. Cathode filtering is accomplished by choke L221 bypassed to ground by capacitors C220 and C228, also 50 mmf each. Sockets for all Tubes JAN-829 have built-in bypass capacitors on cathode, heater, and screen grid terminals to suppress r-f energy as close as possible to its source.

119. REACTANCE MODULATOR.

a. The reactance modulator is a Tube JAN-829-B (V202) which is connected so that when one half of the push-pull tube appears as a capacitive reactance the other half appears as an inductive reactance. Since the grids are operating push-pull, or 180° out of phase with each other as regards the audio voltage (fig. 81), the inductive reactance will be increasing when the capacitive reactance is decreasing; both will be operating in a direction to lower the oscillator frequency. However, when the capacitive reactance is increasing in one half of the tube, the inductive reactance of the other half will be decreasing; both will be tending to increase the oscillator frequency. Thus variations applied to both halves of the tube simultaneously, such as power supply variations, hum, etc., cause no change in oscillator frequencies, since these effects are in phase and cancel out. Audio signals however, applied to the tube in push-pull, are out of phase and the reactive changes they produce cause corresponding changes in oscillator frequency. A level of 100 percent modulation produces a frequency deviation of ± 100 kc at the final carrier frequency. Since the oscillator is operating at one-third carrier frequency, 100 percent modulation causes a deviation of 33-1/3 kc.

b. The plates of the reactance tube modulator are coupled to the tank circuit by coupling loop L208, and the plate voltage is fed through the center tap of the loop with 50-mmf capacitor C208 bypassing radio frequency to ground. The screen grids are fed from the high-voltage supply through 100,000-ohm resistor R206, and the screens are bypassed to ground by 0.1-mf capacitor C207. This capacitor has a low reactance at audio frequencies and prevents audio voltage from appearing on the screens and causing undesirable modulation. Grid coupling loop L209 supplies r-f voltage from the tank circuit to the grids of the modulator through coupling capacitors C206, 2 mmf, and C205 which is adjustable from 0.7 to 3.5 mmf. This loop is different from the other coupling loops in that it is single-ended instead of push-pull, with one side of the loop grounded. The two grids are fed together in parallel with regard to the r-f exciting voltage. This voltage is impressed on each grid with an inductor and resistor combination across them. Grid pin 2 is connected to inductor L201 with 100-ohm resistor R204 in parallel with it. Capacitor C203, 100 mmf, connects the combination to ground. Grid pin 6 is connected to inductor L203 with 100-ohm resistor R205 in parallel with it. Capacitor C204, 100 mmf, connects this combination to ground. The grid coupling capacitors and the resistor-inductor combination form a phase-shifting circuit which serves to rotate the grid voltage 90° with respect to the voltage induced in loop L209. Since the plates of the modulator are operated push-pull, they are 180° out of phase with each other and since the grids are fed together 90° out of phase, one grid *leads* one plate voltage by 90° and the other grid *lags* the other plate voltage by 90°. Thus, the current of one plate leads its current voltage by 90° and appears as *capacitive* reactance, and the other plate current *lags* its plate voltage by 90° and appears as *inductive* reactance.

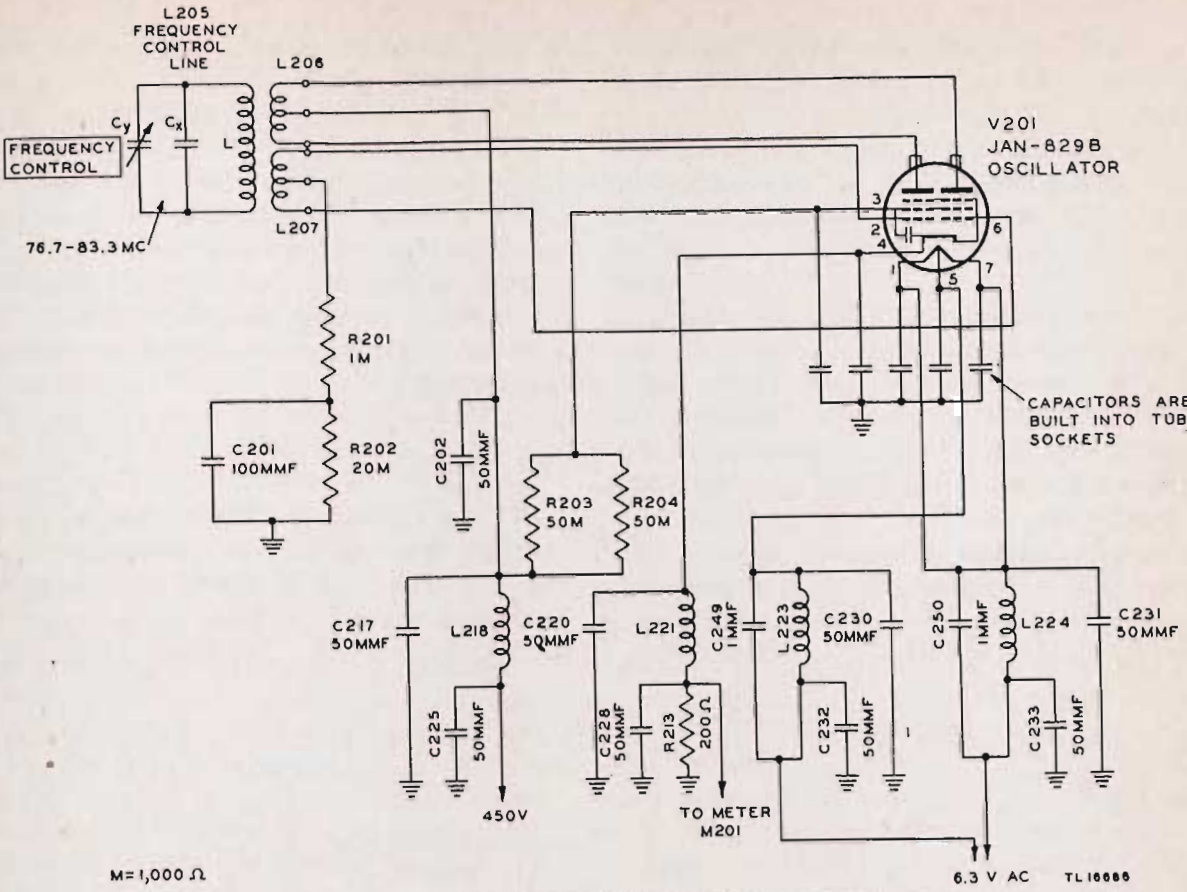


Figure 80. Radio Transmitter T-30 TRC-8 (XC-3), functional diagram of oscillator stage.

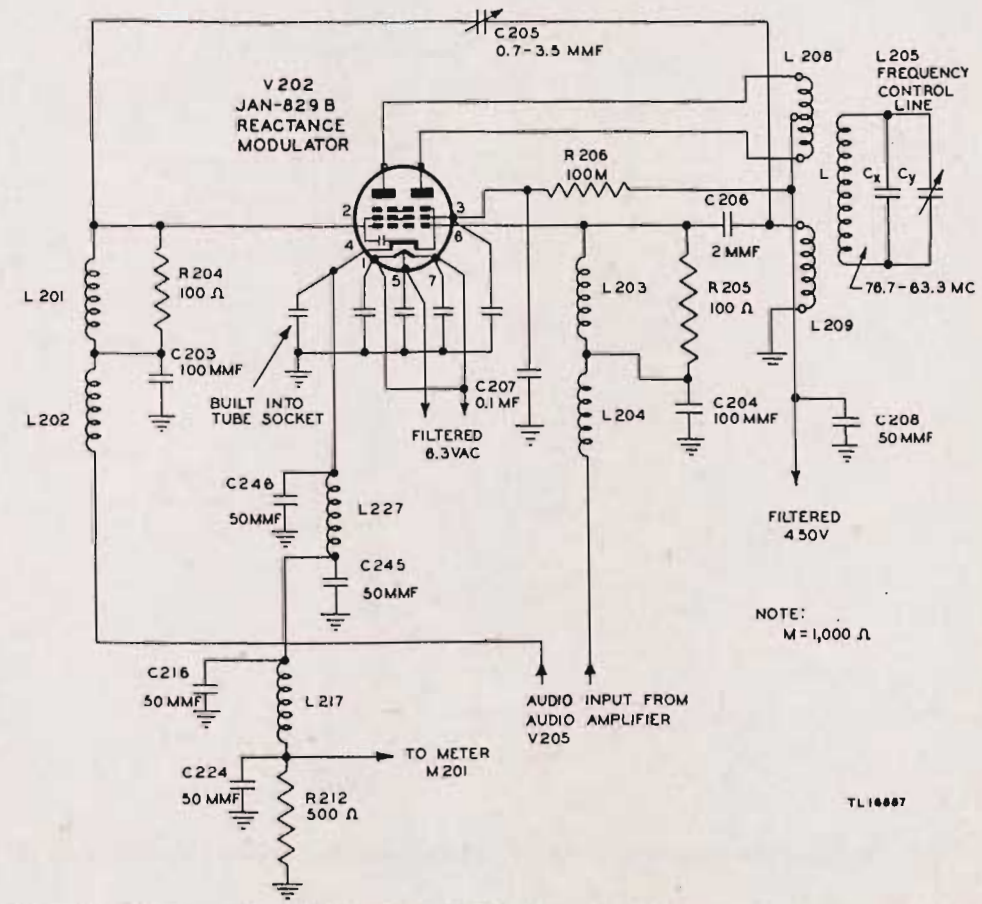


Figure 81. Radio Transmitter T-30/TRC-8 (XC-3), functional diagram of reactance modulator stage.

c. The audio signal from tube V205 varies the current through tube V202 and therefore varies the reactance coupled into the frequency control line L205 (oscillator tank circuit), thus shifting the oscillator frequency higher or lower corresponding to the increasing or decreasing reactance caused by the audio signal.

d. R-f bypass capacitors C203 and C204, and r-f choke coils L202 and L204 serve to prevent radio frequency from feeding back to the audio circuit. The cathode return is fed through r-f filter L227, each end of which is bypassed to ground by means of capacitors C245 and C246 which are 50 mmf each. This filter is mounted close to the tube socket and serves to keep radio frequency out of the cathode circuit by suppressing it close to its source. The cathode is additionally filtered by L217 and capacitors C216 and C224, 50 mmf, and is connected to ground through 500 ohm resistor R212, which furnishes cathode bias. The cathode is also connected to meter M201 through the meter switch so that cathode voltage is indicated on the meter when the switch is in the MOD. position. Resistors R227 and R228 (fig. 77), 100,000-ohms each, serve as grid resistors for the reactance modulator tube which is adjusted to operate linearly, that is, to make the reactance variation proportional to audio input.

120. TRIPLER.

a. Tube JAN-829-B (V203), the power output stage, operates as a class C frequency tripler (fig. 82). The grids of tube V203 are driven from the tank circuit by means of coupling loop L210. The center tap of the loop is connected to

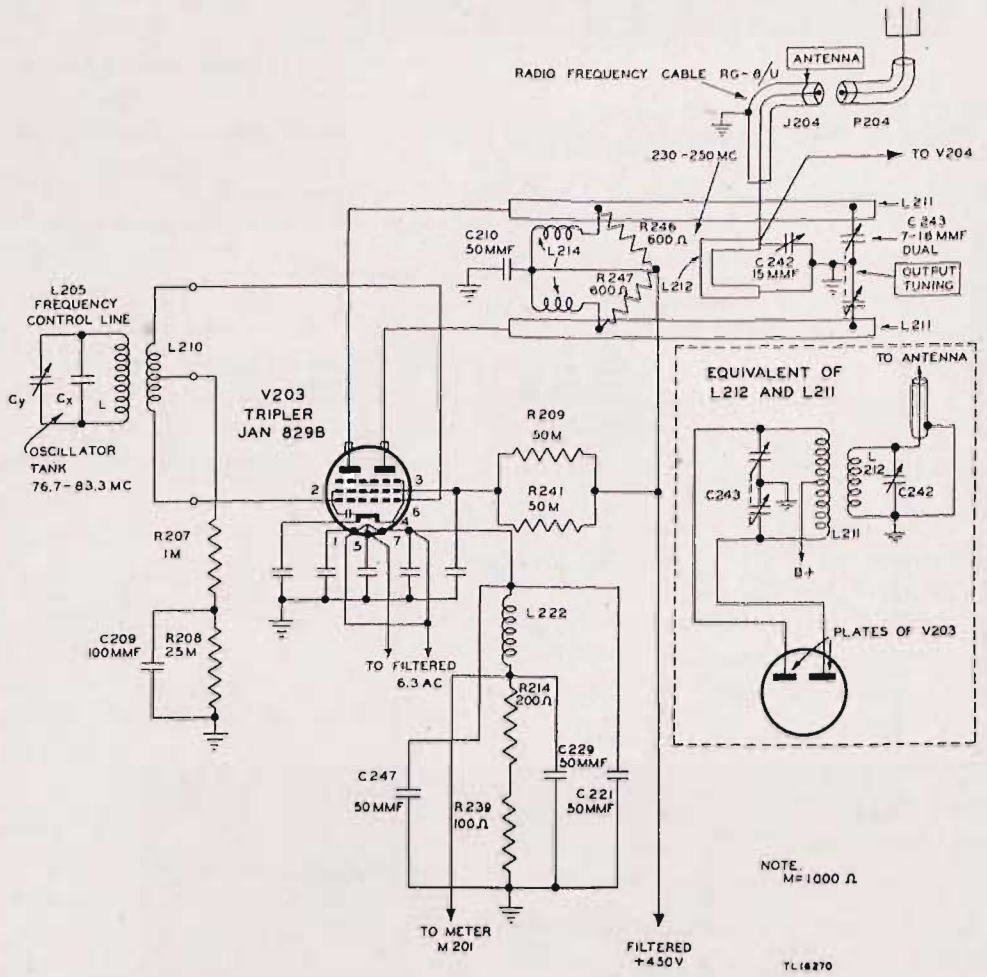


Figure 82. Radio Transmitter T-80/TRC-8 (XC-8), functional diagram of tripler stage.

1,000-ohm parasitic suppressor resistor R207 and then through 25,000-ohm resistor R208 to ground. Grid leak bias is furnished by resistor R208. Capacitor C209, 100 mmf, bypasses the grid leak to ground. Screen voltage is supplied through a 25,000-ohm resistor consisting of 50,000-ohm resistors R209 and R241 in parallel. Cathode bias is developed across resistors R214, 200 ohms, and R239, 100 ohms, in series. The cathode is bypassed at the tube socket by 50-mmf capacitor C247, and the cathode filter consists of L222 bypassed to ground at each end by capacitors C221 and C229, 50 mmf each. A connection is also made from the cathode to meter M201 through the meter switch so that cathode voltage will be indicated when the switch is in the TRIPLER position.

b. The final tank circuit operates at 230 to 250 mc which is the third harmonic of the oscillator frequency. The tank circuit of the tripler stage is composed of two silver-plated rods L211 tuned by dual variable capacitor C243, 7-16 mmf per section, across one end of the rods. These rods are actually very short lengths of transmission line acting as inductances. The plates of tube V203 are connected to the other end of the rods, and plate voltage is furnished through r-f chokes L214 at a point on the rods where the r-f potential is low. Parasitic damping resistors R246 and R247, 600 ohms each, are used across each side of r-f choke L214 to prevent undesired oscillations. Capacitor C210, 50 mmf, bypasses radio frequency to ground at the midpoint of the r-f chokes. Output coupling loop L212 is positioned near the low r-f potential point of the tank circuit and is fixed tuned by capacitor C242. R-f output is fed from the coupling loop through a short length of Radio Frequency Cord RG-8/U to ANTENNA receptacle J204.

121. R-F OUTPUT RECTIFIER.

Tube JAN-6H6 (V204) is coupled to the output loop by another short length of transmission line and provides an indication of the r-f output voltage on meter M201 when the meter switch is in the OUTPUT position. One diode plate of tube V204 (fig. 83) is connected close to the grounded end of this quarter-wave transmission line making the line function as an impedance stepdown transformer, thus permitting a small amount of the r-f output to be impressed on the diode plate without loading the output circuit. The heaters of the diode

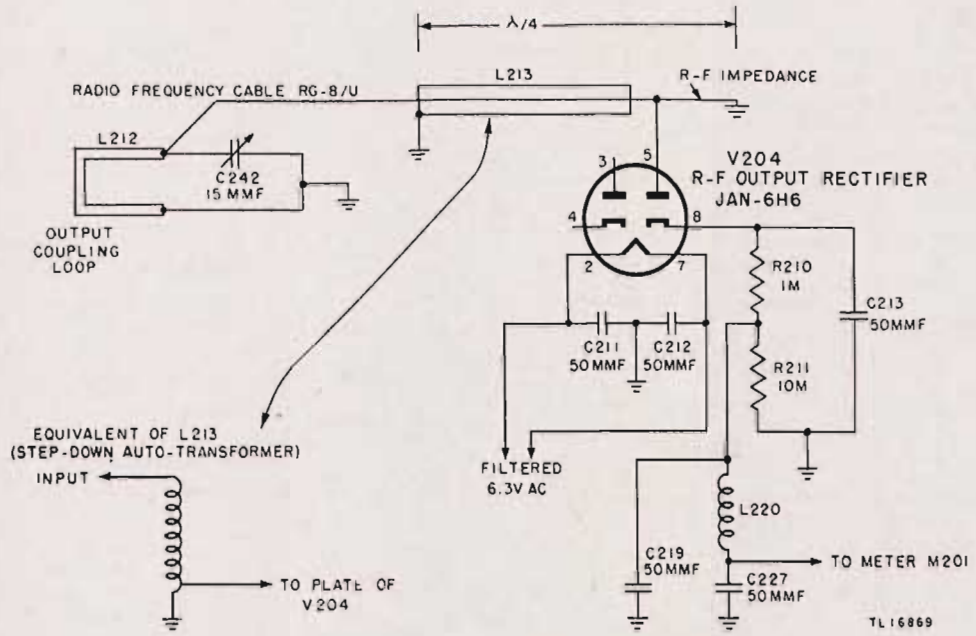


Figure 83. Radio Transmitter T-30/TRC-8 (XC-3), functional diagram of r-f output rectifier stage.

are bypassed to ground by 50-mmf capacitors C211 and C212. Cathode bypassing is accomplished by 50-mmf capacitor C213. D-c metering voltage is taken from the midpoint of the voltage divider composed of 1,000-ohm resistor R210 and 10,000-ohm resistor R211 connected in series from cathode to ground. This metering voltage is fed through r-f filter L220, bypassed to ground at each end by capacitors C219 and C227, 50 mmf each, to meter M201 when the meter switch is in the OUTPUT position. Thus the diode furnishes a reading on the meter which indicates the r-f voltage applied to the antenna terminal.

122. POWER PACK PP-115/TRC-8 (XC-3).

a. Power Pack PP-115/TRC-8 (XC-3) furnishes plate, screen, heater, microphone, and relay voltages for the various stages of the transmitter. D-c output is 450 volts, and heater output is 6.3 volts alternating current. Input power is supplied through power cord W203 at 115 volts, 50 to 60 cycles (fig. 84). Operation on 230 volts, 50 to 60 cycles may be obtained by connecting the primary of the power transformer as described in paragraph 50. Circuit breaker S203 is in series with one side of the primary of transformer T201 and functions both as an OFF-ON switch and overload preventer, since it automatically trips off in the event of a short or overload. Blower B201 circulates air throughout the power supply and r-f section of the transmitter and is connected across the 115-volt terminals of the power transformer. These connections should not be disturbed when the transformer wiring is changed for 230-volt operation. One winding of the blower motor is connected to the a-c line through a 1.75-mf capacitor C244 which acts as a phase splitting device to furnish starting torque.

b. Power transformer T201 has a dual primary winding for 115- or 230-volt operation and three secondary windings. The 6.3-volt a-c secondary is rated at 8.0 amperes and furnishes heater voltage for all tubes except the rectifiers. This filament voltage is taken from terminals 11 and 13 on the transformer and is fed through FILAMENT terminals on terminal strip TS201 through cable W201 to terminals I-C and J-D on output plug P205. Heater voltage for the tubes in the r-f unit is then fed through r-f filters.

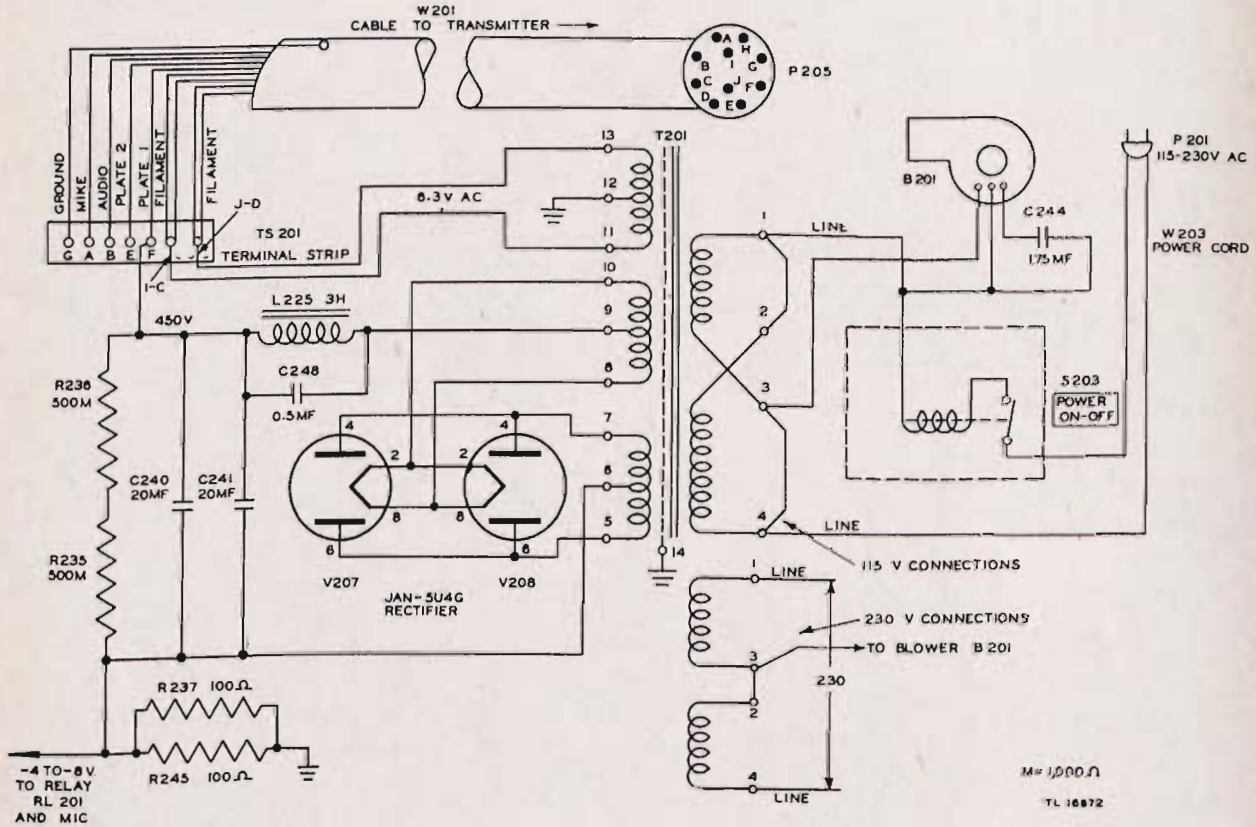


Figure 84. Power Pack PP-115/TRC-8 (XC-3), functional diagram of power circuits

c. High voltage at secondary terminals 5 and 7 of the transformer is connected to the plates of two Tubes JAN-5U4-G (V207 and V208) connected in parallel. Filament supply for the rectifiers is taken from the third secondary winding through terminals 8 and 10 of the transformer. Terminal 6, the center tap of the high-voltage winding, is connected to ground through a 50-ohm resistor consisting of 100-ohm resistors R237 and R245 in parallel. Since the entire d-c output of the power supply flows through this 50-ohm resistor, the voltage drop is utilized to furnish d-c voltage for operating the microphone and relay RL201. Terminal 9, the center tap of the rectifier filament winding, is connected to one terminal of filter choke L225. The other terminal is connected to the PLATE 1 lug of terminal strip TS201. Across these two terminals of the filter choke is connected 0.5-mf capacitor C248 which tunes the choke to make the effective impedance of the combination much higher for 120 cycles than the choke alone would present.

d. From the positive high-voltage output terminal of the filter choke to the negative lead of the power supply are connected 20-mf capacitors C240 and C241 in parallel. Across these capacitors are connected a 1-megohm bleeder consisting of 500,000-ohm resistors R235 and R236 in series. These resistors provide a means of draining off the charge on filter capacitors C240 and C241 if the power pack is operated with the interconnecting plug disconnected or with all the tubes out.

123. PUSH-TO-TALK OPERATION.

a. With the TYPE OF OPERATION switch in position 1, 2, or 4, the transmitter is placed on the air by pressing the push-to-talk switch on Handset H-23/U (fig. 85). Energizing relay RL201 completes the 450-volt plate and screen supply for the tripler V203.

b. A d-c potential of —4 to —8 volts is available at the ungrounded terminals of resistors R237 and R245 for microphone and relay supply. Microphone current is taken from this point and connected through 50-ohm resistor R248 to terminal 2 of microphone transformer T204. The microphone circuit is completed through the primary winding of the transformer, the ring contact of jack J201, the ring of Plug PL-68, the carbon button of the microphone, the push-to-talk switch on the handset, the sleeve contact of Plug PL-68, and the sleeve contact of jack J201 to ground.

c. The secondary of the microphone transformer is fed through switch S202 into the low-fidelity channel of audio amplifier V205. This channel is shown in figure 76.

124. TYPE OF OPERATION SWITCH.

a. Five different types of operation are pos-

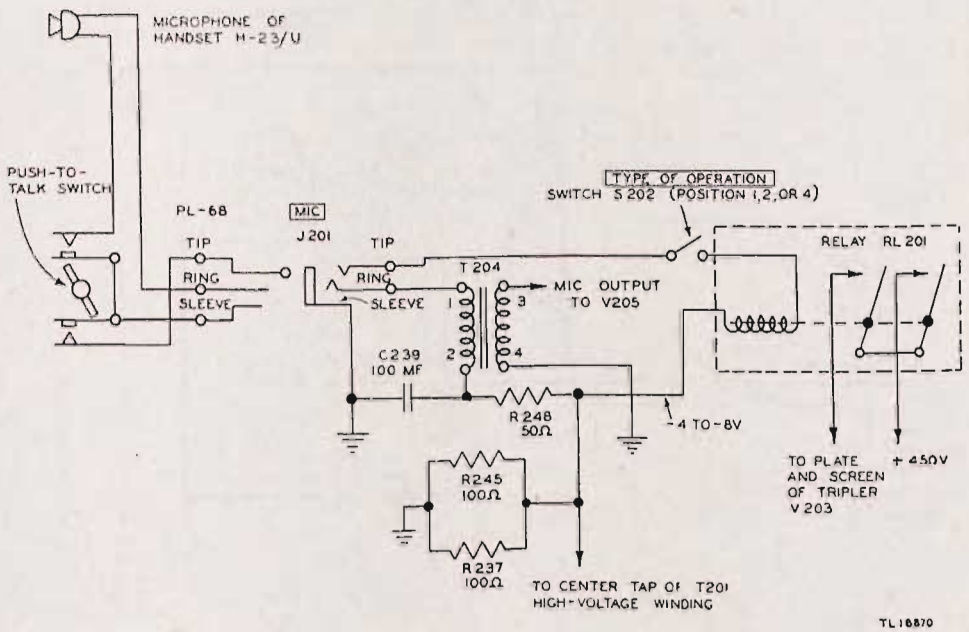


Figure 85. Power Pack PP-115/TRC-8 (XC-3), functional diagram of push-to-talk operation.

sible depending on the setting of the TYPE OF OPERATION switch S202 on the front panel of the power supply. These positions and their functions are as follows:

Position	Transmitter operation	Function	Modulation level
1	Handset operates carrier relay RL201, turns carrier on.	Handset modulates transmitter.	100% (single channel)
2	Handset or squelch relay RL1 operates relay RL201 and turns carrier on.	Handset or receiver output modulates transmitter.	100% (single channel)
3	Relay RL201 operated. Carrier on continuously.	Handset modulates transmitter.	100% (single channel)
4	Handset or squelch relay RL1 operates relay RL201 and turns carrier on.	Handset or receiver output modulates transmitter.	25% per channel (multichannel)
5	Relay RL201 operated. Carrier on continuously.	Handset or receiver output modulates transmitter.	25% per channel (multichannel)

b. Positions 2 and 4, squelch operation (par. 137), permit a received signal to operate the transmitter. This function is as follows:

(1) If there is a weak signal or no signal, current flows through squelch relay RL1 and the relay is energized. The receiver is muted, and the transmitter carrier is off.

(2) If there is a normal signal, no current flows through the squelch relay and the relay is de-energized. The signal is heard in the receiver and modulates the transmitter as carrier relay RL201 is energized.

c. Refer to the schematic diagram of the transmitter (fig. 136) for the following discussion. Figures 76 and 85 are functional diagrams covering the microphone speech channel and push-to-talk operation respectively. Squelch operation is described in paragraph 137. For the discussion of the switch positions, it is sufficient to bear in mind that a normal or strong signal de-energizes the squelch relay in the receiver and places the F lead of J203 at ground potential (fig. 136). For a weak or no signal, the F lead of J203 is open in the receiver.

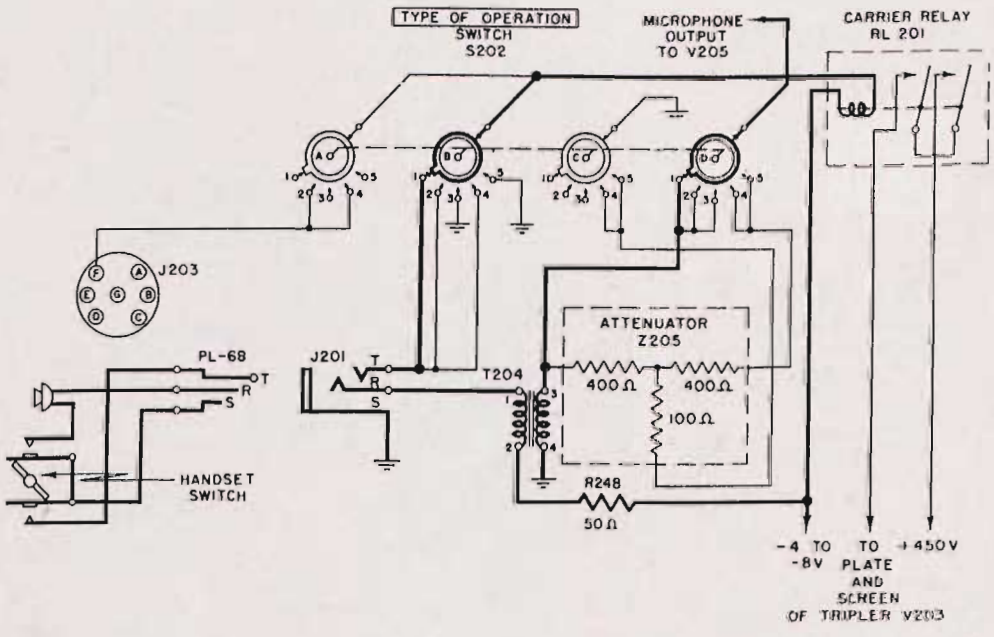


Figure 86. TYPE OF OPERATION switch, functional diagram for position 1.

(1) Position 1, SINGLE CHANNEL MIC., is used for local operation. The carrier is turned on and modulated with the handset (fig. 86). One side of carrier relay RL201 and one side of microphone transformer T204 (through resistor R248) are connected to —4 to —8 volts; either one may be energerized by connecting its other terminal to ground. When the switch on the handset is pressed, the microphone circuit (par. 123) as well as the carrier relay circuit is completed to ground. The carrier relay circuit is completed to ground through section B of switch S202, tip contact of jack J201, tip of Plug PL-68, handset switch, sleeve of Plug PL-68, and sleeve of jack J201 to ground. Thus the carrier is on the air whenever the handset switch is pressed and the handset microphone can modulate the transmitter. Attenuator Z205 is disconnected from the circuit and speaking into the microphone at normal level modulates the transmitter 100 percent. In this position advantage is taken of full modulation on one channel.

(2) Position 2, SINGLE CHANNEL MIC. or SQUELCH, is similar to position 1 except that control of the carrier relay may be obtained either from the handset switch or by means of the squelch relay in the receiver. For squelch operation, the received signal de-energizes the squelch relay, placing the F lead of J203 at ground potential (fig. 87), which in turn energizes the carrier relay in the transmitter and permits the receiver output to modulate the transmitter 100 percent.

(3) Position 3, SINGLE CHANNEL CONTINUOUS, energizes the carrier relay so that the transmitter is always on the air and may be modulated by the local handset or by the receiver output. The carrier relay circuit is completed to ground through position 3, section B, of switch S202 (fig. 85). The handset modulates the transmitter 100 percent. This position is used for single channel point-to-point or relay operation where it is desirable to have the carrier on. An interruption of the carrier serves as an indication of trouble in the circuit.

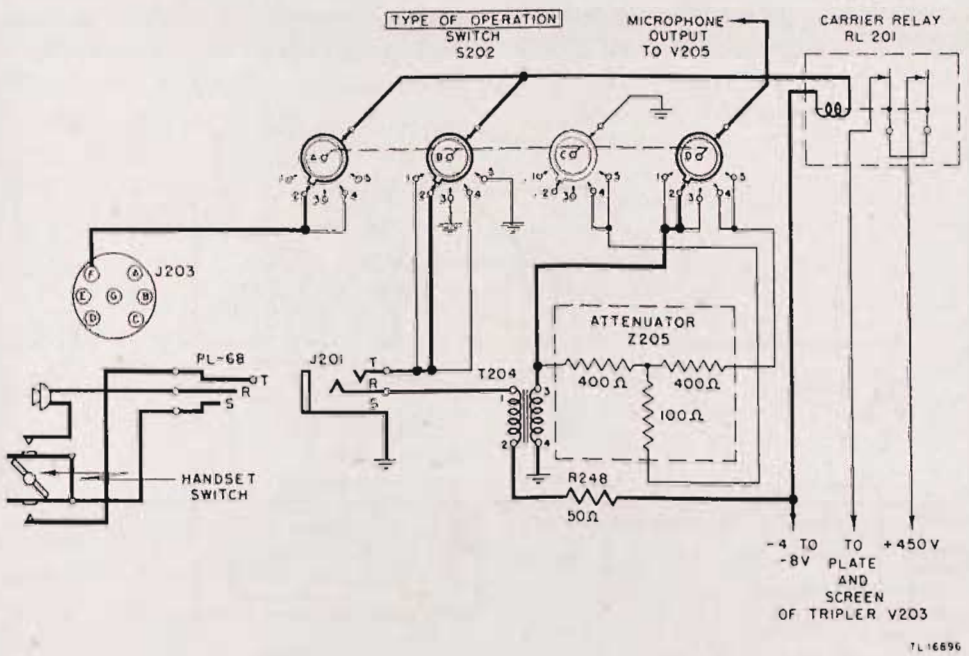


Figure 87. TYPE OF OPERATION switch, functional diagram for position 2.

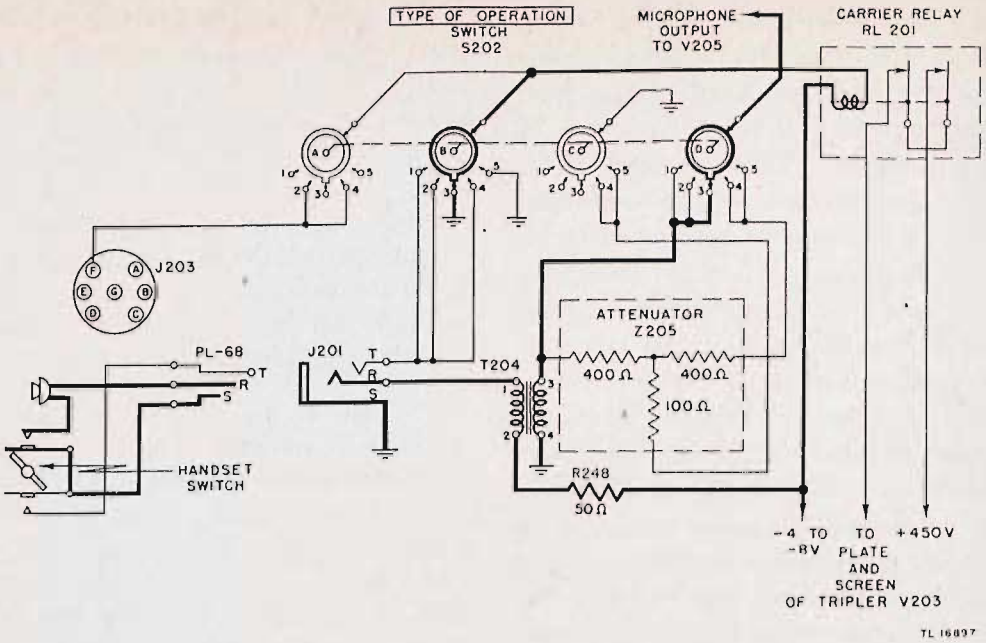


Figure 88. TYPE OF OPERATION switch, functional diagram for position 3.

(4) Position 4, MULTICHANNEL MIC. or SQUELCH, is similar to position 2 in that either the handset or the receiver squelch relay turns the carrier on. However, since four channels will modulate the transmitter simultaneously, the modulation level must be set for 25 percent modulation per channel by means of the MODULATION ADJ. or AUDIO GAIN control (fig. 136). Channel 1 may be modulated locally by means of the handset. Speaking into the microphone at normal level modulates the transmitter 25 percent as attenuator Z205 is switched into the

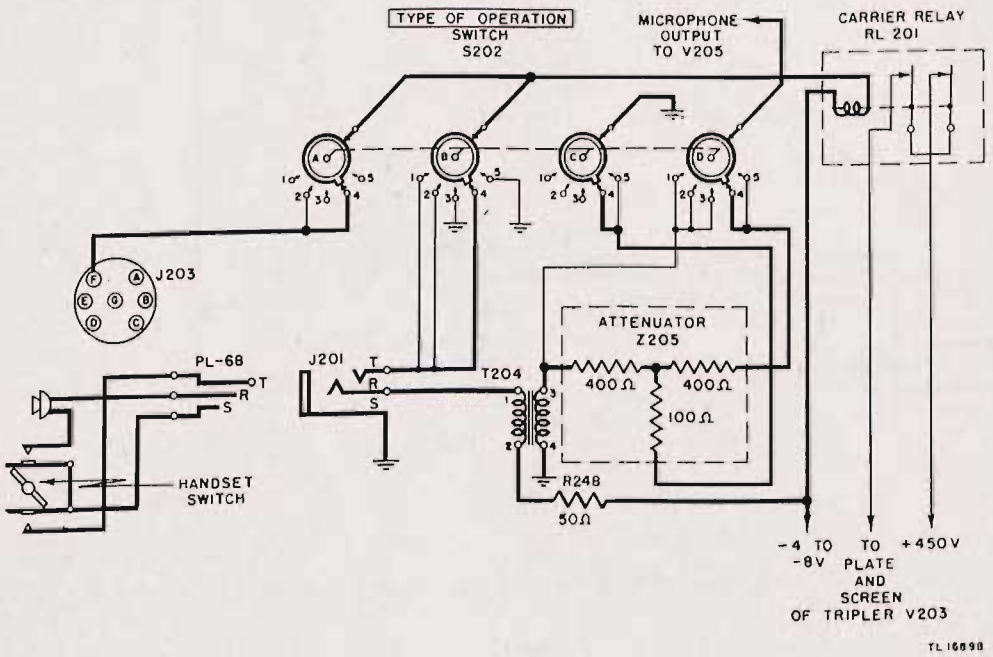


Figure 89. TYPE OF OPERATION switch, functional diagram for position 4.

circuit through position 4, section D, of switch S202 (fig. 89). This attenuator provides 15 db attenuation so that when it is in the circuit, the modulation level is approximately 25 percent; when it is shorted out, the modulation level is increased to 100 percent. No manual adjustment of microphone level is provided, as slight undermodulation or overmodulation does not seriously interfere with intelligibility. This position is used for multichannel relay communication only.

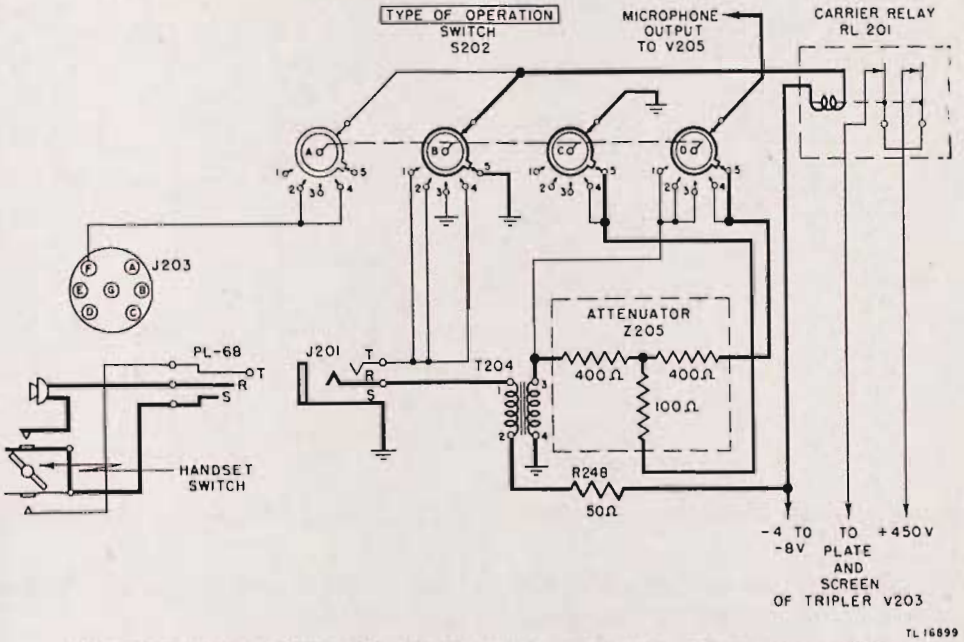


Figure 90. TYPE OF OPERATION switch, functional diagram for position 5.

(5) Position 5, MULTICHANNEL CONTINUOUS, is similar to position 3 except that the modulation level is adjusted to 25 percent per channel so that four channels of communication will modulate the transmitter 100 percent. The carrier relay is completed to ground through position 5, section B, of switch S202 (fig. 90). The modulation circuit is the same as for position 4.

125. TRANSMITTER METERING.

A d-c meter and meter switch are provided on the front panel of the transmitter for checking the operation of every stage. The ranges and switch positions are shown in figure 91.

a. OFF Position. In this position both terminals of the meter are connected to ground, damping the meter needle movement. This position should be used whenever the transmitter is in transit to provide protection for the meter needle bearing and needle against severe shocks.

b. B. VOLTS Position. In this position the negative terminal of the meter is connected to ground, and the positive terminal is connected to high voltage through two 500,000-ohm resistors R232 and R233 in series. When d-c meter M201 is shunted across 10,000-ohm resistor R234, the meter becomes a 1,000 ohm-per-volt d-c voltmeter across the high-voltage supply. Resistor R234 keeps the high voltage from switch S201 when it is in any other position.

c. % MOD. Position. In this position the negative terminal of the meter is connected to ground and the positive terminal is connected to resistor R217, indicating cathode current through diode tube V206B. A reading of full scale indicates 100 percent modulation and a reading of one quarter of the scale indicates 25 percent modulation.

d. OUTPUT Position. In this position the negative terminal of the meter is connected to ground through 10,000-ohm resistor R216, and the positive terminal is connected to the midpoint of resistors R210 and R211 which are in series from the cathode of V204 to ground. Thus the meter reads cathode current of diode indicator tube V204 and furnishes an indication of transmitter r-f output. This position is used to adjust tripler tank capacitor C243 to resonance by tuning OUTPUT TUNING dial on the front panel for a maximum reading on the meter.

SWITCH POSITION	METER RANGE
B VOLTS	0-1,000 VOLTS
% MOD.	0-1 MA
OUTPUT	0-10 VOLTS
AUD. AMP.	0-10 VOLTS
MOD.	0-100 VOLTS
OSC.	0-100 VOLTS
TRIPLER	0-100 VOLTS

NOTE:
M=1,000 Ω.

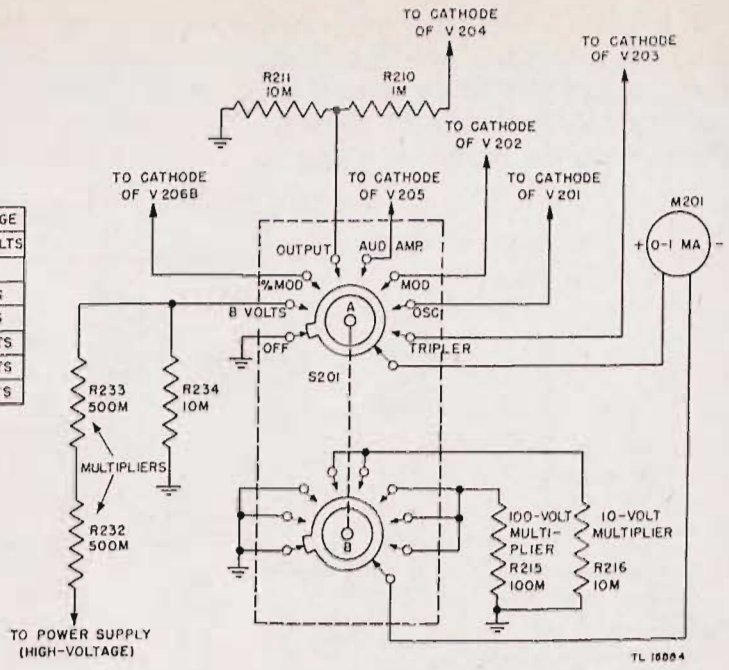


Figure 91. Radio Transmitter T-30/TRC-8 (XC-3), functional diagram of meter switch.

e. AUD. AMP. Position. In this position the negative terminal of the meter is connected to ground through 10,000-ohm resistor R216, and the positive terminal is connected to the cathode of audio amplifier tube V205. Thus the meter acts as a 1,000 ohm-per-volt 0-10 d-c voltmeter across cathode resistor R224 of tube V205 and furnishes an indication of tube operation.

f. MOD. Position. In this position the negative terminal of the meter is connected to ground through 100,000-ohm resistor R215, and the positive terminal is connected to resistor R212, indicating the cathode voltage of the reactance modulator tube V202. The meter is a 0-100 voltmeter in this position.

g. OSC. Position. In this position the negative terminal of the meter is connected to ground through 100,000-ohm resistor R215 and the positive terminal is connected to resistor R213. The meter acts as a 1,000 ohm-per-volt 0-100 d-c voltmeter across the cathode resistor of oscillator tube V201, indicating tube operation.

h. TRIPLER Position. In this position the negative terminal of the meter is connected to ground through 100,000-ohm resistor R215, and the positive terminal is connected to resistor R214, indicating the cathode voltage of tripler tube V203. The meter is a 0-100 voltmeter in this position.

126. TELEPHONE EE-8-A CIRCUIT.

Telephone EE-8-A is provided to furnish communication between a radio terminal station and Telephone Terminal CF-1-(*) (Carrier). The center tap of the primary of transformer T203 is connected to a binding post on the terminal board marked EE-8 (fig. 92). The receiver output transformer T2 is similarly center-tapped and connected to the other EE-8 terminal. At Telephone Terminal CF-1-(*) (Carrier), the T repeater and R repeater coils are also center-tapped and connected to the terminals marked SX TRSG-REC, thus providing a phantom circuit for Telephone EE-8-A between the radio terminal station and Telephone Terminal CF-1-(*) (Carrier). This circuit is called a phantom circuit because ringing or voice currents of Telephone EE-8-A pass through both halves of the transmitter input transformer and receiver output transformer. Thus, the field caused by one half of the transformer cancels the field caused by the other half so that no voltage appears across the other winding of these transformers. Telephone EE-8-A can be used simultaneously with multichannel communication. For a description of Telephone EE-8-A refer to TM 11-333.

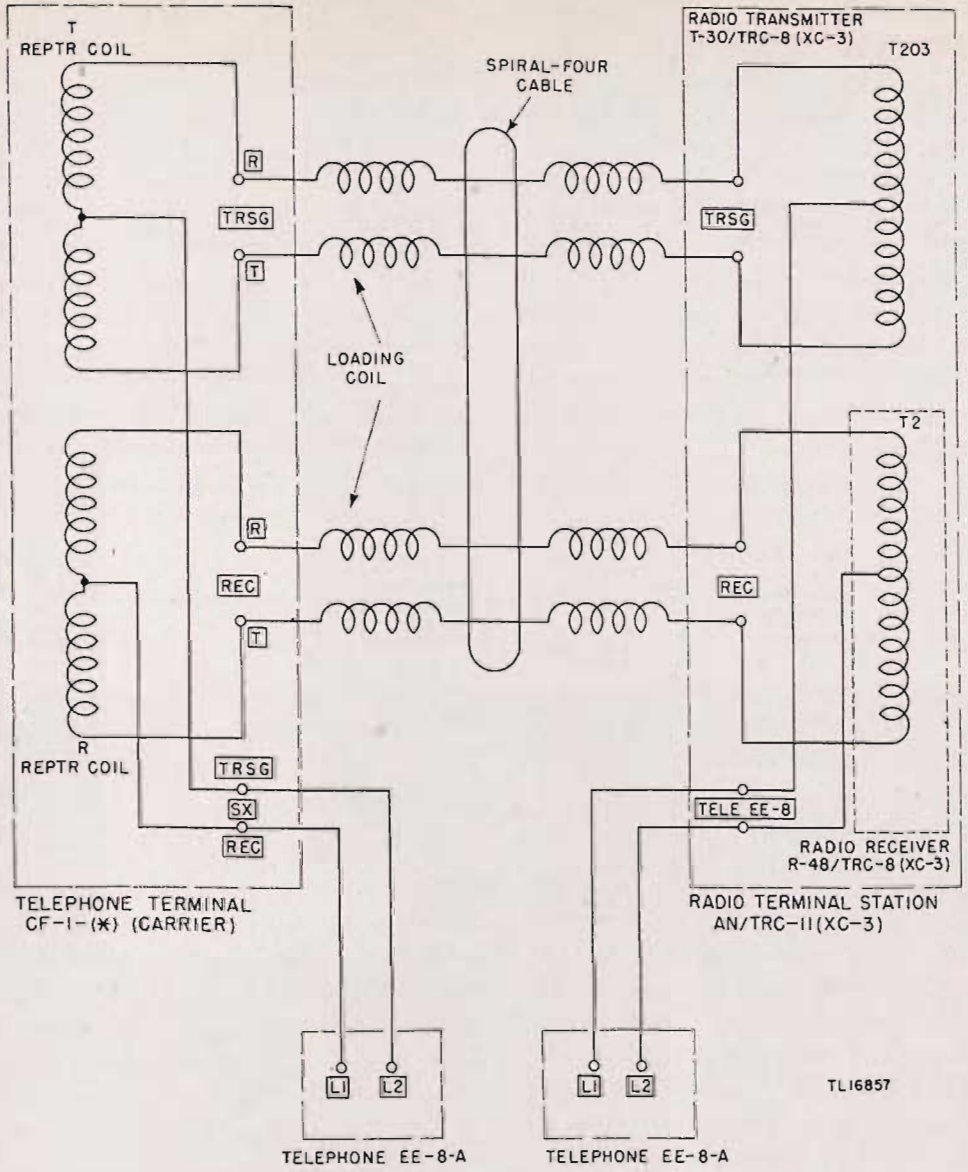


Figure 92. Telephone EE-8-A circuit, functional diagram.

SECTION XIV. THEORY OF RADIO RECEIVER R-48/TRC-8 (XC-3)

127. SIMPLIFIED BLOCK DIAGRAM.

Radio Receiver R-48/TRC-8 (XC-3) is a 15-tube superheterodyne receiver designed to receive frequency-modulated signals with a frequency deviation of ±100 kc. The receiver operates in the frequency range of 230 to 250 mc. Figure 93 shows the signal path through the receiver. The antenna is coupled to the receiver by a coaxial line. The signal from the output of the r-f amplifier tube, V1, is coupled to mixer tube V2. Oscillator tube V3 produces a local oscillator voltage 30 mc lower than the signal frequency. This voltage is combined with the received signal in the mixer stage to produce a difference frequency of 30 mc. Most of the gain and selectivity of the receiver occurs in i-f stages V4, V5, V6, and V7. The output of the fourth i-f stage is fed into V8 and then into V9, first and second limiters. These limiter stages remove any amplitude modulation such as noise, so that a signal of constant amplitude, varying

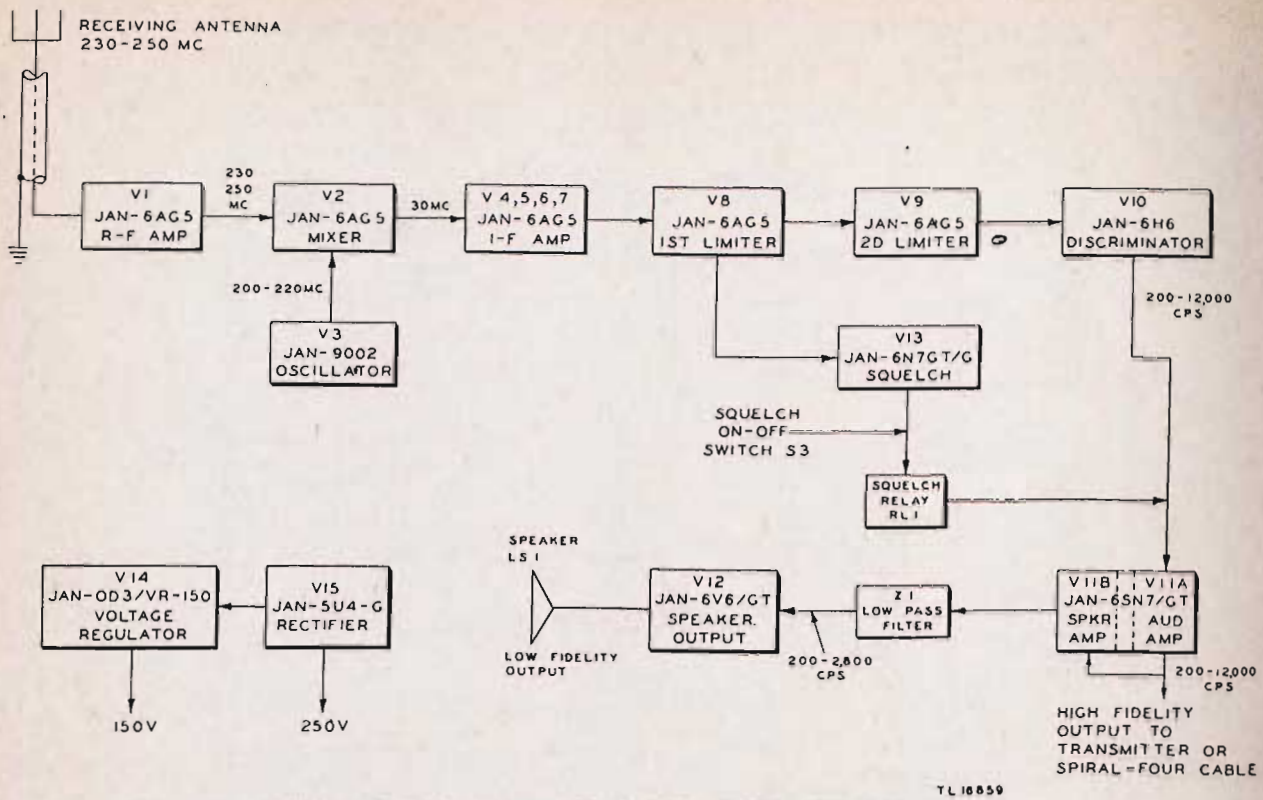


Figure 93. Radio Receiver R-48/TRC-8 (XC-8), block diagram.

only in frequency, is applied to discriminator stage V10. The discriminator demodulates the signal, that is, the frequency variations are changed into an audio signal. Two audio-amplifier stages, dual triode V11A and V11B, follow the discriminator. The output of the first stage, AUD. AMP. V11A, is fed to spiral-four cable at a terminal station or a transmitter input at a relay station. This is considered the high-fidelity output. The other half of the tube, SPKR. AMP. V11B, operates as a second audio amplifier. A low-pass filter, which removes all frequencies above 2,800 cycles, is connected between V11B and the speaker output stage V12. Low-fidelity signals only, 200 to 2,800 cycles, can be heard in the loudspeaker LS1 or monitor headphones. This is the low-fidelity output. Tube V13 operates squelch relay RL1. The 250-volt d-c supply is furnished by tube V15. Tube V14 supplies regulated 150 volts direct current. The schematic diagram is shown in figure 139.

128. R-F UNIT.

a. Concentric Lines. Concentric transmission lines may be constructed so that they act as series or parallel resonant circuits. Lines so designed may be substituted for the ordinary coil and capacitor circuits. At high frequencies, current flows on the outside of the inner conductor and on the inside of the outer conductor due to skin effect so that there is no radiation from a concentric line. It is, therefore, a very high Q circuit element. High Q circuits are necessary to provide amplifier gain, selectivity, and frequency stability of the mixer oscillator. A shorted quarter-wavelength line has a low impedance at the shorted end and a high impedance at the open end. The line can be made somewhat shorter than a quarter wavelength by replacing part of it with a capacitor, but the open end impedance will be slightly reduced. Concentric lines are used in the r-f amplifier, oscillator, and mixer stages. Figure 94 shows the r-f unit. The outer conductors, shown at the left, fit over the inner conductors, shown at the right. Figure 95 is a mechanical equivalent of the three r-f tuned circuits. Corresponding parts may be located by reference to figure 96. The concentric lines used in the three r-f tuned circuits are each composed of an inner conductor, which is a tube substantially shorter than ¼ wavelength, and an outer conductor of square cross-section which sur-

rounds the inner conductor along its entire length and shorts it at one end. The three square outer conductors are made up in the form of a partitioned box which is the foundation of the r-f unit. The impedance between the free end of the inner conductor and its outer conductor is inductive with a very low resistive component. This construction provides a low-loss, highly stable, and concentric-line inductor. Silver-plated steel is used for both the inner and outer conductors. Lines L10, L20, and L30 are used in place of the conventional coils in the r-f portion of the receiver and, if considered as extremely small values of inductance, their operation can be easily understood. Figure 96 is the electrical equivalent of the r-f circuits with coils used as inductors.

b. Tuning. Tuning of the r-f circuits is accomplished by a three-gang capacitor C20, C30, and C60, each section connected from the ungrounded end of each line to ground. C1, C2, and C3 are trimmer capacitors. Inasmuch as the oscillator circuit must track 30 mc lower in frequency than the r-f and mixer circuits and use the same value of tuning capacitance, the oscillator inductor must be slightly higher in value than the other two. To meet this requirement oscillator inductor L30 has been increased in value by making its inner conductor smaller in diameter while maintaining the same length. Frequency stability of the oscillator circuit over wide variations in temperature is obtained by the use of a temperature-compensated capacitor C4 in parallel with the oscillator frequency

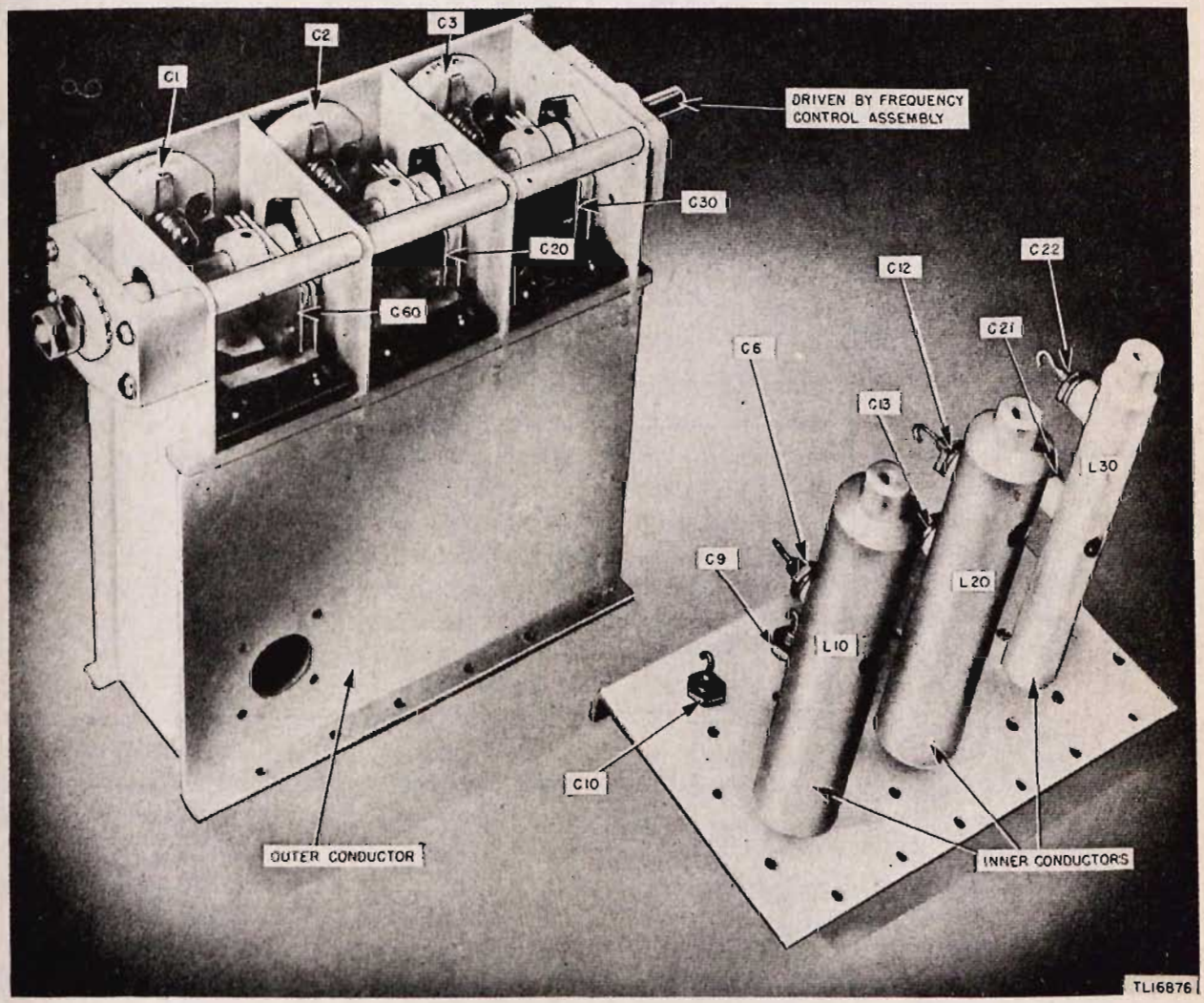


Figure 94. Radio Receiver R-48/TRC-8 (XC-3), r-f unit.

control tuning capacitor. Capacitor C4 has a negative temperature coefficient, that is, its capacity decreases with an increase in temperature. Under conditions of rising temperatures the tubing elements in the oscillator circuit will expand and tend to *decrease* the frequency. This tendency is counteracted by the compensating capacitor which *increases* the frequency with rising temperatures thus keeping the oscillator frequency substantially free from drift.

c. Feed-through Capacitors. (1) Capacitors C6, C7, C8, C10, C11, C12, C13, C14, C18, C21, C22, and C24 serve as conventional bypass and coupling capacitors in the r-f section of the receiver (fig. 94). In their electrical functioning, they are identical with the usual capacitor which consists of two conducting plates (electrodes), separated by a nonconducting dielectric, which may be air, paper, oil, ceramic, etc. These capacitors, however, are quite unconventional in their mechanical construction and are referred to as feed-through capacitors.

(2) Instead of two parallel plates, they have two concentric cylindrical plates, separated by a ceramic dielectric sleeve. All three parts are physically bonded together as shown in the cross-sectional view (fig. 97). The outer plate (electrode), is in the form of a threaded bushing, which serves to mount the capacitor, and also to connect that plate electrically to the proper point in the circuit. Thus capacitors C21, C18, and C6 are connected to ground by mounting them on the chassis, while capacitors C6, C13, C21, and C22 are screwed into the tuned lines, thereby connecting them electrically to these points, in addition to mounting them mechanically. The other plate (electrode) of the capacitor is the inner concentric conductor. It is in the form of a wire extending through the center of the unit, and has a hook at each end. Consequently, *testing between these two outer hooked ends will always show continuity*, but capacity will be indicated only between the outer threaded bushing and either of the hooked ends of the inner conductor.

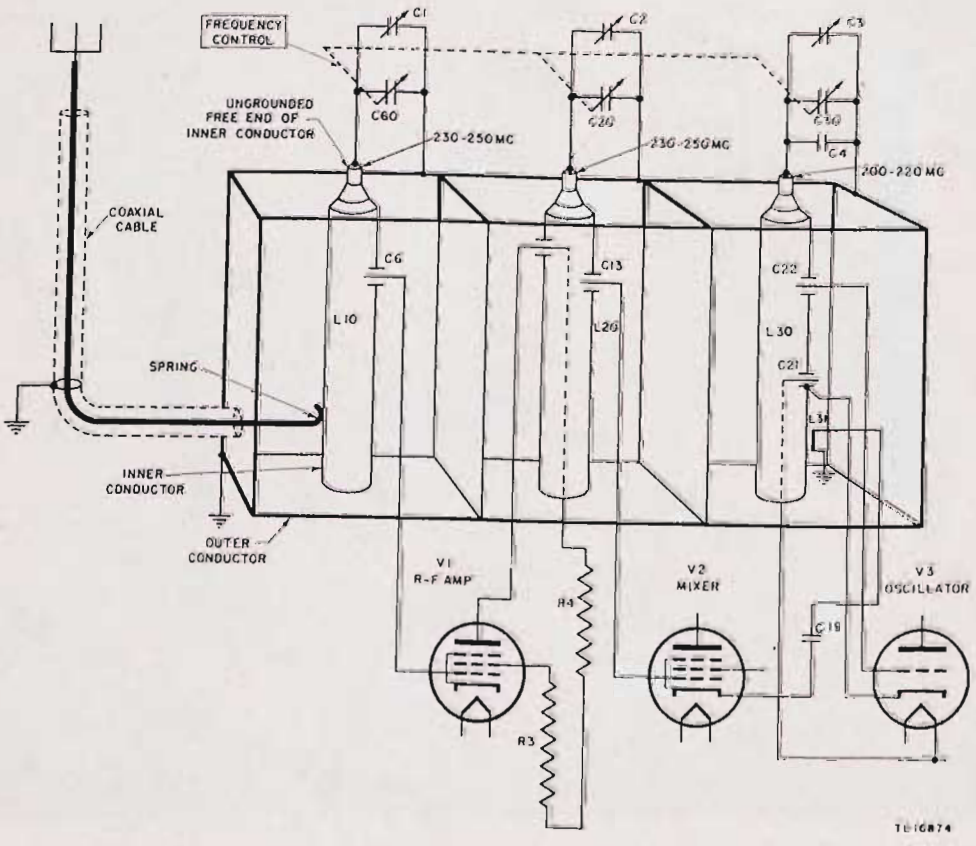


Figure 95. Radio Receiver R-48/TRC-8 (XC-3), mechanical equivalent of r-f unit.

A shorted capacitor will show continuity between the outer threaded bushing and the inner conductor. Connections to the inner plate of this capacitor may be made at either one or both ends, the hooks serving as convenient terminals for soldering leads.

129. R-F AMPLIFIER.

a. The antenna is coupled to the receiver by means of a 50-ohm coaxial transmission line. This line terminates in a spring which makes contact with antenna line L10 at a point having approximately 50 ohms impedance to ground (fig. 96). The antenna inductor acts as an autotransformer with maximum impedance at the ungrounded end, and is tuned to signal frequency by the antenna section of frequency control tuning capacitor C60 paralleled by trimmer capacitor C1. Capacitor C6 couples the line to the grid of i-f amplifier Tube JAN-6AG5 (V1). Resistor R1 is the grid resistor and is connected to the automatic bias circuit through decoupling circuit resistor R2 and capacitors C7 and C10. The grid is tapped down on L10 for impedance matching. Grid bias is furnished by the SQUELCH ADJ. control on the front panel which permits the r-f amplifier stage to be operated at reduced gain when fairly strong signals are received. Under some conditions of operation, it may be advisable to use this control to reduce r-f gain so that strong adjacent frequency signals will not cause cross-modulation.

b. Resistor R3 is used as a screen dropping resistor and capacitor C5 is the screen bypass. The high-voltage supply, 250 volts, is decoupled by resistor R5, and capacitors C9, C15 and C16. The plate circuit of tube V1 has high impedance and is therefore coupled to a similarly high impedance point on line L20 which is tuned to signal frequency by the mixer section of frequency control tuning capacitor C20 paralleled by trimmer capacitor C2. Resistor R4 and the lead length through the center of the line are used in a manner similar to an untuned primary of an r-f coil. The plate lead is placed in the inside of the inner conductor to keep it out of the field of the resonant line which would reduce the Q. Plate and screen current flow through meter resistor R46 so that the r-f amplifier plate and screen current is indicated on meter M1 when the switch is in the R.F. AMP. position. Resistor R46 is a meter shunt. L1 is a heater choke, bypassed to ground at each end by capacitors C11 and C8. Capacitor C12 is used to couple the signal from plate of tube V1 to line L20.

c. Plate and screen current flow through meter resistor R46 so that the r-f amplifier plate and screen current is indicated on the meter M1 when the switch is in the R.F. AMP. position. Resistor R46 is a meter shunt. L1 is a heater choke, bypassed to ground at each end by capacitors C11 and C8.

130. MIXER.

a. The mixer serves to combine signal frequency (230-250 mc) with the local oscillator frequency (200-220 mc) to produce a third, or intermediate frequency (30 mc). The r-f signal is coupled to the grid of mixer Tube JAN-6AG5 (V2) by capacitor C13. R6 is the grid resistor. R7 is the screen dropping resistor bypassed to ground at each end by capacitors C14 and C17. The heater is bypassed by capacitor C18 and one side of the heater as well as *one side* of the cathode is grounded. The local oscillator signal is fed to the ungrounded end of the cathode. Sufficient oscillator voltage is developed from cathode to ground due to the impedance of the cathode structure of the tube and the lead length to ground to modulate the electron stream, to produce the 30-mc intermediate frequency in the plate circuit.

b. Plate voltage is fed through i-f coil L4 and resistor R11. Resistor R11 is the plate decoupling resistor bypassed to ground at each end by capacitors C27 and C29. Resistor R13 further decouples the plate supply. The mixer output is coupled to the i-f stages by capacitor C25. Plate and screen current flow through meter resistor R47 so that mixer plate and screen current is indicated when the switch is in the MIXER position. Resistor R47 is a meter shunt.

c. The output of oscillator V3 is coupled to the mixer cathode by means of coupling loop L31 and coupling capacitor C19. L3 is a heater choke for mixer tube V2 and oscillator V3.

131. OSCILLATOR.

a. The local oscillator produces an r-f voltage 30 mc lower in frequency than signal frequency so that mixing these two signals will produce a 30-mc component or intermediate frequency. The

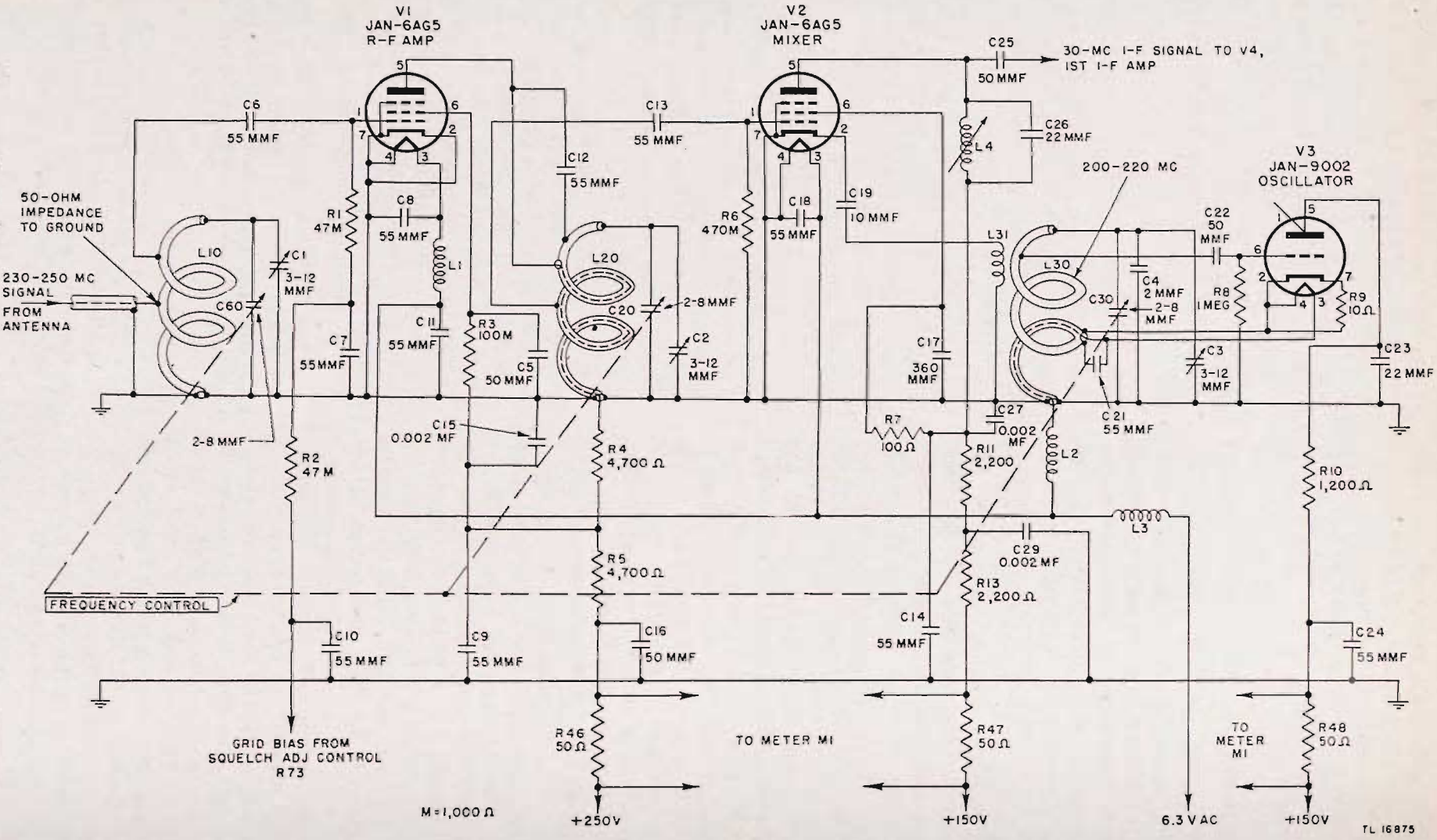


Figure 96. Radio Receiver R-48/TRC-8 (XC-3), functional diagram of r-f circuits.

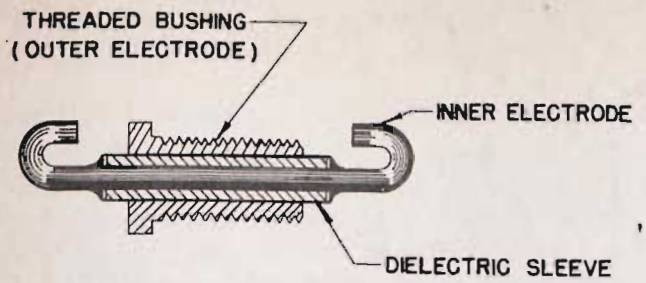


Figure 97. Feed-through capacitors, cross-sectional view.

oscillator circuit is the Hartley type (fig. 96). L30 is the oscillator line. The inner conductor has a smaller diameter than the r-f and mixer inductors. It operates over a frequency range of 200 to 220 mc. Capacitor C22 couples the grid of Tube JAN-9002 (V3) to the line, and resistor R8 is the oscillator grid leak. C30 is the oscillator section of the frequency control tuning capacitor, and it is paralleled by trimmer capacitor C3 and temperature-compensation capacitor C4. Plate voltage is supplied through resistor R10, bypassed to ground at both ends by capacitors C24 and C23.

b. Plate current flows through resistor R48 so that oscillator plate current will be indicated on the meter when the switch is in the OSC. position. Resistor R48 serves as a meter shunt. Plate voltage is taken from the regulated 150-volt output of the power supply to further improve frequency stability. L2 is a heater choke. One side of the heater is tied to one side of the cathode to minimize the effect of heater voltage variations on frequency stability. The cathode, in turn, is connected to a point on the line above r-f ground potential. In order to prevent a difference of r-f potential from appearing on the other heater terminal and causing hum modulation of the oscillator, it is bypassed to the same point on the line by capacitor C21. Resistor R9 is a parasitic suppressor. The r-f current flowing through L30 is coupled to mixer tube V2 by coupling loop L31.

132. I-F STAGES.

a. First I-f Amplifier. Coil L4 tuned to 30 mc by capacitor C26 is the first i-f transformer and is coupled to the plate of mixer tube V2 (fig. 98).

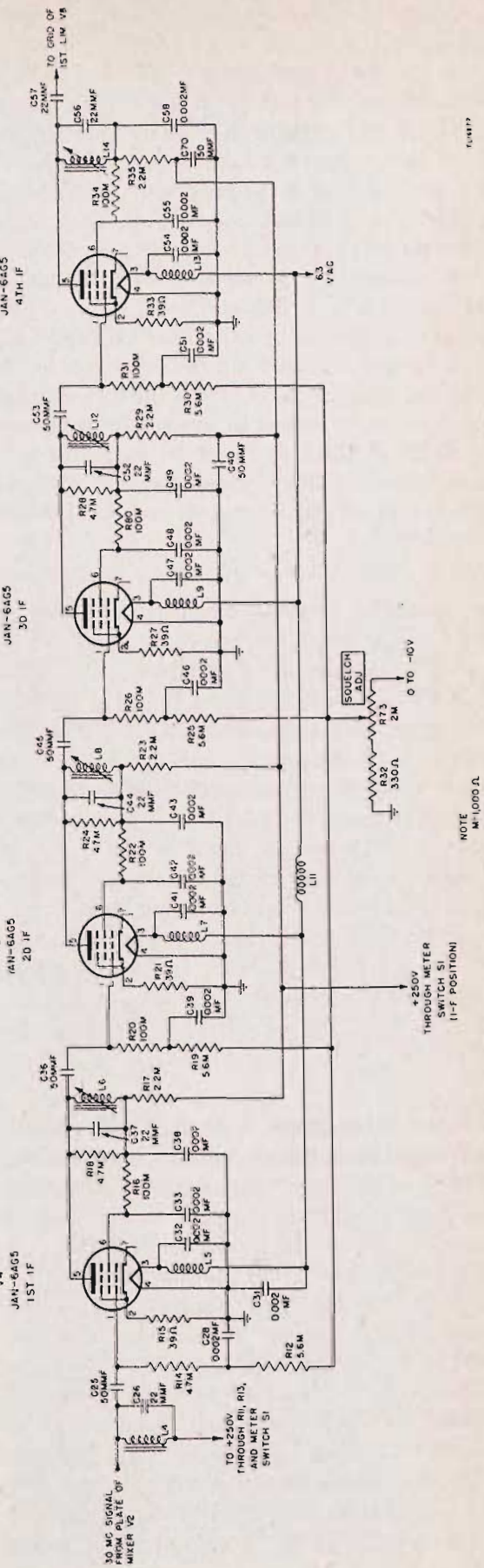


Figure 98. Radio Receiver R-48/TRC-8 (XC-3), functional diagram of i-f amplifier stages.

This stage, as well as the other three i-f stages, uses Tube JAN-6AG5 as an i-f amplifier. C25 is the coupling capacitor and R14 is the grid resistor. Capacitor C28 bypasses the grid return to ground and resistor R12 connects the grid return to the moving arm of the SQUELCH ADJ. control. R12 is the grid return decoupling resistor. R15 is the cathode resistor. This unbypassed resistor serves to reduce detuning caused by the change in grid capacity with change in grid bias. L5 is a heater choke, bypassed to ground at both ends by capacitors C31 and C32. R17 is the plate decoupling resistor bypassed to ground by capacitor C38. R16 is the screen dropping resistor, bypassed to ground by capacitor C33. Coil L6 tuned to 30 mc by capacitor C37 is the second i-f transformer. Resistor R18 reduces the Q of the i-f circuit to increase the bandwidth.

b. Second I-f Amplifier. Capacitor C36 couples the i-f signal from the preceding stage V4 to the grid of the second i-f amplifier, Tube JAN-6AG5 (V5). Resistor R20 is the grid resistor and is bypassed to ground by capacitor C39. The grid return is decoupled from the SQUELCH ADJ. control by resistor R19. Resistor R21 is the cathode resistor and L7 is a heater choke bypassed to ground by capacitor C41. R23 is the plate decoupling resistor bypassed to ground by C43. R22 is the screen dropping resistor and the screen is bypassed to ground by capacitor C42. Coil L8 tuned to 30 mc by capacitor C44 is the third i-f transformer. Resistor R24 reduces the Q of the i-f circuit to increase the bandwidth.

c. Third I-f Amplifier. Capacitor C45 couples the i-f signal from the preceding stage V5 to the grid of the third i-f amplifier, Tube JAN-6AG5 (V6). Resistor R26 is the grid resistor and is bypassed to ground by capacitor C46. The grid return is decoupled from the SQUELCH ADJ. control by resistor R25. Resistor R27 is the cathode resistor and L9 is a heater choke bypassed to ground by capacitor C47. The high-voltage supply is bypassed to ground by capacitor C40. The plate decoupling resistor R29 is bypassed to ground by capacitor C49. Resistor R80 is the screen dropping resistor and the screen is bypassed to ground by capacitor C48. Coil L8 tuned to 30 mc by capacitor C52 is the fourth i-f transformer. Resistor R28 reduces the Q of the i-f circuit to increase the bandwidth.

d. Fourth I-f Amplifier. Capacitor C53 couples the i-f signal from the preceding stage V6 to the grid of the fourth i-f amplifier, Tube JAN-6AG5 (V7). Resistor R31 is the grid resistor and is bypassed to ground by capacitor C51. The grid return is decoupled from the SQUELCH ADJ. control by resistor R30. Resistor R33 is the cathode resistor and L13 is a heater choke bypassed to ground by capacitor C54. The high-voltage supply is bypassed to ground by capacitor C70, and resistor R35 is the plate decoupling resistor bypassed to ground by capacitor C58. Resistor R34 is the screen dropping resistor and the screen is bypassed to ground by capacitor C55. Coil L4 tuned to 30 mc by capacitor C56 is the fifth i-f transformer. Plate supply for all i-f stages flows through the meter switch so that total plate and screen current of the i-f amplifiers will be indicated when the meter switch is in the i-f position. Resistor R73 is the SQUELCH ADJ. control and resistor R32 serves as a minimum bias resistor when the control is in the full clockwise position. L11 is an additional heater choke which serves to isolate the heater circuits of all stages up to the second i-f amplifier from the remaining stages.

133. LIMITER STAGES.

a. First Limiter. The limiter stages (fig. 99) remove all amplitude variations of the signal so that the discriminator input voltage is constant. Two limiters are used so that more perfect limiting is obtained. These tubes operate at their saturation point. Therefore any amplitude modulation present, such as high-frequency noise voltages, cause no change in limiter plate current and these unwanted noises are rejected. Capacitor C57 couples the i-f signal from the preceding stage to the grid of the first limiter, Tube JAN-6AG5 (V8). Resistor R36, bypassed to ground by capacitor C59, reduces the Q of the i-f circuit to increase the bandwidth. R74 and R45 are grid resistors. The grid return voltage is applied to the grid of the squelch tube so that rectified grid current, a function of limiting, will increase the bias applied to the squelch tube and cause squelch relay RL1 to drop out with a strong signal. L15 is the heater choke bypassed to ground by capacitor C61. The high-voltage supply is bypassed

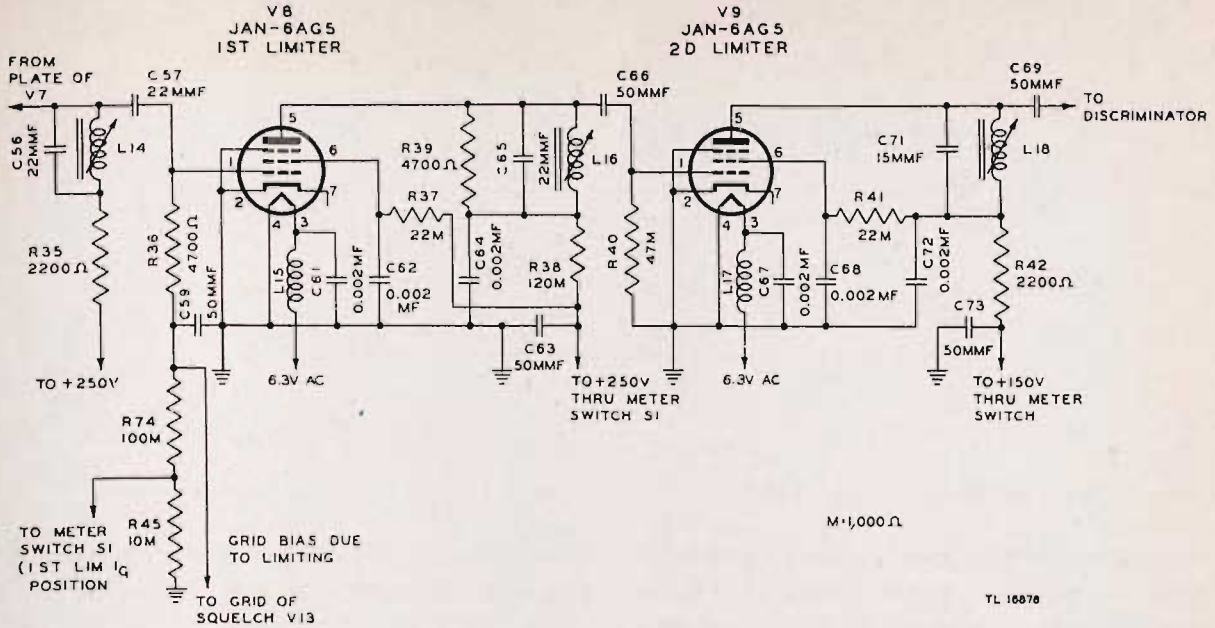


Figure 99. Radio Receiver R-48 TRC-8 (XC-3), functional diagram of first and second limiter stages.

to ground by capacitor C63. Resistor R37 is the screen dropping resistor and the screen is bypassed to ground by capacitor C62. Resistor R38 is the plate decoupling resistor bypassed to ground by capacitor C64. Coil L16 tuned to 30 mc by capacitor C65 is the first limiter transformer. Resistor R39 reduces the Q of the i-f circuit to increase the bandwidth. Plate current flows through the meter so that limiter plate current is indicated on the meter when the meter switch is in the 1st LIM. Ip position.

b. Second Limiter. Capacitor C66 couples the signal from the preceding stage V8 to the grid of the second limiter, Tube JAN-6AG5 (V9) (fig. 99). Resistor R40 is the grid resistor. L17 is the heater choke and is bypassed to ground by capacitor C67. The high-voltage supply is bypassed to ground by capacitor C73. Resistor R42 is the plate and screen decoupling resistor bypassed to ground by capacitor C72. Resistor R41 is the screen dropping resistor and the screen is bypassed to ground by capacitor C68. Coil L18 tuned to 30 mc by capacitor C71 is the second limiter transformer. Plate and screen voltage for this limiter stage is taken from the regulated 150-volt output of the power supply and flows through the meter so that limiter plate current is indicated on the meter when the meter switch is in the 2d LIM. Ip position. Sufficient gain is provided for limiting action to start on the noise voltage generated in the grid circuit of the r-f amplifier (shot-effect). The output of this stage, free of amplitude variations, is a variable-frequency, constant-amplitude 30-mc signal.

134. DISCRIMINATOR.

a. The function of the discriminator stage V10 (fig. 100) is similar to that of the demodulator stage of the conventional superheterodyne receiver. It removes the audio frequency component from the modulated r-f signal. The audio component in an f-m signal is represented by shifts or deviations in frequency, and the signal smoothed out by the limiter stages is of constant amplitude with no voltage variations due to modulation. The function of the discriminator, therefore, is to convert these frequency variations into voltage or amplitude variations so that the signal will operate a loudspeaker.

b. Capacitor C69 couples the signal from the second limiter output to the discriminator transformer L19 which is tuned by capacitor C75. This circuit, as well as the limiter and i-f circuits, is resonant at 30 mc. Transformers L18 and L19 are shielded from each other so that they have no common electromagnetic coupling. Signal voltage applied to the center tap of L19 provides a signal component on the diode plates of the discriminator Tube JAN-6H6 (V10) which are in phase. To extract the audio

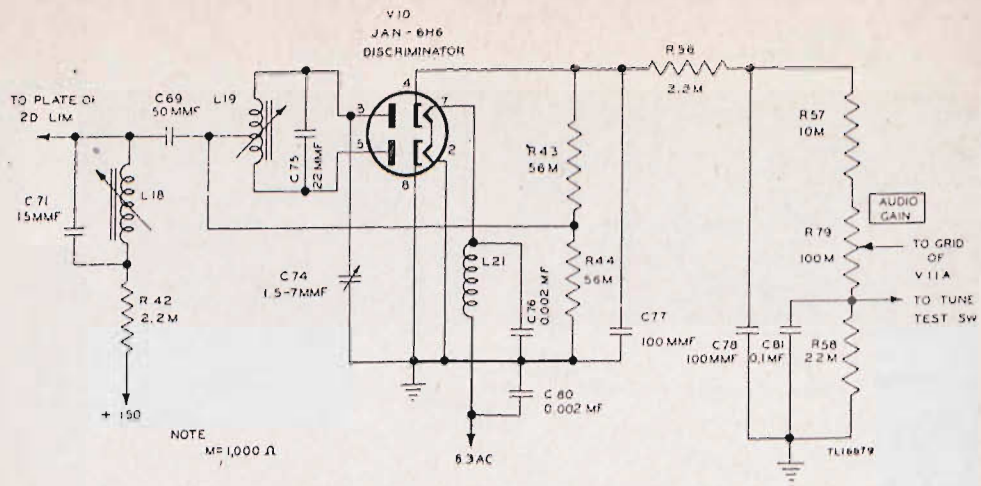


Figure 100. Radio Receiver R-48/TRC-8 (XC-3), functional diagram of discriminator stage.

component from the signal, a second signal component is required which places the diode plates 180° out of phase with each other and substantially 90° out of phase with the first signal component. The second component is normally obtained by direct coupling between L18 and L19. Since no direct magnetic coupling exists between L18 and L19 to provide this phase-shifting voltage, this coupling is obtained by capacitor C74 which produces electrical unbalance in the discriminator tuned circuit L19 and C75 with the result that currents flow in L19 in the same phase relation as would occur with direct magnetic coupling. The degree of this unbalance is controlled by the value of C74, and since this determines the bandwidth of the discriminator, the adjustment is rather critical. *The adjustment of L18, L19, and C74 must not be changed without proper test equipment.*

c. The signal components impressed on the diode plates are combined and, due to rectification, audio voltages appear across resistors R43 and R44, the diode load. Capacitor C77 serves to remove any radio frequency that appears in the audio output. L21 is the heater choke and is bypassed at each end by capacitors C76 and C80.

d. When the carrier is not modulated, that is, the frequency is constant, the phase relations between the two voltages on each diode plate are such that the output into the diode load resistors is equal in magnitude but of opposite polarity. The algebraic value of the voltage is zero and no sound is heard in the loudspeaker. However, when the carrier is modulated, signal frequency is increasing and decreasing at an audio rate from the resting frequency. These swings in frequency cause the discriminator circuit to become inductive at frequencies above resonance and capacitive below resonance. The phase relations between the diode plates are shifted in such a manner as to unbalance the diode outputs at an audio rate. Thus deviations in r-f input frequency appear across the diode load as alternating voltages that have the same waveshape as the original modulating voltage at the transmitter, and the loudspeaker reproduces an audible sound corresponding to that impressed on the transmitting microphone.

e. A d-c component also appears across diode load resistors R43 and R44 due to rectification of the constant-amplitude carrier. When a signal is tuned in properly, this voltage becomes zero. When the signal is tuned to one side of the band, this d-c voltage will have a positive or negative polarity depending upon which side of the center frequency the receiver is tuned to. This voltage is used as an indication of proper tuning by being applied to the meter through filter systems C77, R56, and C78, R57, R79, C81, and R58 to TUNE TEST switch S2 and meter switch S1 (fig. 104). The d-c voltage appearing across R58 results in a meter reading. Thus a zero reading on the meter with meter switch S1 in the TUNE position indicates that the receiver is properly tuned. The TUNE TEST button merely reverses the meter so that a small deflection will indicate mistuning. Resistor R79, 100,000 ohms, is the AUDIO GAIN control.

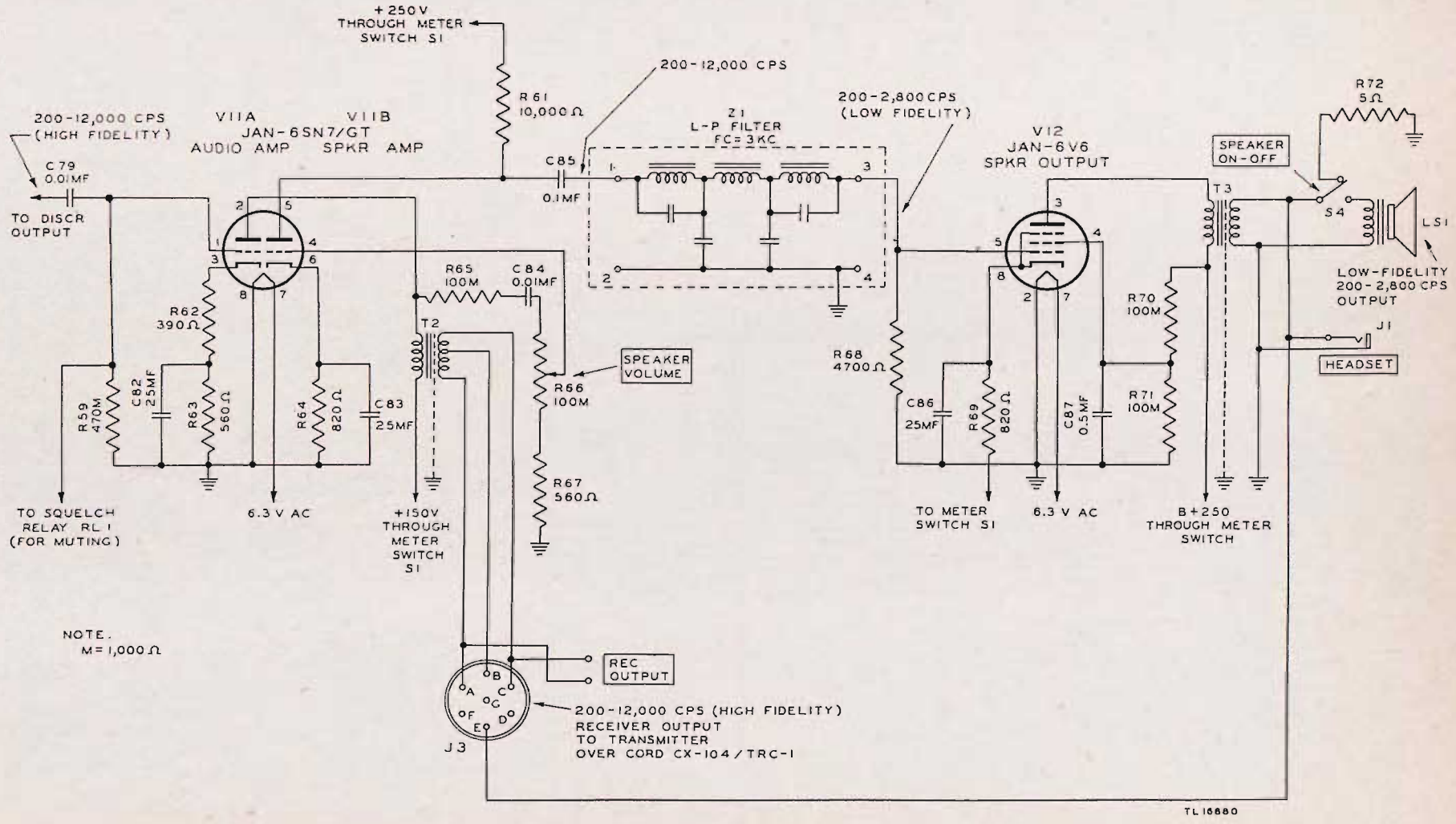


Figure 101. Radio Receiver R-48/TRC-8 (XC-3), functional diagram of audio and speaker amplifier stages.

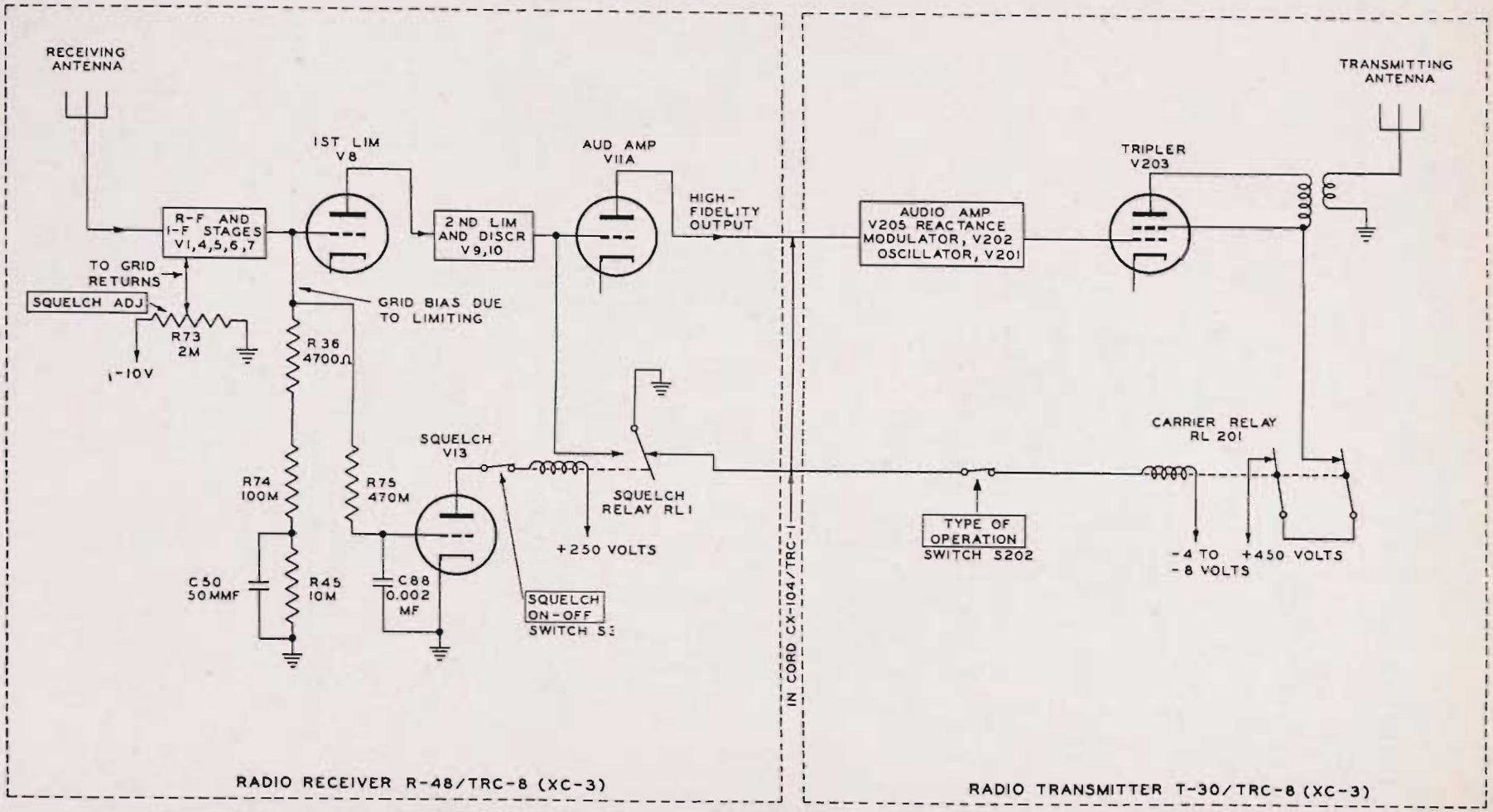


Figure 102. Radio Receiver R-48/TRC-8 (XC-3), functional diagram of squelch operation.

135. AUDIO AND SPEAKER AMPLIFIER.

a. Audio Amplifier. (1) V11A and V11B (fig. 101) are the twin-triode sections of a single Tube JAN-6SN7/GT. V11A is the amplifier and output tube for the high-fidelity signal; V11A and V11B are amplifier stages for the low-fidelity circuit. Audio voltage across the AUDIO GAIN control R79 is applied to the grid of V11A by C79. R59 is the grid resistor. The junction point of resistors R59 and R60 is connected to the squelch relay so that background noises are grounded out, and the loudspeaker is muted, whenever the squelch relay is energized. R62 and R63 are cathode bias resistors and their junction point is bypassed by capacitor C82 so that R62 will furnish some degeneration, and thereby reduce distortion. Plate voltage is taken from the regulated output of the power supply (150 volts) through the meter switch S1 and is connected to the plate of the tube through the primary of transformer T2. Thus plate current is indicated on the meter when the meter switch is in the AUD. AMP. position.

(2) The impedance of the secondary of transformer T2 is 500 ohms. The transformer is terminated in receptacle J3 and the two binding posts on the front panel marked REC. OUTPUT. The center tap of this transformer as well as the two outside terminals are connected to the transmitter by means of Cord CX-104/TRC-1. This center tap terminates at a binding post marked Telephone EE-8, and the transmitter high-fidelity transformer T203 is similarly center-tapped and brought out to the other Telephone EE-8 post. Thus, at terminal stations, advantage is taken of the simplex or phantom circuit obtained over the spiral-four lines to furnish intercommunication facilities between terminal station operators and Telephone Terminal CF-1-(*) operators by means of Telephones EE-8-A (par. 126).

(3) Terminating the high-fidelity channel at the transmitter front panel enables this circuit to modulate the transmitter at relay stations by interconnecting the REC and TRSG binding posts with short leads. A convenient termination is provided for spiral-four cable at terminal stations. The high-fidelity channel is designed for use with modulation frequencies of 200 to 12,000 cycles per second.

b. Speaker Amplifier. The second half of Tube JAN-6SN7/GT, V11B, functions as the speaker amplifier stage for the low-fidelity channel (fig. 101). Signal voltage is taken from the plate of tube V11A, through resistor R65 and coupling capacitor C84 and fed to one end of the SPEAKER VOLUME control R66. R67 is a minimum volume limiting resistor. The moving arm of the volume control is connected to the grid of the tube. Cathode bias resistor R64 is bypassed by capacitor C83. Plate voltage is applied through meter switch S1 so that plate current is indicated on the meter when the meter switch is in the SPKR. AMP. position. Audio output is fed from the plate of the tube through coupling capacitor C85 to low-pass filter, Z1, which removes all frequencies over 2,800 cycles.

136. SPEAKER OUTPUT.

a. The audio signal from the output terminal of the low-pass filter Z1 is applied to the grid of speaker output Tube JAN-6V6 (V12) (fig. 101). R68 terminates the filter and also serves as the grid resistor. R69 is the cathode bias resistor and is bypassed by capacitor C86. Resistor R69 is connected to ground through the meter switch so that cathode current is indicated on the meter when the meter switch is in the SPKR. OUT position.

b. Screen voltage is supplied from the midpoint of voltage dividing resistors R70 and R71 and the screen is bypassed by capacitor C87. Plate voltage is applied through the primary of transformer T3.

c. The secondary of T3 is connected to the loudspeaker through SPEAKER ON-OFF switch S4 and to HEADSET jack J1. The low-fidelity output signal is also connected to the E lead of receptacle J3 on the front panel and is made available at transmitter HEADSET jack J202 so that the operator may monitor the receiver output by means of the handset. R72 is a dummy load resistor which takes the place of the speaker load when the SPEAKER ON-OFF switch is turned OFF.

137. SQUELCH STAGE.

a. Squelch operation is accomplished by Tube JAN-6N7 (V13) (fig. 102). There are two conditions under which squelch operation is used. At a terminal station the squelch circuit mutes the receiver output when no signal is present to eliminate background noises. At relay stations squelch operation is used to mute the receiver output when no carrier is present and also automatically operate a transmitter by de-energizing relay RL201 when a carrier is present.

b. Squelch operation is shown in a functional diagram (fig. 102). The grid return of the first limiter, V8, is connected to the grid of the squelch tube through decoupling resistor R75. With no carrier present, and SQUELCH ADJ. control R73 adjusted properly, little or no bias voltage appears on the grid of squelch tube V13 and the resultant plate current energizes squelch relay RL1 and grounds the audio signal applied to V11A. As a carrier appears, rectified grid current, which is a function of limiting, appears in the grid return circuit of the first limiter tube. This voltage is applied to the grid of squelch tube V13 and the additional negative bias fed to the grid causes a drop in plate current which de-energizes squelch relay RL1. This removes the ground from the audio circuit, permitting the signal to be heard in the loudspeaker, and grounds a contact which is connected to one side of carrier relay RL201 in the transmitter. Thus squelch relay RL1, operated by the carrier, automatically energizes carrier relay RL201 in the transmitter and permits the receiver output to modulate the transmitter.

c. Resistor R74 and capacitor C50 filter the first limiter grid return circuit and R74 is connected to the meter switch so that grid current is indicated on the meter when the meter switch is in the 1st LIM. Ig position. R45 is a meter shunt resistor. Plate voltage for the squelch tube is applied through relay coil RL1 and the SQUELCH ON-OFF switch. When squelch operation is not required, the squelch circuit may be disabled by throwing the SQUELCH ON-OFF switch OFF. Capacitor C88 is a bypass which serves to keep signal fluctuations such as instantaneous noise out of the squelch grid circuit.

138. POWER SUPPLY.

a. Rectifier. The high-voltage rectifier for the power supply is Tube JAN-5U4-G (V15) (fig. 103). The power transformer T1 is designed for either 115- or 230-volt operation (par. 50 and fig. 139). The primary is fused by F1 and F2, available for replacement on the front panel.

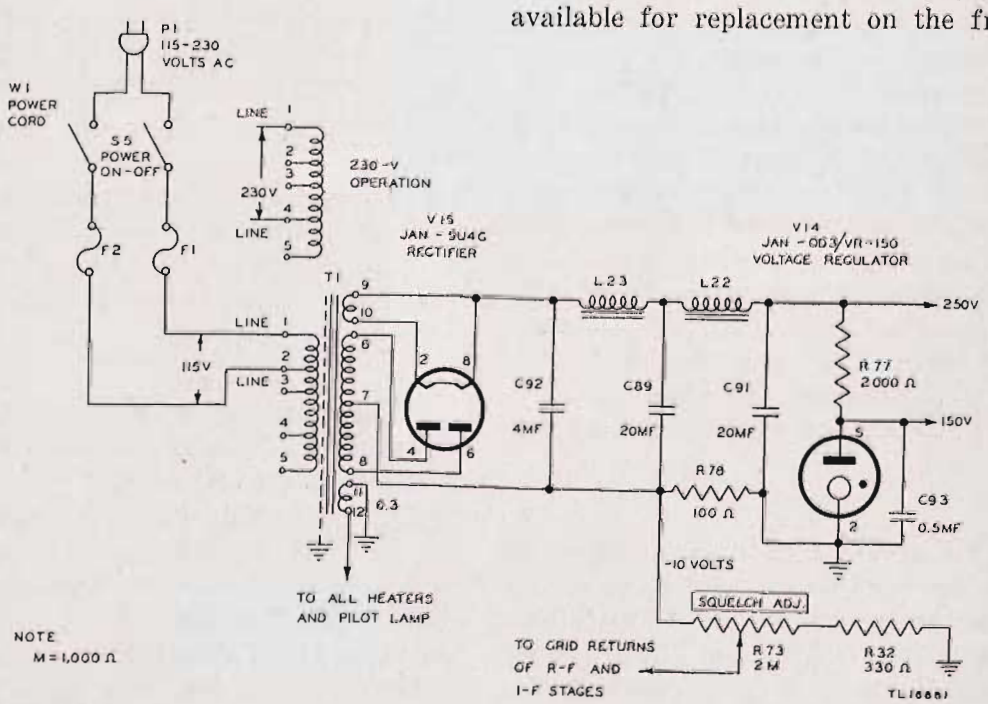


Figure 103. Radio Receiver R-48/TRC-8 (XC-3), functional diagram of power supply.

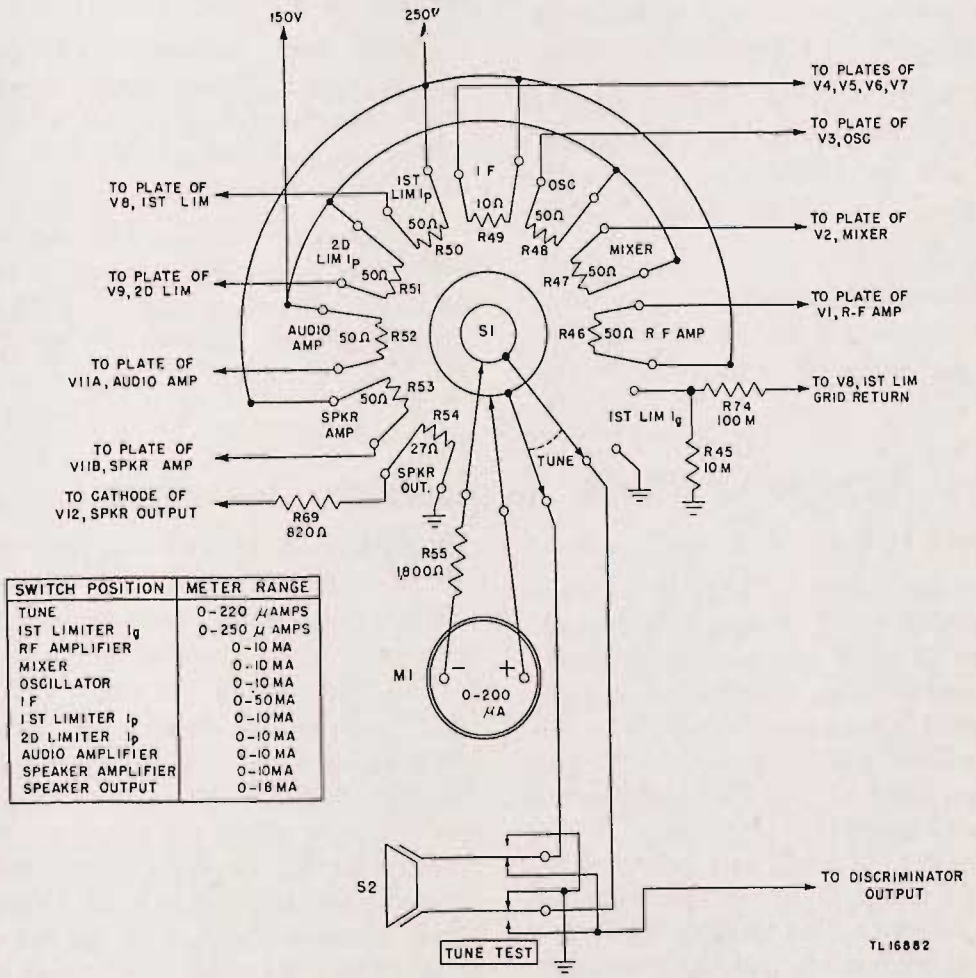
Switch S5 is a double-pole POWER ON-OFF switch and the primary is connected to an a-c plug P1 by a 10-foot power cord W1. The output of the full-wave rectifier works into a capacitor input filter consisting of filter chokes L22 and L23 and capacitors C92, C89, and C91. All of the output current flows through resistor R78 so that approximately 10 volts negative to ground is obtained for bias supply through the SQUELCH ADJ. control R73. The filtered high-voltage output of the power supply is approximately 250 volts. Heater voltage for all the tubes in the receiver is supplied by the 6.3-volt winding of the transformer. Receptacle J2, on the front panel, furnishes 250 volts for the plate circuit and 6.3 volts for the heater of Test Oscillator TS-237/TRC-8 (XC-3).

b. Voltage Regulator. Tube JAN-OD3/VR-150 (V14) is a voltage regulator (fig. 103). It is characteristic of this tube to maintain a constant voltage drop across its terminals. R77 is the voltage-dropping resistor and C93 functions as a bypass capacitor. The regulated 150-volt output of this tube is applied to the mixer, oscillator, second limiter, and audio-amplifier tubes in order to provide maximum frequency and output stability.

139. RECEIVER METERING.

A meter M1 and meter switch S1 are provided on the front panel of the receiver for checking the operation of each stage. Resistors R45 to R55, in conjunction with meter M1, provide the ranges shown in the table in figure 104. The function of each switch position is as follows:

a. TUNE Position. In this position one side of the meter is connected to ground through the TUNE TEST switch and the other terminal,



SWITCH POSITION	METER RANGE
TUNE	0-220 μAMPS
IST LIMITER I_g	0-250 μ AMPS
RF AMPLIFIER	0-10 MA
MIXER	0-10 MA
OSCILLATOR	0-10 MA
IF	0-50 MA
IST LIMITER I_p	0-10 MA
2D LIMITER I_p	0-10 MA
AUDIO AMPLIFIER	0-10 MA
SPEAKER AMPLIFIER	0-10MA
SPEAKER OUTPUT	0-18 MA

Figure 104. Radio Receiver R-48/TRC-8 (XC-3), functional diagram of meter switch.

also through the TUNE TEST switch, is connected to the discriminator output circuit. If a signal is tuned in properly no reading will appear on the meter. However, if the FREQUENCY CONTROL dial is even slightly off resonance, the discriminator unbalance will cause a reading on the meter. Thus the tuning dial can be adjusted until a zero reading on the meter indicates proper tuning. The TUNE TEST button reverses the polarity of the meter so that even a small deflection will indicate that the receiver is improperly tuned.

b. 1st LIM. Ig Position. In this position the positive terminal of the meter is grounded and the negative terminal is connected to the first limiter grid return circuit through R74. The reading indicates the relative signal strength of the received signal.

c. R.F. AMP. Position. In this position one side of the meter is connected to the 250-volt supply and the other terminal to the plate circuit of r-f amplifier tube V1, indicating plate current.

d. MIXER Position. In this position one side of the meter is connected to the regulated 150-volt supply and the other terminal to the plate circuit of mixer tube V2 indicating plate current.

e. OSC. Position. In this position one side of the meter is connected to the regulated 150-volt supply and the other terminal to the plate circuit of oscillator tube V3, indicating plate current.

f. I.F. Position. In this position one side of the meter is connected to the 250-volt supply and the other terminal to the plate circuits of all four i-f tubes indicating total plate current.

g. 1st LIM. Ip Position. In this position one side of the meter is connected to the 250-volt supply and the other terminal to the plate circuit of first limiter tube V8, indicating plate current.

h. 2nd LIM. Ip Position. In this position one side of the meter is connected to the regulated 150-volt supply and the other terminal is connected to the plate circuit of second limiter tube V9, indicating plate current.

i. AUD. AMP. Position. In this position one side of the meter is connected to the regulated 150-volt supply and the other terminal to the plate circuit of audio-amplifier tube V11A, indicating plate current.

j. SPKR. AMP. Position. In this position one side of the meter is connected to the 250-volt supply and the other terminal to the plate circuit of the speaker-amplifier tube V11B, indicating plate current.

k. SPKR. OUT Position. In this position one side of the meter is connected to ground and the other terminal to cathode resistor R69, indicating cathode current of speaker output tube V12.

SECTION XV. THEORY OF ACCESSORY EQUIPMENT

140. ANTENNA SYSTEM.

a. Transmission Lines. The output of the transmitter is coupled to the antenna with a coaxial cable. A coaxial cable, or concentric transmission line, consists of an outer conductor operated at ground potential and a carefully centered inner conductor. The characteristic impedance of these cables is low; those used in this system have an impedance of 50 ohms. The antenna is a half-wave dipole fed at the center where the antenna radiation resistance is approximately 50 ohms. The standing wave ratio on the coaxial line is more than 0.85 from 230 to 250 mc.

b. Antenna Assemblies. (1) The antenna assemblies used with this system consist of a half-wave dipole mounted in front of a corner reflector. The corner reflector is somewhat like a funnel into which the signal is poured. By use of the reflector the antenna becomes directional and a gain of approximately 6 db is obtained in the desired direction (fig. 105). Best response occurs when the receiving antenna is directly facing the distant transmitting antenna. The antenna should be aimed so as to obtain maximum signal at the receiver; this occurs when the antenna is directed properly within plus or minus 15°. Either horizontal

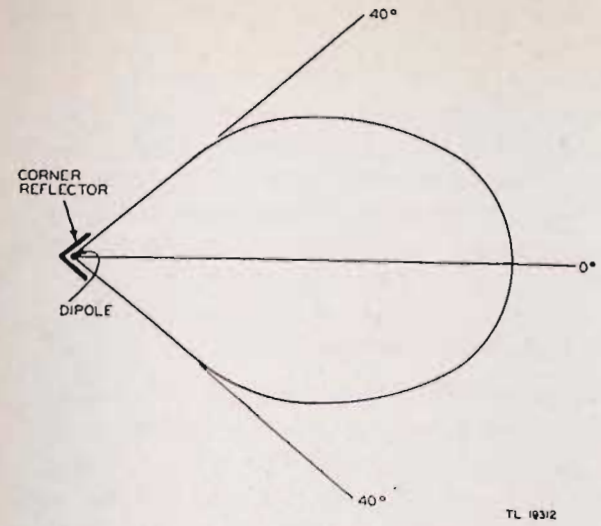


Figure 105. Antenna directivity pattern.

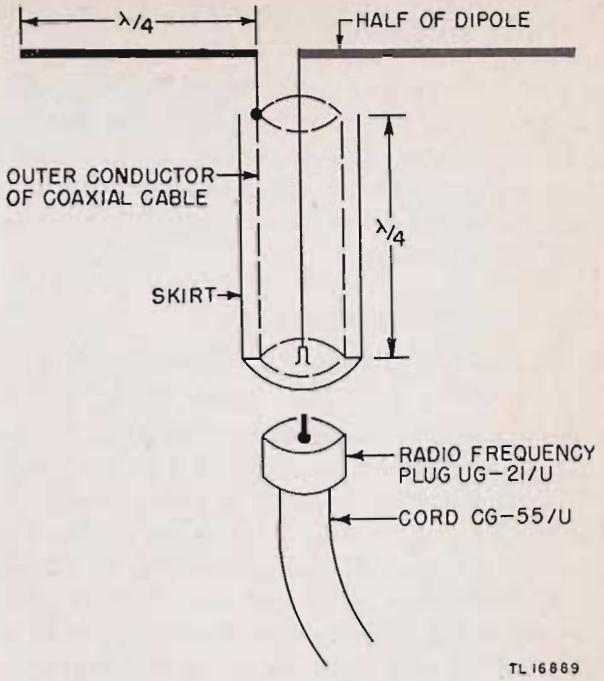
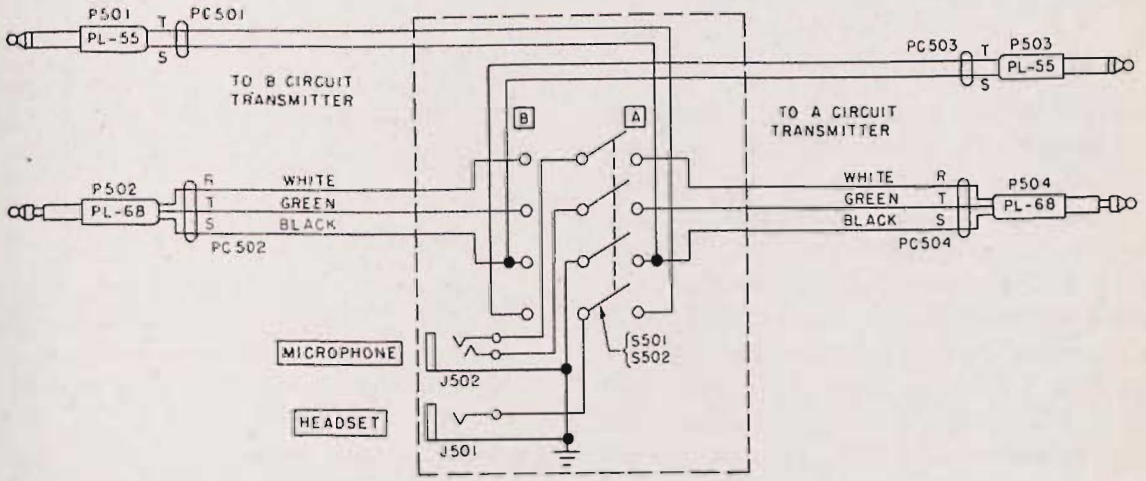


Figure 106. Dipole and coaxial transmission line, functional diagram.

or vertical polarization may be used but companion antennas must be similarly polarized or considerable signal attentuation will occur. Vertical polarization is generally recommended for best results when the signal path is over water.

(2) The signal is picked up by the dipole and fed to the receiver through the coaxial transmission line (fig. 106). The dipole support contains a por-



APPARATUS LEGEND

SWITCHES		CORDS	
S501	CIRCUIT DIRECTION	PC501	HEADSET CORD
S502	CIRCUIT DIRECTION	PC502	MICROPHONE CORD
		PC503	HEADSET CORD
PLUGS		PC504	MICROPHONE CORD
P501	HEADSET PLUG		
P502	MICROPHONE PLUG	JACKS	
P503	HEADSET PLUG	J501	HEADSET JACK
P504	MICROPHONE PLUG	J502	MICROPHONE JACK

TL 16862

Figure 107. Control Box C-21A/TRC-1, schematic diagram.

tion of the coaxial cable and this is surrounded by a quarter-wave skirt which serves to prevent radiation or pick-up in the transmission line. A length of polystyrene is inserted in the skirt to improve the electrical characteristics. No adjustments of any kind are required for satisfactory antenna performance over the frequency range of 230 to 250 mc.

141. CONTROL BOX C-21A/TRC-1.

Control Box C-21A/TRC-1 (figs. 16 and 107) consists of a four-pole, double-throw switch which enables the operator's handset to be instantly connected to either of two positions. This permits the operator to communicate in either circuit direction at a relay station by flipping the circuit direction switch to either A or B. Handset jacks J501 and J502 are connected to the moving arms of circuit direction switch S501 and S502. Throwing the switch to the left, A position, connects the handset to plugs P501 and P504. Throwing the switch to position B connects the handset to the other pair of plugs, P502 and P503. Thus, if plugs P503 and P504 are inserted into one transmitter, and plugs P501 and P502 are inserted in the other transmitter, the operator can switch rapidly from one circuit direction to the other by throwing ganged switch S501 and S502.

142. HANDSET H-23/U.

Handset H-23/U (fig. 14) is a standard issue handset with a butterfly type press-to-talk switch located on the handle for controlling microphone and transmitter keying circuits. The single-button carbon microphone has an impedance of approximately 50 ohms and the earphone an impedance of approximately 250 ohms. A rubber-covered cord terminates in two plugs: Plug PL-55 for earphone connections, and Plug PL-68 for the microphone and push switch connections (fig. 108). In actual operation the earphone is connected across the 4-ohm secondary winding of receiver output transformer T3. This impedance mismatch is desirable as the loss of power resulting reduces the receiver output to a comfortable listening level. The 50-ohm microphone connects to the 50-ohm primary of transformer T204 in the transmitter. The resulting impedance match permits high microphone efficiency.

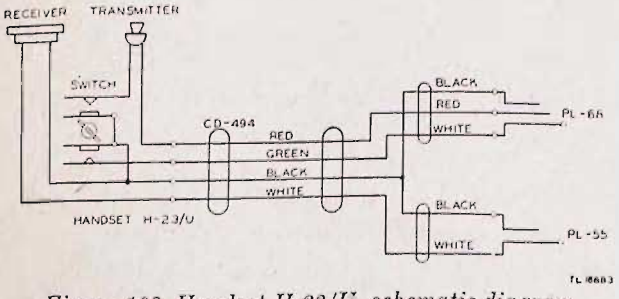


Figure 108. Handset H-23/U, schematic diagram.

143. TELEPHONE EE-8-A.

Telephone EE-8-A is designed for field use on either local battery or common battery systems. It is compact, rugged, and portable, and in performance equal to the best present-day commercial telephones. It contains all the elements necessary for a combination local battery and common battery telephone, and the circuit elements are arranged for anti-sidetone transmission. For a complete description of Telephone EE-8-A, refer to TM 11-333.

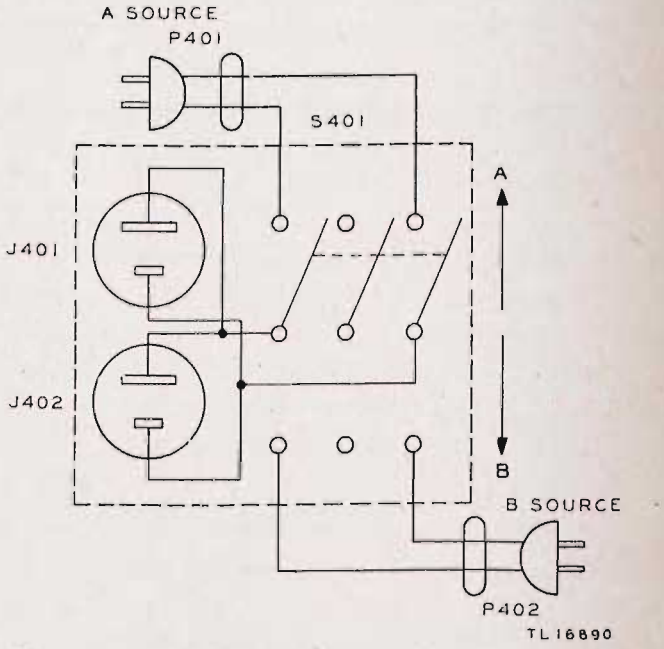


Figure 109. Junction Box J-85/G, schematic diagram.

144. JUNCTION BOX J-85/G.

Junction Box J-85/G permits either of two power sources to be connected to a single load (figs. 18 and 109). This allows two sources of power, such as two Power Units PE-75-( ), to be permanently connected to the junction box and permits either one to be connected to the load by throwing the toggle switch to either A or B position. The two 10-foot cords, termi-

nating in plugs P401 and P402, are each plugged into a Power Unit PE-75-( ). The load, or extension Cord CD-711, is plugged into either receptacle J401 or J402, which are paralleled. Depending on the direction of the three-pole, double-throw switch S401, either input cord is connected to the output receptacles. This arrangement is necessary as the Power Units PE-75-( ) can only be operated 24 hours at a time due to maintenance requirements. Junction Box J-85/G permits continuous operation of radio stations without power interruptions due to refueling or maintenance.

145. JUNCTION BOX JB-110.

Junction Box JB-110 contains 10 outlet receptacles wired in parallel and connected to a 10-foot rubber-covered cord terminating in a standard male plug (figs. 19 and 110). The junction box is used at radio stations as a multiple outlet box to permit up to 10 devices to be plugged into an a-c line at the same time. Plug P601 is connected to the receptacle of Cord CD-711 or to the power source. The 10 receptacles accommodate the plugs of the transmitters, receivers, shelter lights, trouble lamps, soldering irons, etc.

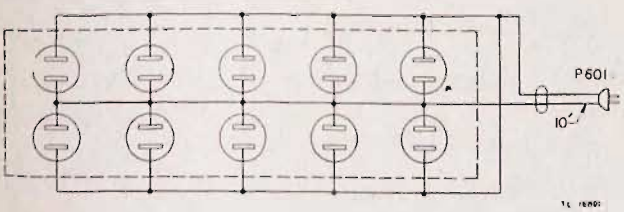


Figure 110. Junction Box JB-110, schematic diagram.

146. CABLE ASSEMBLY CC-368 AND CABLE STUB CC-356.

The cable assembly and stub used to connect the spiral-four cable to the transmitter at a radio terminal station are described in paragraphs 29 and 30. Their schematic diagrams are shown in figures 111 and 112.

147. DUMMY ANTENNA.

The dummy antenna (fig. 113) provides a visual means of determining the transmitter output. It is composed of four pilot lamps rated at

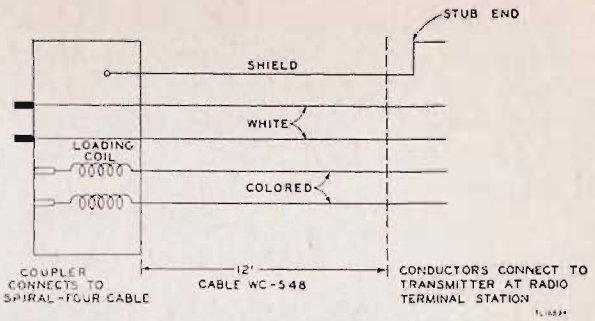


Figure 111. Cable Assembly CC-368, schematic diagram.

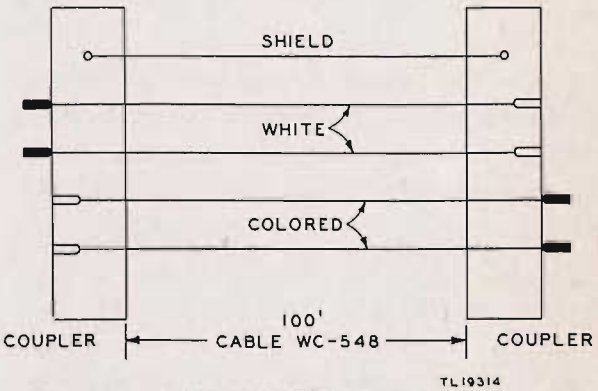


Figure 112. Cable Stub CC-356, schematic diagram.

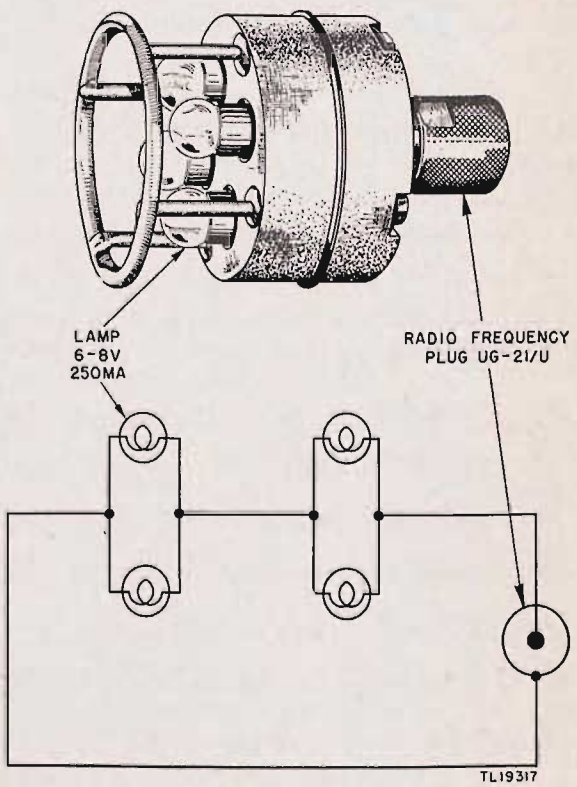


Figure 113. Dummy antenna, sketch and schematic diagram.

250 ma (milliamperes), 6 to 8 volts, connected to a Radio Frequency Plug UG-21/U. These are the same pilot lamps used with the receiver and transmitter. In use, the dummy antenna is connected to the ANTENNA receptacle on the transmitter and lights when there is any r-f output. The brilliancy of the bulbs is directly proportional to the r-f output.

SECTION XVI. TROUBLE-SHOOTING PROCEDURES

148. GENERAL TROUBLE-SHOOTING INFORMATION.

No matter how well equipment is designed and manufactured, faults occur in service. When such faults occur, the repairman must locate and correct them as rapidly as possible. This section contains general information to aid personnel engaged in the important duty of trouble shooting.

a. Trouble-shooting Data. Take advantage of the material supplied in this manual to help in the rapid location of faults. Consult the following data when necessary:

(1) RADIO TRANSMITTER T-30/TRC-8 (XC-3).

Figure No.	Description
136	Schematic diagram.
137	Wiring diagram.
116	Chassis, front panel removed.
117	Chassis, right side panel removed.
118	Chassis, top panel removed.
119	Chassis, left side panel removed.
120	Chassis, bottom panel removed.
121	Tube-socket voltage diagram.
122	Resistor-capacitor board voltage diagram.

(2) POWER PACK PP-115/TRC-8 (XC-3).

Figure No.	Description
138	Wiring diagram.
123	Chassis, top view.
124	Chassis, bottom view.
125	Tube-socket voltage diagram.

(3) RADIO RECEIVER R-48/TRC-8 (XC-3).

Figure No.	Description
139	Schematic diagram.
140	Wiring diagram.
126	Chassis, top view.
127	Chassis, r-f section.
128	Chassis, bottom view.
129	Tube-socket voltage diagram.
130	R-f tube-socket voltage diagram.
131	Resistor-capacitor board voltage diagram.

(4) TEST OSCILLATOR TS-237/TRC-8 (XC-3).

Figure No.	Description
141	Schematic diagram.
142	Wiring diagram.
132	Chassis.
133	Tube-socket voltage diagram.

(5) MISCELLANEOUS FIGURES.

Figure No.	Description
92	Telephone EE-8-A circuit, functional diagram.
107	Control Box C-21A/TRC-1, schematic diagram.
108	Handset H-23/U, schematic diagram.
109	Junction Box J-85/G, schematic diagram.
111	Cable Assembly CC-368, wiring diagram.
112	Cable Stub CC-356, wiring diagram.
143	Cord CX-104/TRC-1, wiring diagram.
144	Assembly instructions for Radio Frequency Plug UG-21/U.
145	Capacitor color codes.
146	Resistor color codes.

b. Trouble-shooting Steps. The first step in servicing a defective radio set is to sectionalize the fault. *Sectionalization* means tracing the faults to the component or circuit 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. Some faults such as burned-out resistors, and overheated transformers can be located by sight and smell. The majority of faults, however, must be located by checking voltage and resistance.

c. Sectionalization. Careful observation of the performance of the radio set while turning the equipment on often sectionalizes the fault to the transmitter or the receiver, and careful observation of the meters on the transmitter and receiver front panel often determines the stage or circuit at fault.

d. Meter Readings. Since most break-downs in radio equipment are apparent by a lack of voltage or a change of voltage at some point, careful attention to meter readings in each switch position will indicate to an operator which stage of the inoperative component is at fault. Normal meter readings are indicated on the front panels of the receiver and transmitter. An additional feature of the metering system provided is means for checking the merits of all tubes. A low-emission tube will cause a subnormal meter reading. In most cases, therefore, the meter and meter switch is all that is necessary in trouble shooting since the proper use of this switch will not only check the condition of the tubes but will also indicate which stage is at fault.

149. VOLTAGE MEASUREMENTS.[1]

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 taken easily, because they are always made between two points in a circuit and the circuit need not be interrupted.

a. 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.

b. In checking cathode voltage, remember that a reading can be obtained when the cathode resistor is actually open. The resistance of the meter may act as a cathode resistor. However, this almost always indicates a voltage much higher than normal. Check between cathode and plate instead of from cathode to ground to determine if the cathode resistor is open.

c. In locating the fault in a circuit having a leaky or shorted coupling capacitor, bear in mind that excessive plate current flows in the tube and a reliable indication of this condition is abnormally high-cathode voltage and sometimes low-plate voltage. After replacing the faulty capacitor, check the cathode resistor as well as the plate coupling resistor if used, to see that no harm has been done by excessive current through them.

d. Certain precautions must be followed when measuring voltages above a few hundred volts. High voltages are dangerous and can be fatal. When it is necessary to measure high voltages, observe the following rules:

[1] Unless otherwise indicated, all diagrams show sockets as viewed from the bottom. The exception appears in figure 121.

(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.

150. VOLTMETER LOADING.

a. It is essential that the voltmeter resistance be at least 10 times as large as the resistance of the circuit measured. If the voltmeter resistance is comparable to the circuit resistance, the voltmeter will indicate a voltage lower than the actual voltage present when the voltmeter is removed from the circuit. The resistance of the voltmeter on any range can always be determined by multiplying the ohms per volt by the full scale range in volts. For example: The resistance of a 1,000 ohm-per-volt meter on the 300-volt range is 300,000 ohms (1,000 ohms per volt times 300 volts equals 300,000 ohms).

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

c. 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 that 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.

d. The ohm-per-volt sensitivity of the voltmeter used to obtain the readings recorded on the voltage and resistance charts in this manual is printed on each chart. Use a meter having the same ohm-per-volt sensitivity. Otherwise, it will be necessary to consider the effect of loading.

151. FAULTS NOT INDICATED BY CHANGE IN VOLTAGE.

There are some causes of poor or no operation in equipment that are not made apparent by a change in voltage at any point. It is essential that the trouble shooter become familiar with these items so that they can be checked after it is determined that all voltages are normal.

a. Receiver. The following list of receiver conditions will cause weak or no reception without appreciably changing the voltage readings.

(1) Open or shorted coaxial cable.

(2) Shorted tuning or trimmer capacitors.

(3) Open coupling capacitor in any circuit.

(4) Open audio or i-f coil or transformer winding shunted by a resistor.

(5) Shorted terminals of audio or i-f transformer windings.

(6) Open secondary of output transformer or open speaker voice coil.

(7) Shorted tuning capacitor across any i-f coil.

(8) Open cathode bypass capacitors.

b. Transmitter. The following list of transmitter conditions will cause weak or no output without appreciably changing the voltage readings.

(1) Open or shorted coaxial cable or shorted dipole.

(2) Shorted capacitor C242 or short in coaxial cable L213.

(3) Open coupling capacitor.

(4) Open audio transformer winding shunted by a resistor.

(5) Open inductors L215 or L216 resulting in no modulation.

(6) Open attenuator Z202, Z203, Z204, or Z205 resulting in no modulation.

(7) Shorted lightning arrestors resulting in no modulation.

(8) Open low-pass filter Z201 resulting in no modulation on low-fidelity channel.

(9) Shorted capacitor C248 resulting in hum on carrier.

(10) Open transformer T204 or T203 resulting in no modulation.

(11) Open capacitor C239 resulting in distortion on low-fidelity channel only.

152. 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. 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 (fig. 146).

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 burned out.

(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 its movement and in some cases may endanger life. The shorting stick (par. 93) should be used on the filter capacitors.

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 0 ohms, even if the resistance is as high as 500 ohms. When checking high resistance 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 1 meg (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 meg. If the resistor were measured and found to have a value between 0.8 meg and 1.2 meg, 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.

(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.

153. CAPACITOR TESTS.

NOTE: Feed-through capacitors are used in the r-f stages of the receiver. The hooked terminals of these capacitors are part of the inner electrode and constitute only one plate of each capacitor. For a description of these capacitors, refer to paragraph 128c.

a. General. It is often necessary to check capacitors for leakage or open or short circuits which are caused by break-down of the dielectric between the plates. This applies only to capacitors of the tinfoil paper or mica type since the dielectric film of wet electrolytic capacitors is self-healing.

b. Open Capacitors. To check a capacitor suspected of being open, place a good capacitor in parallel with it. In r-f circuits, keep the capacitor leads as short as those of the suspected capacitor. In low-frequency circuits (less than 1 mc), the test capacitor leads may be several inches long.

c. Shorted or Leaky Capacitors. To check shorted or leaky capacitors observe the kick indication on an ohmmeter. Before attempting to check the capacitor, remove one lead from the circuit, since the capacitor is usually in parallel with some other circuit element. Adjust the ohmmeter to its highest range and connect it across the capacitor. If the capacitor is good, the needle flicks over slightly and gradually drops back to infinity. This shows that the capacitor has taken a charge and is not shorted. If the needle does not go back to infinity, the capacitor is leaky and should be replaced. This test does not apply to capacitors which are smaller than about 0.05.

d. Capacitor Color Code. A capacitor color code is shown in figure 145. This code can be used for checking the capacitor values against the values shown on the circuit diagram, and for replacing defective capacitors.

154. CURRENT MEASUREMENTS.

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.

a. When the meter is inserted in a circuit to measure current, it should always be inserted away from the r-f end of the resistance. For example, when measuring *plate* current, do not insert the meter next to the plate of a tube, but insert it next to the end of the resistor which connects to the power. This precaution is necessary to keep the meter from upsetting the r-f voltages.

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.

155. TUBE CHECKING.

a. Purpose. Tubes are most frequently the cause of defective operation. For this reason, the first step in trouble shooting within a component is check and replace any tubes whose failure may account for the observed symptoms, such as a faulty meter reading in one particular stage. Tube checkers are used to check the emission of electrons from the cathode and to test for shorted elements.

b. Tube Replacement Check. 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.

c. Tube Checking Instructions. 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.

156. 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 r-f or i-f circuits, it must be placed exactly as the original one was. 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.

SECTION XVII. TEST EQUIPMENT

157. TEST OSCILLATOR TS-237/TRC-8 (XC-3).

a. General. Test Oscillator TS-237/TRC-8 (XC-3) is a crystal-controlled signal generator designed to provide harmonic output for aligning the r-f and i-f stages of the receiver (fig. 15). A single Tube JAN-6AG5 (fig. 141) is used in conjunction with a 5-mc crystal to provide harmonic frequencies of 30 mc for i-f alignment as well as harmonic output of 230 to 250 mc in 5-mc steps for r-f alignment. No tuning controls are provided as the oscillator operates at the fundamental frequency of the crystal and all available output frequencies are harmonics, or multiples, of 5 mc. An output cord, Radio Frequency Cable RG-8/U, is provided which plugs into the ANTENNA receptacle on the receiver front panel for r-f alignment. An adapter (fig. 114) is provided for i-f alignment. A plug, P301, flush-mounted on the oscillator case, engages the TEST OSC. receptacle on the receiver front panel and thus draws heater and plate power from the receiver.

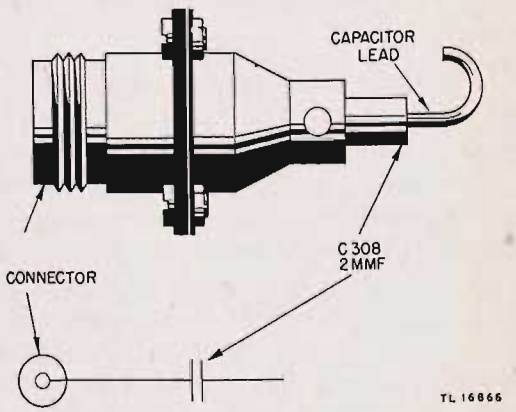


Figure 114. I-f adaptor, sketch and schematic diagram.

b. Functioning. (1) The oscillator is of the tuned-plate, tune-grid type with a crystal substituted for the tuned-grid circuit to provide stability at the operating frequency, 5 mc. However, since appreciable power up to the fiftieth harmonic (250 mc) is required, feedback is provided from a voltage divider consisting of

capacitors C305 and C306. Feedback voltage is taken from the midpoint of these capacitors. This type of positive, crystal return circuit feedback is adjusted to provide the square current pulse through the oscillator tube which is necessary for sufficient high harmonic output. Resistor R301, 50,000 ohms, is the oscillator grid leak and furnishes bias due to rectified grid current. Resistor R302, 33,000 ohms, is the screen dropping resistor.

(2) Capacitor C303, 0.001 mf, bypasses the screen to ground. Capacitor C301, 0.001 mf, bypasses radio frequency from the ungrounded side of the heater. Capacitor C302, 0.001 mf, is the high-voltage bypass to prevent undesirable radio frequency from feeding back to the receiver. Capacitor C304, 1.5 to 7.0 mmf, tunes the oscillator tank circuit to the fundamental frequency, 5 megacycles. Capacitors C305, 100 mmf, and C306, 500 mmf, are in series with the tank tuning capacitor C304 to act as a voltage divider in order to feed back a portion of the oscillator output to the crystal. These two capacitors, by being in series with the tank capacitors, do not materially change the effective value of capacitor C304 since their value is many times that of the tank capacitor. However, they act as a voltage divider so that a predetermined value of feedback voltage is available for oscillator output of high harmonic content.

(3) Capacitor C307, 5 mmf, is the output coupling capacitor and L301 is the oscillator tank inductor. L302 provides considerable impedance at 230 to 250 mc so that the r-f power developed across it can be coupled to the output cable. C307 and L302 form an output coupling circuit designed to deliver maximum r-f voltage at the mean frequency (48th harmonic or 240 mc) and discriminate against the 30-mc output (6th harmonic) reducing it to a reasonable level. This attenuation is desirable as the 6th harmonic has a much higher output than the 48th harmonic. Instructions for using the test oscillator are given in paragraph 172.

158. SIGNAL GENERATOR I-208.

Signal Generator I-208 is a frequency and voltage standard for testing frequency-modulated radio equipment. It is used in the calibration, alignment, and determination of sensitivity of frequency-modulated radio receivers. The signal generator covers the frequency range of 1.9 to 4.5 mc and 19 to 45 mc. The frequency deviation can be adjusted from 0 to 5 kc each side of center frequency for the 1.9- to 4.5-mc band, and from 0 to 50 kc each side of center frequency for the 19- to 45-mc band. Modulation frequencies are 150, 400, 1,000, 2,500 and 5,000 cps (cycles per second). Output voltage up to 100,000 μv (microvolts) is developed at the termination of a 30-ohm line. It may be operated from a 12-volt, d-c source, or a 115-volt, a-c, 60-cycle source. Refer to TM 11-317 for further information. Signal Generator I-208 is not furnished with the radio sets.

159. TEST SET I-56-(*).

Test Set I-56-(*) comprises electrical instruments designed for the maintenance and repair of radio equipment. It is used to analyze radio trouble, test vacuum tubes and pilot lamps, to measure voltage, current, and resistance. Further information regarding its use is obtained in the technical manual or manuals supplied with the test set. Test Sets I-56-C, -D, -H, -J, are covered in TM 11-303. Components of Test Set I-56-K (fig. 115) are covered in TM 11-2613, TM 11-2626, and TM 11-2627.

Figure 115. Test Set I-56-K.

SECTION XVIII. TROUBLE-SHOOTING CHARTS

160. USE OF TROUBLE-SHOOTING CHARTS.

The five trouble-shooting charts given in succeeding paragraphs, if properly used, simplify trouble shooting.

a. The first chart (par. 161) covers the sectionalization of trouble in a system. This chart lists the sequence of steps to follow in locating and correcting trouble in a system. They tell the operator whether the spiral-four cable or the radio circuit between radio terminal stations is at fault. Faults in the radio relay circuit are sectionalized to a particular radio relay station. By proper use of this chart, the operator can save time that might otherwise be lost in checking components that are free of trouble.

b. The second chart (par. 162) sectionalizes the cause of excessive noise in the system to a particular radio station.

c. The third chart (par. 163) sectionalizes trouble to a receiver or transmitter at a particular radio station. This chart lists the symptoms which may be recognized easily by the operator and gives the probable location of the trouble.

d. The fourth chart (par. 164) localizes the trouble in a receiver to the individual part in the circuit which is causing the abnormal condition.

e. The fifth chart (par. 165) is similar to the fourth except that it deals with localizing trouble in the transmitter.

161. SECTIONALIZING SYSTEM TROUBLE.

a. General. (1) The System Control Station (par. 55) is responsible for proper operation of both telephone and radio equipment. The operator at this station should be notified at once when trouble is indicated. If this is impossible, the Alternate System Control Station should be notified. The operator at the System Control Station should supervise the necessary repair. If it is impossible to notify the system control operator and the trouble is of an emergency nature, the operator at the defective station should make the necessary repairs and quickly notify the terminal operator.

(2) If trouble occurs in the system and its location is not immediately determined, each station operator should inspect the equipment in use for satisfactory operation. The radio equipment may be tested in accordance with the equipment performance check list (par. 72).

b. Sectionalizing Trouble. The location of trouble in the system may not be apparent. Trouble can be localized by testing:

(1) The spiral-four circuit between the terminal radio station and terminal telephone station at each end of the system.

(2) The radio circuit between terminal stations in both directions.

c. Sectionalizing an Open Circuit. Below is a chart listing a sequence of steps to localize trouble, and methods of correction following a complete system break.

Steps	Remedy
1. Radio and telephone terminals communicate with each other by means of Telephone EE-8-A. If communication is not possible, the spiral-four cable circuit is defective.	1. Check spiral-four cable. See TM 11-369 and TM 11-2001
2. If step 1 indicates no trouble, send a test tone on channel 1 from the telephone terminal over the TRSG pair of spiral-four. The transmitter meter at the radio terminal in % MOD. position should indicate. If there is no indication, the transmitter is defective.	2. Check transmitter. Refer to paragraph 165.
3. If step 2 indicates no trouble, tune the radio terminal receiver to the terminal transmitter frequency. If the test tone sent on the TRSG pair of spiral-four cable from the telephone terminal does not return to the same telephone terminal, place an output meter across the REC. OUTPUT terminals on the transmitter. A reading of less than 0.5 volt on the output meter when the transmitter in the % MOD. position reads 0.25, indicates a defective receiver.	3 Check receiver. Refer to paragraph 164.
4. If steps 1 to 3 indicate no trouble, each radio terminal station (acting as Radio Control Station) calls each relay station in succession, starting with the nearest relay station, until an open circuit is indicated. This locates the particular station in trouble. Before calling the relay stations, disconnect one TSRG and one REC. wire of spiral-four cable from the radio terminal set. Communication over Telephone EE-8-A is still possible.	4. Allow sufficient time (approx 30 min) for minor repairs or substituting spares. Then send help.

162. SECTIONALIZING SYSTEM NOISE.

a. Excessive noise in a system is caused by:

(1) Signal strength weak at any receiver.

(2) Cables and connectors at any station defective or loose.

(3) Interference from other radio equipment or ignition noise.

b. In most cases of system noise, the cause is apparent and can be remedied easily. To check, follow the chart outlined below. The Radio Control Station directs for any necessary correction.

Symptom	Probable trouble	Remedy
1. Excessive receiver noise.	1. Signal strength weak at any receiver.	1. Check tuning of receiver and transmitter.
		Check that the antenna is pointed in the right direction.
		Check proper polarization of antenna.
		Substitute spares if necessary.
		If caused by poor line-of-sight transmission path, relocate the stations.
	Cables and connectors at any station defective or loose.	Inspect all cords and connectors. Clean and repair when necessary.
	Interference from other radio equipment.	Change to another assigned frequency.
	Ignition noise.	Make sure that Power Unit PE-75-( ) is to the side of the antennas.
		Remove the cause of ignition noise.
	Key clicks from other radio equipment.	Suppress clicks or relocate equipment.
2. Howling and singing.	2. Feedback in receiver.	2. Reduce the setting of AUDIO GAIN control.

163. SECTIONALIZING TROUBLE TO TRANSMITTER OR RECEIVER.

Symptom	Probable trouble	Remedy
1. Transmitter and receiver dead. Pilot lamps out.	1. Power Unit PE-75-( ) inoperative.	1. Check Power Unit PE-75-( ).
	Junction Box J-85/G defective.	Repair.
	Cord CD-711 defective.	Repair.
	Junction Box JB-110 defective.	Repair.
	Power cords of receiver or transmitter are defective.	Repair.
	Equipment operating from 115 volts but connected for operation on 230 volts.	Connect equipment for 115-volt operation. Replace fuse. Reset circuit breaker.

163. SECTIONALIZING TROUBLE TO TRANSMITTER OR RECEIVER (contd).

Symptoms	Probable trouble	Remedy
2. Equipment inoperative. Pilot lights on receiver and transmitter lighted.	2. Interconnecting cables improperly connected or connectors not making good contact. Controls on receiver and transmitter not properly set for operation. Defective tubes.	2. Check interconnecting cables and tighten connectors. Check control settings and reset if necessary. Replace defective tubes. Check meter readings to help determine defective tube.
3. Receiver and transmitter in same direction operative, but communication poor.	3. Intervening terrain causes excessive attenuation of signal. Antennas not directed properly.	3. Select better operating sites. Check antenna direction and polarization.
4. Receiver dead. Pilot lamp out.	4. Fuse F1 or F2 blown. Poor connection into Junction Box JB-110.	4. Replace fuse. Repair.
5. Transmitter dead. Pilot lamp out.	5. Power ON-OFF switch snapped OFF. Poor connection into Junction Box JB-110.	5. Throw ON. Repair.
6. Receiver dead. Pilot lamp O.K. No meter readings.	6. Defective receiver.	6. See par. 164.
7. Transmitter dead. Pilot lamp O.K. No meter readings.	7. Defective transmitter.	7. See par. 165.
8. Receiver dead. Pilot lamp O.K. Meter readings normal.	8. SQUELCH control out of adjustment. Squelch relay RL1 inoperative.	8. Readjust. Repair relay.
9. Transmitter dead. Pilot lamp O.K. All readings except TRIPLER O.K.	9. Carrier relay RL 201 inoperative.	9. Repair relay.
10. Receiver signals weak. Meter readings normal.	10. Open or shorted coaxial cable. Antennas improperly polarized.	10. Replace. Check polarization.
11. No transmitter output. Meter readings normal.	11. Open or shorted coaxial cable or antenna dipole faulty.	11. Replace.

164. LOCALIZING RECEIVER TROUBLE.

Symptoms	Probable trouble	Remedy
1. No meter readings.	1. Defective power supply.	1. Repair.
	Open filter choke L22 or L23.	Replace.
	Shorted capacitors C89, C91 or C92	Replace
	Open resistor R78.	Replace.
	Defective rectifier tube V15.	Replace.
2. No readings on MIXER, OSC., 2nd LIM. Ip, and AUD. AMP. positions.	2. Open resistor R77 in power supply.	2. Replace.
	Shorted capacitor C93.	Replace.
3. High readings on MIXER, OSC., 2nd LIM. Iq, and AUD. AMP. positions.	3. Defective regulator tube V14.	3. Replace.
4. All meter readings low.	4. Defective rectifier tube V15.	4. Replace.
5. Low reading, any one position.	5. Defective tube or circuit element in associated stage.	5. Replace.
6. No reading, TUNE position.	6. Shorted capacitor C81.	6. Replace.
	Defective discriminator tube V10.	Replace.
7. No reading, 1st LIM. Ig position.	7. Defective 1st limiter tube V8.	7. Replace.
	Open resistor R36 or R74.	Replace.
	Shorted capacitor C50 or C59.	Replace.
8. No reading, R.F. AMP. position.	8. Defective r-f tube V1.	8. Replace.
	Open resistor R5.	Replace.
	Open resistor R4.	Replace.
High reading, R.F. AMP. position.	Leaky or shorted capacitor C15 or C16.	Replace.
	Leaky or shorted capacitor C9 or C12.	Replace.
	Open resistor R46.	Replace.
9. No reading, MIXER position.	9. Defective mixer tube V2.	9. Replace.
	Open resistors R11 or R13.	Replace.
	Open i-f coil L4.	Replace.
High reading, MIXER position.	Shorted capacitors C27 or C29.	Replace.
	Open resistor R47.	Replace.

164. LOCALIZING RECEIVER TROUBLE (contd).

Symptoms	Probable trouble	Correction
10. No reading, OSC. position.	10. Defective oscillator tube V3.	10. Replace.
	Open resistor R10.	Replace.
High reading, OSC. position.	Shorted capacitors C23 or C24.	Replace.
	Open resistor R48.	Replace.
11. Low reading I.F. position.	11. Defective i-f tube V4, V5, V6, or V7.	11. Replace.
High reading I.F. position.	Shorted capacitors C35, C40, or C70.	Replace.
12. No reading, 1st LIM. Ip position.	12. Defective 1st limiter tube V8.	12. Replace.
	Open resistor R38.	Replace.
	Open i-f coil L16	Replace.
High reading, 1st LIM. Ip position.	Shorted capacitors C63 or C64.	Replace.
	Shorted capacitor C57.	Replace.
13. No reading, 2nd LIM. Ip position.	13. Defective 2d limiter tube V9.	13. Replace.
	Open resistor R42.	Replace.
Low reading.	Open i-f coil L18.	Replace.
High reading, 2nd LIM. Ip position.	Shorted capacitors C72 or C73.	Replace.
	Shorted capacitors C66.	Replace.
14. No reading, AUD. AMP. position.	14. Defective audio amplifier tube V11A.	14. Replace.
	Open primary in transformer T2.	Replace.
	Open resistors R62 or R63.	Replace.
High reading, AUD. AMP. position.	Shorted capacitor C82.	Replace.
15. No reading, SPKR. AMP. position.	15. Open resistors R61 or R64.	15. Replace.
High reading, SPKR. AMP.	Shorted capacitor C83.	Replace.
16. No reading, SPKR. OUT position.	16. Open primary in transformer T3.	16. Replace.
	Open resistor R69.	Replace.
High reading, SPKR. OUT.	Shorted capacitor C86.	Replace.

165. LOCALIZING TRANSMITTER TROUBLE.

Symptoms	Probable trouble	Remedy
1. No meter readings.	1. Defective Power Pack PP-115/TRC-8 (XC-3).	1. Repair.
	Open filter choke L225.	Replace.
	Shorted capacitors C240 or C241.	Replace.
	Defective rectifier tubes V207, V208.	Replace.
2. No reading, B. VOLTS position.	2. Open resistors R232 or R233.	2. Replace.
	Shorted capacitors C217, C225, C202, C208.	Replace.
High reading, B. VOLTS position.	Open resistor R234.	Replace.
3. No reading, % MOD. position.	3. Open capacitor C237.	3 Replace.
	Open resistor R230	Replace.
Low reading, % MOD. position.	Defective tube V206.	Replace.
4. No reading, OUTPUT position.	4. Open r-f choke L220.	4. Replace.
	Defective tube V204.	Replace.
	Open resistor R210 or R216.	Replace.
	Short capacitors, C213, C219, C227.	Replace.
High reading, OUTPUT position.	Open resistor R211.	Replace.
5. No reading, AUD. AMP. position.	5. Open resistor R223.	5. Replace.
	Defective tube V205.	Replace.
High reading, AUD. AMP. position.	Open resistor R224.	Replace.
6. No reading, MOD. position.	6. Open r-f choke L217 or L227, or R215.	6. Replace.
	Shorted capacitors C216, C224, C245, C246.	Replace.
High reading, MOD. position.	Open resistor R212.	Replace.
7. No reading, OSC. position.	7. Open r-f chokes L218 or L221.	7. Replace.
High reading, OSC. position.	Open resistor R213.	Replace.
8. No reading, TRIPLER position.	8. Open r-f chokes L219 or L222.	8. Replace.
	Defective relay RL201.	Repair.
High reading, TRIPLER position.	Open resistors R214 or R239.	Replace.

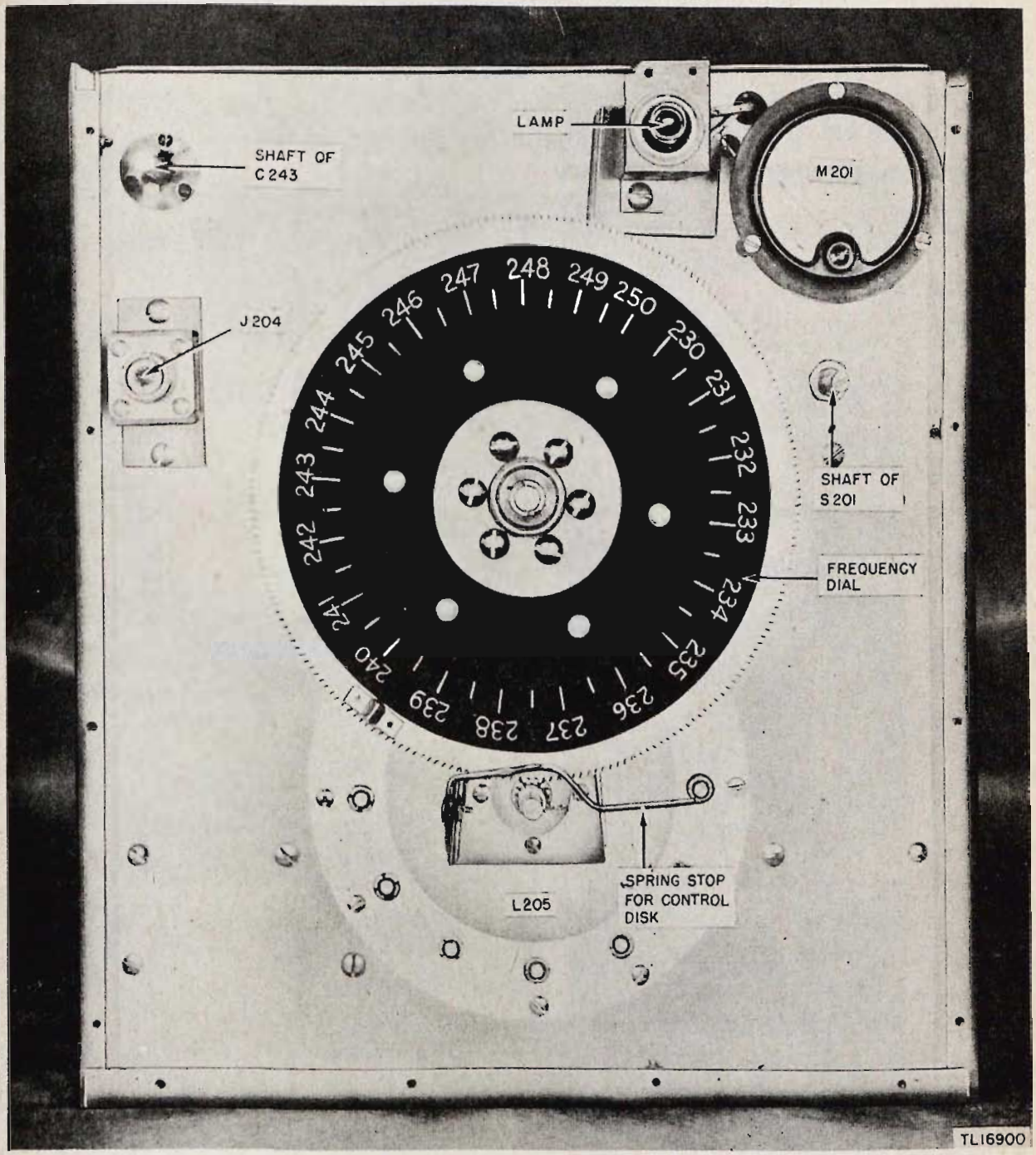


Figure 116. Radio Transmitter T-30/TRC-8 (XC-8), chassis, front panel removed.

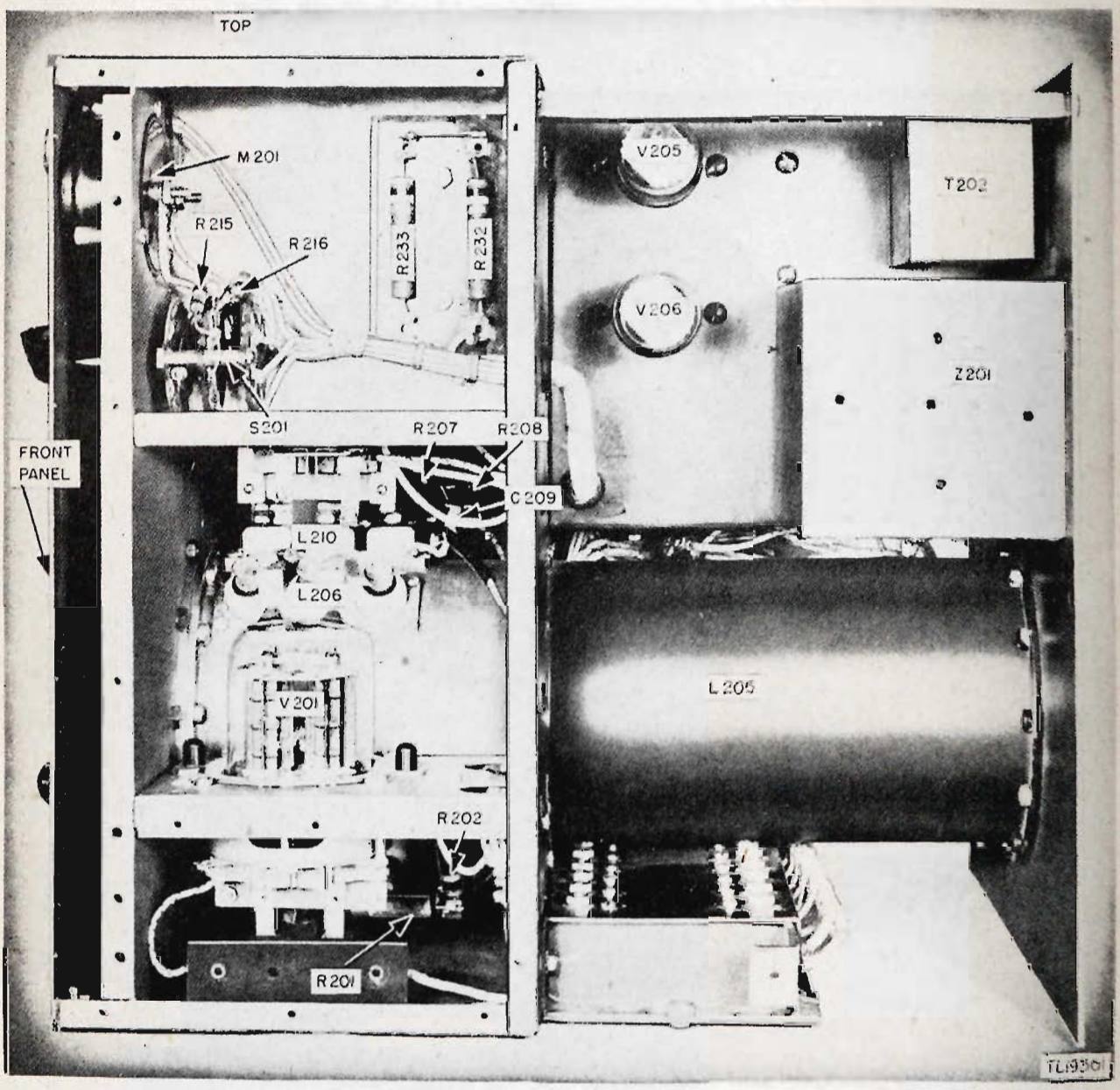


Figure 117. Radio Transmitter T-30/TRC-8 (XC-3), chassis, right side panel removed.

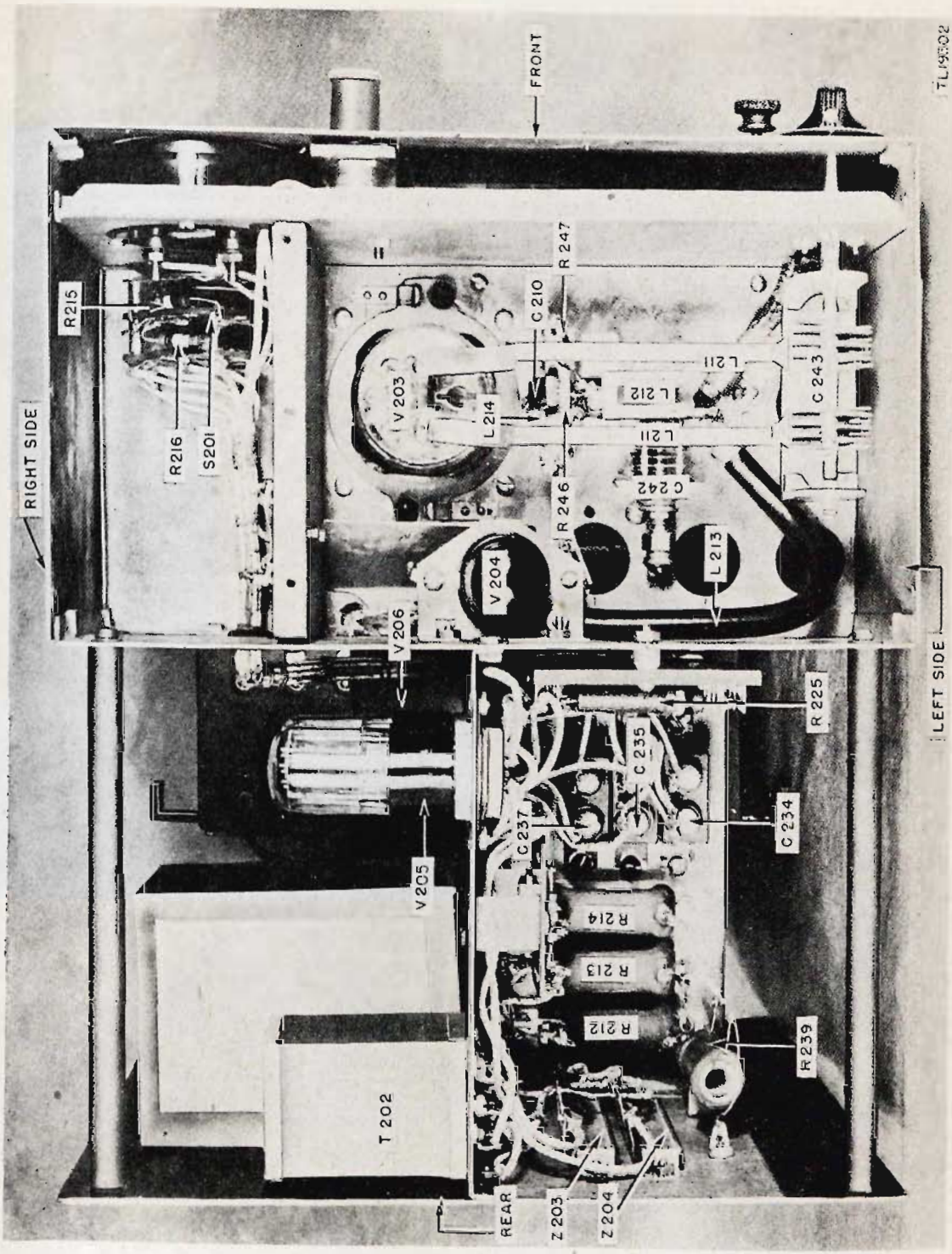


Figure 118. Radio Transmitter T-30/TRC-8 (XC-8), chassis, top panel removed.

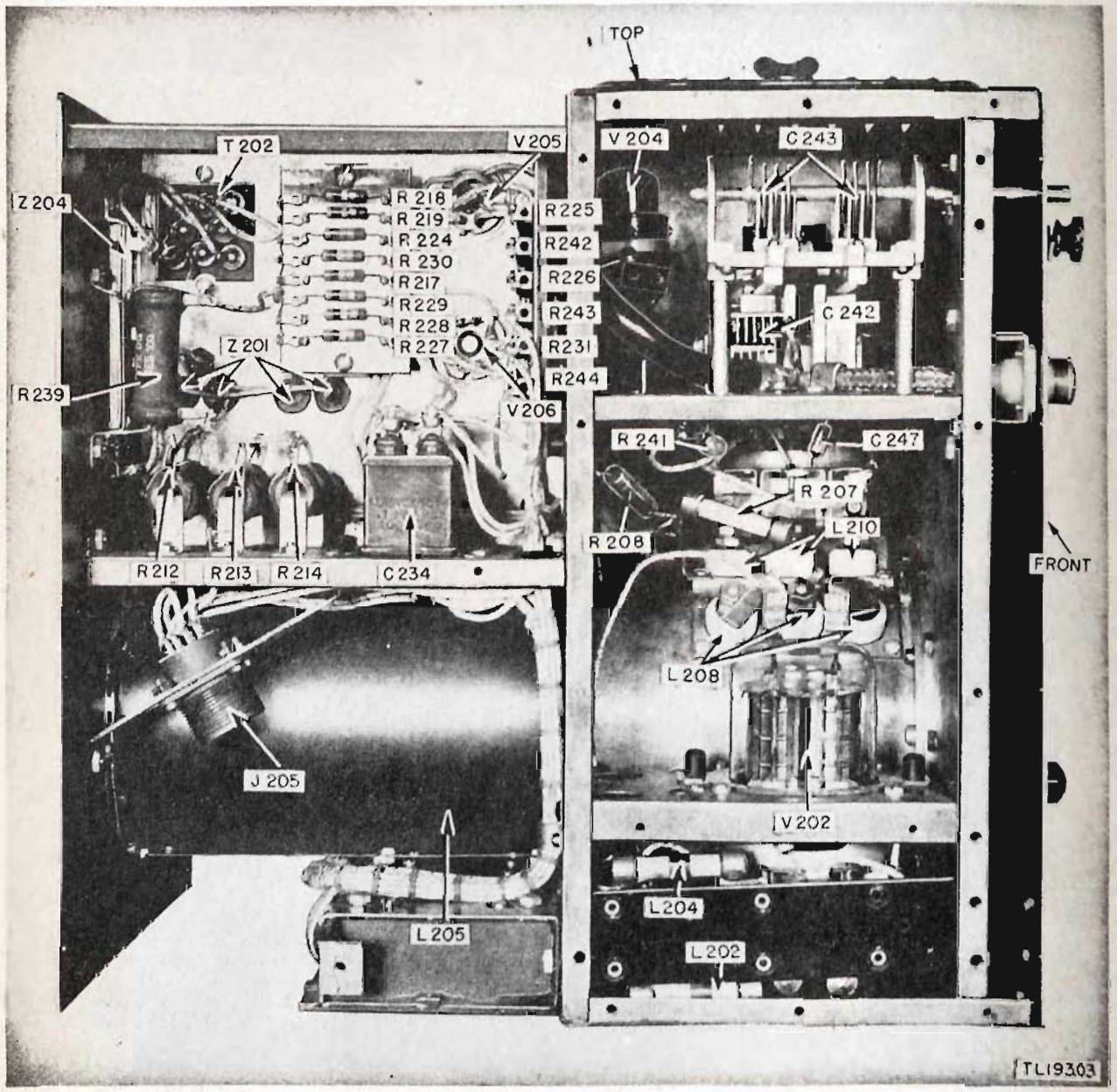


Figure 119. Radio Transmitter T-30/TRC-8 (XC-8), chassis, left side panel removed.

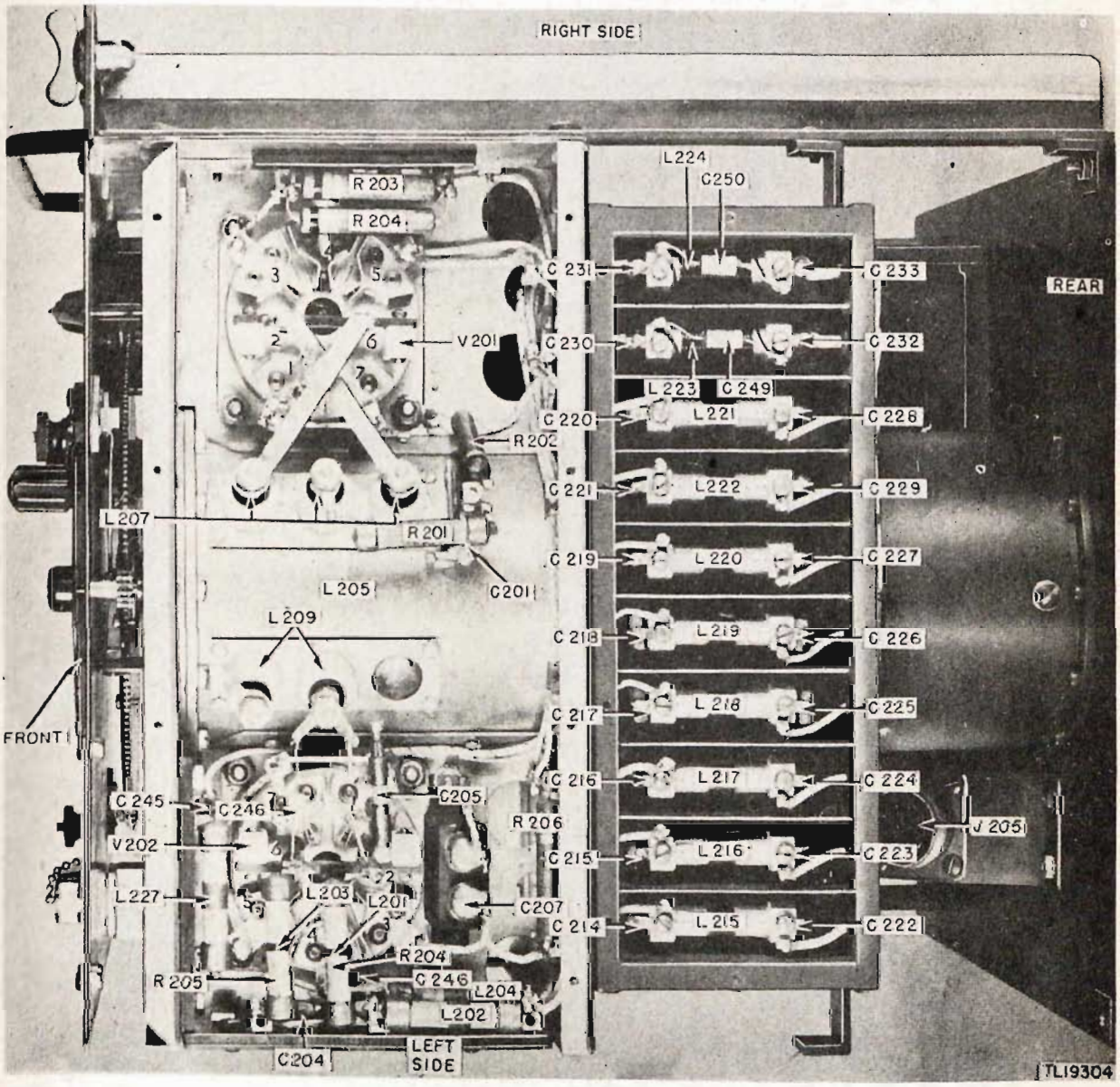


Figure 120. Radio Transmitter T-30/TRC-8 (XC-3), chassis, bottom panel removed.

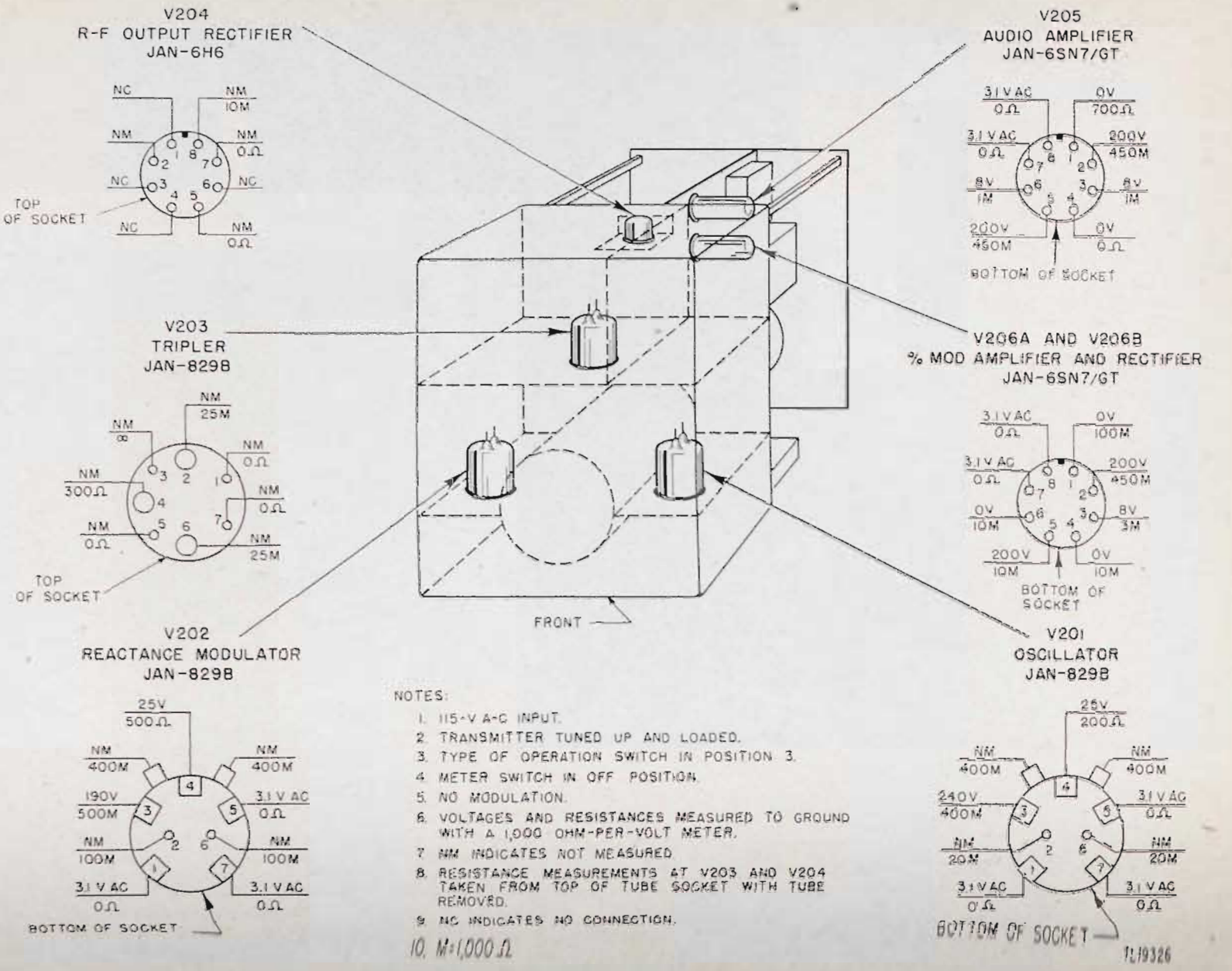


Figure 121. Radio Transmitter T-30/TRC-8 (XC-3), tube-socket voltage diagram.

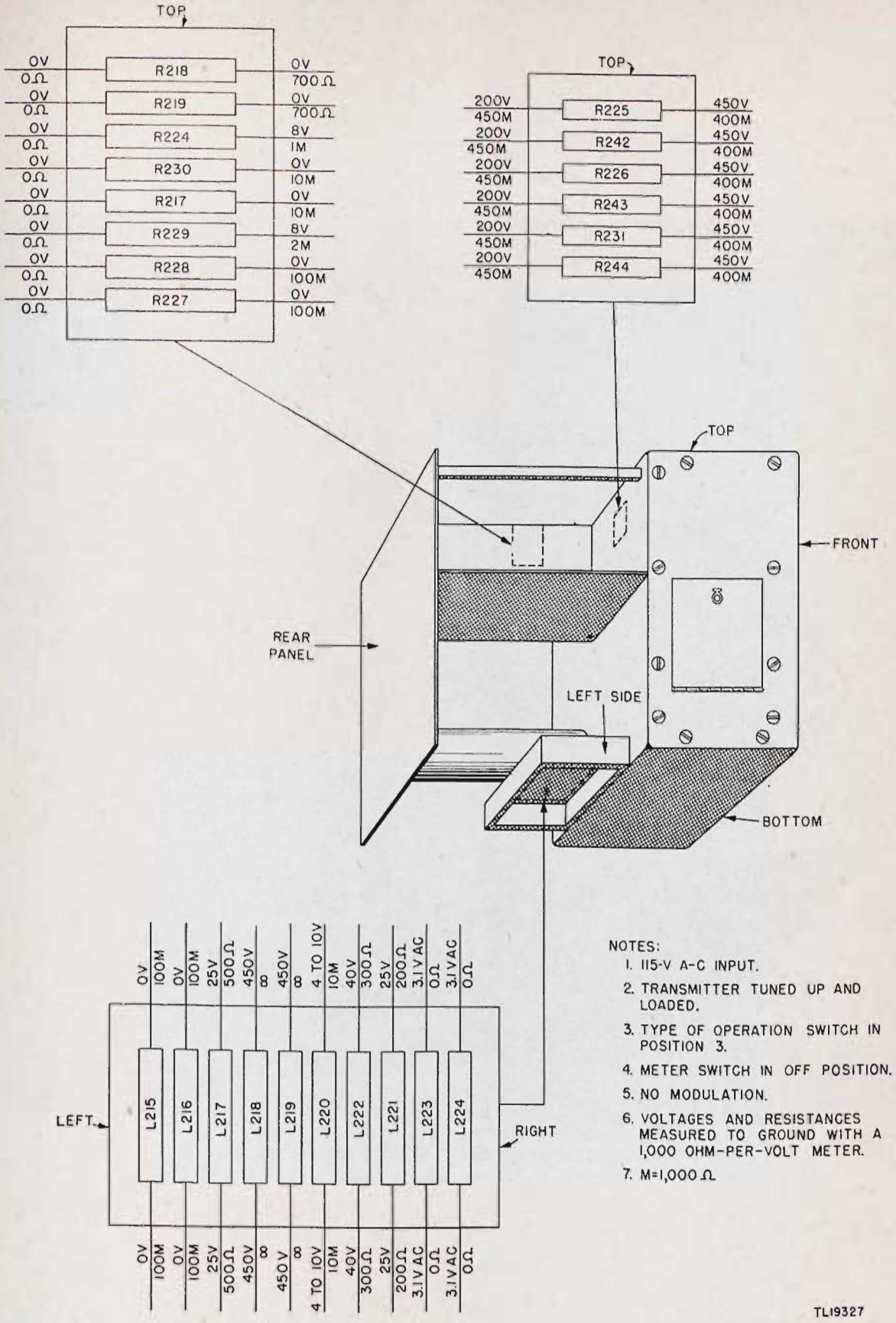


Figure 122. Radio Transmitter T-30/TRC-8 (XC-3), resistor-capacitor board voltage diagram.

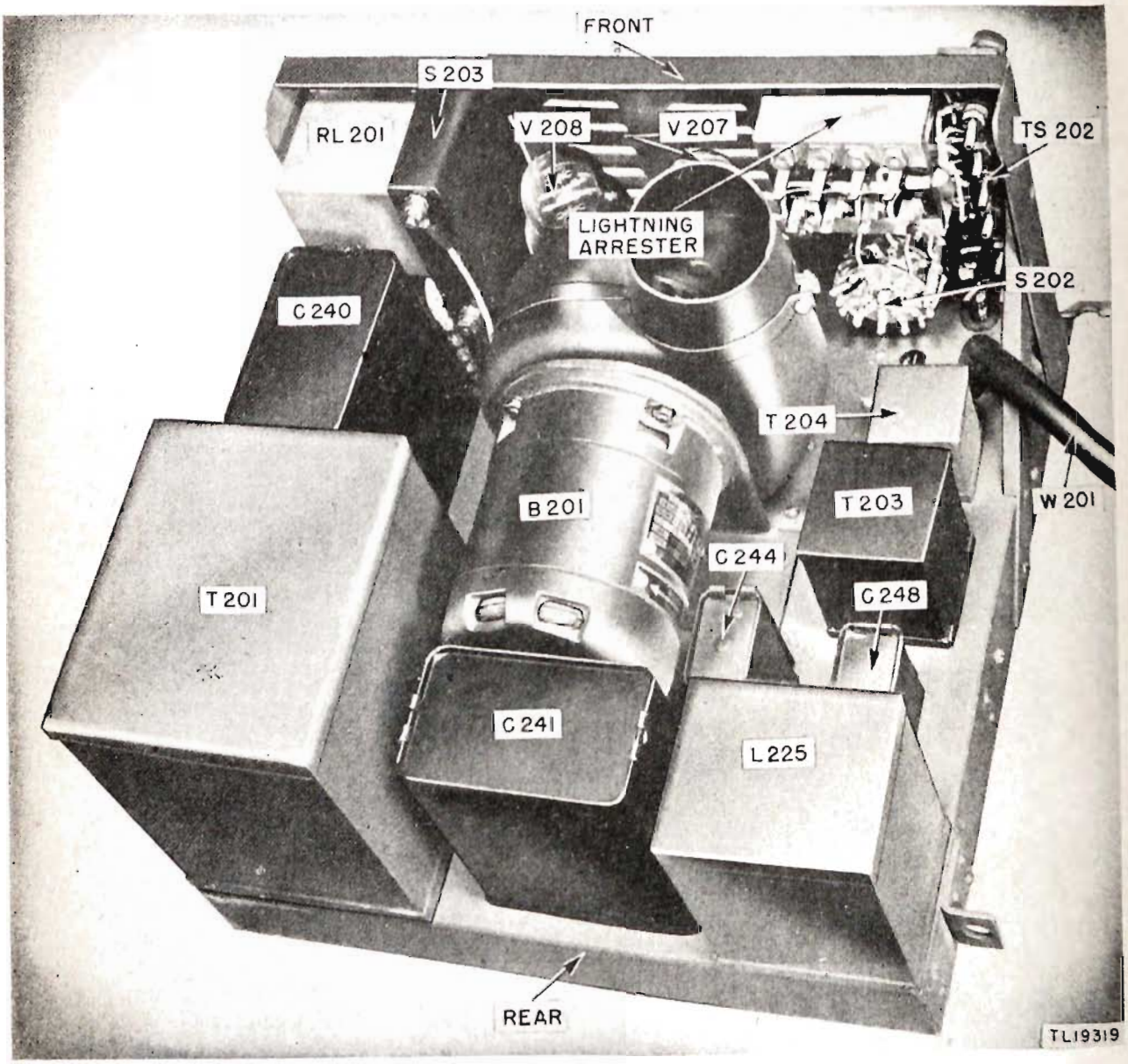


Figure 123. Power Pack PP-115/TRC-8 (XC-3), chassis top view.

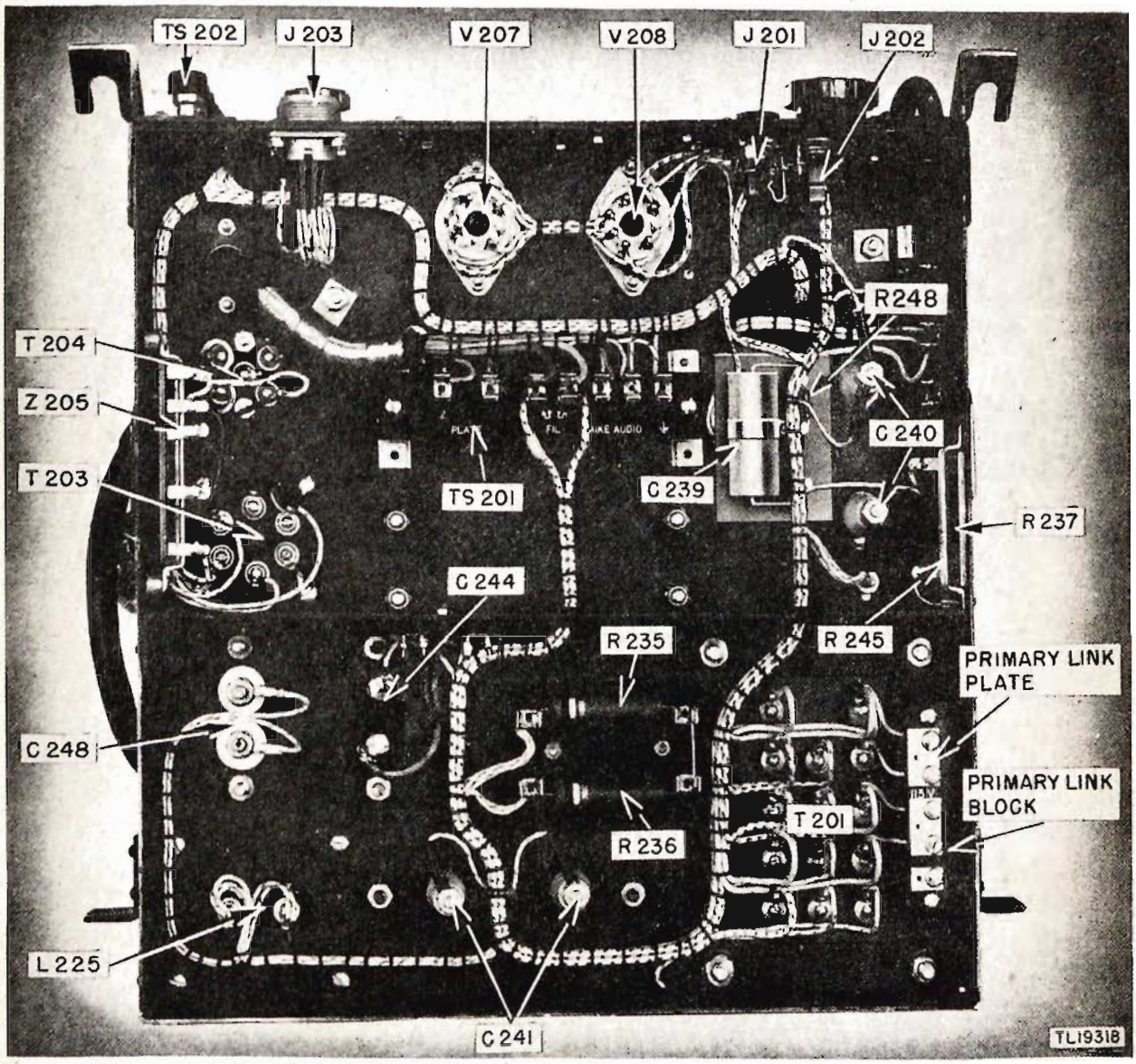
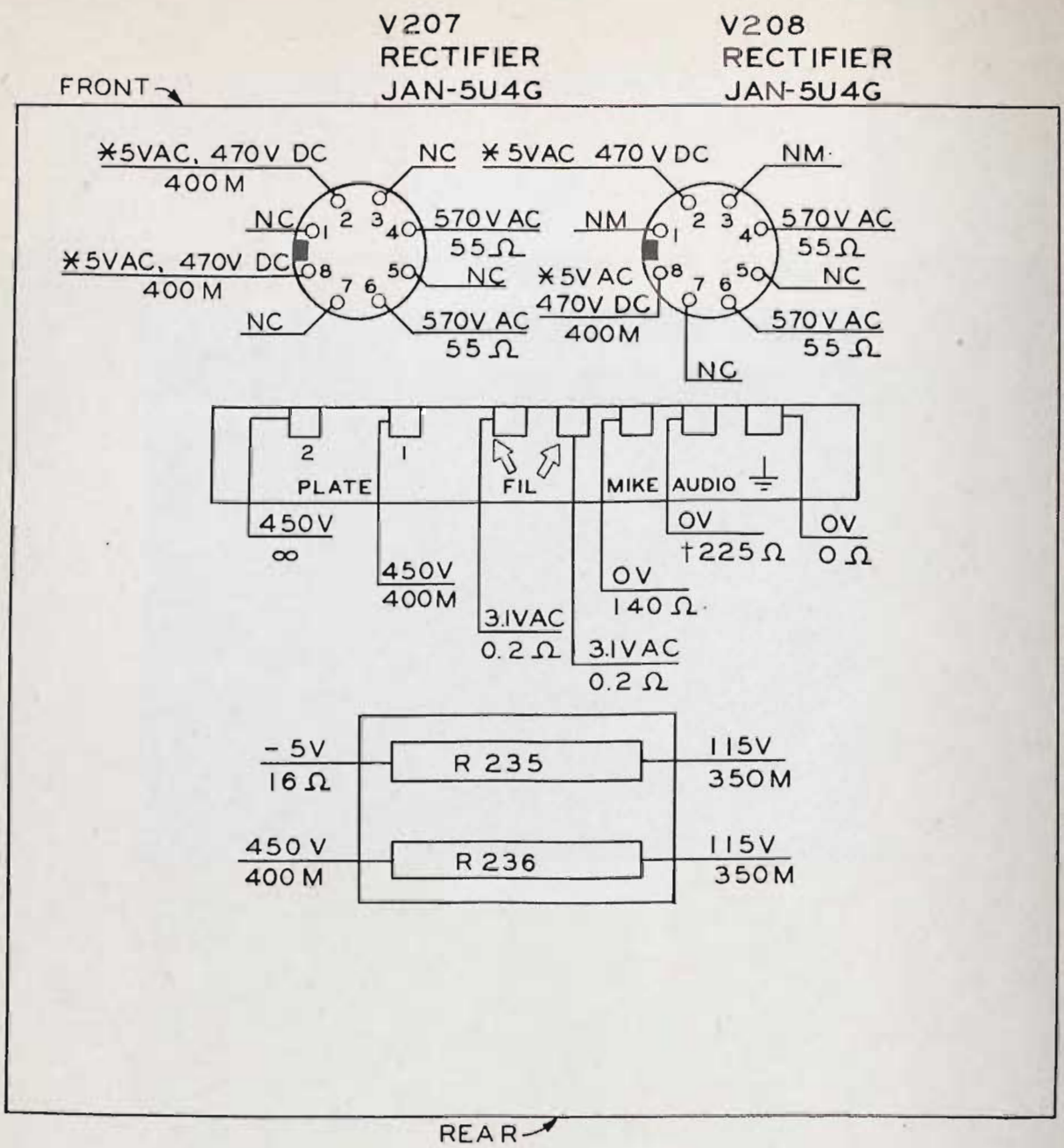


Figure 124. Power Pack PP-115/TRC-8 (XC-3), chassis, bottom view.



NOTES:

1. 115-VA-C INPUT.
2. LOADED BY PROPERLY TUNED TRANSMITTER.
3. TYPE OF OPERATION SWITCH IN POSITION 3.
4. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH A 1,000 OHM-PER-VOLT METER.
5. * MEASURED ACROSS FILAMENTS.
6. NM NOT MEASURED.
7. † MODULATION ADJ CONTROL IN MAXIMUM COUNTERCLOCKWISE POSITION.

TL19328

Figure 125. Power Pack PP-115/TRC-8 (XC-3), tube-socket voltage diagram.

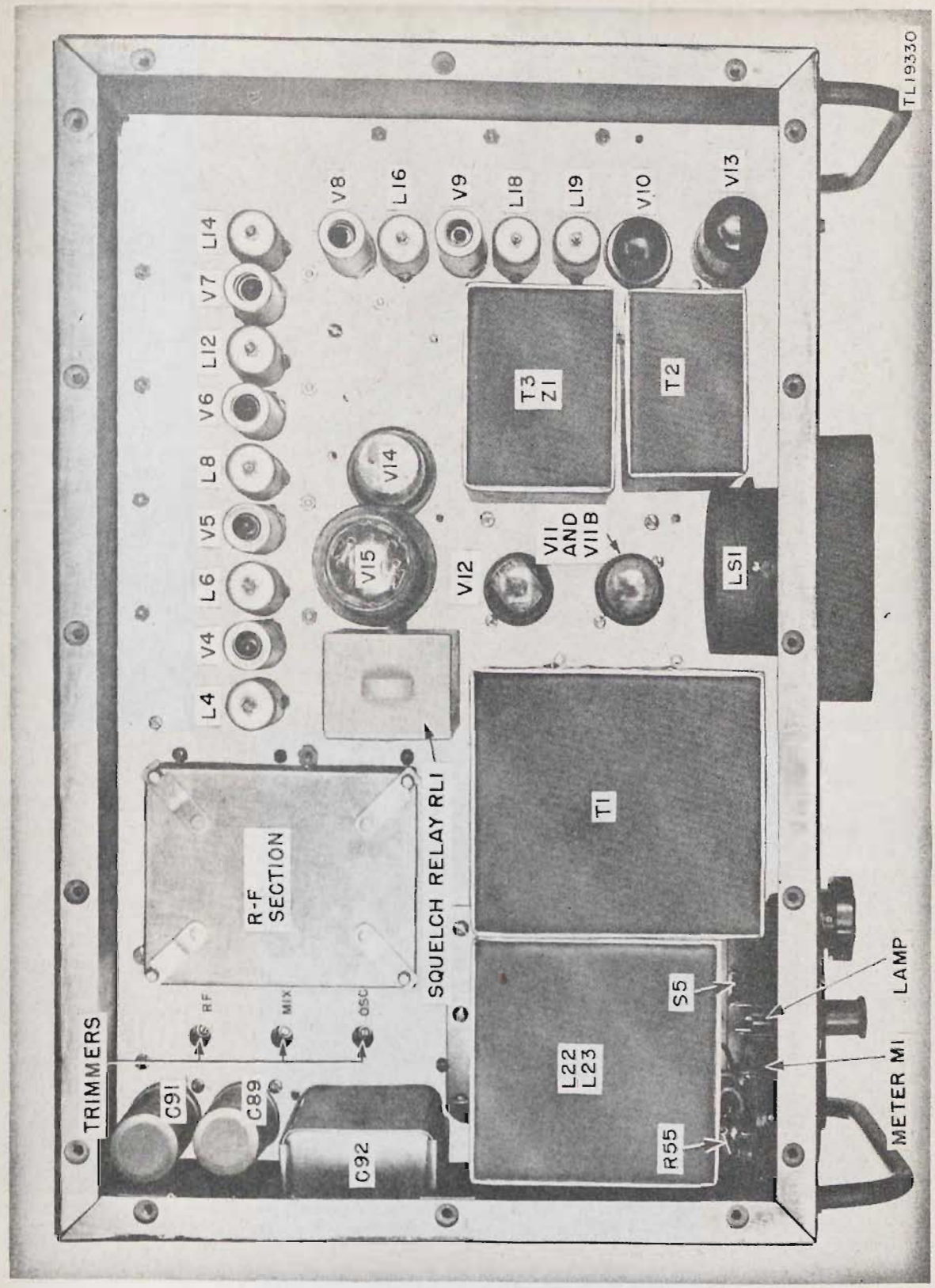


Figure 126. Radio Receiver R-48/TRC-8 (XC-3), chassis, top view.

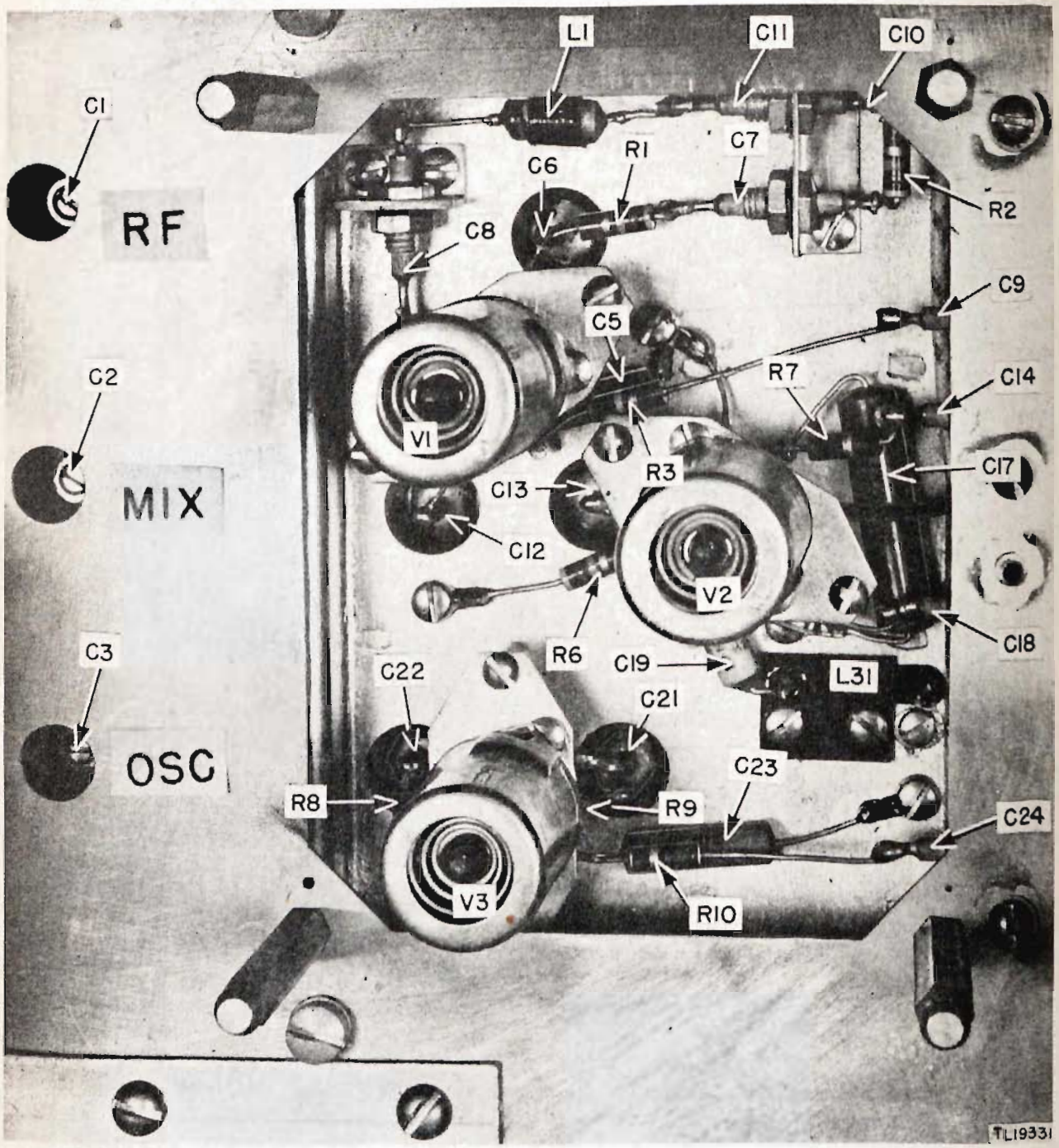


Figure 127. Radio Receiver R-48/TRC-8 (XC-3), chassis, r-f section.

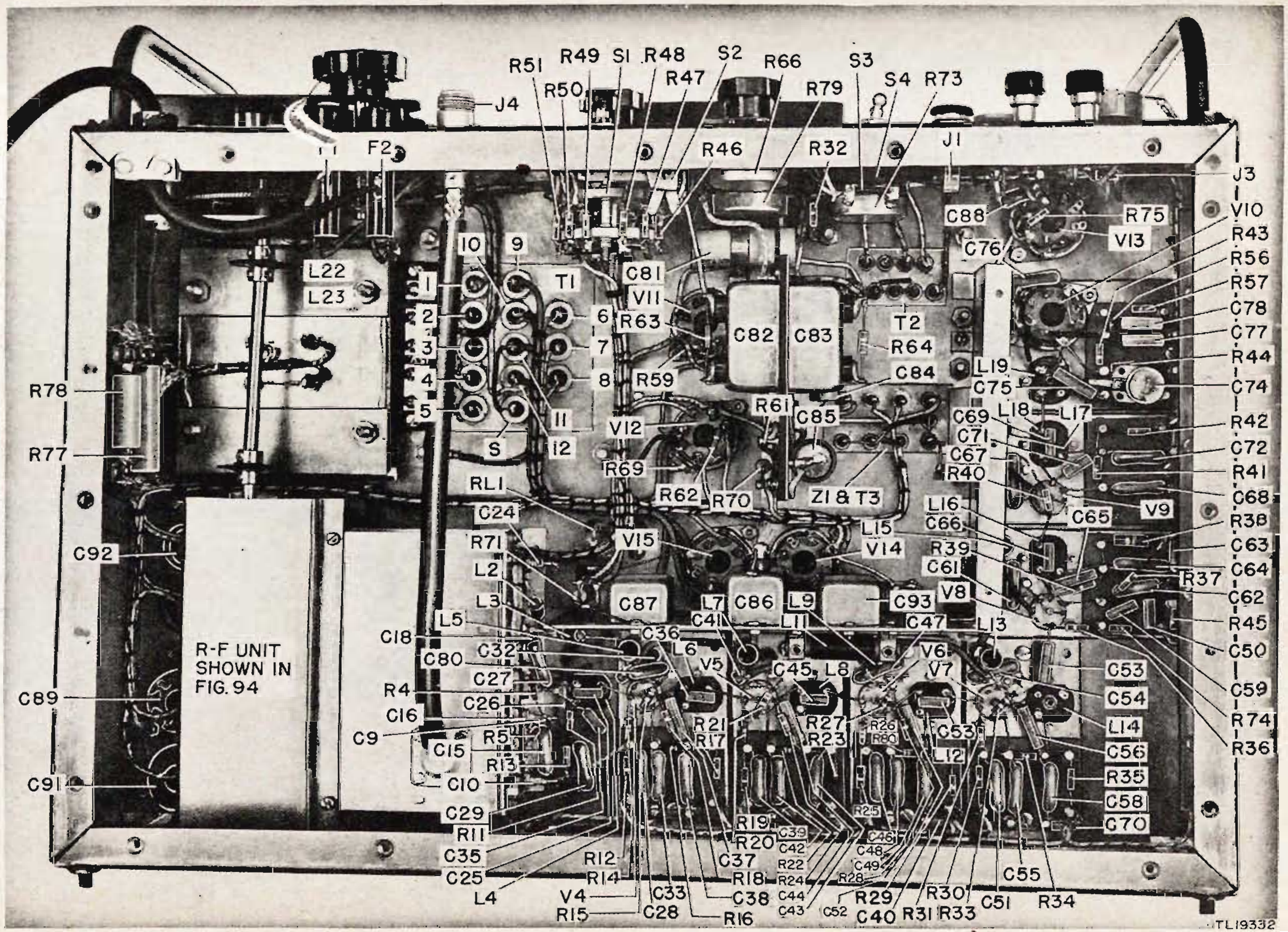
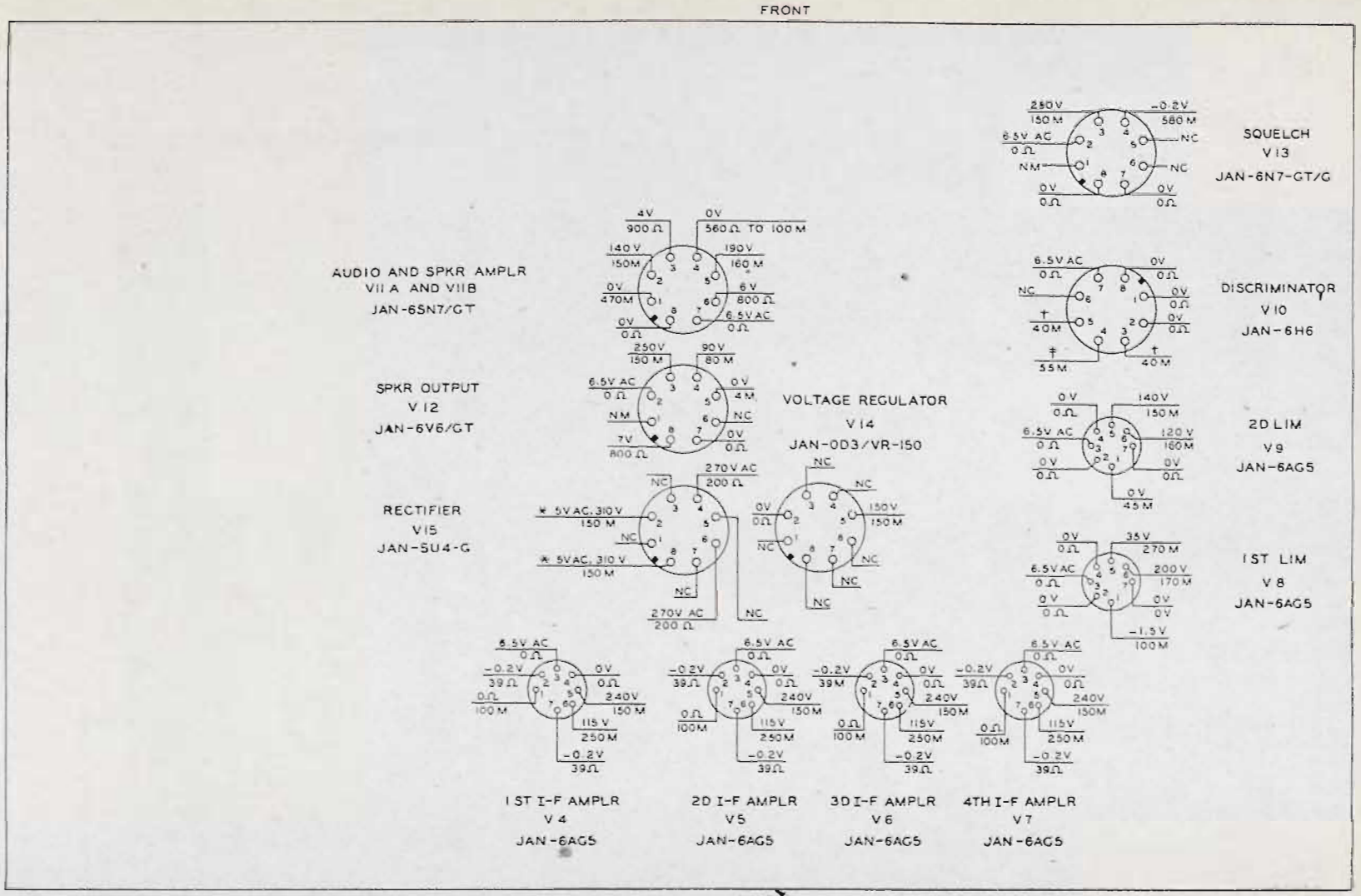


Figure 128. Radio Receiver R-48/TRC-8 (XC-8), chassis, bottom view.

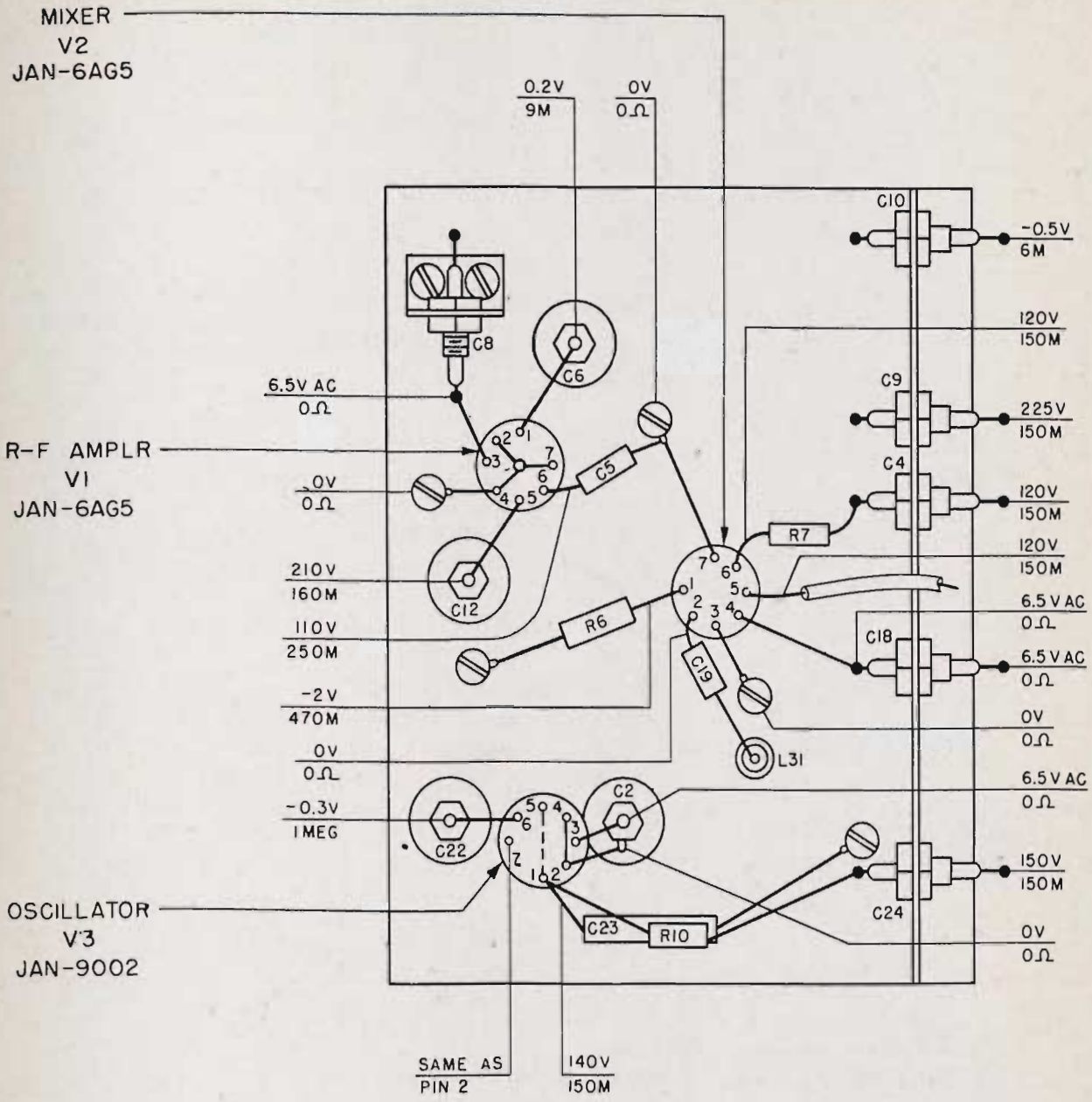


NOTES:

1. 115-V A-C INPUT
2. SQUELCH SWITCH ON.
3. SQUELCH ADJ IN MAXIMUM COUNTERCLOCKWISE POSITION.
4. METER SWITCH IN TUNE POSITION.
5. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH A 1,000 OHM-PER-VOLT METER.
6. NM INDICATES NOT MEASURED.
7. NC INDICATES NO CONNECTION
8. * INDICATES MEASURMENT ACROSS FILAMENTS.
9. † INDICATES A SMALL NEGATIVE VOLTAGE.
10. ‡ INDICATES A SLIGHT POSITIVE OR NEGATIVE VOLTAGE
11. M = 1,000 Ω

TL 19323

Figure 129. Radio Receiver R-48/TRC-8 (XC-3), tube-socket voltage diagram.



NOTES:

1. 115-V A-C INPUT.
2. SQUELCH ADJ IN MAXIMUM COUNTERCLOCKWISE POSITION.
3. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH A 1,000 OHM-PER-VOLT METER.
4. MEASUREMENTS MADE FROM TOP OF RECEIVER CHASSIS.
5. M=1,000 Ω

TL19325

Figure 130. Radio Receiver R-48/TRC-8 (XC-3), r-f tube-socket voltage diagram.

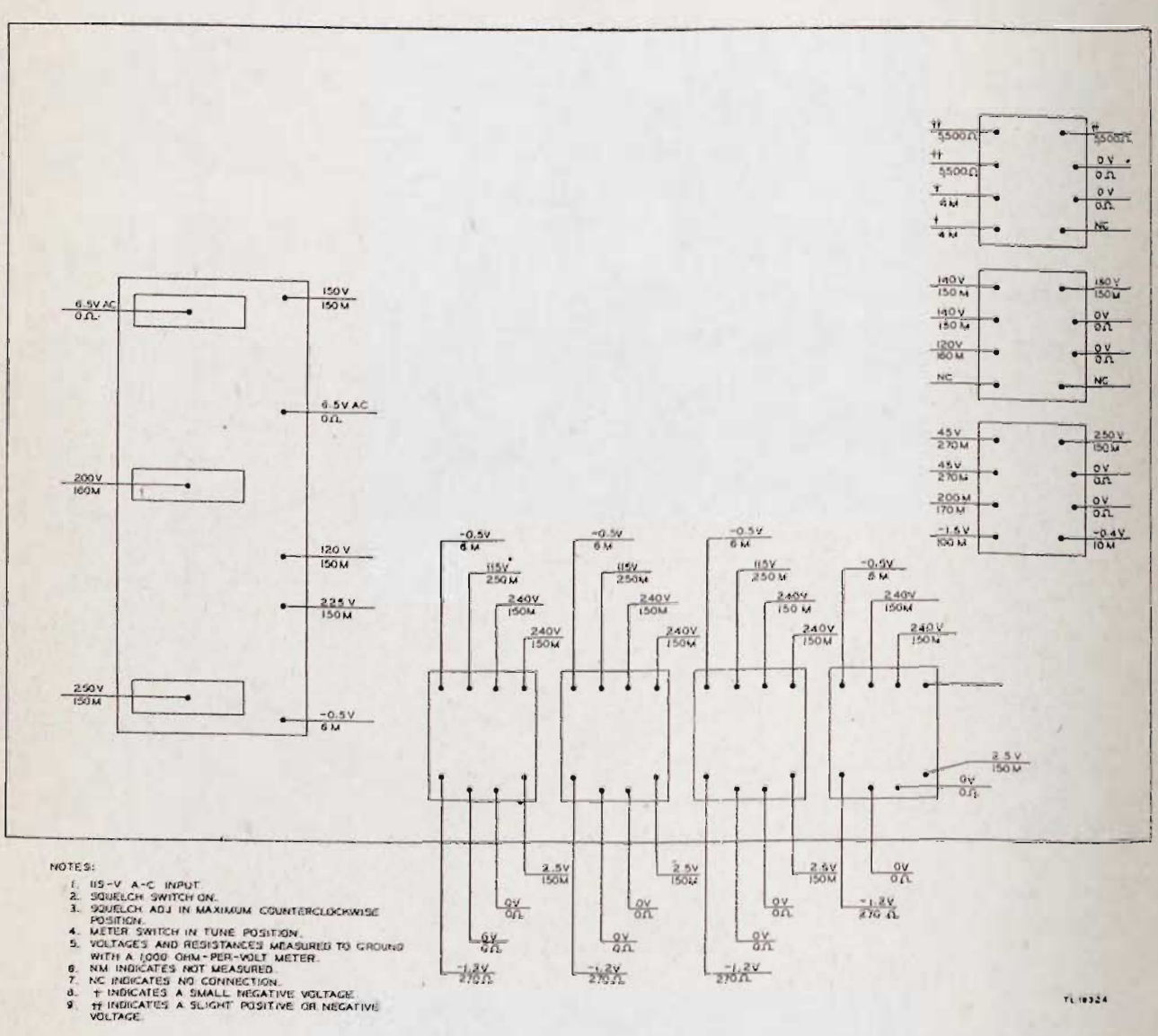


Figure 131. Radio Receiver R-48/TRC-8 (XC-3), resistor-capacitor board voltage diagram.

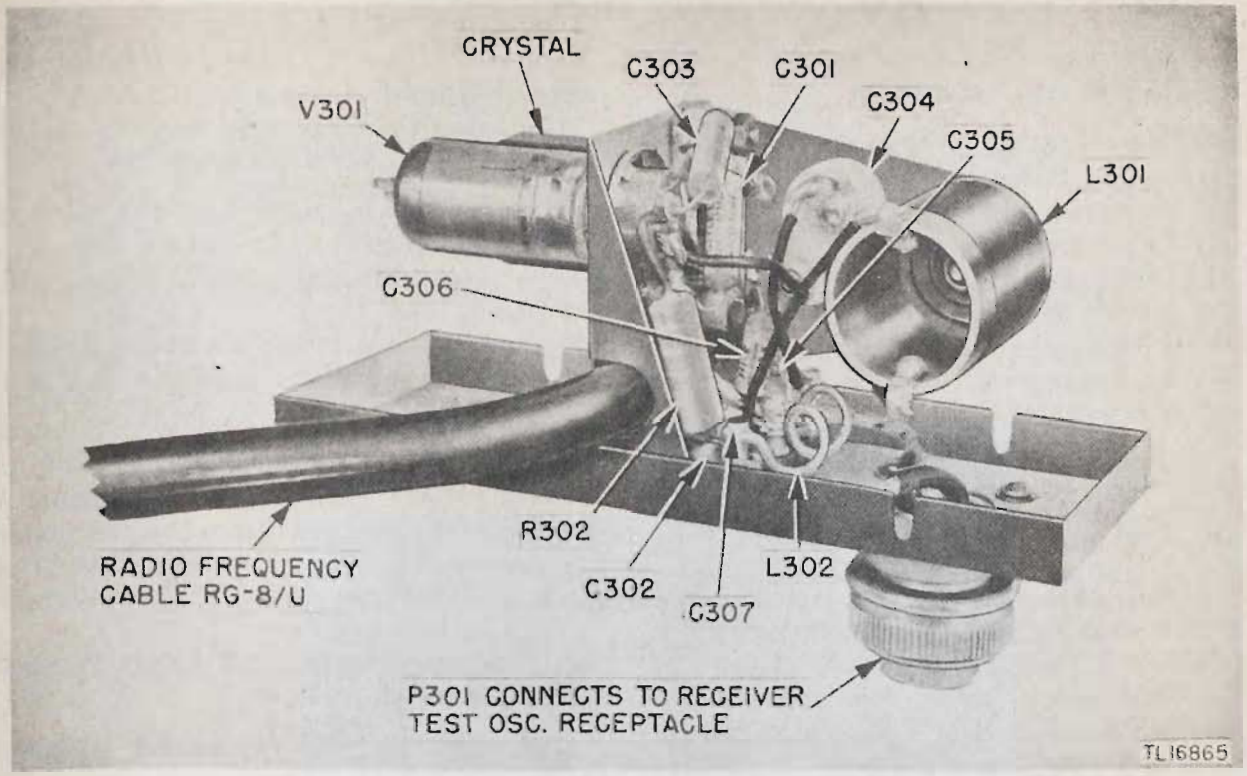


Figure 132. Test Oscillator TS-237/TRC-8 (XC-3), chassis.

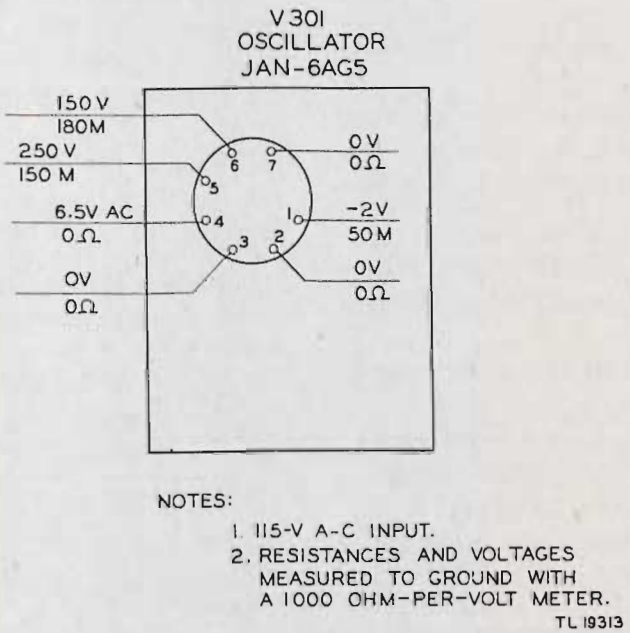


Figure 133. Test Oscillator TS-237/TRC-8 (XC-3), tube-socket voltage diagram.

166. PART REPLACEMENT FOR RADIO TRANSMITTER T-30/TRC-8 (XC-3).

a. Meter M201 (fig. 116). In order to replace this unit the transmitter front panel must first be removed.
(1) Loosen two setscrews on the hub of the FREQUENCY CONTROL disc.
(2) Remove the dials from capacitor C243 and switch S201.
(3) Remove 16 screws from the outer edges of the transmitter front panel and remove the panel.
(4) Remove three screws on the meter flange holding it to the rear of the front panel, and disconnect the leads.

b. Filter Chokes L215 to L224 and Capacitors C222 to C233 (fig. 120). Access to these units is obtained through a bottom cover panel over the choke section shield. Two screws mount these chokes with their associated capacitors to a small metal strip, which in turn is mounted to the box by an additional pair of screws. Removal of any one of these chokes or capacitors requires unsoldering of the two leads connected to the choke and the removal of the two screws which hold the metal mounting strip to the choke shield box.
(1) Remove 10 screws holding the cover of the choke shield box.
(2) Unsolder two leads from the defective choke or capacitor.
(3) Remove two associated choke mounting screws from the outside of the choke field box.
(4) Remove the choke, metal strip, and associated capacitor.

c. Meter Switch S201 (fig. 117). (1) Remove four screws from the track on the bottom right side of the transmitter.
(2) Remove 15 screws from the right side panel.
(3) Remove the side panel.
(4) Remove the knob on the meter switch.
(5) Unsolder the leads to the meter switch.
(6) Remove the switch mounting nut.
(7) Remove the meter switch and the attached resistors.

167. PART REPLACEMENT FOR POWER PACK PP-115/TRC-8 (XC-3).

a. Relay RL201 (fig. 123). (1) From the front panel of the power supply remove the two screws which mount the relay shield.
(2) Unsolder the leads from the relay and remove the four screws which mount the relay.

b. Blower B201 (fig. 123). (1) Unsolder three blower leads from the terminal board and capacitor C244 on the under side of the power supply chassis.
(2) From the base of the blower remove four bolts which mount this unit on the chassis.

c. Attenuator Z202. (1) Remove capacitor C240 (fig. 123) to permit the removal of the attenuator (MODULATION ADJ. control).
(2) Unsolder three leads from the attenuator.
(3) Remove the two attenuator mounting screws from the front panel of the power supply.

168. PART REPLACEMENT FOR RADIO RECEIVER R-48/TRC-8 (XC-3).

a. Meter M1 (fig. 126). (1) Remove the three screws on the meter flange.
(2) Pull the meter forward and remove the leads.

> **CAUTION:** Do not attempt to attach or disconnect leads from the meter while it is bolted to the panel.

b. POWER ON-OFF Switch S5 (fig. 126). (1) Remove meter M1 from the panel as described in subparagraph *a* above.
(2) Remove the nut holding the switch to the panel.
(3) Remove the switch through the meter hole.
(4) Unsolder the leads while the switch is dismounted from the panel.

c. Speaker LS1 (fig. 126). (1) Remove the four screws at the front of the speaker housing. These screws hold the cover in position and also mount the speaker on its mounting studs.
(2) Unsolder one lead and remove the speaker from its housing.

d. Capacitors C89, C91 (fig. 126). These are of the plug-in type and can be removed from their octal sockets in the same manner as a tube is removed.

e. Relay RL1 (fig. 126). (1) Unsolder the leads from the five terminal lugs on the bottom of the chassis.

WAR DEPARTMENT

UNSATISFACTORY EQUIPMENT REPORT

FOR (Technical service): Signal Corps — DATE: 15 Dec 44

FROM (Organization): 502 Sig Repair Co. APO 171 (Station) — MATERIEL (Station): New York, N.Y.

TO (Next superior headquarters): Signal Officer Third Army (Station) — (Technical service)

COMPLETE MAJOR ITEM

NOMENCLATURE: Radio Transmitter T-30/TRC-8 (XC-3) — TYPE: Ground, transportable

MODEL: XC-3 — MANUFACTURER: Lewyt Corp

U. S. A. REG. NO.: Contract No. 3227-CCGSA-44 — SERIAL NO: 138 — DATE RECEIVED: 2 Nov 44

EQUIPMENT WITH WHICH USED (IF APPLICABLE): Radio Relay Set AN/TRC-12 (XC-3)

NOMENCLATURE OF DEFECTIVE COMPONENT

PART NO: S.C. Stock No. 000.000 — TYPE: Resistor (ref symbol R-296) fixed; 10 watts; 7200 ohms

MANUFACTURER: Lewyt Corp. — DATE INSTALLED: 2 Nov 44

LENGTH OF SERVICE

DATE OF INITIAL TROUBLE: 15 Dec 44

	TOTAL	YEARS	MONTHS	DAYS
TIME INSTALLED	0 1 13	0	0	0

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

HOURS	MILES	ROUNDS
200	—	—

DESCRIPTION OF TROUBLE AND PROBABLE CAUSE

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

Resistor open-circuited due to humid operating conditions

UNUSUAL SERVICE CONDITIONS

GIVE BRIEF DESCRIPTION

Operation in humid location

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

DESCRIPTION OF ANY REMEDIAL ACTION TAKEN

Resistor R-296 replaced

RECOMMENDATIONS

Substitution with vitreous-enamel type resistor

1ST IND. — ORIGINATING OFFICER

OFFICE — STATION — DATE

SIGNATURE: Lawrence P Miller

(Technical service)

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

NAME: LAWRENCE P. MILLER

RANK AND TITLE: Capt., Sig. C.

STATION — RANK

ORGANIZATION: 502 Sig Repair Co.

INSTRUCTIONS

1. It is imperative that the Chief of Technical Service concerned be advised of 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).

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

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.

TL16860

Figure 134. W. D., A. G. O. Form No. 468 with sample entries.

(2) Remove two screws and the relay will drop free.

169. RUSTPROOFING AND REPAINTING.

When the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surface as follows:

a. Use #000 or #00 sandpaper to clean the surface down to the bare metal. Obtain a bright smooth finish.

> **CAUTION:** The use of steel wool, although permitting rapid removal of rust, is not recommended. Minute particles of steel wool frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. When numerous scars and scratches warrant complete repainting, remove the radio set chassis and spray paint over the entire case. Remove rust from the case by cleaning corroded metal with dry-cleaning solvent. In severe cases it may be necessary to use dry-cleaning solvent to soften the rust, and sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations.

170. 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, War Department Unsatisfactory Equipment Report, W.D., A.G.O. Form No. 468 should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D.C.

b. When trouble in equipment used by Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form No. 54 should be filled out and forwarded through channels.

c. If either form is not available, Form No. 468 (fig. 134) may be reproduced, filled out, and forwarded through channels. When Army Air Forces Form No. 54 is required but unavailable, reproduce Form No. 468 and forward it through channels in accordance with directions on Form No. 468.

SECTION XX. ALIGNMENT AND ADJUSTMENT

> **CAUTION:** Alignment should not be attempted unless it has been definitely determined that lack of sensitivity is not caused by a weak tube or a defective receiver component. In any case, mark in pencil the slot position of all aligning screws on the adjacent shields so that the initial setting can be returned to in the event realignment does not restore normal receiver sensitivity.

171. MATERIAL REQUIRED.

a. **Receiver.** The following tools and test equipment are required for receiver alignment:

Test Oscillator TS-237/TRC-8 (XC-3).
I-f adaptor P303.
Alignment screwdriver (Vaco-130, provided in draw of receiver case) or equivalent narrow blade tool.

b. **Receiver Discriminator.** For discriminator alignment, the following additional material is required:

Signal Generator I-208 or equivalent.
Voltmeter I-166 or equivalent.

c. **Transmitter.** For transmitter calibration a dummy antenna or load is provided.

172. RECEIVER ALIGNMENT.

All aligning adjustments for Radio Receiver R-48/TRC-8 (XC-3) are located on the re-

ceiver chassis and are made accessible by removing the receiver top cover. The procedure for receiver alignment is as follows:

a. Plug Test Oscillator TS-237/TRC-8 (XC-3) into the TEST OSC. receptacle on the receiver front panel. The adaptor, consisting of a Radio Frequency Receptacle UG-58/U containing a 2.0-mmf capacitor, (fig. 114), is plugged into the coaxial cable of the test oscillator. (This places the 2.0-mmf capacitor in series with the test oscillator output.)

b. Remove the shield cover from the r-f section of the receiver (fig. 126). Remove mixer tube V2, and oscillator tube V3 (fig. 135).

c. Bend a small hook at the end of the 2.0-mmf capacitor and attach it to the plate contact of the mixer tube socket (No. 5 contact of tube V2) (fig. 135).

d. Place the meter switch in the 1st LIM. Ig position.

e. Throw the POWER ON-OFF switch ON and allow the tubes to reach operating temperature. Adjust the iron core tuning slug of i-f coils, L6, L8, L12, and L14 respectively, with a screwdriver, for a maximum reading on the meter (fig. 128). Readjust these coils in reverse order for a maximum reading on the meter. This reading should be approximately 170 microamperes.

f. Disconnect the test oscillator coaxial cable from the mixer plate and remove the adaptor. Plug the test oscillator coaxial cable directly into the ANTENNA receptacle on the receiver front panel. Replace the mixer and oscillator tubes. Replace the r-f shield.

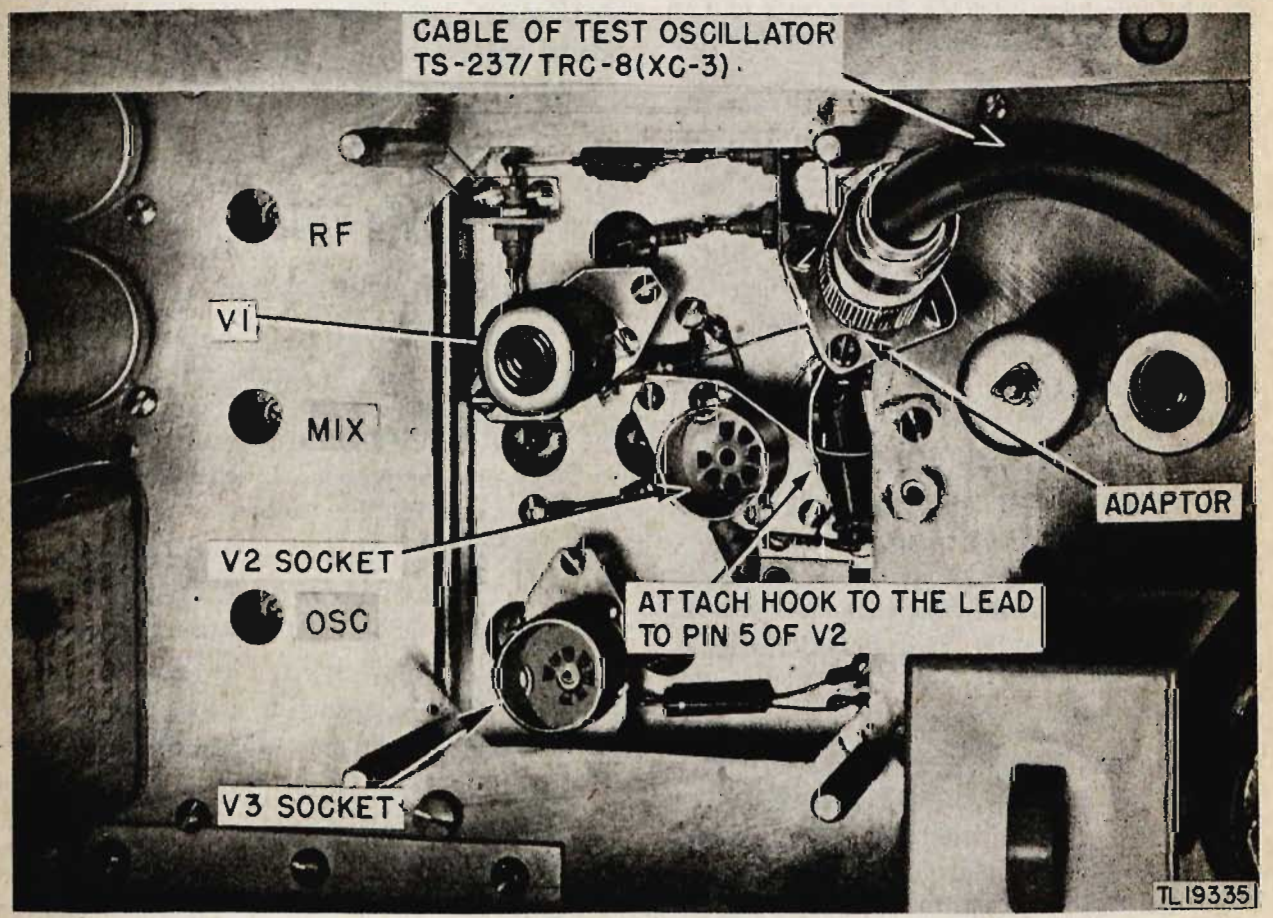


Figure 135. Hooking i-f adaptor to plate contact of mixer tube socket.

g. Rotate the FREQUENCY CONTROL dial to 250 mc and tune for maximum reading on the meter. This reading should be approximately 170 microamperes. Adjust the tuning slug of i-f coil L4 to a maximum reading on the meter. Do not disturb the adjustments of L6, L8, L12, or L14.

h. Adjust the FREQUENCY CONTROL dial to indicate exactly 250 mc and adjust the trimmer capacitor marked OSC. on the receiver chassis for a peak reading on the meter (fig. 126).

i. Additional peak meter readings should occur at 230 mc, 235 mc, 240 mc, and 245 mc. If peak readings do not occur exactly at these points, repeat steps a to h above.

j. Adjust the trimmer capacitors marked RF and MIX for peak meter reading with the FREQUENCY CONTROL dial set at 250 mc.

k. Place the meter switch in the 2nd LIM. Ip position and adjust the tuning slug of L16 for *minimum* meter reading. The meter dip should be slight and the adjustment very broad, that is, not critical.

l. Place the meter switch in the TUNE position and adjust the tuning slug of L19 for a meter reading of zero. Adjustment of L18 is normally not required as small variations are corrected by the tuning of L19. *Do not adjust L18 unless a frequency-modulated signal generator is available.*

173. DISCRIMINATOR ALIGNMENT.

A frequency-modulated signal generator, Signal Generator I-208 or equivalent, is necessary for the alignment of the discriminator stage. *Do not attempt this alignment without an f-m signal generator.* Steps in paragraph 172 should be completed before starting discriminator alignment.

a. Connect the HIGH OUTPUT of Signal Generator I-208 to the receiver ANTENNA receptacle by pushing a small piece of bus wire into the center conductor of the antenna receptacle and connecting the red lead from the signal generator to the bus wire and the black lead to the receiver case.

b. Connect Voltohmmeter I-166 adjusted for a-c voltage measurements at 300 ohms impedance, or an equivalent meter to the REC. OUTPUT binding posts.

c. Tune the receiver to 240 mc and adjust the signal generator for an output of 40 mc. The deviation should be set to 16 kc which will produce a final deviation of 96 kc since the 6th harmonic of 40 mc is being used. Adjust the modulation frequency to 1,000 cycles.

d. Place the meter switch in the 1st LIM. Ig position and tune the receiver FREQUENCY CONTROL DIAL for maximum reading on the meter.

e. Adjust the tuning slug in L18 for maximum power output meter reading; then adjust L19 for zero reading on the receiver meter with the meter switch in the TUNE position. Repeat these adjustments at least once.

f. Capacitor C74 on the under side of the receiver chassis (fig. 128) determines the discriminator bandwidth. It is not critical and normally should require no adjustment. If this adjustment has been disturbed, or if the receiver output is distorted, this capacitor should be removed and measured with a Q meter, or other capacity indicator, and set at 3.0 mmf. This completes the discriminator alignment.

174. TRANSMITTER CALIBRATION.

a. Transmitter frequency calibration is corrected by adjusting the transmitters to receivers known to be in alignment. The window above the FREQUENCY CONTROL dial is adjustable so that small changes in calibration can be corrected by moving the window.

b. Calibrate a receiver as follows:

(1) Plug Test Oscillator TS-237/TRC-8 (XC-3) into the TEST OSC. receptacle on the receiver front panel.

(2) Plug the test oscillator coaxial cable into the ANTENNA receptacle on the receiver front panel.

(3) Throw the POWER ON-OFF switch ON and allow the tubes to reach operating temperature.

(4) Proceed as in paragraph 172 steps h to j.

(5) Remove the test oscillator.

c. Install the dummy load (fig. 113) provided for the transmitter in the ANTENNA receptacle. Set the transmitter to 250 mc and adjust for maximum output by rotating the OUTPUT TUNING control until the transmitter meter reads maximum with the meter switch in the OUTPUT position and the bulbs on the dummy load are most brilliant.

d. Adjust the FREQUENCY CONTROL dial on the transmitter for a peak meter reading on the receiver with the meter switch in the 1st LIM. Ig position. It is not necessary to connect an antenna to the receiver if the distance between the receiver and transmitter is less than 100 feet.

e. Loosen the mounting screws on the transmitter dial window and shift it laterally so that the hairline indicates exactly 250 mc.

f. Capacitor C205 (fig. 120) is a phase adjustment for the reactance modulator. The adjustment is not critical and should be made only if a distortion meter is available. Measure the distortion in the receiver output while modulating a transmitter and adjust capacitor C205 for minimum distortion.

g. Capacitor C242 (fig. 119) is an antenna tuning capacitor that is adjusted at the factory for optimum performance with the antenna equipment supplied. This capacitor need not be adjusted.

175. MINIMUM TEST REQUIREMENTS FOR RADIO RECEIVER R-48/TRC-8 (XC-3).

a. **General.** This paragraph is intended for use by Signal Corps radio repair organizations in determining the quality of a repaired Radio Receiver R-48/TRC-8 (XC-3). Radio equipment which passes the tests outlined below is suitable for field operation.

b. **Test Instruments Required.** The following instruments are required to make the test outlined in subparagraph d below.

(1) Signal generator (General Radio type 804B) or similar instrument. The signal generator should be able to put out a signal at 240 mc.

(2) Signal Generator I-208 or similar f-m signal generator. Refer to paragraph 158.

(3) Signal Generator I-192-( ) or equal audio oscillator.

(4) Output meter, electronic meter (Ballantine type 330) or equivalent.

(5) 500-ohm resistor.

c. **Moving Parts and Finish.** In addition to making the electrical tests described in subparagraph d below, check the receiver for smoothness of operation in moving or rotating parts and for condition of the finish.

(1) Check the radio set for cleanliness inside and outside.

(2) Rotate all tuning and volume controls. Operation across the arc of rotation should be smooth. There should be no appreciable backlash or slipping of controls.

(3) Try all switches, both rotary and toggle. They should snap firmly into each contact position.

(4) Insert the appropriate plugs into the proper jacks. The plugs should seat firmly and make good contact.

(5) Check fuse holders to see that fuses may be removed easily but will lock tightly when inserted.

(6) Observe the condition of the finish and plating. Both paint and plating should be free from corrosion, blisters, flaking, bare or worn spots, or deep scratches.

d. **Electrical Check.** Check Radio Receiver R-48/TRC-8 (XC-3) electrically, using the chart shown below as a guide.

Test	Signal generator settings				1st LIM. Ig (ma)	Output meter reading (mw)
	Attenuator setting (μv)	Carrier Frequency (mc)	Modulation			
			Frequency (cps)	Deviation (kc)		
1. Sensitivity.	6	240	None		*A-140-170	Receiver output 16 Speaker output 1000
2. Noise ratio and output.	6	240	1000	100	A	
a. Signal modulated.						
b. Signal unmodulated.	6	240	None		A	Receiver output 0.04
3. Selectivity.	†B 60-100	30	None		A	
	B x 10	29.56	None		A	
	B x 10	30.44	None		A	
4. Fidelity.	6	240	200	100	A	9.0 to 11.0
	6	240	1000	100	A	10
	6	240	12000	100	A	9.0 to 11.0

*A indicates a specific reading in the range of 140 to 170 ma. This specific reading for A remains constant for all succeeding tests.

†B indicates a specific reading in the range of 60 to 100 μv.

NOTE: See legend for details.

LEGEND

1. SENSITIVITY.

a. Connect signal generator (General Radio type 804B) or similar instrument to the receiver ANTENNA receptacle.

b. Set the SQUELCH ADJ. control to full clockwise position. Set SQUELCH control to OFF. The setting of AUDIO GAIN is not critical.

c. Set the receiver meter switch in 1st LIM. Ig position.

d. Adjust the signal generator to 240 mc and tune the receiver to maximum meter reading.

e. The meter reading is indicated on the chart. Note this meter reading.

2. NOISE RATIO.

a. Signal Modulated.

(1) Connect Signal Generator I-208 or similar f-m signal generator to the receiver ANTENNA receptacle using the HIGH OUTPUT connections.

(2) Adjust the signal generator to 40 mc and the modulation to 16.6-kc deviation using 1,000-cps modulation.

(3) Set the receiver to 240 mc and adjust the SQUELCH and SQUELCH ADJ. as in paragraph 1b above. Tune the receiver until the meter in the 1st LIM. Ig position is at peak reading. The deviation is 100 kc because the 6th harmonic of 40 mc is being received.

(4) Adjust the Signal Generator I-208 output until the receiver meter in the 1st LIM. Ig position reads the same as was obtained in paragraph 1d above (A on chart).

(5) The receiver output, measured with an electronic meter (Ballantine type 330), should be at least 16 mw (milliwatts) measured across a 500-ohm resistor at the REC. OUTPUT terminals. The speaker output should be at least 1.0 watt measured across 10-ohm resistor R72 in the receiver with the SPEAKER ON-OFF switch OFF. If the output is not 16 mw, adjust the AUDIO GAIN control until the output meter reads 16 mw.

b. Signal Not Modulated.

(1) Complete steps a(1) to a(5) above.
(2) Turn the modulation off.
(3) Adjust the signal generator for a meter reading of A. (Refer to chart.)
(4) The output should be 0.04 mw or less measured across 500 ohms at the REC. OUTPUT terminals of the receiver.

3. SELECTIVITY.

a. Disconnect capacitor C13 from pin 1 of V2 at the tube socket. Leave R6 connected.

b. Adjust the receiver controls as in 1b above.

c. Connect the high side marked A of the r-f output of Signal Generator I-208 to the grid of the mixer tube and fasten the ground clip to the chassis.

d. Adjust Signal Generator I-208 to 30 mc and its output so that the receiver meter in the 1st LIM. Ig position reads A. The output from the signal generator should be between 60 and 100 μv (microvolts), B.

e. Adjust the Signal Generator I-208 to 10 times its output in c above (600 to 1,000 microvolts) and adjust the frequency so that the receiver meter reads A again. The frequencies should be 29.56 mc $\pm$ 75 kc and 30.44 mc $\pm$ 75 kc. The bandwidth is 880 kc $\pm$ 150 kc.

f. With an output of 120-220 μv the bandwidth should be 300 kc $\pm$ 75 kc.

g. With an output of 6,000-100,000 μv, the bandwidth should be 980 kc $\pm$ 150 kc.

h. Reconnect C13 to pin 1 of V2.

4. FIDELITY.

a. Use the same set-up as in 2a above, but use an audio oscillator to modulate Signal Generator I-208.

b. Set the audio oscillator frequency to 1,000 cps.

c. Adjust the AUDIO GAIN of the receiver for 10-mw output across the REC. terminals loaded with a 500-ohm resistor.

d. The output at 200 and 12,000 cycles, should be as indicated in the table.

APPENDIX

SECTION XXI. MAINTENANCE PARTS

176. MAINTENANCE PARTS FOR RADIO SET AN/TRC-8 (XC-3), RADIO TERMINAL SET AN/TRC-11 (XC-3), AND RADIO RELAY SET AN/TRC-12 (XC-3).

The following information was compiled on 24 February 1945. The appropriate sections of the ASF Signal Supply Catalog for Radio Set AN/TRC-8 (XC-3), Radio Terminal Set AN/TRC/11 (XC-3), and Radio Relay Set AN/TRC-12 (XC-3) are:

Organizational Spare Parts

SIG 7-AN/TRC-8	When published
SIG 7-AN/TRC-11	When published
SIG 7-AN/TRC-12	When published
SIG 7-T-30/TRC-8	When published
SIG 7-R-48/TRC-8	When published
SIG 7-TS-237/TRC-8	When published
SIG 7-AS-52/TRC-8	When published
SIG 7-AB-48/TRC-8	When published
SIG 7-PE-75	
SIG 7-I-56	

Higher Echelon Spare Parts

SIG 8-AN/TRC-8	When published
SIG 8-AN/TRC-11	When published
SIG 8-AN/TRC-12	When published
SIG 8-T-30/TRC-8	When published
SIG 8-R-48/TRC-8	When published
SIG 8-TS-237/TRC-8	When published
SIG 8-AS-52/TRC-8	When published
SIG 8-AB-48/TRC-8	When published
SIG 8-H-23/U	When published
SIG 8-GN-38	When published
SIG 8-TS-9	When published
SIG 8-EE-8	When published
SIG 8-PE-75	When published
SIG 8-I-56	When published
SIG 8-I-176	When published
SIG 8-I-177	When published
SIG 8-I-166	When published

For the latest index of available catalog sections, see ASF Signal Supply Catalog SIG 2.

a. Maintenance Parts for Radio Set AN/TRC-8 (XC-3).

Signal Corps stock No.	Name of part and description
2S5002-8.1	RADIO SET AN/TRC-8 (XC-3): ground; fm; 12-w; Sig C Spec No. SCL-654-A.
2A264-52.1	ANTENNA ASSEMBLY AS-52/TRC-8 (XC-3): includes 2 dipoles, brass, olive drab, ea 97/8″ x 1/2″ x 0.020″ wall, sealed in polystyrene holder; attached to 14″ lg steel mtg support, with 9″ lg coax cable and Connector UG-58/U; mounted on corner reflector; 30″ lg x 23″ h x 8″ wd.
2A248-48.1	ANTENNA SUPPORT AB-48/TRC-8 (XC-3): 40-ft sectional steel mast to support Antenna Assembly AS-52/TRC-8; 8 mast sect, ea 65″ lg x 2″ wd; Lewyt dwg No. 2597.

a. Maintenance Parts for Radio Set AN/TRC-8 (XC-3) (contd).

Signal Corps stock No.	Name of part and description
1B812.11	CABLE, power: copper; 2 No. 12 AWG stranded cond, ea 65 No. 30 AWG strands; 5/8" over-all diam; rubber jacketed; 100-ft roll (part of Junction Box JB-110).
3E6000-104	CABLE ASSEMBLY, power: Sig C Cord CX-104/TRC-1; rubber jacketed; 9/16" diam; 10 ft lg; 6 cond No. 16 AWG stranded, ea 65 No. 34 AWG strands; Sig C dwg No. SC-D-14466; (with 7 cont male connector AN-3106-16S-1P and clamp at ea end); (connects receiver and transmitter).
3E7160-37	CABLE ASSEMBLY, power: Buna S covered; round, 39/64" diam; 10 1/2 ft lg; 2 No. 12 AWG cond, tinned copper, ea 65 strands No. 30 wire; Sig C dwg SC-D-15910-A (with metal covered cord grip cap Hubbell No. 7238 one end; two solder lugs other end) (part of Junction Box J-85/G).
3E1711	CABLE ASSEMBLY, power: Sig C Cord CD-711; rubber jacketed; 50 ft lg; 2-cond; No. 14 AWG, copper tinned, ea cond 41 strands No. 30 wire; Sig C dwg SC-A-8888; (with connector body Hubbell No. 7187 one end, plug cap Hubbell No. 7238 other end); (connects junction box at power units to junction box at radio station).
6L405-13.68	CLAMP, mounting: steel; olive drab; 13 11/16" lg x 5/16" thk; Lewyt part dwg No. L2850: (fastens receiver to vehicle body).
6L405-20	CLAMP, mounting: steel; olive drab; 20" lg x 5/16" thk; Lewyt part dwg L2851; (fastens transmitter to vehicle body).
2Z3065-14	CONNECTOR, female contact: 2 T slot cont; straight; 4" lg x 1 1/2" wd x 1" h; Bryant No. 4832; (part of Junction Box JB-110).
6Z7591-10	CONNECTOR, female contact: 2 T slot cont straight; 1 3/8" diam x 1 5/16" h; Hubbell No. 7187; (part of Cord CD-711).
6Z1734.1	CONNECTOR, male contact: 2 semi-circular twist lock blades; straight; 1 1/2" diam x 5/8" d less blades; Hubbell No. 7238; (part of Cord CD-711 and Junction Box J-85/G).
6Z1727-2	CONNECTOR, male contact: two flat parallel blades; straight; 1 1/2" diam x 5/8" lg less cont; Hubbell No. 7057; (part of Junction Box JB-110).
2Z7117.4	CONNECTOR, male contact: 7 round cont; straight; 1 1/4" diam x 1 1/2" lg; Amphenol No. AN-3106-16S-1P; (part of Cord CX-104/TRC-1).
2B620-23	HANDSET H-23/U: receiver impedance 250 ohms; black phenolic, 9" lg x 2 3/4" wd x 3 15/16" d; Sig C Spec No. 71-1058; (with Cord CD-494 and Plugs PL-55 and PL-68).
2Z5600-85	JUNCTION BOX J-85/G: steel, zinc coated, olive drab; with cover; 5 3/8" lg x 4 7/8" h; two 1 3/16" threadless outlets; two 2-cond cables with male plugs; 2 female connectors Hubbell No. 7210 and toggle switch C-H No. 8792-K4; (connects two Power Units PE-75 to extension cord or directly to load).
6Z1041	JUNCTION BOX JB-110: steel, olive drab; with face plate; 4 1/2" wd x 2 1/4" thk x 2 1/4" lg; one threadless outlet 13/16" diam; 5 duplex female connectors; 10 ft, 2 cond No. 12 rubber jacketed cable; with Hubbell No. 7057 male connector; Sig C dwg No. SC-D-11461.

a. Maintenance Parts for Radio Set AN/TRC-8 (XC-3) (contd).

Signal Corps stock No.	Name of part and description
6Z6897-2	LIGHT, extension: 50-w, 115-v; with 25 ft extension cord.
6Z6815-2.1	LAMP, incandescent: 115-v, 50-w; bulb A-19 clear; medium screw base; Mazda No. 50A/CL; (part of extension light).
3H4575	POWER UNIT PE-75: gasoline: 2.500-w at 100% pf; 120-v, 60-c; single-phase; Sig C Spec No. 71-952-A.
2C4180-48-1	RADIO RECEIVER R-48/TRC-8 (XC-3): fm; 230- to 250-mc; input 115-230 v, 50-60 c, 120 w; mtd in steel cabinet; 22½" x 17" x 18⅛".
2C6900-30-1	RADIO TRANSMITTER T-30/TRC-8 (XC-3): fm; 230- to 250-mc; output 12 w; input 115-230 v, 50-60,C 350 w; steel cabinet; 20" x 17" x 24"
6R15292	SCREWDRIVER: alignment; 2" blade; 3⅞" lg over-all; Vaco No. A-130-2ZK.
6R16091	SCREWDRIVER: 6" lg x 3/16" blade; Xcellite No. 3166.
3Z9849.162	SWITCH, toggle: DPDT, 6-pole, 2-position single-deck; bakelite body; C-H No. 8792-K4; (part of Junction Box J-85/G).
3F4325-237.1	TEST OSCILLATOR TS-237/TRC-8 (XC-3): unmodulated crystal controlled with harmonic output of 30 mc and 230-250 mc in 5 mc steps; 5⅜" x 3⅜" x 2⅛"; Lewyt part dwg No. 989.
3F4056	TEST SET I-56: consists of Voltohmmeter I-166, Test Unit I-176, and Tube Tester I-177.
1B110B.1	WIRE W-110-B: insulated; 2-cond; 7 strands 4 steel 13 mil and 3 copper 13 to 14 mil; Sig C Spec No. 71-478; (on Reel DR-4; ½ mile of wire per reel).
6R55118-20	WRENCH, box: 9/16" and 5/8"; Williams No. 9727.
	GENERAL HARDWARE
6L3106-32	NUT, hexagon: brass; No. 6-32.
6L3108-32	NUT, hexagon: brass; No. 8-32.
6L6632-16.1	SCREW, machine: RH; brass; No. 6-32; 1" lg.
6L6832-16.1	SCREW, machine: RH; brass; No. 8-32; 1" lg.
6L72206	WASHER, lock: steel, smooth, for No. 6RH mach screw; 9/32" OD x 0.018" thk; Shakeproof No. 1206.
6L72208	WASHER, lock: steel, smooth; for No. 8 RH mach screw; Shakeproof No. 1208.

b. Maintenance Parts for Radio Terminal Set AN/TRC-11 (XC-3).

Signal Corps stock No.	Name of part and description
2S50002-11.1	RADIO TERMINAL SET AN/TRC-11 (XC-3): ground; FM; 12-w; Sig C Spec No. SCL-654-A.
2A264-52.1	ANTENNA ASSEMBLY AS-52/TRC-8 (XC-3): includes 2 dipoles, brass, olive drab, ea 9⅞" x ½" OD x 0.020" wall, sealed in polystyrene holder; attached to 14" lg steel mtg support; with 9" lg coax cable and Connector UG-58/U; mounted on corner reflector 30" lg x 23" h x 8" wd.
2A248-48.1	ANTENNA SUPPORT AB-48/TRC-8 (XC-3): 40 ft sectional steel mast for Antenna Assembly AS-52/TRC-8; 8 mast sect, ea 65" lg x 2" wd; Lewyt dwg No. 2597.

b. Maintenance Parts for Radio Terminal Set AN/TRC-11 (XC-3) (contd).

Signal Corps stock No.	Name of part and description
1B812.11	CABLE, power: copper; 2 No. 12 AWG stranded cond, ea 65 No. 30 AWG strands; 5/8" over-all diam; rubber jacketed; 100-ft roll; (part of Junction Box JB-110).
3E6000-104	CABLE ASSEMBLY, power: Sig C Cord CX-104/TRC-1; rubber jacketed; 9/16" diam; 10 ft; 6 cond No. 16 AWG stranded, ea 65 No. 34 AWG strands; Sig C dwg No. SC-D-14466; (with 8 cont male connector AN-3106-16S-1P and clamp at ea end); (connects receiver and transmitter).
3E7160-37	CABLE ASSEMBLY, power: Buna S covered; round, 39/64" diam; 10½ ft lg; 2 No. 12 AWG cond, tinned copper, ea 65 strands No. 30 wire; Sig C dwg SC-D-15910-A; (with metal covered cord grip cap Hubbell No. 7238 one end; two solder lugs other end); (part of Junction Box J-85/G).
3E1711	CABLE ASSEMBLY, power: Sig C Cord CD-711; rubber jacketed; 50 ft; 2-cond; No. 14 AWG, copper tinned, ea cond 41 strands No. 30 wire; Sig C dwg SC-A-8888; (with connector body Hubbell No. 7187 one end, plug cap Hubbell No. 7238 other end); (connects junction box at power units to junction box at radio station).
6L405-13.68	CLAMP, mounting: steel; olive drab; 13 11/16" lg x 5/16" thk; Lewyt part dwg No. L2850; (fastens receiver to vehicle body).
6L405-20	CLAMP, mounting: steel; olive drab; 20" lg x 5/16" thk; Lewyt part dwg No. 2851; (fastens transmitter to vehicle body).
2Z3065-14	CONNECTOR, female contact: 2 T slot cont; straight; 4" lg x 1½" wd x 1" h; Bryant No. 4832; (part of Junction Box JB-110).
6Z7591-10	CONNECTOR, female contact: 2 T slot cont; straight; 1 3/8" diam x 1 5/16" h; Hubbell No. 7187; (part of Cord CD-711).
6Z1734.1	CONNECTOR, male contact: 2 semicircular twist lock blades; straight; 1½" diam x 5/8" d; Hubbell No. 7238; (part of Cord CD-711 and Junction Box J-85/G).
2Z7117.4	CONNECTOR, male contact: 7 round cont; straight; 1¼" diam x 1½" lg; Amphenol No. AN-3106-16S-1P; (part of Cord CX-104/TRC-1).
6Z1727-2	CONNECTOR, male contact: 2 flat parallel blades; straight; 1½" diam x 5/8" lg less cont; Hubbell No. 7057; (part of Junction Box JB-110).
2B620-23	HANDSET H-23/U: receiver impedance 250 ohms; black phenolic; 9" lg x 2¾" wd x 3 15/16" d; Sig C Spec No. 71-1058; (with Cord CD-494 and Plugs PL-55 and PL-68).
2Z5600-85	JUNCTION BOX J-85/G: steel, zinc coated, olive drab; with cover; 5 3/8" lg x 4 7/8" wd x 5½" h; two 1 7/16" threadless outlets; two 2-cond cables with male plugs; 2 female connectors Hubbell No. 7210 and toggle switch C-H No. 8792-K4; (connects two Power Units PE-75 to extension cord or directly to load).
6Z1041	JUNCTION BOX JB-110: steel, olive drab; with face plate; 4½" wd x 2¼" thk x 2¼" lg; one threadless outlet 1 3/16" diam; 5 duplex female connectors; 10 ft, 2 cond No. 12 rubber jacketed cable; with Hubbell No. 7057 male connector; Sig C dwg No. SC-D-11461.
6Z6897-2	LIGHT, extension: 50-w, 115-v; with 25-ft extension cord.
6Z6815-2.1	LAMP, incandescent: 115-v; 50-w; bulb A-19 clear; medium screw base; Mazda No. 50A/CL; (part of extension light).
3H4575	POWER UNIT PE-75: gasoline; 2,500 w at 100% pf; 120-v, 60-c; single-phase; Sig C Spec No. 71-952-A.
2C4180-48-1	RADIO RECEIVER R-48/TRC-8 (XC-3): fm; 230- to 250-mc; input 115-230 v, 50-60 c, 120-w; mtd in steel cabinet; 22½" x 17" x 18½".

b. Maintenance Parts for Radio Terminal Set AN/TRC-11 (XC-3) (contd).

Signal Corps stock No.	Name of part and description
2C6900-30-1	RADIO TRANSMITTER T-30/TRC-8 (XC-3): fm; 230-250 mc; output 12 w; input 115-230 v, 50-60 c, 350 w; steel cabinet; 20″ x 17″ x 24″.
6R15292	SCREWDRIVER: alignment; 2″ blade; 3 7/8″ lg over-all; Vaco No. A-130-2zK.
6R16091	SCREWDRIVER: 6″ lg x 3/16″ blade; Xcellite No. 3166.
3Z9849.162	SWITCH, toggle: DPDT, 6-pole, 2-position single-deck; bakelite body; C-H No. 8792-K4; (part of Junction Box J-85/G).
4B5008	TELEPHONE EE-8: local or common battery; portable; self-contained; with leather case 3 1/2″ x 7 1/16″ x 9 1/2″ with carrying strap; Sig C Spec No. 71-631.
3F4325-237.1	TEST OSCILLATOR TS-237/TRC-8 (XC-3): unmodulated; crystal controlled with harmonic output of 30 mc and 230-250 mc in 5 mc steps; 5 3/8″ x 3 3/8″ x 2 1/8″; Lewyt part dwg No. 989.
3F4056	TEST SET I-56: consists of Voltohmmeter I-166, Test Unit I-176, and Tube Tester I-177.
1B110B.1	WIRE W-110-B: insulated; 2-cond; 7 strands; 4 steel 13 mil and 3 copper 13 to 14 mil; Sig C Spec No. 71-478; (on Reel DR-4; 1/2 mile of wire per reel).
6R55118-20	WRENCH, box: 9/16″ and 5/8″; 12 point Williams No. 9727; 6″ lg chrome.
	GENERAL HARDWARE
6L3106-32	NUT, hexagon: brass; No. 6-32.
6L4108-32	NUT, hexagon: brass; No. 8-32.
6L6632-16.1	SCREW, machine: RH; brass; No. 6-32; 1″ lg.
6L6832-16.1	SCREW, machine: RH; brass; No. 8-32; 1″ lg.
6L72206	WASHER, lock: steel, smooth; for No. 6 RH mach screw; 9/32″ OD x 0.018″ thk; Shakeproof No. 1206.
6L72208	WASHER, lock: steel, smooth; for No. 8 RH mach screw; Shakeproof No. 1208.

c. Maintenance Parts for Radio Relay Set AN/TRC-12 (XC-3).

Signal Corps stock No.	Name of part and description
2S5002-12.1	RADIO RELAY SET AN/TRC-12 (XC-3): ground; fm; 12-w; Sig C Spec No. SCL-654-A.
2A264-52.1	ANTENNA ASSEMBLY AS-52/TRC-8 (XC-3): includes 2 dipoles, brass, olive drab, ea 9 7/8″ x 1/2″ OD x 0.020″ wall, sealed in polystyrene holder; attached to 14″ lg steel mtg support; with 9″ lg coax cable and Connector UG-58/U; mtd on corner reflector 30″ lg x 23″ h x 8″ wd.
2A248-48.1	ANTENNA SUPPORT AB-48/TRC-8 (XC-3): 40 ft sectional steel mast for Antenna Assembly AS-52/TRC-8 (XC-3); 8 mast sect, ea 65″ lg x 2″ wd; Lewyt dwg No. 2597.
1B812.11	CABLE, power: copper; 2 No. 12 AWG stranded cond, ea 65 No. 30 AWG strands; 5/8″ over-all diam; rubber jacketed; 100-ft roll; part of Junction Box JB-110).

c. Maintenance Parts for Radio Relay Set AN/TRC-12 (XC-3) (contd).

Signal Corps stock No.	Name of part and description
3E6000-104	CABLE ASSEMBLY, power: Sig C Cord CX-104/TRC-1; rubber jacketed; 9/16" diam: 10 ft; 6 cond No. 16 AWG stranded, ea 65 No. 34 AWG strands; Sig C dwg No. SC-D-14466; with 8 cont male connector AN-3106-16S-1P and clamp at ea end); (connects receiver and transmitter).
3E7160-37	CABLE ASSEMBLY, power: Buna S covered; round, 39/64" diam; 11 ft lg; two No. 12 AWG cond. tinned copper, ea 84 strands No. 31 wire; Sig C dwg SC-D-15910-A; (with metal Sherman cord grip cap; Hubbell No. 7238 one end; two solder lugs other end); (part of Junction Box J-85/G).
3E1711	CABLE ASSEMBLY, power: Sig C Cord CD-711; rubber jacketed; 50-ft; 2-cond; No. 14 AWG, copper tinned, ea cond 41 strands No. 30 wire; Sig C dwg SC-A-8888; (with connector body Hubbell No. 7187 one end, plug cap Hubbell No. 7238 other end); (connects junction box at power units to junction box at radio station).
6L405-13.68	BOLT J, mounting: steel; olive drab; 13 11/16" lg x 5/16" thk; Lewyt part dwg No. L2850; (fastens receiver to vehicle body).
6L405-20	BOLT J, mounting; steel; olive drab; 20" x 5/16" thk; Lewyt part dwg No. 2851; (fastens transmitter to vehicle body).
2Z3065-14	CONNECTOR, female contact: 2 T slot cont; straight; 4" lg x 1 1/2" wd x 1" h; Bryant No. 4832; (part of Junction Box JB-110).
6Z7591-10	CONNECTOR, female contact: 2 T slot cont; straight; 1 3/8" diam x 1 5/16" h; Hubbell No. 7187; (part of Cord CD-711).
6Z1734.1	CONNECTOR, male contact: 2 semicircular twist lock blades; straight; 1 1/2" diam x 5/8" d; Hubbell No. 7238; (part of Cord CD-711 and Junction Box J-85/G).
2Z7117.4	CONNECTOR, male contact: 7 round cont; straight; 1 1/4" diam x 1 1/2" lg; Amphenol No. AN-3106-16S-1P; (part of Cord CX-104/TRC-1).
6Z1727-2	CONNECTOR, male contact: 2 flat parallel blades; straight 1 1/2" diam x 5/8" lg less cont; Hubbell No. 7057; (part of Junction Box JB-110).
2C666-21A	CONTROL BOX C-21/TRC-1: steel cadmium pl, olive drab; 4 3/4" lg x 3" wd x 2 1/2" h; Link Radio Corp; (2 pr cables AH and H; 1 Jack JK-33-A; 1 Jack JK-34-A).
2B620-23	HANDSET H-23/U: receiver impedance 250 ohms; black phenolic; 9" lg x 2 3/4" wd x 3 15/16" d; Sig C Spec No. 71-1058; (with Cord CD-494 and Plugs PL-55 and PL-68).
2Z5533	JACK JK-33: telephone; for 3 cond plug 0.208" diam; 1 1/4" x 15/16" x 3/4" h; (part of Control Box C-21A/TRC-1).
2Z5534	JACK JK-34: telephone; for two cond 0.250" diam plug; 1 1/4" x 1" x 3/4" h; (part of Control Box C-21A/TRC-1).
2Z5600-85	JUNCTION BOX J-85/G: steel, zinc coated, olive drab; with cover; 5 3/8" lg x 4 7/8" wd x 5 1/2" h; two 1 1/16" threadless outlets; two 2-cond cables with male plugs; 2 female connectors Hubbell No. 7210 and toggle switch C-H No. 8792-K4; (connects two Power Units PE-75 to extension cord or directly to load).
6Z1041	JUNCTION BOX JB-110: steel, olive drab; with face plate; 4 1/2" wd x 2 1/4" thk x 2 1/4" lg; one threadless outlet 1 3/16" diam; 5 duplex female connectors; 10 ft, 2 cond No. 12 rubber jacketed cable; with Hubbell No. 7057 male connector; Sig C dwg No. SC-D-11461.
6Z6897-2	LIGHT, extension: 50-w, 115-v; with 25 ft extension cord.

c. Maintenance Parts for Radio Relay Set AN/TRC-12 (XC-3) (contd).

Signal Corps stock No.	Name of part and description
6Z6815-2.1	LAMP, incandescent: 115-v, 50-w; bulb A-19 clear; medium screw base; Mazda No. 50A/CL; (part of extension light).
2Z7155	PLUG PL-55: telephone; 2-way; single-shank; tubular, black bakelite; shank 1⅛″ lg x ¼″ diam; (part of Control Box C-21A/TRC-1).
2Z7168	PLUG PL-68: telephone; 3-way; single-shank; tubular, black bakelite; shank 1⅛″ lg x 0.205″ diam; Sig C Spec No. 71-805-F; (part of Control Box C-21A/TRC-1).
3H4575	POWER UNIT PE-75: gasoline; 2,500 w at 100% pf; 120 v, 60 c; single-phase; Sig C Spec No. 71-952-A.
2C4180-48-1	RADIO RECEIVER R-48/TRC-8 (XC-3): fm; 230-250 mc; input 115-230 v, 50-60 c, 120-w; mtd in steel cabinet; 22½″ x 17″ x 18½″.
2C6900-30-1	RADIO TRANSMITTER T-30/TRC-8 (XC-3): fm; 230-250 mc; output 12 w; input 115-230 v, 50-60 c, 350 w; steel cabinet; 20″ x 17″ x 24″.
6R15292	SCREWDRIVER: alignment; 2″ blade; 3⅞″ lg over-all; Vaco No. A-130-2ZK.
6R16091	SCREWDRIVER: 6″ lg x 3/16″ blade; Xcellite No. 3166.
3Z9849.162	SWITCH, toggle: DPDT, 6-pole, 2-position; single-deck; bakelite body; C-H No. 8792-K4; (part of Junction Box J-85/G).
3Z9858-8.64	SWITCH, toggle: DPDT, 6-pole, 2-position; bakelite; 1″ lg x ⅝″ wd x 15/32″ h; AH & H No. 20905-Z-SWS; (part of Control Box C-21A/TRC-1).
4B5008	TELEPHONE EE-8: local or common battery; portable, self-contained; with leather case 3½″ x 7 1/16″ x 9½″ with carrying strap; Sig C Spec No. 71-631.
3F4325-237.1	TEST OSCILLATOR TS-237/TRC-8 (XC-3): unmodulated; crystal controlled with harmonic output of 30 mc and 230-250 mc in 5 mc steps; 5⅜″ x 3⅜″ x 2⅛″; Lewyt part dwg No. 989.
3F4056	TEST SET I-56: consists of Voltohmmeter I-166, Test Unit I-176, Tube Tester I-177.
1B110B.1	WIRE W-110-B: insulated; 2-cond; 7 strands, 4 steel 13 mil and 3 copper 13 to 14 mil; Sig C Spec No. 71-478; (on Reel DR-4; ½ mile of wire per reel).
6R55118-20	WRENCH, bos: 9/16″ and ⅝″; Williams No. 9727.
	GENERAL HARDWARE
6L3106-32	NUT, hexagon: brass; No. 6-32.
6L3108-32	NUT, hexagon: brass; No. 8-32.
6L6632-16.1	SCREW, machine: RH; brass; No. 6-32; 1″ lg.
6L6832-16.1	SCREW, machine: RH; brass: No. 8-32; 1″ lg.
6L72206	WASHER, lock: steel, smooth; for No. 6 RH mach screw; 9/32″ OD x 0.018″ thk; Shakeproof No. 1206.
6L72208	WASHER, lock: steel, smooth for No. 8 RH mach screw; Shakeproof No. 1208.

177. MAINTENANCE PARTS FOR RADIO TRANSMITTER T-30/TRC-8 (XC-3).

The following information was compiled on 27 February 1945. The appropriate sections of the ASF Signal Supply Catalog for Radio Transmitter T-30/TRC-8 (XC-3) are:

Organizational Spare Parts

SIG 7-T-30/TRC-8 when published

Higher Echelon Spare Parts

SIG 8-T-30/TRC-8 when published

For the latest index of available catalog sections, see ASF Signal Supply Catalog SIG 2.

Ref symbol	Signal Corps stock No.	Name of part and description
Z203, Z204, Z205	3Z6034J9	ATTENUATOR, fixed: T; wire-wound; 500 ohm ±10%; 10-w; metal clad, bakelite molded; 3½″ lg x 11/16″ OD; IRC type No. MW-3; Lewyt No. 984-68.
Z202	2Z395.44	ATTENUATOR, variable: T; wire-wound; 500 ohm ±5%; aluminum case; 2¾″ diam x 2 1/16″ d; shaft ¼″ diam x 15/16″ lg Daven Co. No. T-324-F; Lewyt No. 984-16.
B201	3H388.1-7	BLOWER, centrifugal: electric; steel rotor centrifugal blades; non-portable; guarded; with motor 1/40 hp, 3,400 rpm, 60 c, single-ph, 115 v, 7 17/32″ lg x 5 23/32″ wd x 5¾″ d; Amer. Blower No. 00 Sirocco; Lewyt part dwg No. 984-60.
TS-202	2Z9407-68	BOARD, terminal: 7 Eby Sergeant binding posts; bakelite; 6¼″ lg x 1″ wd x 3/16″ thk; Lewyt part dwg No. L2615-C.
TS-201	2Z9407-69	BOARD, terminal: 7 soldering lugs; bakelite; 5 3/16″ lg x 1″ wd x 3/16″ thk; Lewyt part dwg No. L-2616C.
S203	3H900-7.5-1	BREAKER, circuit: magnetic; single-pole; 110/230 v ac, 7.5 amp; bakelite inclosed case; 3¾″ lg x 0.990″ wd x 2¾″ d; Heinman No. AM-1513; Lewyt No. 984-42.
W201	3E7257-1	CABLE ASSEMBLY, power: power supply; rubber jacketed; round, ¾″ diam; 24″ lg; 4 No. 16 and 4 No. 20 AWG copper cond, stranded; No. 16 consisting of 26 No. 30 strands; No. 20 consisting of 10 No. 30 strands; with Amphenol No. 3108-18-1P connector on one end; tinned leads on other end; Sig C spec 71-684 and 71-4945; Lewyt No. 984-80.
W203	3E7257-2	CABLE ASSEMBLY, power: power supply; rubber jacketed; round, 0.540″ OD; 10 ft lg; 2 No. 14 AWG copper cond, ea comprising 26 No. 28 AWG strands; with Hubbell No. 7057 two-prong male connector on one end; tinned wire leads on other end; Lewyt part dwg No. 984-58.
C206	3D9002-21	CAPACITOR, fixed: ceramic; 2 mmf ±10%; 500 vdcw; 7/16″ lg x 7/32″ diam; Erie No. NPOK2; Lewyt No. 984-3.
C211, C212, C213, C214, C215, C216, C219, C220, C221, C222, C223, C224, C227, C228, C229, C230, C231, C232, C233, C245, C246, C247	3D9050-22	CAPACITOR, fixed: ceramic; 50 mmf ±5%; 500 vdcw; 7/16″ lg x 7/32″ diam; Erie No. N-750-K-50; Lewyt No. 984-5.
C211, C213, C214, C219	3D9100-65	CAPACITOR, fixed: ceramic; 100 mmf ±10%; 500 vdcw; 11/16″ lg x 7/32″ diam; Erie type ceramicon No. N-750-L-100.
C239	3DB100-27	CAPACITOR, fixed: electrolytic; 100 mf; 25 vdcw; 1¾″ lg x 15/16″ diam; Aerovox No. PRS-25; Lewyt No. 984-6.
C202, C208, C210, C217, C218, C225, C226	3D9050-7	CAPACITOR, fixed; mica; 50 mmf ±5%; 1,000 vdct; 29/64″ lg x 45/64″ wd; Aerovox No. 1469.

177. MAINTENANCE PARTS FOR RADIO TRANSMITTER T-30/TRC-8 (XC-3) (contd).

Ref symbol	Signal Corps stock No.	Name of part and description
C244	3DB1E75-1	CAPACITOR, fixed: paper; 1.75 mmf ±10%; 250 vdcw; 1¾" lg x 1" wd x 1½" h; GE No. 21-F-213; Lewyt No. 984-9.
C207, C234, C235, C237	3DA100-430	CAPACITOR, fixed: paper; 100,000 mmf ±10%; 1,000 vdcw; 1⅝" wd x 11/16" d x 1 7/16" h; Aerovox No. 1016; Lewyt No. 984-4.
C248	3DA500-322	CAPACITOR, fixed: paper; 500,000 mmf ±10%; 1,000 vdcw; 2⅛" x 1 13/16" x 1 1/16" Aerovox No. 1009; Lewyt No. 984-64.
C240, C241	3DB20-76	CAPACITOR, fixed: paper; 20 mf ±10%; 600 vdcw; 5¼" h x 3½" wd x 2¼" thk; Sprague No. 7963; Lewyt No. 984-7.
C242	3D9015V-35	CAPACITOR, variable: air; 3.6 mmf to 15 mmf; 0.045" air gap; ¾" lg x 1 5/16" wd x 1 9/32" d; shaft ½" lg x ¼" diam; Hammarlund No. HF-15X.
C243	3D9016V-10	CAPACITOR, variable: air; dual; 7-16 mmf per sect; 0.030" air gap; 1¾" h x 1⅜" wd x 2⅞" lg; Stephan Decatur; Lewyt No. 984-66.
C205	3D9003VE5-4	CAPACITOR, variable: steatite; 0.7 to 3.5 mmf; 500 v; 1¼" lg x ¼" diam Lewyt No. 984-65.
	2Z2635.136	CLAMP, dial: brass; nickel pl; 1⅛" lg x ⅞" OD; Lewyt part No. 984-41 m; Lewyt dwg No. L-2320.
	2Z2635.138	CLAMP, tube: paper; laminated phenolic; 3½" h x 2¾" wd x 1/16" thk, less knob; Lewyt part No. 984-25M; Lewyt dwg No. L-2715.
	2Z2712.34	CLIP, tube contact: beryllium capped; 2 5/16" lg x 5/16" wd x 0.015; Lewyt part No. 984-72M; Lewyt dwg No. L-2208.
L225	3C323-132K	COIL, radio AF: filter; single-winding; 3-h; 350-ma, 25 ohms; 4⅜" h x 2 13/16" wd 3¼" d; NY Transf No. 6102; Lewyt part dwg No. 984-13.
L227	3C323-132M	COIL, radio RF: choke; single-winding, single-layer wound; unshielded; 26 turns on No. 26DSC wire, wound on 1RC type F-2 resistor; 1 13/16" lg x 1/32" diam; Lewyt part No. 984-73.
L223, 224	3C323-132L	COIL, radio, RF: choke; single-winding, single-layer wound; unshielded; 23 turns No. 18 enameled wire; 1⅞" lg x ⅜" diam; Lewyt part dwg No. 984-72.
L215, L216, L217, L218, L219, L220, L221, L222	3C323-132J	COIL, radio RF: choke; single-layer wound; unshielded; 30 turns on No. 32 DSC wire; 1⅞" lg x ⅜" diam; Lewyt part dwg No. 984-70.
L202, L204	3C323-132H	COIL, radio RF: choke; single-winding, single-layer wound; unshielded; 26 turns No. 32DSC wire; 1 15/16" lg x 13/32" diam; Lewyt No. 984-76.
L214	3C323-132P	COIL, radio, RF: choke; 2-sect, single-layer close wound; unshielded; ea sect 5 turns No. 26DSC wire; 1⅞" lg x ⅜" diam; Lewyt part dwg No. 984-71.

177. MAINTENANCE PARTS FOR RADIO TRANSMITTER T-30/TRC-8 (XC-3) (contd).

Ref symbol	Signal Corps stock No.	Name of part and description
L201, L203	3C323-132N	COIL, radio RF: inductor; single-winding, single-layer wound; unshielded; 4 turns No. 26 DSC wire; 1 13/16" lg x 13/32"; Lewyt No. 984-75.
J204	2Z3062-28	CONNECTOR, female contact: single-cont; straight; 1" x 1" x 1 1/2" d; Selector No. JNL-2; Lewyt No. 984-109; (antenna connector).
J203	2Z8677.49	CONNECTOR, female contact: 7 round female cont, straight; 1 9/32" x 1 9/32" x 58/64" d; Amphenol No. 3102-16S-1S; Lewyt No. 984-18; (power plug receptacle).
J205	2Z8680	CONNECTOR, female contact: 10 round female cont; straight; 1 3/8" x 1 3/8" x 1 11/32" d; Amphenol No. 3102-18-1S; Lewyt No. 984-85.
P201	6Z1727	CONNECTOR, male contact: AC plug; 2 flat parallel blades; straight; 1 1/2" diam x 5/8" lg less cont; Hubbell No. 7057; Lewyt No. 984-59.
P203	2Z7117.4	CONNECTOR, male connector: 7 round male prongs; straight; 1 3/8" lg x 1 3/16" diam; Amphenol No. 3106-16S-1P; Lewyt No. 984-20/21.
P205	2Z7120	CONNECTOR, male contact: 10 round male prongs; 90° type; 2 19/32" x 25/32" lg x 1 5/16" diam; Amphenol No. 3108-18-1P; Lewyt No. 984-84/83.
	2Z1612.22	CAP, connector: with chain; aluminum; sand blast satin finish; 1 1/8" diam x 9/16" lg over-all; Amphenol No. 9760-16; Lewyt No. 984-90; (used for all AN-3100 and AN-3102 receptacles).
	3F4325-125/C2	CAP, connector: with chain; aluminum; sand blast satin finish; 3/4" diam x 9/16" lg over-all; Amphenol No. 9760-10; Lewyt No. 984-119.
	2Z5824.63	DIAL, calibrated dish: etched nickle silver; for antenna tuning; 1 5/8" diam; National type R; Lewyt part No. 984-118; (with bar knob).
	6Z3809-16	FASTENER, Dzus: for doors; steel cadmium pl; 7/16" diam OH; 1/4" body diam x 0.350" lg; Dzus No. AW4-35; Lewyt dwg No. L-2257; (item 2).
	6Z3809-21	FASTENER, Dzus: for rails; steel cadmium pl; 11/16" diam OH; 13/32" body diam x 0.450" lg; Dzus No. AW-6 1/2-45; Lewyt part No. L-2285.
Z201	3Z1892-1.1	FILTER, low-pass: 1,000-c peak, 0-2800-C band wd; 3 3/8" x 3 3/8" x 4 3/8" h; WECO No. D161692; Lewyt No. 984-15.
	3G112-27	INSULATOR, bushing: round; grade G steatite, white glazed; 0.437" lg over-all; Isolantite No. 927; (mounts tuned line).
J201	2Z5533-A	JACK JK-33-A: telephone; for 2 cond plug, 0.208" diam; 1/4" lg x 1/4" ID x 3/8" OD.
	2Z5534-A	JACK JK-34-A: telephone; for 2 cond plug, 0.250" diam; 7/8" diam x 1 7/8" lg over-all.
	2Z5786.40	KNOB, round: black bakelite; for 1/4" diam shaft; with set-screw; transparent printer with red indicator line; 1 1/8" diam x 5/8" h over-all; Crowe No. 6566; Lewyt part No. 986-96.
	2Z5934-I	LAMP, incandescent: 6-8 v, 0.25 amp; bulb G-3 1/2; 7/16" diam x 15/16" lg over-all; miniature bayonet base; Mazda No. 51; Lewyt No. 984-56.
X210	2Z5882-44	LAMPHOLDER: brass; miniature bayonet base; olive drab finish; 2 1/4" lg x 11/16" diam; Dialco No. S-867; Lewyt No. 984-47; (pilot light assembly).

177. MAINTENANCE PARTS FOR RADIO TRANSMITTER T-30/TRC-8 (XC-3) (contd).

Ref symbol	Signal Corps stock No.	Name of part and description
M201	3F891-37	METER, milliammeter: 0-1 ma; round metal flush mtg case; 2.55 diam flange x 2.06″ diam body x 0.98″ d; MR24WOO1DC.
	2Z8403-33	MOUNT, vibration: square; 12-lb load rating; 1¼″ x 1¼″ x 0.875″ h over-all; Lord SK-1157-6.
	2Z7390-21	PLUG, Sig C Type UG-21/V.
LA-1, LA-2, LA-3, LA-4	4E927	PROTECTOR, lightning; carbon, air gap; 1¼″ h x ⅜″ wd x 5/16″ d; spring clip mtg; WECo No. EP453979; Lewyt No. 984-22.
RL-201	2Z7588-88	RELAY: DPDT normally open; 1 13/16″ lg x 1 13/32″ wd x 1⅞″ h over-all; Allied Control Boy 6D29; Lewyt No. 984-44.
R210, R224	3RC21BE102K	RESISTOR, fixed: composition; 1,000 ohms ±10%; ½-w; max dimen 0.655″ lg x 0.249″ diam; RC21BE102K.
R201, R207	3Z6100-217	RESISTOR, fixed: composition; 1,000 ohms ±10%; 2-w; 1 13/16″ lg x 13/32″ diam; IRC type F-2; Lewyt No. 984-23.
R229	3RC21BE202J	RESISTOR, fixed: composition, 2,000 ohms ±10%; ½-w; max dimen 0.655″ lg x 0.249″ diam; RC21BE202K.
R211, R216, R217, R230, R234	3RC21BE103K	RESISTOR, fixed: composition; 10,000 ohms ±10%; ½-w; max dimen 0.655″ lg x 0.249″ diam; RC21BE103K.
R202	3RC41BE223K	RESISTOR, fixed: composition; 20,000 ohms ±10%; max dimen 1.78″ lg x 0.342″ diam 2-w; RC41BE223K.
R208	3RC41BF273K	RESISTOR, fixed: composition; 27,000 ohms ±10%; 2-w; max dimen 1.78″ lg x 0.405″ diam; RC41BE253K.
R218, R219	3RC21BE513J	RESISTOR, fixed: composition; 51,000 ohms ±10%; ½-w; max dimen 0.655″ lg x 0.249″ diam; RC21BE513J.
R203, R209, R240, R241	3RC41BE513J	RESISTOR, fixed: composition; 51,000 ohms ±10%; 2-w; max dimen 1.78″ lg x 0.405″ diam; RC41BE513J.
R215, R227, R228	3RC21BE104K	RESISTOR, fixed: composition; 100,000 ohms ±10%; ½-w; max dimen 0.655″ lg x 0.249″ diam; RC21BE104K.
R206, R225, R226, R231, R242, R244,	3RC41BE104K	RESISTOR, fixed: composition; 100,000 ohms ±10%; 2-w; max dimen 1.78″ lg x 0.405″ diam; RC41BE104K.
R246, R247	3Z6060-79	RESISTOR, fixed: metalized crown; 600 ohms ±10%; ⅓-w; 15/64″ OD x 47/64″ lg; IRC F⅓, Lewyt No. 984-161.
R248	3Z6005-31	RESISTOR, fixed: composition; 50 ohms ±10%; ½-w; 0.375″ lg x 0.140″ diam; Allen-Bradley type EB; Lewyt No. 986-17.
R232, R233, R235, R236	3RC41BE514J	RESISTOR, fixed: composition, 510,000 ohms ±5%; 2-w; RC41BE514J.
R237, R239, R245	3Z4900.17	RESISTOR, fixed: wire-wound; 100 ohms ±10%; 20-w; 2″ lg x 9/16″ OD x ⅜″ ID; WL type 2T; Lewyt No. 984-112; (R237 consists of two 100-ohm resistors in parallel).

177. MAINTENANCE PARTS FOR RADIO TRANSMITTER T-30/TRC-8 (XC-3) (contd).

Ref symbol	Signal Corps stock No.	Name of part and description
R213, R214	3Z5000-8	RESISTOR, fixed: wire-wound; 200 ohms ±10%; 20-w; 2″ lg x 9/16″ OD x 3/8″ ID; WL type 2T; Lewyt No. 984-111.
R212	3Z5350-18	RESISTOR, fixed: wire-wound; 500 ohms ±10%; 20-w; 2″ lg x 9/16″ OD x 3/8″ ID; WL type 2T; Lewyt No. 984-110.
X201, X202, X203	2Z8677.89	SOCKET, tube: 7-prong; metal base; 2 3/4″ diam x 1 7/8″ h over-all; RCA UT-107; Lewyt No. 984-45.
X204, X205, X206, X207, X208	2Z8678.63	SOCKET, tube: 8-prong octal; steatite body; 1 1/4″ diam x 3/4″ h over-all; Miller No. 33008; Lewyt No. 984-46.
S201	3Z9825-62.202	SWITCH, rotary: non-locking; 2-pole, 8-position; 2-deck; cadmium plated steel body; 1 7/8″ diam x 1 7/8″ lg; Oak type H; Lewyt part dwg No. 984-40; (circuit selector).
S202	3Z9825-62.201	SWITCH, rotary: non-locking; 4-pole, 5-position; 2-deck; cadmium plated steel body; 1 7/8″ diam x 1 7/8″ lg; Oak type H; Lewyt part dwg No. 984-115.
T202	2Z9631.250	TRANSFORMER, AF: input; pri No. 1,550 ohms, pri No. 2, 50 ohms; sec push-pull, 100,000 ohms total with ct; fully shielded metal case; 2 5/8″ h x 1 3/4″ wd x 2 1/4″ d; NY Transf No. 5391; Lewyt part dwg No. L984-49.
T203	2Z9637.51	TRANSFORMER, AF: isolation; pri 500 ohms ct; sec 500 ohms ct; fully inclosed metal case; 2 5/8″ h x 2 1/8″ wd x 2 1/8″ d; NY Transf No. 6614; Lewyt part dwg No. 984-50.
T204	2Z9631.251	TRANSFORMER, AF: microphone input; pri 50 ohms; sec 500 ohms; fully shielded metal case; 1 7/8″ h x 1 1/2″ wd x 1 1/2″ d; NY Transf No. 5390; Lewyt part dwg No. L-984-51.
T201	2Z9608-54	TRANSFORMER, power: plate and filament; pri 115-230 v 50/60 c; sec No. 1, 6.3 v 8 amps ct; sec No. 2, 5 v 6 amps ct; sec No. 3, 1,100 v 350 ma ct; fully inclosed metal case; 6 1/8″ h x 5 5/8″ wd x 4 11/16″ d; NY Transf No. 6982; Lewyt part dwg No. 984-48.
V207, V208	2J5U4G	TUBE, electron: JAN-5U4-G.
V204	2J6H6	TUBE, electron: JAN-6H6.
V205, V206	2J6SN7	TUBE, electron: JAN-6SN7.
V201, V202, V203	2J829B	TUBE, electron: JAN-829-B.

178. MAINTENANCE PARTS FOR RADIO RECEIVER R-48/TRC-8 (XC-3).

The following information was compiled on 27 February 1945. The appropriate sections of the ASF Signal Supply Catalog for Radio Receiver R-48/TRC-8 (XC-3) are:

Organizational Spare Parts
SIG 7-R-48/TRC-8 when published

Higher Echelon Spare Parts
SIG 8-R-48/TRC-8 when published

For the latest index of available catalog sections, see ASF Signal Supply Catalog SIG 2.

Ref symbol	Signal Corps stock No.	Name of part and description
W1	3E7257	CABLE ASSEMBLY, power: general purpose; rubber jacketed; round, 0.540″ OD; 10 ft lg; two #14 AWG copper conductors each comprising 26 #28 AWG wires; Lewyt No. 986-87; (Hubbell No. 7057 male connector on one end, tinned wire leads on other end).
	2Z1612.1	CAP, connector: with chain; aluminum; sand blast satin finish; ¾″ diam x 9/16″ lg over-all; Amphenol No. 9760-10; Lewyt No. 986-79.
	2Z1612.26	CAP, connector: with chain; aluminum; metallic sand blast satin finish; 1″ diam x 9/16″ lg over-all; Amphenol No. 9760-14; Lewyt No. 986-78.
	2Z1612.22	CAP, connector: with chain; aluminum; metallic sand blast satin finish; 1⅛″ diam x 9/16″ lg over-all; Amphenol No. 9760-16; Lewyt No. 986-77.
	2ZK5650-A	CAP, jack: metal; olive-drab finish; 23/32″ wd x 3/16″ h; Crowe No. A-22227; Lewyt No. 986-95.
C4	3D9002-22	CAPACITOR, fixed: ceramic; 2 mmf ±20%; 500 vdcw; 7/16″ lg x 7/32″ diam; Erie No. N-750-K; Lewyt No. 986-29.
C15, 27, 28, 29, 31, 32, 33, 38, 39, 40, 41, 42, 43, 46, 47, 48, 49, 51, 54, 55, 58, 61, 62, 64, 67, 68, 72, 76, 80, 88	3DKA2-118	CAPACITOR, fixed: paper; 2,000 mmf ±20%; 300 vdcw; 7/8″ lg x ¼″ diam; Muter No. C5BK1200; Lewyt No. 986-36.
C19	3D9010-51	CAPACITOR, fixed: ceramic; 10 mmf ±5%; 500 vdcw; 7/16″ lg x 7/32″ diam; Erie No. N-080-K; Lewyt No. 986-31.
C71	3D9015-28	CAPACITOR, fixed: ceramic; 15 mmf ±5%; 500 vdcw; 7/16″ lg x 7/32″ diam; Erie No. N-080-K; Lewyt No. 986-70.
C23, 26, 37, 44, 52, 56, 57, 65, and 75	3D9022-15	CAPACITOR, fixed: ceramic; 22 mmf ±5%; 500 vdcw; 7/16″ lg x 7/32″ diam; Erie No. N-080-L; Lewyt No. 986-32.
C5, 16, 25, 36, 40, 45, 50, 53, 59, 63, 66, 69, 70, and 73	3D9050-22	CAPACITOR, fixed: ceramic; 50 mmf ±5%; 500 vdcw; 7/16″ lg x 7/32″ diam; Erie N-750-K; Lewyt No. 986-30.
C6, 7, 8, 9, 10, 11, 12, 13, 14, 18, 21, 22, and 24	3D9055-6	CAPACITOR, fixed: ceramic; 55 mmf ±10%; 600 vdcw; 5/8″ lg x ⅛″ diam; Erie No. 357-000; Lewyt No. 986-35.
C77, 78	3D9100-15.1	CAPACITOR, fixed: ceramic; 100 mmf ±5%; 500 vdcw; 11/16″ lg x 7/32″ diam; Erie No. N-750-L; Lewyt No. 986-33.

178. MAINTENANCE PARTS FOR RADIO RECEIVER R-48/TRC-8 (XC-3) (contd).

Ref symbol	Signal Corps stock No.	Name of part and description
C17	3D9360-6	CAPACITOR, fixed; ceramic; 360 mmf ±5%; 500 vdcw; 19/64" lg x 5/16" diam; Erie No. N-750-M; Lewyt No. 986-34.
C89, 91	3DB20-74	CAPACITOR, fixed: electrolytic; 20-mf; 400 vdcw; 2 1/2" lg x 1 5/32" diam; Aerovox No. AEP; Lewyt No. 986-42.
C82, 83, 86	3DB25-61	CAPACITOR, fixed: electrolytic; 25 mf; 25 vdcw; 1 3/4" lg x 1" wd x 7/8" h; Sprague No. 1970-2; Lewyt No. 986-39.
C79, 84	3DA10-143.6	CAPACITOR, fixed: paper; 10,000 mmf ±10%; 600 vdcw; 11/16" lg x 7/16" diam; Sprague No. PX-24B; Lewyt No. 986-37.
C81, 85	3DA100-307	CAPACITOR, fixed: paper; 100,000 mmf ±10%; 600 vdcw; 1 11/16" lg x 5/8" diam; Sprague No. PX-24B; Lewyt No. 986-38.
C87, 93	3DA500-30	CAPACITOR, fixed: paper; 500,000 mmf ±10%; 600 vdcw; 1 13/16" lg x 1" wd x 3/4" diam; Dubilier No. DYR-6050; Lewyt No. 986-41.
C92	3DB4-189	CAPACITOR, fixed: paper; 4 mf +20%–10%; 600 vdcw; 2 1/2" wd x 1" d x 3 7/8" h over-all; Sprague No. 2547-3; Lewyt No. 986-40.
C1, 2, 3	3D9012V-15	CAPACITOR, variable: air dielectric; 3 to 12 mmf; 3/4" lg x 15/16" wd x 17/32" h, shaft 5/16" lg x 9/32" diam; Hammarlund No. APC-25 modified Lewyt No. 986-119.
C74	3D9007V-9	CAPACITOR, variable: ceramic; 1.5 to 7.0 mmf; 500 vdcw; 27/32" lg x 41/64" wd x 3/8" h; Erie No. TS2A-NPO; Lewyt No. 986-43; (trimmer).
	2Z2635.136	CLAMP, dial: brass; nickel-plated; 1 1/8" lg x 7/8" diam; Lewyt part No. 986-50M; Lewyt dwg No. L-2320.
L22, 23	3C323-132E	COIL, radio, AF: filter; dual winding; 11-h; 100-ma, 200-ohm; 3 3/4" lg x 4" wd x 5 1/2" h; Lewyt No. 986-48.
L1, 2, 3	3C323-132A	COIL, radio, RF: choke; single-winding, single-layer wound; unshielded; 12 turns No. 24 enameled wire; wound on IRC No. BT-1/2 500,000-ohm resistor, 7/16" lg x 0.215" diam; Lewyt No. 986-91.
L5, 7, 9, 13, 15, 17, 21	3C323-132G	COIL, radio, RF: choke; single-winding, single-layer wound; unshielded; 30 turns No. 28 enameled wire; 1 9/16" lg x 3/8" diam; Lewyt No. 986-92.
L11	3C323-132D	COIL, radio, RF: choke; single-winding, single-layer wound; unshielded; 30 turns No. 20 enameled wire; 1 7/8" lg x 3/8" diam; Lewyt No. 986-93.
L31	3C323-132F	COIL, radio, RF: oscillator coupling; one turn loop; unshielded; 13/16" h x 35/32" wd; Lewyt No. 986-120.
J4	2Z3062-28	CONNECTOR, female contact: single-cont; straight; 1" lg x 1" wd x 1 1/2" d; Selector No. JNL-2; Lewyt No. 986-103; (antenna connector).

178. MAINTENANCE PARTS FOR RADIO RECEIVER R-48/TRC-8 (XC-3) (contd).

Ref symbol	Signal Corps stock No.	Name of part and description
J2	2ZK7409-20	CONNECTOR, female contact: 5 round female cont; straight; 1 3/16" lg x 1 3/16" wd x 29/32" d; thd 7/8"-20 x 3/8" d; Amphenol No. 3102-14S-5S; Lewyt No. 986-55.
J3	2ZK3096-31	CONNECTOR, female contact: 7 round female cont; straight; 1 9/32" lg x 1 9/32" wd x 58/64" d; thd 1"-20 x 1/2" d; Amphenol No. 3102-16S-1S; Lewyt No. 986-54.
P1	6Z1727	CONNECTOR, male contact: a-c plug; two flat parallel blades; straight, 1 1/2" diam x 5/8" lg less cont; Hubbell No. 7057; Lewyt part No. 986-80.
F1, 2	3Z1950	FUSE FU-50; 3-amp, 250-v glass body; ferrule ends, 1/4" diam x 1/4" lg; 1 1/4" lg x 1/4" diam over-all; Littelfuse 3AG No. 1043; Lewyt No. 986-86.
	3Z3275-9	HOLDER, fuse: extractor post; for single 3AG fuse; bakelite body; 10-amp, 125 v max; 2 1/8" lg x 1/2" diam over-all; Littelfuse No. 1075-F; Lewyt No. 986-25.
J1	2Z5534A	JACK JK-34-A: telephone; for two-conductor 0.250" diam plug; 3/4" diam x 1 1/4" lg over-all; Mallory No. SC-1A; Lewyt No. 986-81.
	2Z5753.36	KNOB, round: black bakelite; for 1/4" diam shaft; with setscrew; 1 5/8" diam x 3/4" h over-all; Crowe No. 6539; Lewyt No. 986-97.
	2Z5786.40	KNOB, round: black bakelite; for 1/4" diam shaft; with setscrew; transparent pointer with red indicator line; 1 1/8" diam x 5/8" h over-all; Crowe No. 6566; Lewyt No. 986-96.
	2Z5934-1	LAMP, incandescent: 6- 8-v; 1-cp; bulb G-3 1/2 0.25-amp; 7/16" x 15/16" lg over-all; miniature bayonet base; Mazda No. 51.
	2Z5882-44	LAMPHOLDER: miniature bayonet base; brass, olive drab; 2 1/4" lg x 11/16" diam; Dialco No. S-867; Lewyt No. 984-47; (pilot light).
M1	3F872-6	METER, microammeter: 0- 200-ma; 2.55" diam flange x 2.06 diam body x 0.98" d; MR24W200DC.
	2Z8502-PH-45	MOUNT, vibration: square; 45-lb load rating; 3" lg x 3" wd x 1 1/2" d over-all; Lord No. 204-PH-45; Lewyt part No. 986-100.
RL-1	2Z7588-87	RELAY, squelch: DPDT; 4" lg x 1 5/8" wd x 1 5/32" h; Auto Elec AQA Cat. No. RA-18 type C; Lewyt No. 986-68.
R9, 49	3RC20BE100K	RESISTOR, fixed: composition; 10 ohms ±10%; 1/2-w; max dimen 0.468" lg x 0.249" diam; RC20BE100K.
R54	3RC20BE270K	RESISTOR, fixed: composition; 27 ohms ±10%; 1/2-w; max dimen 0.468" lg x 0.249" diam; RC20BE270K.
R15, 21, 27, 33	3RC20BE390K	RESISTOR, fixed: composition; 39 ohms ±10%; 1/2-w; max dimen 0.468" lg x 0.249" diam; RC20BE390K.
R46, 47, 48, 50, 51, 52, 53	3Z6005-31	RESISTOR, fixed: composition; 50 ohms ±10%; 1/2-w; 0.375" lg x 0.140" diam; Allen-Bradley type EB; Lewyt No. 986-17.
R7	3RC20BE101K	RESISTOR, fixed: composition; 100 ohms ±10%; 1/2-w; max dimen 0.468" lg x 0.249" diam; RC20BE101K.

178. MAINTENANCE PARTS FOR RADIO RECEIVER R-48/TRC-8 (XC-3) (contd).

Ref symbol	Signal Corps stock No.	Name of part and description
R32	3RC20BE331K	RESISTOR, fixed: composition; 330 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE331K.
R62	3RC20BE391K	RESISTOR, fixed: composition; 390 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE391K.
R63, 67	3RC20BE561K	RESISTOR, fixed: composition; 560 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE561K.
R64, 69	3RC20BE821K	RESISTOR, fixed: composition; 820 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE821K.
R10	3RC20BE122K	RESISTOR, fixed: composition; 1,200 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE122K.
R55	3RC20BE182K	RESISTOR, fixed: composition; 1,800 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE182K.
R11, 13, 17, 23, 29, 35, 42, and 56	3RC20BE222K	RESISTOR, fixed: composition; 2,200 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE222K.
R4, 5, 14, 18, 24, 28, 36, 39, and 68	3RC20BE472K	RESISTOR, fixed: composition; 4,700 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE472K.
R12, 19, 25, 30	3RC20BE562K	RESISTOR, fixed: composition; 5,600 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE562K.
R61	3RC31BE103K	RESISTOR, fixed: composition; 10,000 ohms ±10%; 1-w; max dimen 0.468″ lg x 0.249″ diam; RC31BE103K.
R45, 57	3RC20BE103K	RESISTOR, fixed: composition; 10,000 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE103K.
R37, 41, 58	3RC20BE223K	RESISTOR, fixed: composition; 22,000 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE223K.
R1, 2, 40	3RC20BE473K	RESISTOR, fixed: composition; 47,000 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE473K.
R43, 44	3RC20BE563K	RESISTOR, fixed: composition; 56,000 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE563K.
R3, 16, 20, 22, 26, 31, 34, 65, 74, and 80	3RC20BE104K	RESISTOR, fixed: composition; 100,000 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE104K.
R70, 71	3RC31BE104K	RESISTOR, fixed: composition; 100,000 ohms ±10%; 1-w; max dimen 1.28″ lg x 0.310″ diam: RC31BE104K.
R38	3RC31BE124K	RESISTOR, fixed: composition; 120,000 ohms ±10%; 1-w; max dimen 1.28″ lg x 0.31″ diam; RC31BE124K.
R6, 59, 75	3RC20BE474K	RESISTOR, fixed: composition; 470,000 ohms ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE474K.

178. MAINTENANCE PARTS FOR RADIO RECEIVER R-48/TRC-8 (XC-3) (contd).

Ref symbol	Signal Corps stock No.	Name of part and description
R8	3RC20BE105K	RESISTOR, fixed: composition; 1 meg ±10%; ½-w; max dimen 0.468″ lg x 0.249″ diam; RC20BE105K.
R78	3Z6010-174	RESISTOR, fixed: wire-wound; 100 ohms ±5%; 5-w; 1 7/32″ lg x 15/32″ diam; Sprague Koolohm No. 5KT; Lewyt No. 986-26.
R77	3Z6200-160	RESISTOR, fixed: wire-wound; 2,000 ohms ±5%; 10-w; 1 27/32″ lg x 15/32″ diam; Sprague-Koolohm No. 10KT; Lewyt No. 986-24.
R73	3Z7320-4	RESISTOR, variable: carbon; 2,000 ohms; ½-w; 3-term; body 1¼″ diam x 9/16″ d; slotted shaft 3/8″ x 3/8″-32; IRC No. CM; Lewyt No. 986-27.
R66, 79	2Z7298-1	RESISTOR, variable (potentiometer): carbon; 100,000 ohms; ½-w; body 1¼″ diam x 9/16″ d; slotted shaft 3/8″ x 3/8″-32; IRC No. CM; Lewyt No. 986-28 or 986-154.
	6L17110-16.49	SCREW, thumb: RH, knurled, slotted; steel, zinc-plated No. 10-24 thd class 2; 1″ lg over-all with 3/16″ lg thd; 5/8″ diam x 1/8″ lg hd; Lewyt dwg No. L-2424.
1, 2, 3, 4, 5, 6, 7, 8 and 9	2Z8677.75	SOCKET, tube: miniature; 7-cont; ceramic; with 1¾″ No. 7798 shield; ¾″ diam x 1½″ h over-all Eby type 102-M Lewyt part No. 986-57.
X10, 11, 12, 13, 14, 15	2Z8678.215	SOCKET, tube: octal; phenolic; 1¼″ diam x ½″ h over-all; Cinch type No. 9888; Lewyt No. 986-56.
LS1	6C292-2	SPEAKER, dynamic: 3½″ diam cone; PM; 1-w normal, 2-w peak; voice coil impedance 4 ohms; 4″ x 4″ x 2½″ d over-all; Permaflux No. E24040X2; Lewyt No. 986-66.
S2	3Z9824-27	SWITCH, push: DPDT, non-locking; metal frame; 1 11/16″ lg x 1⅛″ d x ¾″ h over-all; Mallory No. 2006; Lewyt No. 986-49; (tune-test switch).
S1	3Z9825-58.105	SWITCH, rotary: 2-pole, 11-position; double-sect; steatite body; 2¼″ diam x 13/16″ lg; Centralab No. 2513; Lewyt No. 986-69; (circuit selector).
S3, 4	3Z9849.177	SWITCH, toggle: SPDT; bakelite housing; 1″ lg x 17/32″ diam x ½″ h; bushing 15/32″-32 thd; C-H No. 8360K2; Lewyt No. 986-50/51; (speaker switch; squelch switch).
S5	3Z9849.92	SWITCH, toggle: DPST; bakelite housing; 1 1/32″ lg x 13/16″ diam x 21/32″ h; bushing 15/32″-32 thd; C-H No. 8360K2; Lewyt No. 986-52; (power on-off).
T2	2Z9632.356	TRANSFORMER, AF: output; pri 20,000 ohms; sec 500 ohms; ct; fully enclosed hermetically sealed metal case; 3½″ h x 2″ wd x 3″ lg; Ferranti No. 5234; Lewyt No. 986-46.
T3	2Z9632.357	TRANSFORMER ASSEMBLY, AF: output and filter; pri 10,000 ohms, sec 4 ohms; fully enclosed hermetically sealed metal case; 4″ h x 2½″ wd x 3¼″ lg; Ferranti No. 5325; Lewyt No. 986-47.
L19	2Z9643.174	TRANSFORMER, IF: discriminator; shielded; 1¼″ lg x 9/32″ diam; Lewyt No. 986-102; (10 turns ±¼ turn No. 30 enameled wire with center tap).

178. MAINTENANCE PARTS FOR RADIO RECEIVER R-48/TRC-8 (XC-3) (contd).

Ref symbol	Signal Corps stock No.	Name of part and description
L4, 6, 8, 12, 14, 16, 18	2Z9643.173	TRANSFORMER, IF: 30 mc; interstage; shielded; 1¼" lg x 9/32" diam; Lewyt No. 986-101.
T1	2Z9608-53	TRANSFORMER, power: fully enclosed hermetically sealed metal case; 4 1/16" wd x 4¾" lg x 5" h; Ferranti No. 5322; Lewyt No. 986-45 (pri 230 v 50/60 c; sec No. 1, 610 v at 100 ma, ct; sec No. 2, 5 v at 30 amps; sec No. 3, 6.3 v at 5 amps).
V14	2J0D3/VR150	TUBE, ballast: JAN-0D3/VR-150; voltage regulator.
V1, 2, 4, 5, 6, 7, 8, and 9	2J6AG5	TUBE, electron: JAN-6AG5.
V3	2J9002	TUBE, electron: JAN-9002.
V10	2J6H6	TUBE, electron: JAN-6H6; twin diode.
V11	2J6SN7GT	TUBE, electron: JAN-6SN7GT; twin triode amplifier.
V12	2J6V6	TUBE, electron: JAN-6V6; beam amplifier.
V13	2J6N7GT/G	TUBE, electron: JAN-6N7GT/G; class B twin triode amplifier.
V15	2J5U4G	TUBE, electron: JAN-5U4G; full-wave rectifier.

179. MAINTENANCE PARTS FOR TEST OSCILLATOR TS-237/TRC-8 (XC-3).

The following information was compiled on 27 February 1945. The appropriate sections of the ASF Signal Supply Catalog for Test Oscillator TS-237/TRC-8 (XC-3) are:

Organizational Spare Parts
SIG 7-TS-237/TRC-8 when published

Higher Echelon Spare Parts
SIG 8-TS-237/TRC-8 when published

For the latest index of available catalog sections, see ASF Signal Supply Catalog SIG 2.

Ref symbol	Signal Corps stock No.	Name of part and description
	3F4325-237.1	TEST OSCILLATOR TS-237/TRC-8 (XC-3): unmodulated; crystal controlled with harmonic output of 30 mc and 230 to 250 mc in 5-mc steps; 5 3/8" x 3 3/8" x 2 1/8".
P303	2Z307-52	ADAPTOR, connector: female one end, wire lead on other; one round female contact; straight type; adapts cable of Test Oscillator TS-237/TRC-8 (XC-3) to i-f input of Radio Receiver R-48/TRC-8 (XC-3); 1" x 1" x 2" over-all; Lewyt No. 989-33.
E301	2Z9403.166	BOARD, terminal: 3 brass silver plated term; bakelite; 1½" lg x ¼" wd x 9/32" thk; Lewyt part No. 989-14 dwg No. 11604.
C307	3D9005-24	CAPACITOR, fixed; ceramic; 5 mmf ±20%; 500 vdcw; ½" lg x 7/32" diam; Erie Ceramicon N-750-K; Lewyt No. 989-26.
C305	3D9100-65	CAPACITOR, fixed: ceramic; 100 mmf ±10%; 500 vdcw; ½" lg x 7/32" diam; Erie Ceramicon N-750-L; Lewyt No. 989-24.

179. MAINTENANCE PARTS FOR TEST OSCILLATOR TS-237/TRC-8 (XC-3) (contd).

Ref symbol	Signal Corps stock No.	Name of part and description
C306	3D9500-117	CAPACITOR, fixed: ceramic; 300 mmf ±10%; 500 vdcw; ½″ lg x 7/32″ diam; Erie Ceramicon Hi-K, style K; Lewyt No. 989-25.
C301, 302, 303	3DA1-174	CAPACITOR, fixed: ceramic; 1,000 mmf ±5%; 300 vdcw; 13/16″ lg x 7/32″ diam; Erie Ceramicon type L; Lewyt No. 989-7.
C304	CD9007V-9	CAPACITOR, variable: ceramic; 1.5- to 7-mmf; 500 vdcw; 27/32″ lg x 41/64″ wd x 3/8″ h; Erie TS2A-NPO; Lewyt No. 989-23.
L302	3C323-132C	COIL, radio, RF: oscillator; unshielded; air wound, 2 turns No. 14 gauge bare tinned copper wire; ¼″ ID x ¾″ lg; Lewyt part No. 989-27 dwg No. 11603.
L301	3C323-132B	COIL, radio, RF: oscillator; single winding; single layer wound; unshielded; 68 turns No. 27 enameled copper wire; 1½″ lg x 1″ diam; Lewyt part No. 989-3 dwg No. 11602.
P302	2Z7390-21	CONNECTOR, male contact: Army-Navy Radio Frequency Plug UG-21/U; 1 round male cont; straight; 2″ lg x ¾″ diam; Selector N type No. PNPT5-S; Lewyt No. 989-15.
P301	2Z3025-26	CONNECTOR, male contact: 5 round male cont; straight; 1″ lg x 1″ wd x 1″ d; Amphenol No. 97-5105-5P.
V301	2X15-5000	CRYSTAL UNIT, quartz: one wafer; 5-mc; bakelite with metal cover; 1″ lg x 13/16″ wd x 7/16″ d; Lewyt No. 989-20.
R302	3RC31AE333K	RESISTOR, fixed: composition; 33,000 ohms ±10%; 1-w; max dimension 1.28″ lg x 0.310″ diam; RC31AE333K.
R301	3Z6650-45	RESISTOR, fixed: composition; 50,000 ohms ±10%; ½-w; max dimen 0.655″ lg x 0.249″ diam; 3Z6650-45.
X302	2Z8761-22	SOCKET, crystal: two-pin; glazed porcelain body; 1¼″ lg x ⅜″ wd x ½″ d, less cont; Millen No. 33102.
X301	2Z8677.87	SOCKET, tube: 7-prong; miniature; porcelain body; 1¼″ lg x ¾″ diam; Eby No. 90-10-C.
T301	2J6AG5	TUBE, electron: JAN-6AG5.

180. MAINTENANCE PARTS FOR ANTENNA ASSEMBLY AS-52/TRC-8 (XC-3).

The following information was compiled on 27 February 1945. The appropriate sections of the ASF Signal Supply Catalog for Antenna Assembly AS-52/TRC-8 (XC-3) are:

Organizational Spare Parts

SIG 7-AS-52/TRC-8 when published

Higher Echelon Spare Parts

SIG 8-AS-52/TRC-8 when published

For the latest index of available catalog sections, see ASF Signal Supply Catalog SIG 2.

Signal Corps stock No.	Name of part and description
2A288A-35	ANTENNA ASSEMBLY AS-52-TRC-8 (XC-3): dipole; brass, steel support, olive drab; one piece; ½″ x 20″ wd spread, support 14″ lg; Lewyt dwg No. L-2531.
2Z3061-29	ADAPTER UG-29/U: connector; double ended female; one round cont each end; straight; 2 1/16″ lg x ⅝″ diam; Selector type JNJ; (connects 2 Jacks UG-21/U).
6Q2107-24	BAG, tool: canvas, olive drab; 24″ h x 18″ wd; Lewyt dwg No. L-2661; Sig C Spec CCC-D-771A type III.
1F425-8	CABLE ASSEMBLY, RF: Army-Navy Cord RG-8/U; coaxial; flexible; 52 ohms; 60 ft; 7 strands No. 21 AWG bare copper; polyethylene insulation; Selector No. PNPT-5S; Lewyt dwg No. L-2669; (with connector on each end).
2Z2643.49	CLAMP: cable; steel; zinc plated; 1 thumb screw and 1 eye snap; Lewyt dwg No. L-2574.
2A3167-4	REFLECTOR, antenna: corner type; galv steel wire mesh and frames; olive drab; when folded 30″ lg x 23″ h x 8″ wd over-all; Lewyt dwg No. L-2652.
2A3186-3	ROD, bracing: ant; steel; zinc plated; olive drab; half hard Shelby tubing; ½″ OD x 0.035″ wall thk x 16″ lg; Lewyt dwg No. L-2538.
6L17504-24.51S1	SCREW, thumb: zinc plated; lacquer finish; ¼″ diam drop-forged thumb screw blank; ¾″ lg, ¼″-28 thd; staking end; Williams type D; Lewyt dwg No. 2545B; item A.
6L17504-24.51S	SCREW, thumb: zinc plated; lacquer finish; ¼″ diam drop-forged thumb screw blank; 9/16″ lg, ¼″-28 thd; staking end; Williams type D; Lewyt dwg No. 2545B; item B.
6L71014-5C	WASHER, lock: steel, zinc plated; ¼″ OD x 3/32″ ID x 1/16″ thk; split ring type.

181. MAINTENANCE PARTS FOR ANTENNA SUPPORT AB-48/TRC-8 (XC-3).

The following information was compiled on 27 February 1945. The appropriate sections of the ASF Signal Supply Catalog for Antenna Support AB-48/TRC-8 (XC-3) are:

Organizational Spare Parts

SIG 7-AB-48/TRC-8 when published

Higher Echelon Spare Parts

SIG 8-AB-48/TRC-8 when published

For the latest index of available catalog sections, see ASF Signal Supply Catalog SIG 2.

Signal Corps stock No.	Name of part and description
2A248K48.1	ANTENNA SUPPORT AB-48/TRC-8 (XC-3): 40 ft sectional steel mast; 8-mast sections, each 65″ lg x 2″ wd.
6Q1001	AX LC-1: single bit; steel; 3⅝″ blade; 16″ handle.
2A326-3	BASE, mast: steel, zinc pl; olive drab; for 2″ mast; base over-all 12″ x 7½″; cradle 4″ h; Lewyt dwg No. L-2530.
2A3005-1	BLOCK, pulley: one single, one double sheave blocks; Lewyt dwg No. L-2573.
6Z7904A.1	ROPE: twisted cotton; ⅜″ diam; white; 150 ft lg; ends whipped and paint coated.
2A1344-4	GUY: gin pole; sisal rope ⅜″ diam x 26 ft lg; one end attached to galv mal iron boat snap by means of ⅜″ galv thimble; 5 tuck splice; other end whipped; Lewyt dwg No. L-2534.
2A1344-3	GUY: mast; preformed; ⅛″ OD x 29 ft lg; Lewyt dwg No. L-2532; (2,000 lb test).
2A1344-2	GUY: mast; preformed; ⅛″ OD x 41 ft lg; Lewyt dwg No. L-2532; (2,000 lb test).
6Q49003	HAMMER HM-3: sledge; 8 lbs; cross peen with handle.
6Q51146-36	HANDLE, hammer: sledge; 36″ lg; (for Hammer HM-3).
2A2496-1	MAST SECTION, antenna: tubular; Shelby half hard steel; zinc pl, olive drab; 65″ lg x 2″ OD one end; opposite end 1⅞″ OD; Lewyt dwg No. L-2562B.
2A2819-5	PLATE, guy: steel, zinc pl; olive drab; 3½″ x 3½″ x 3/16″ thk; Lewyt dwg No. L-2558.
2A3302	STAKE GP-2: guy; wrought steel; galv; ¾″ diam x 16″ lg; Sig C spec 71-393-A.
2A3325	STAKE GP-25: guy; steel tubing; galv; 3 ft lg x 1⅜″ diam; Sig C dwg No. RL-D-3659.

SECTION XXII. REFERENCES

182. SUPPLY PUBLICATIONS.

SIG 5 Stock list of all items.

183. TECHNICAL MANUALS ON ACCESSORY, AUXILIARY, AND TEST EQUIPMENT.

TM 11-303 Test Sets I-56-C, I-56-D, I-56-H, and I-56-J.

TM 11-317 Signal Generator I-208.

TM 11-333 Telephones EE-8-A and EE-8.

TM 11-341 Telegraph Terminal CF-1-A (Carrier) and Repeater CF-3-A (Carrier).

TM 11-342 Ringing Equipment EE-100-T1, EE-100-A (Voice Frequency) and EE-101-A (Voice Frequency).

TM 11-354 Telegraph Printer Sets (Teletypewriter) EE-97 and EE-98, Teletypewriter Sets EE-97-A, EE-98-A, and EE-102.

TM 11-355 Telegraph Terminal CF-2-A (Carrier).

TM 11-355B Telegraph Terminal CF-2B (Carrier).

TM 11-358 Telegraph Central Office Set TC-3.

TM 11-369 Spiral-Four Cable.

TM 11-472 Repair and Calibration of Electrical Measuring Instruments.

TM 11-900 series Power Unit PE-75 series.

TM 11-2201 Reperforator Teletypewriter Sets TC-16 and TC-17.

TM 11-2613 Voltohmmeter I-166.

TM 11-2621 Remote Control Equipment AN/TRA-2.

TM 11-2626 Test Unit I-176.

TM 11-2627 Tube Tester I-177.

184. PAINTING, PRESERVING, AND LUBRICATION.

TB SIG 13 Moistureproofing and Fungiproofing Signal Corps Equipment.

TB SIG 69 Lubrication of Ground Signal Equipment.

SB 11-10 Signal Corps Kit and Materi for Moisture- and Fun resistant Treatment.

185. SHIPPING INSTRUCTIONS.

U. S. Army Spec No. 100-14A Army-Navy General Spec cation for Packaging a Packing for Overseas Sh ment.

186. DECONTAMINATION.

TM 3-220 Decontamination.

187. DEMOLITION.

FM 5-25 Explosives and Demolitions

188. CAMOUFLAGE.

FM 5-20 Camouflage, Basic Princip

FM 5-200 Camouflage of Bivouacs, Co mand Posts, Supply Poi and Medical Installations.

189. OTHER TECHNICAL PUBLICATIONS.

FM 21-6 List of Publications for Tra ing.

FM 24-10 Combined Radiotelegraph (W/T) Procedure.

FM 24-12 Army Extract of Combine Operating Signals.

TM 1-455 Electrical Fundamentals.

TM 11-227 Signal Communication Eq ment Directory, Radio C munication Equipment.

TM 11-310 Schematic Diagrams for M tenance of Ground Ra Communication Sets.

TM 11-314 Antennas and Antenna S tems.

TM 11-454 The Radio Operator.

TM 11-455 Radio Fundamentals.

TM 11-462 Reference Data.

TM 11-483 Suppression of Radio No

TM 11-499 Radio Propagation.

TM 37-250 Basic Maintenance Manual.

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.

TB SIG 123 Preventive Maintenance Practices for Ground Signal Equipment.

190. FORMS.

Refer to Unsatisfactory Equipment Report (W.D., A.G.O. Form No. 468) or Army Air Forces Form No. 54 (unsatisfactory report). If this form is not available, refer to paragraph 170c.

191. LIST OF ABBREVIATIONS.

ac	alternating current
af	audio frequency
amp	ampere
cps	cycles per second
db	decibel
dbm	decibels above 1 milliwatt
dc	direct current
fm	frequency modulation
if	intermediate frequency
kc	kilocycle
ma	milliampere
mc	megacycle
meg	megohm
mf	microfarad
mmf	micromicrofarad
mw	milliwatt
osc	oscillator
rf	radio frequency
μv	microvolt
v	volt

NOTE: Refer to appendix I of TM 11-455, 22 May 1944, for additional abbreviations of radio terms.

192. GLOSSARY.

ALIGN. The process of adjusting the tuned circuits of a transmitter or receiver for maximum signal response.

AMPLIFIER. A device, used to increase the signal voltage, current, or power, which is generally made up of a vacuum tube and associated circuit called a stage. It may contain several stages in order to obtain a desired gain.

AMPLITUDE. The maximum instantaneous value of an alternating voltage or current, measured in either the positive or negative direction.

AMPLITUDE MODULATION. The process of changing the amplitude of an r-f carrier wave in accordance with the variations of an a-f wave.

ANTENNA. A device for radiating or absorbing radio waves.

ARRESTER. Apparatus with suitably arranged electrodes and short air gap used to protect equipment against lightning discharges.

ATTENUATION. The reduction in strength of a signal. May be deliberate by means of an attenuator, or involuntary because of inherent circuit resistance or impedance.

AUDIO FREQUENCY. A frequency audible to the human ear. The range extends from approximately 20 to 20,000 cycles per second.

BAND OF FREQUENCIES. The frequencies existing between two definite limits.

BAND-PASS FILTER. A circuit designed to pass frequencies within a definite band with uniform response, and to reduce substantially the amplitude of all other frequencies.

BEAM ANTENNA. A unilateral directive antenna the radiation of which is substantially confined to a narrow beam.

BIAS. The d-c voltage maintained between the control grid and the cathode of a vacuum tube.

BLEEDER. A resistance connected in parallel with a power-supply output to protect equipment from excessive voltages when the load is removed or substantially reduced, and to drain the charge remaining in the filter capacitors when the unit is turned off.

BLOCKING CAPACITOR. A capacitor used to block the flow of direct current while permitting alternating current to pass. Also called coupling capacitor.

BYPASS CAPACITOR. A capacitor used to provide an alternating-current path of comparatively low impedance around a circuit element.

CAPACITIVE COUPLING. A method of transferring energy from one circuit to another by means of a capacitor that is common to both circuits.

CAPACITIVE FEEDBACK. The process of returning part of the energy of the output of a tube to the input circuit by means of a capacitor common to both.

CAPACITOR. Two electrodes, in the form of plates, separated from each other by an insulating material called the dielectric.

CARRIER WAVE. The r-f component of a transmitted wave upon which an audio signal or other form of intelligence can be impressed.

CATHODE BIAS. The method of biasing a tube by placing the biasing resistor in the common cathode-return circuit, making the cathode more positive, rather than the grid more negative, with respect to ground.

CIRCUIT BREAKER. A circuit breaker is a special type of switch arranged to open a circuit rapidly when an overload occurs.

CHOKE. A coil used to impede the flow of pulsating direct current or alternating current, and to permit the flow of direct current.

CLASS A OPERATION. Operation of a vacuum tube at the center of the straight portion of its characteristic curve. Plate current flows throughout the entire operating cycle and distortion is kept at a minimum.

CLASS C OPERATION. Operation of a vacuum tube with grid bias considerably greater than cut-off. The plate current is zero with no input signal to the grid, and flows for appreciably less than one half of each cycle of the input signal.

COAXIAL CABLE. A transmission line consisting of an inner conductor within and insulated from an outer conductor. Losses in this type of line are low and radiation is practically zero.

DECIBEL. The standard unit of comparison between two quantities of electrical or acoustical power. The number of decibels denoting the ratio of the two amounts of power is 10 times the logarithm to the base 10 of this ratio.

DECOUPLING NETWORK. A network of capacitors and chokes, or resistors, placed in leads which are common to two or more circuits to prevent unwanted and harmful interstage coupling.

DETECTION. The process of recovering the audio component from a modulated carrier wave.

DEVIATION. A term used in frequency modulation to indicate the amount by which the carrier or resting frequency increases or decreases when modulated. It is usually expressed in kilocycles.

DISCRIMINATOR. A vacuum-tube circuit whose output voltage varies in amplitude and polarity in accordance with the frequency of the applied signal. It is used as the detector stage of frequency-modulated receivers.

DUMMY ANTENNA. A device possessing all the necessary characteristics of an antenna with the exception that it dissipates all the power fed to it in some form other than that of radiation.

EQUIVALENT CIRCUIT. A simplified arrangement of circuit elements to permit easier analysis.

FACSIMILE TRANSMISSION. The electrical transmission of a copy or reproduction of a picture, drawing, or document.

FREQUENCY TRIPLER. An amplifier whose output is resonant to the third harmonic of the input signal. The output frequency is triple that of the input.

FREQUENCY MODULATION. The process of varying the frequency of an r-f carrier wave in accordance with the amplitude and frequency of an audio signal.

GAIN OF AN ANTENNA. The measured gain of one transmitting or receiving antenna over another is the ratio of the signal power one produces at the receiver input terminals to that produced by the other, the transmitted power level remaining fixed.

GRID CURRENT. Current which flows between the cathode and the grid whenever the grid becomes positive with respect to the cathode.

GRID LEAK. A resistor placed in the grid circuit of a vacuum tube to provide a path to the cathode for the negative charge on the grid, thus providing a constant bias voltage on the grid during both halves of the signal cycle.

HALF-WAVE DIPOLE. A half-wave dipole is a straight ungrounded antenna substantially one-half wavelength long.

HARMONIC. An integral multiple of a fundamental frequency. The second harmonic is twice the frequency of the fundamental.

HIGH FIDELITY. The ability to reproduce all audio frequencies up to 20,000 cycles without serious distortion.

IMPEDANCE. The total opposition offered to the flow of an alternating current.

IN PHASE. The condition that exists when two waves of the same frequency pass through their maximum and minimum values of like polarity at the same instant.

INTERMEDIATE FREQUENCY. The fixed frequency to which all r-f carrier waves are converted in a superheterodyne receiver.

JAMMING. Interference from hostile transmissions.

LAG. The amount one wave is behind another in time, expressed in electrical degrees. When two waves are out of phase, the one that reaches maximum or zero amplitude behind the other is said to lag.

LEAD. The opposite of lag.

LIMITER. That part of f-m receiver which eliminates all variations in carrier amplitude, thus removing all noise present in the carrier as amplitude modulation.

LOCAL OSCILLATOR. The oscillator used in a superheterodyne receiver whose output is heterodyned with the desired r-f carrier to form the difference or intermediate frequency.

MIXER. A vacuum tube and suitable circuit used to combine the incoming and local oscillator frequencies to produce an intermediate frequency.

MODULATED CARRIER. An r-f carrier whose amplitude or frequency has been varied in accordance with the intelligence to be conveyed.

MODULATION. The process of varying the amplitude or the frequency of a carrier wave in accordance with other signals in order to convey intelligence.

MODULATOR. That part of a transmitter which supplies the modulating signal to the modulated circuit, where it can act upon the carrier wave.

MULTIPLEX RADIO TRANSMISSION. Multiplex radio transmission is the simultaneous transmission of two or more signals using a common carrier wave.

OSCILLATOR. A vacuum tube feedback circuit capable of generating self-sustained a-c voltages when the proper d-c potentials are applied to the tube elements.

PERCENTAGE MODULATION. A measure of the degree of change in a carrier wave caused by the modulating signal, expressed as percentage.

PUSH-PULL AMPLIFIER. Two vacuum tubes whose grids are excited with equal voltages 180° out of phase, and whose plate outputs are additive across a center-tapped output circuit.

Q. The symbol of merit or efficiency of a circuit or a coil. Numerically, it is equal to the inductive reactance divided by the resistance: $Q = \frac{X_1}{R}$

RADIO FREQUENCY. Any frequency of electrical energy capable of propagation into space; radio frequencies are normally much higher than those associated with sound waves.

REACTANCE TUBE MODULATOR. A modulator used in the Crosby system of frequency modulation, in which the modulator tube is made to act as a varying reactance in the oscillator circuit.

REFLECTOR. A reflector is a rear portion of a directional antenna, not connected to the transmitter or receiver, and so designed as to increase r-f radiation in the forward direction.

RESTING FREQUENCY. The initial frequency of the carrier wave of an f-m transmitter before modulation. Also called the center frequency.

SELECTIVITY. The degree to which a receiver is capable of discriminating between signals of different carrier frequencies.

SIDE BANDS. The new frequencies, both above and below the carrier frequency, produced as a result of modulation of a carrier.

SUPERHETERODYNE. A receiver in which the incoming signal is mixed with a locally generated signal to produce an intermediate frequency which is then amplified and detected a second time to produce the audio frequency.

TANK CIRCUIT. An intermediate oscillatory circuit, associated with the output circuit of a vacuum tube transmitter, which absorbs the output of the vacuum tube transmitter in the form of energy impulses of high value and short duration, and delivers the power to the load in substantially sinusoidal form.

TELEGRAPH-MODULATED WAVES. Continuous waves, the amplitude or frequency of which is varied by means of telegraphic keying.

TEMPERATURE COEFFICIENT. A factor used to calculate the change in the characteristics of a substance, device, or circuit element, with changes in its temperature. Examples: The shift in frequency of a crystal-per-degree change in temperature. The change in the resistance of a resistor-per-degree change in temperature.

TRACKING. The process of adjusting the individual tuning action of each of several stages which are ganged so that a given tuning change in the central control results in an equal frequency change in each stage at any point over the tuning range.

TRANSMISSION UNIT. Over the usual range of sound intensities, one transmission unit (1 db) corresponds very closely to the minimum perceptible change in loudness that can be detected by the human ear.

TRIMMER CAPACITOR. A small variable capacitor used to adjust main tuning capacitors so that they track properly.

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TECHNICAL MANUAL

RADIO SET AN/TRC-8 (XC-3)
RADIO TERMINAL SET AN/TRC-11 (XC-3)
RADIO RELAY SET AN/TRC-12 (XC-3)

CHANGE No. 1

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *18 October 1955*

TM 11-618, 19 March 1945, is changed as follows:

68.1. Antijamming Procedures

(Added)

When the radio relay communications system is being jammed by unwanted signals, notify the immediate superior officer promptly. However, each operator must keep the equipment operating under any condition. One or more of the following procedures may be used for obtaining the maximum intelligibility from the desired signals during the jamming process.

a. Radio Relay System. When it is determined that jamming signals are interrupting communications in the radio relay system, determine the particular link effected; the direction; and the particular channel involved.

b. Operation at Transmitters. Do not change the position of the transmitting antenna in the system. Use the maximum power output of the transmitter. The transmitter cannot be jammed, but it is essential that its maximum power output be beamed toward the receiving site at all times.

c. Operation of Receivers in Jammed Link, and Jammed Channel.

(1) Monitor the carrier modulation at the REC OUTPUT terminals.

(2) Slowly vary the FREQUENCY CONTROL dial through several degrees, on either side of the desired signal. Better copy may be possible on either of the sides. While performing this procedure, keep the SQUELCH OFF ON toggle switch in the OFF position.

(3) Operate the SQUELCH OFF ON switch to ON. Adjust the SQUELCH ADJ control until the best copy can be made. The squelch control must be varied to obtain the best read-through in each type interference encountered. In each case, perform the functions outlined in (2) above after varying the squelch control.

(4) Turn the AUDIO GAIN control in both directions for the most satisfactory read-through. If this is a relay station, readjust the MODULATION adjustment control.

(5) If the antenna is vertically polarized, gradually vary its position until it is horizontal, or vice versa.

(6) Rotate the receiving antenna in either direction as much as 40° each side of the center position. Vary the height of the antenna to minimize the strength of the jamming signal with regard to the desired signal. Readjust the AUDIO GAIN control to compensate for the lower signal level of the transmitter.

(7) Place an object such as a tree, tank, jeep, truck, hill, or mountain between the receiving antenna and the source of the jamming signals. This may decrease the strength of the jamming signals and permit copy of the desired signals.

(8) When the receiving antenna is lowered to obtain effective shielding from the jamming, signal, the transmitting antenna directed toward it, must be raised so that the line-of-sight operation may be maintained.

(9) If all the above procedures fail, request a change in frequency and call signals.

Note. Antenna techniques that are used to reduce jamming, are dependent upon the type terrain and other conditions. Always try to locate the receiving antennas between some object and the source of the jamming signal. Take advantage of obstacle gain; other paths of transmission may be obtained by bouncing signals off obstacles. This permits reorientation of the receiving antenna, and may permit much better read-through of the desired signals.

TAGO 2155A—Oct. 360468°—55

(10) If the jamming action is so complete that the use of alternate frequencies will not permit communication, use another means for getting the message through. Continue to operate the equipment. Constant operation will keep the enemy in uncertainty about the jamming success, and it is probably that the frequency will not be changed at the source of the jamming signals. The jamming equipment will be tied to what is considered the active frequency.

BY ORDER OF THE SECRETARY OF THE ARMY:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

OFFICIAL:

JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General.

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NG: State AG (6); units—same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see SR 320-50-1.

U. S. GOVERNMENT PRINTING OFFICE: 1955

TECHNICAL MANUAL

RADIO SETS AN/VRC-16, AN/VRC-17, AND AN/VRC-18

CHANGES
No. 3

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *23 July 1954*

TM 11-611, 15 May 1951, is changed as follows:

60.1. Antijamming Procedures

(Added)

When the radio sets are jammed by unwanted signals, notify the immediate superior officer promptly, and continue to operate the equipment under any condition. Follow the procedures below until the desired signal read-through is possible and communication re-established.

a. Slowly vary the TENTH MCS tuning knob (fig. 4) of the jammed radio set to both sides of the assigned frequency. This may affect some separation of the desired signal from the undesired jamming signal. However, if the control is in the detent position, turn the TENTH MCS knob fully counterclockwise. This will release the detent and permit continuous tuning. Again vary the TENTH MCS tuning knob as above. This may re-establish signal read-through on one side or the other of the assigned frequency.

b. If the auxiliary receiver is jammed by unwanted signals, turn the TUNING knob (fig. 6) first to one side and then to the other side of the assigned frequency. This may re-establish signal read-through on one side, or the other side of the assigned frequency.

c. Vary the SQUELCH control (fig. 4) slowly, from one position to another. If this does not decrease or eliminate the strength of the jamming signal, operate the control to the OFF position.

d. Locate the radio set so that an object such as a truck, tank, jeep, or tree is between the source of the jamming signal and the antenna. The strength of the jamming signal may be decreased or eliminated entirely,

e. If the above instructions fail to produce the desired results, request a change in frequency and call sign.

f. If after a change in frequency and call sign, signal read-through is still impossible, use another means to get the message through and continue to operate the equipment. Continued operation of the equipment may cause the enemy to be uncertain of the jamming success and to cease transmitting the jamming signal, or to switch to other frequencies. Continued operation of the radio set transmitter will keep the enemy uncertain as to the jamming success at what the enemy believes is the active communicating frequency of the radio transmitter.

[AG 413.44 (12 Jul 54)]

BY ORDER OF THE SECRETARY OF THE ARMY:

M. B. RIDGWAY,
General, United States Army,
Chief of Staff.

OFFICIAL:

JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General.

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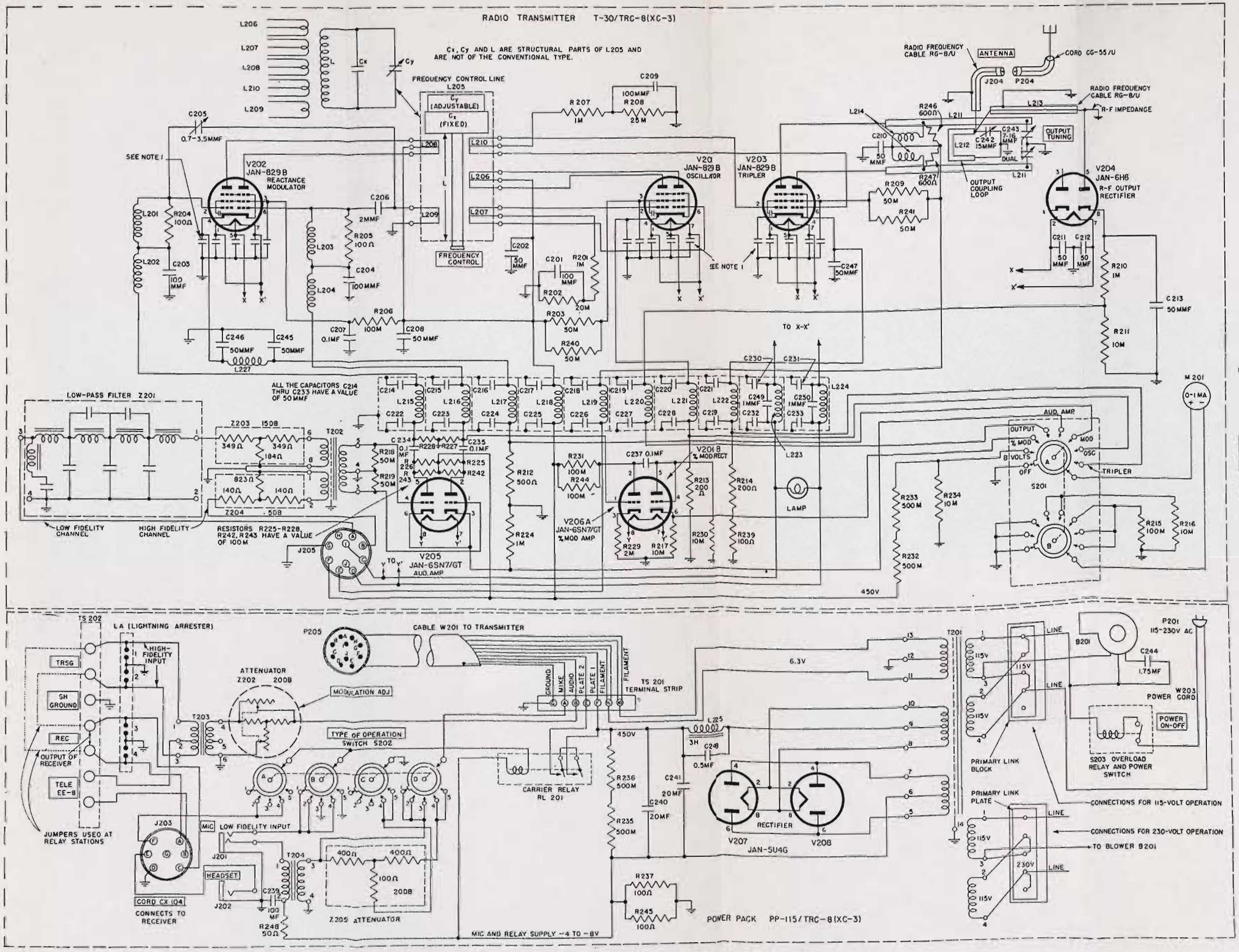
11-592, Hq & Hq Co, Sig Base Depot (2)
11-597, Sig Base Depot Co (2)
19-57A, MP Co (2)

NG: Same as Active Army except allowance is one copy for each unit.
USAR: None.
Unless otherwise noted, distribution applies to ConUS and overseas.
For explanation of abbreviations used, see SR 320-50-1.

U. S. GOVERNMENT PRINTING OFFICE: 1954



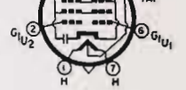
NOTE 1
FILAMENT CATHODE AND SCREEN BYPASS CAPACITORS OF TUBE JAN-829B ARE BUILT INTO TUBE SOCKET

NOTE 2
POSITIONS OF TYPE OF OPERATION SWITCH

POS	CHANNEL	TRANSMITTER CONTROL
1	SINGLE	MIC
2	SINGLE	MIC OR SQUELCH
3	SINGLE	CONTINUOUS
4	MULTI	MIC OR SQUELCH
5	MULTI	CONTINUOUS

NOTE 3
M = 1,000 Ω

BOTTOM VIEW OF TUBE JAN-829B



TL 16300

Figure 136. Radio Transmitter T-30/TRC-8 (XC-3), schematic diagram.

FIGURE 136

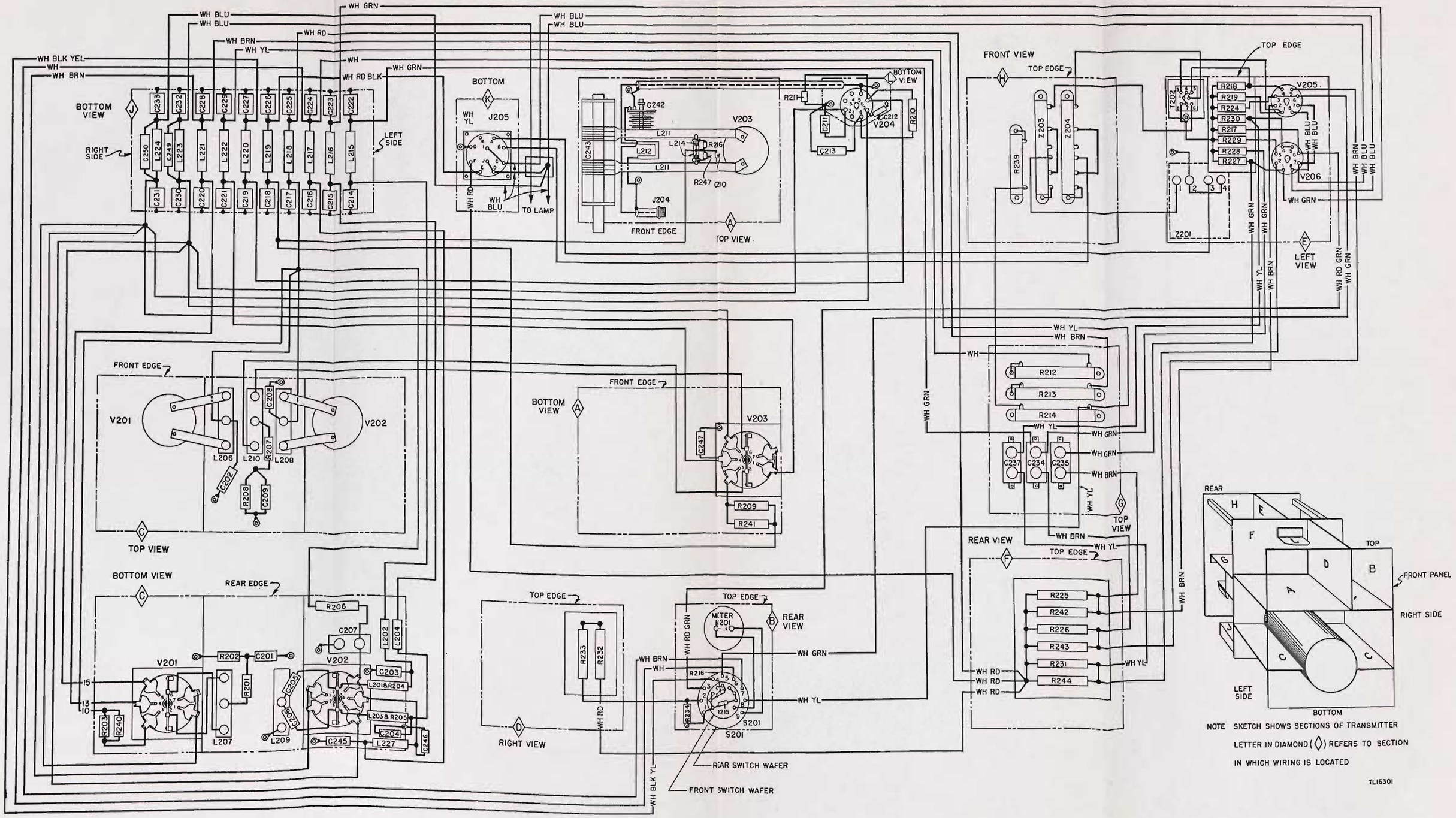
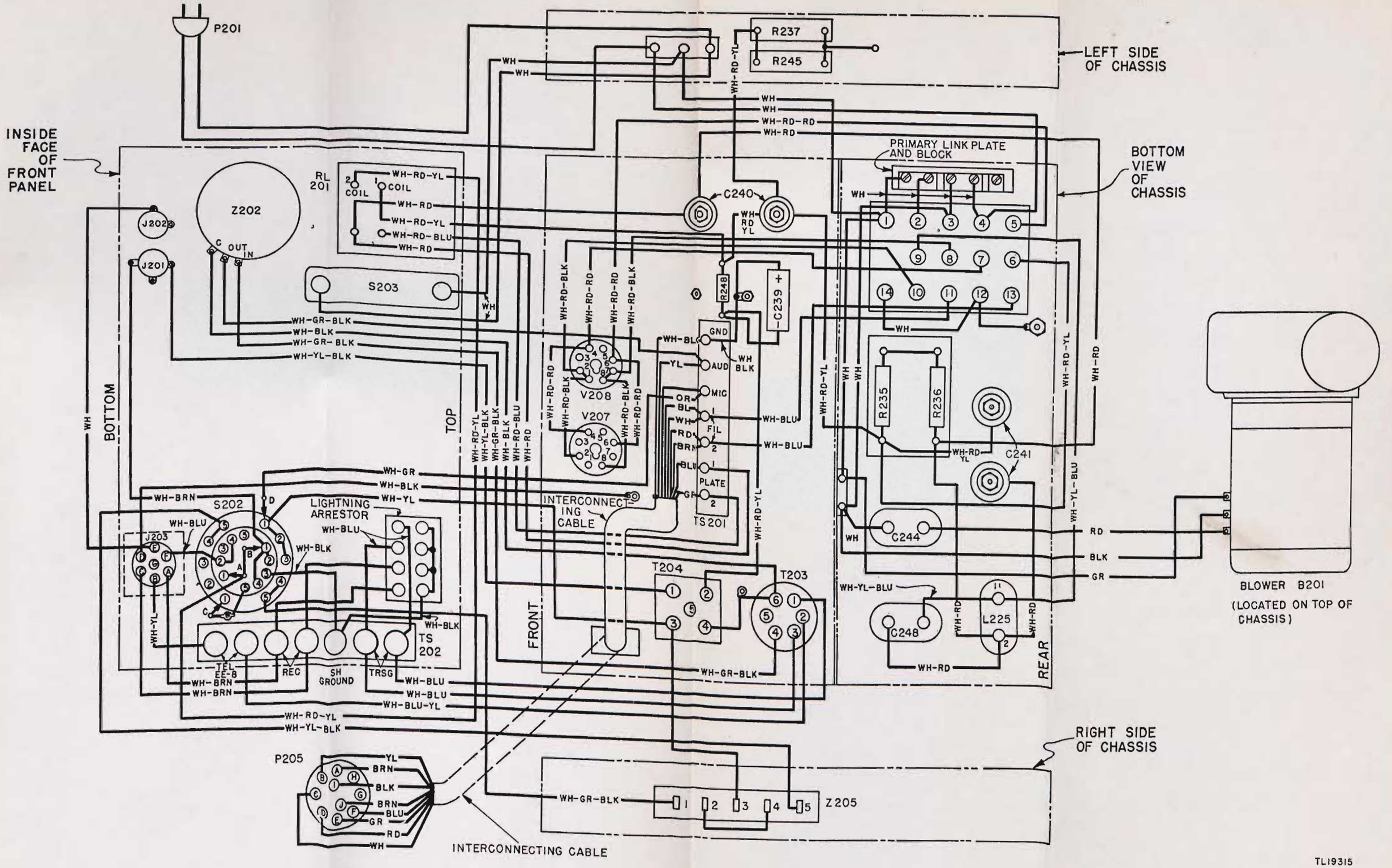


Figure 137. Radio Transmitter T-30/TRC-8 (XC-8), wiring diagram.

FIGURE 137



TL19315

Figure 138. Power Pack PP-115/TRC-8 (XC-3), wiring diagram.

FIGURE 138

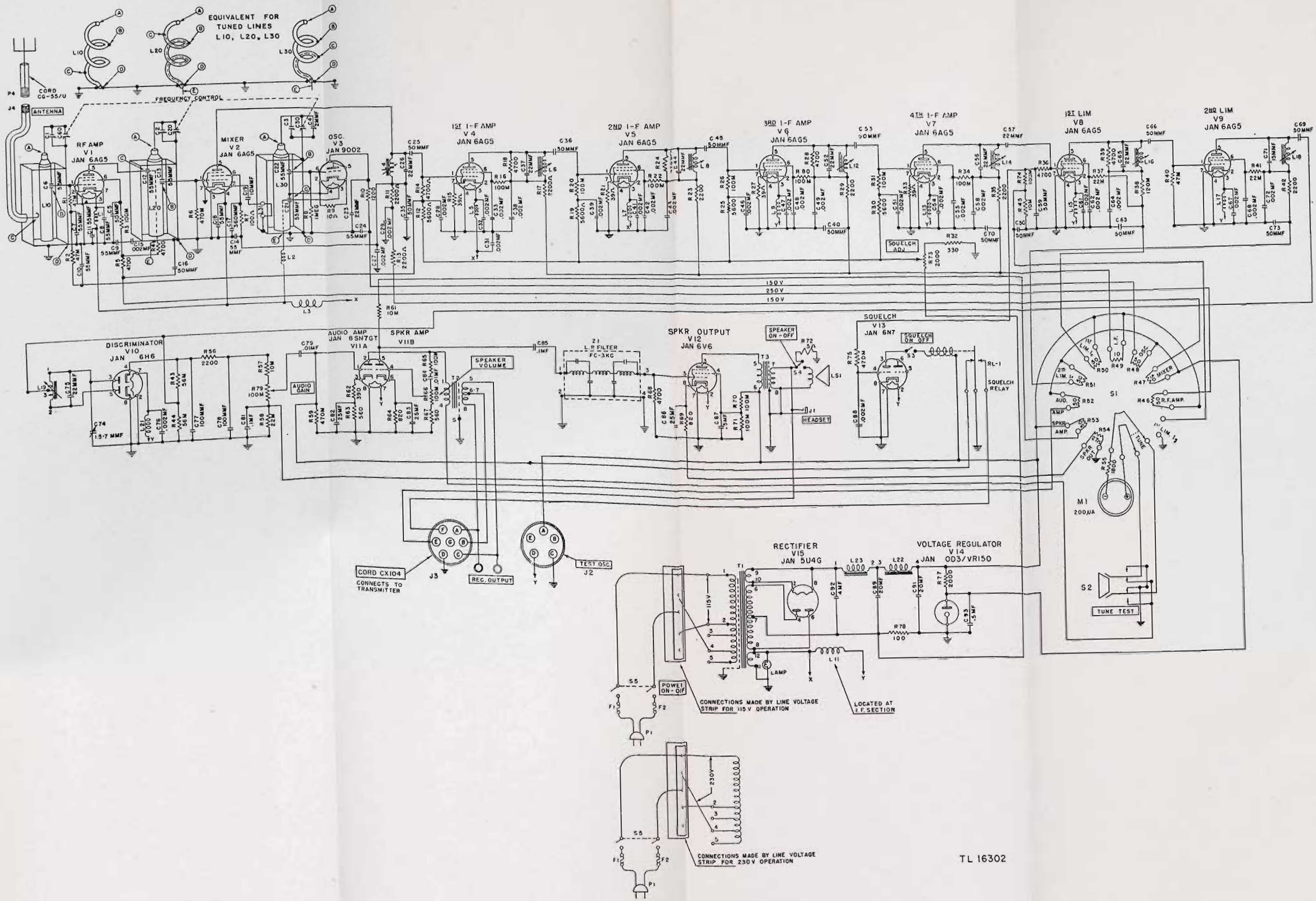


Figure 139. Radio Receiver R-48/TRC-8 (XC-8), schematic diagram.

FIGURE 139

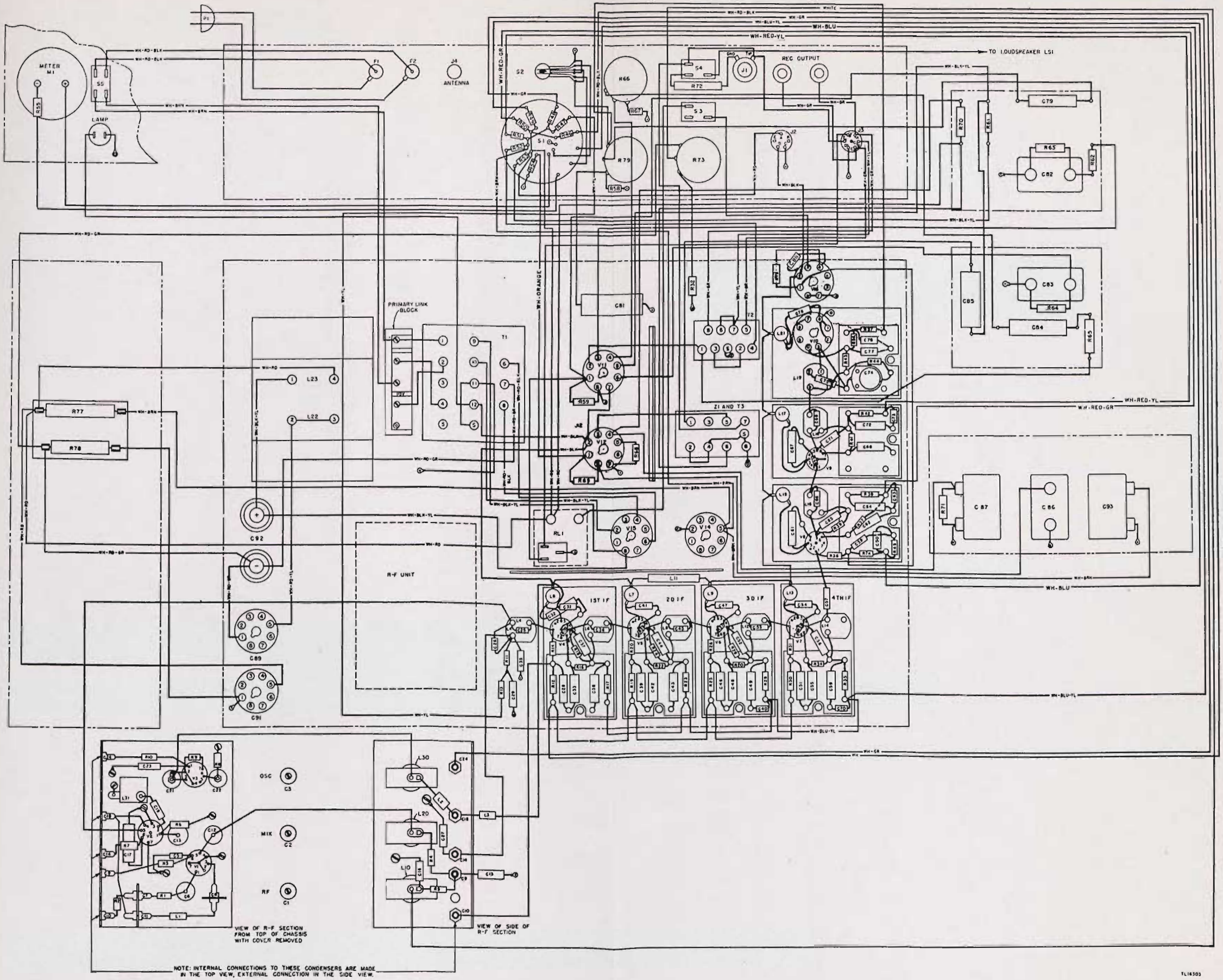
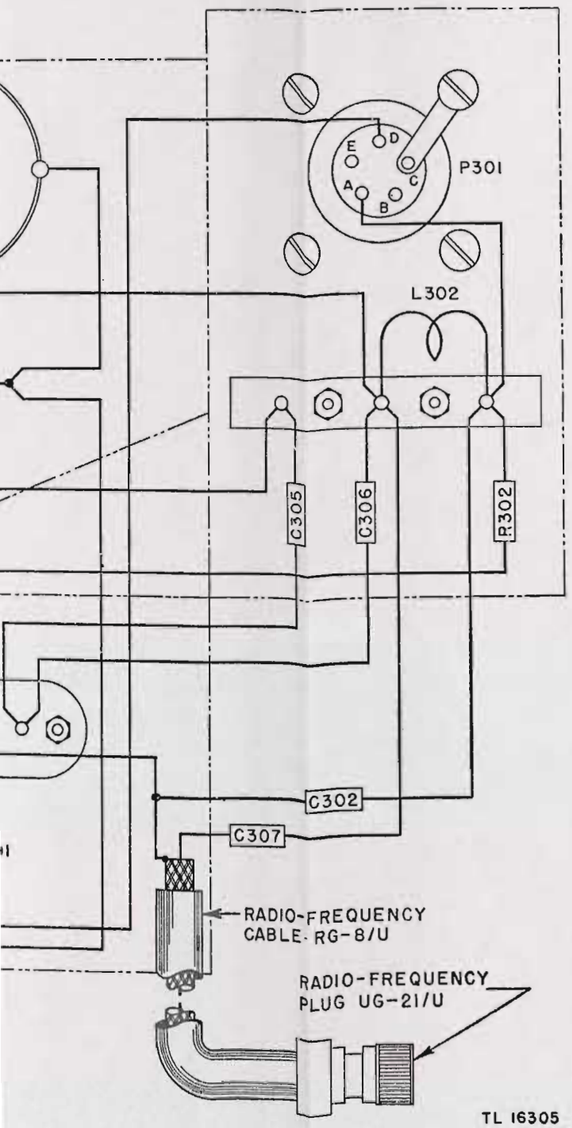


Figure 140. Radio Receiver R-48/TRC-8 (XC-8), wiring diagram.

FIGURE 140



llator TS-237/TRC-8 (XC-8), wiring diagram.

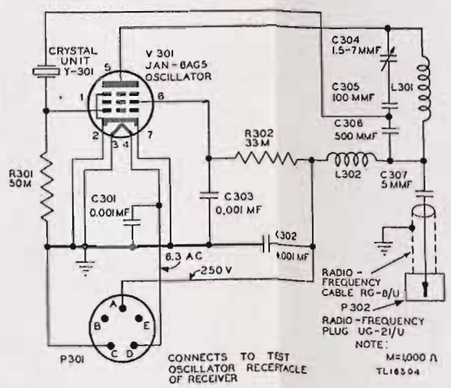


Figure 141. Test Oscillator TS-237/TRC-8 (XC-8), schematic diagram.

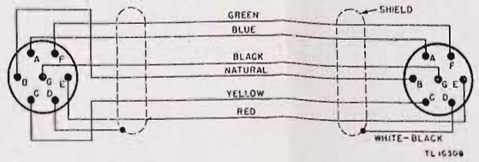
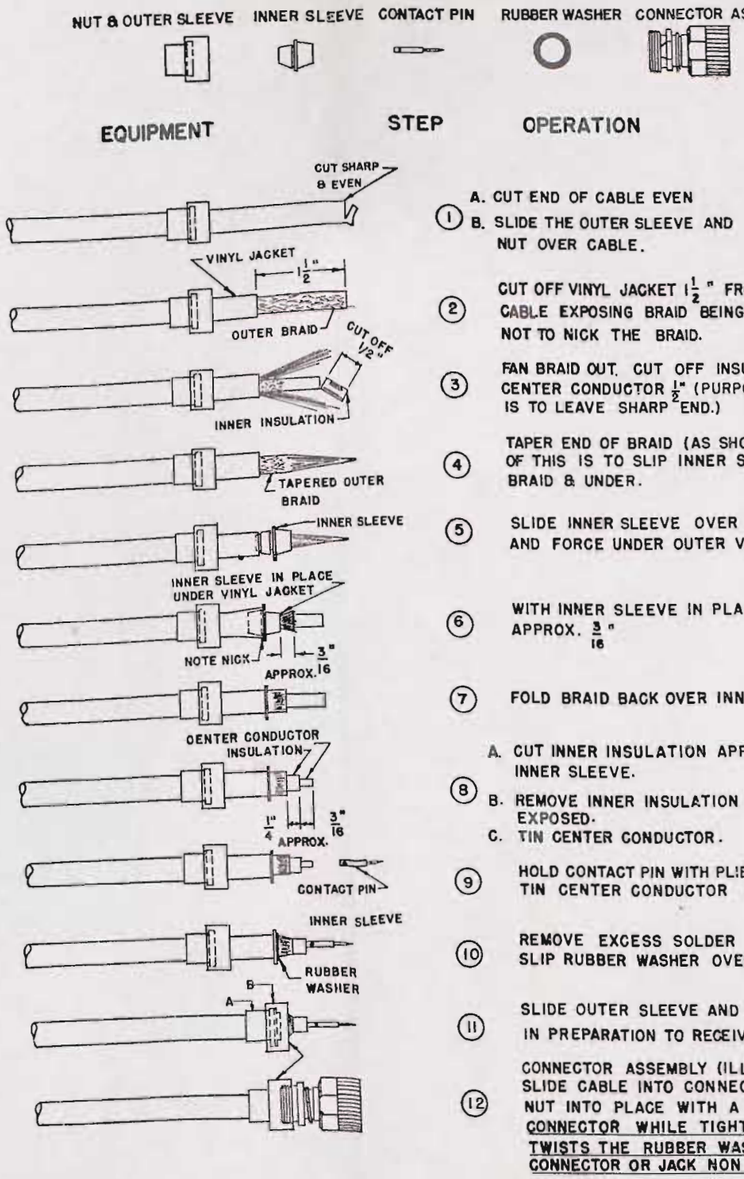


Figure 143. Cord CX-104/TRC-1, wiring diagram.



① A. CUT END OF CABLE EVEN
B. SLIDE THE OUTER SLEEVE AND NUT OVER CABLE.

② CUT OFF VINYL JACKET $1\frac{1}{2}$" FROM END OF CABLE EXPOSING BRAID BEING CAREFULL NOT TO NICK THE BRAID.

③ FAN BRAID OUT. CUT OFF INSULATION AND CENTER CONDUCTOR $\frac{1}{2}$" (PURPOSE OF THIS IS TO LEAVE SHARP END.)

④ TAPER END OF BRAID (AS SHOWN) PURPOSE OF THIS IS TO SLIP INNER SLEEVE OVER BRAID & UNDER.

⑤ SLIDE INNER SLEEVE OVER TAPERED BRAID AND FORCE UNDER OUTER VINYL JACKET.

⑥ WITH INNER SLEEVE IN PLACE CUT BRAID APPROX. $\frac{3}{16}$"

⑦ FOLD BRAID BACK OVER INNER SLEEVE & SMOOTH.

⑧ A. CUT INNER INSULATION APPROX $\frac{1}{4}$" MEASURING FROM INNER SLEEVE.
B. REMOVE INNER INSULATION LEAVING $\frac{3}{16}$" CENTER CONDUCTOR EXPOSED.
C. TIN CENTER CONDUCTOR.

⑨ HOLD CONTACT PIN WITH PLIERS. FILL HOLE WITH SOLDER. TIN CENTER CONDUCTOR AND INSERT INTO PIN.

⑩ REMOVE EXCESS SOLDER
SLIP RUBBER WASHER OVER INNER SLEEVE (AS SHOWN).

⑪ SLIDE OUTER SLEEVE AND NUT AS CLOSE AS POSSIBLE IN PREPARATION TO RECEIVING CONNECTOR ASSEMBLY.

⑫ CONNECTOR ASSEMBLY (ILLUSTRATED)
SLIDE CABLE INTO CONNECTOR ASSEMBLY. SCREW NUT INTO PLACE WITH A WRENCH. DO NOT TURN CONNECTOR WHILE TIGHTENING NUT AS THIS TWISTS THE RUBBER WASHER MAKING THE CONNECTOR OR JACK NON WATERPROOF.

Figure 144. Assembly instructions for Radio Frequency Plug UG-21/U.

FIGURES 141, 142, 143, 144

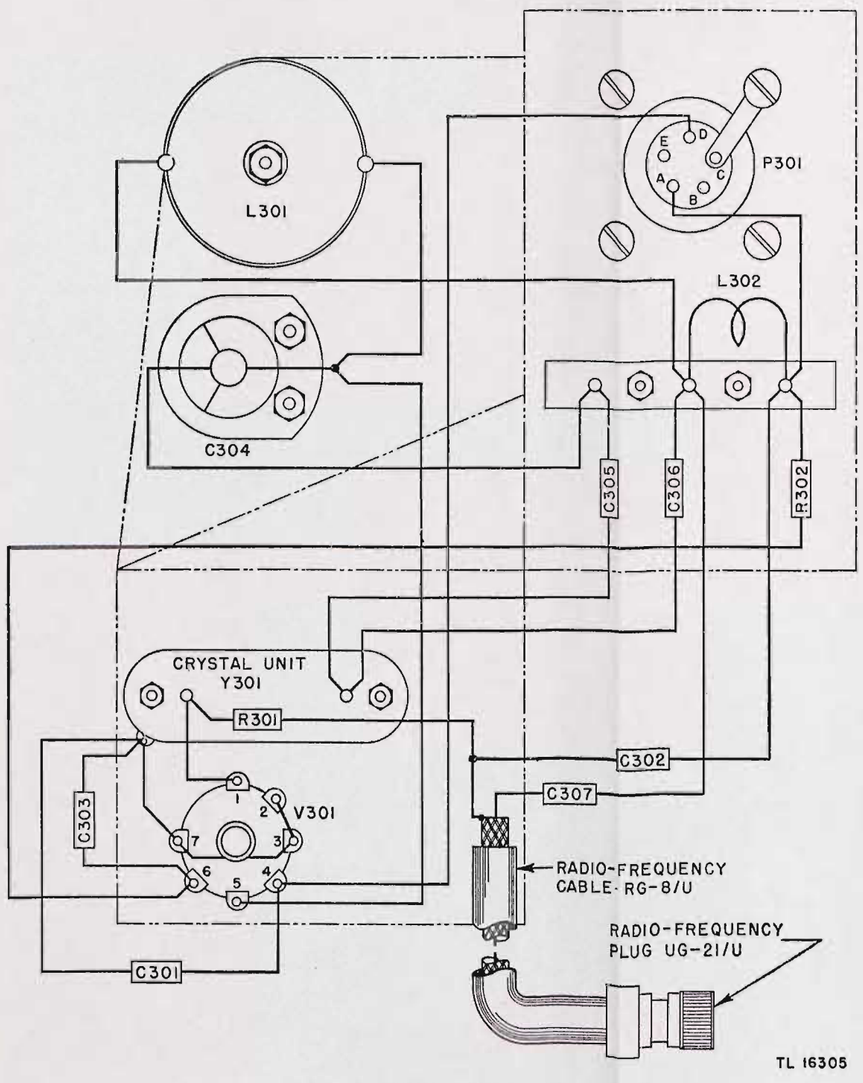


Figure 142. Test Oscillator TS-237/TRC-8 (XC-8), wiring diagram.

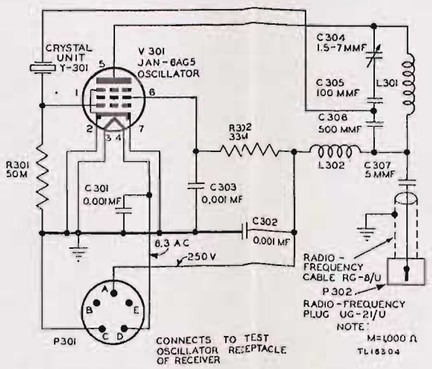


Figure 141. Test Oscillator TS-237/TRC-8 (XC-8), schematic diagram.

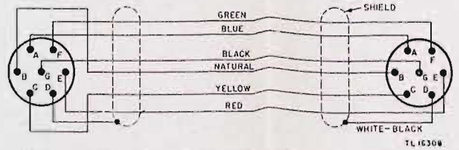


Figure 143. Cord CX-104/TRC-1, wiring diagram.

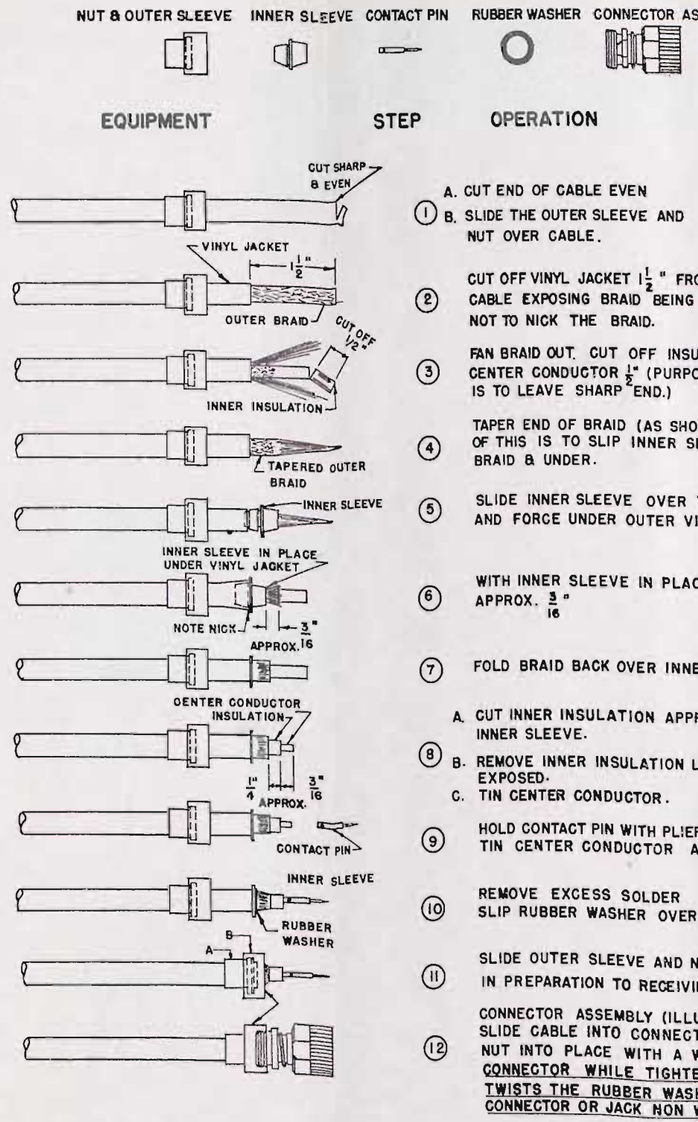
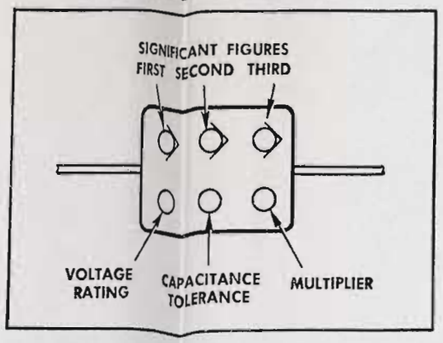
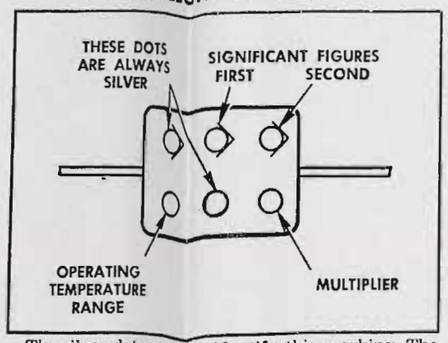


Figure 144. Assembly instructions for Radio Frequency Plug UG-21/

RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

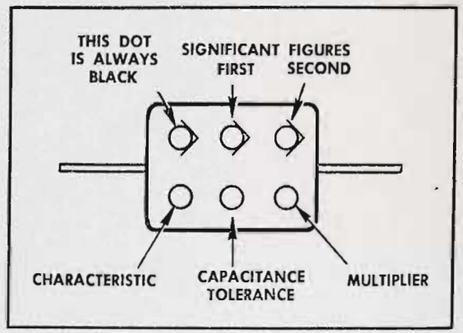


AWS 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



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).

AWS 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

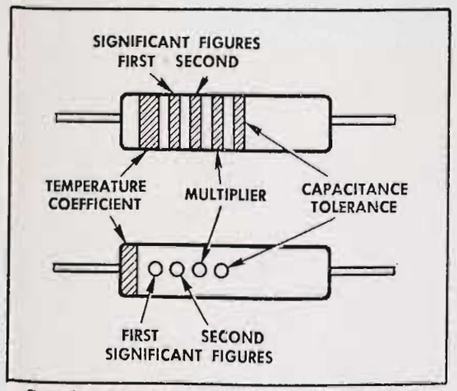


The black dot serves to identify the AWS marking. Capacitors marked with this code are rated at 500 volts, except the following. AWS type CM35 capacitors with capacitances of 6,800, 7,500, and 8,200 micromicrofarads, and AWS type CM40 capacitors with capacitances of 9,100 and 10,000 micromicrofarads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

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

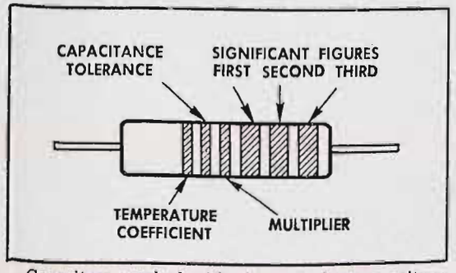
NOTE: These color codes give all capacitances in *micromicrofarads*.

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.

MULTIPLIER		VOLTAGE RATING (VOLTS)	CHARACTERISTIC (AWS MICA-DIELECTRIC)	CAPACITANCE TOLERANCE				TEMPERATURE COEFFICIENT OF CAPACITANCE ×10⁻⁶ MMF/MMF/°C
C	AWS CERAMIC-DIELECTRIC			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)	
	1		A	20	20	20	2.0	0
	10	100	B	1	1	1		− 30
	100	200	C	2	2	2		− 80
	1000	300	D	3	3	2.5	0.25	−150
		400	E	4	4			−220
		500	F	5	5	5	0.5	−330
		600	G	6	6			−470
		700		7	7			−750
	0.01	800		8	2.5			+ 30
	0.1	900		9	10	10	1.0	Not specified
		1000		5				
		2000		10				
		500		20				

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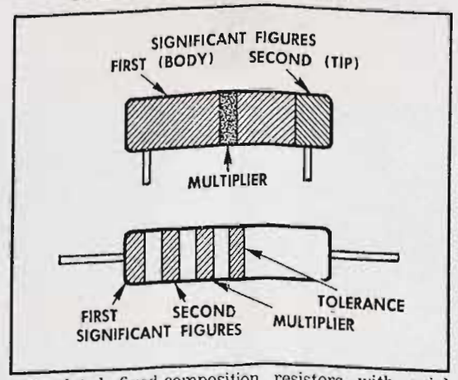
Figure 145. Capacitor color codes.

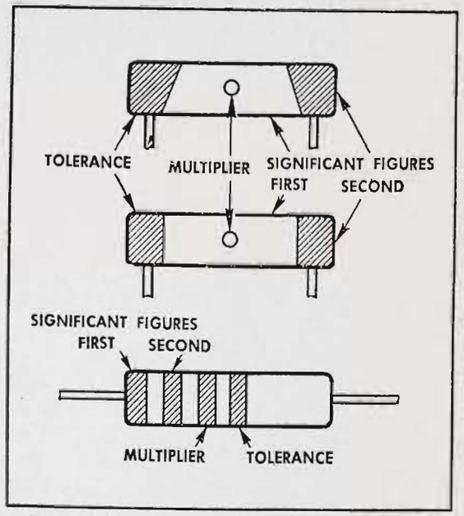
RESISTOR COLOR CODES

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)*

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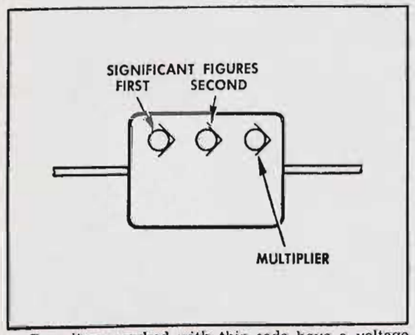
Figure 146. Resistor color codes.

FIGURES 145, 146

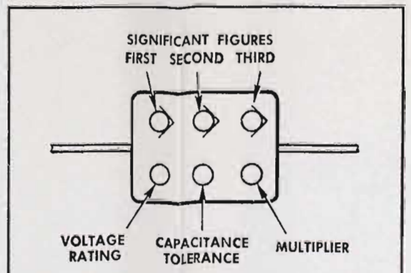
CAPACITOR COLOR CODES

RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

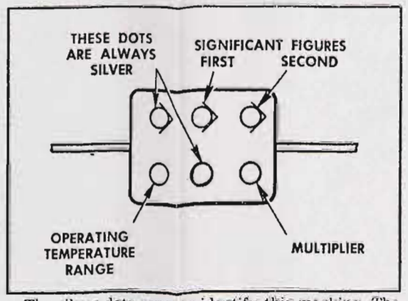


Capacitors marked with this code have a voltage rating of 500 volts.

RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

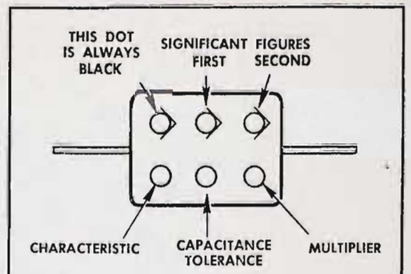


AWS 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



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).

AWS 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



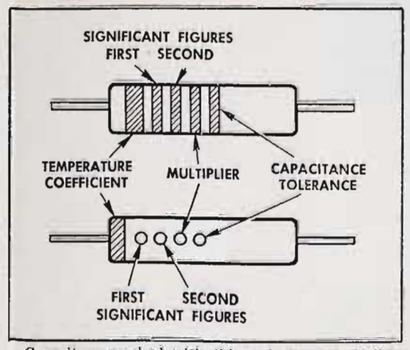
The black dot serves to identify the AWS marking. Capacitors marked with this code are rated at 500 volts, except the following. AWS type CM35 capacitors with capacitances of 6,800, 7,500, and 8,200 micromicrofarads, and AWS type CM40 capacitors with capacitances of 9,100 and 10,000 micromicrofarads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

RMA: *Radio Manufacturers Association*

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

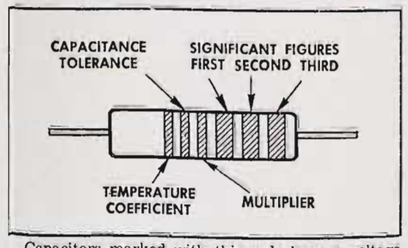
NOTE: These color codes give all capacitances in *micromicrofarads*.

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.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER: RMA MICA- AND CERAMIC-DIELECTRIC AWS MICA- AND PAPER-DIELECTRIC	MULTIPLIER: AWS CERAMIC-DIELECTRIC	VOLTAGE RATING (VOLTS)	CHARACTERISTIC (AWS MICA-DIELECTRIC)	CAPACITANCE TOLERANCE: RMA & AWS MICA- AND PAPER-DIELECTRIC (PERCENT)	CAPACITANCE TOLERANCE: RMA CERAMIC-DIELECTRIC (PERCENT)	CAPACITANCE TOLERANCE: AWS CERAMIC-DIELECTRIC GREATER THAN 10 MMF (PERCENT)	CAPACITANCE TOLERANCE: AWS CERAMIC-DIELECTRIC LESS THAN 10 MMF (MMF)	TEMPERATURE COEFFICIENT OF CAPACITANCE x10⁻⁶ MMF/MMF/°C
BLACK	0	1	1		A	20	20	20	2.0	0
BROWN	1	10	10	100	B	1	1	1		− 30
RED	2	100	100	200	C	2	2	2		− 80
ORANGE	3	1000	1000	300	D	3	3	2.5	0.25	−150
YELLOW	4	10,000		400	E	4	4			−220
GREEN	5	100,000		500	F	5	5	5	0.5	−330
BLUE	6	1,000,000		600	G	6	6			−470
VIOLET	7	10,000,000		700		7	7			−750
GRAY	8	100,000,000	0.01	800		8	2.5			+ 30
WHITE	9	1,000,000,000	0.1	900		9	10	10	1.0	Not specified
GOLD		0.1		1000		5				
SILVER		0.01		2000		10				
NO COLOR				500		20				

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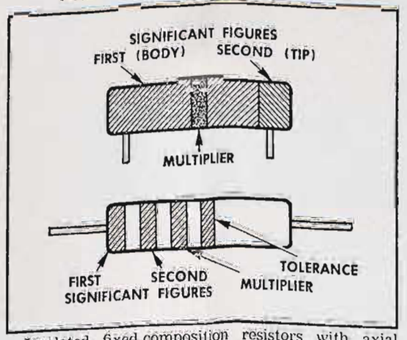
Figure 145. Capacitor color codes.

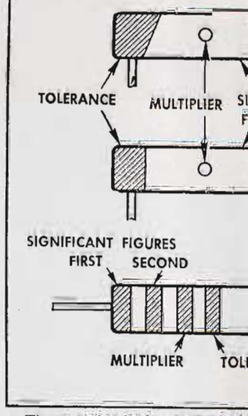
RESISTOR COLOR CODES

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 CO FIXED COMPOSITION



The exterior body color of ins be any color except black. The tan. The exterior body color of with axial leads may be either exterior body color of uninsu radial leads may be black or it the first significant figure of th

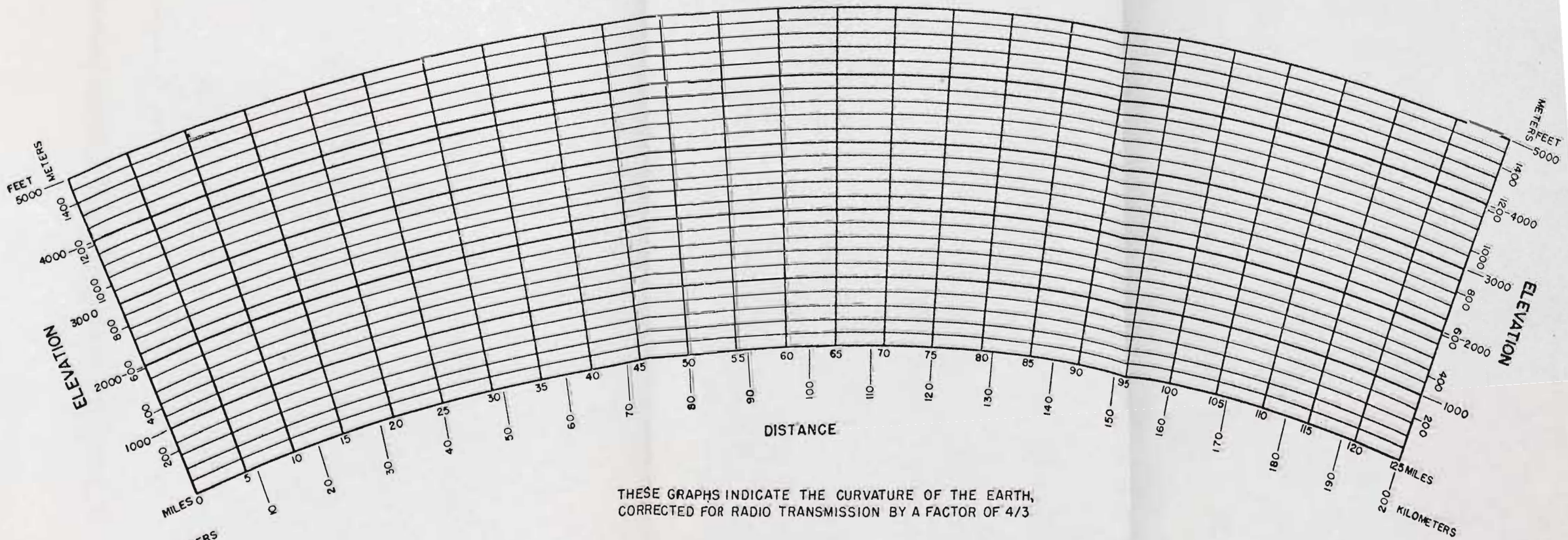
COLOR	SIGNIFICANT FIGURE	MULTIPLIER	TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	
RED	2	100	
ORANGE	3	1000	
YELLOW	4	10,000	
GREEN	5	100,000	
BLUE	6	1,000,000	
VIOLET	7	10,000,000	
GRAY	8	100,000,000	
WHITE	9	1,000,000,000	
GOLD		0.1	5
SILVER		0.01	10
NO COLOR			20

RMA: *Radio Manufac*

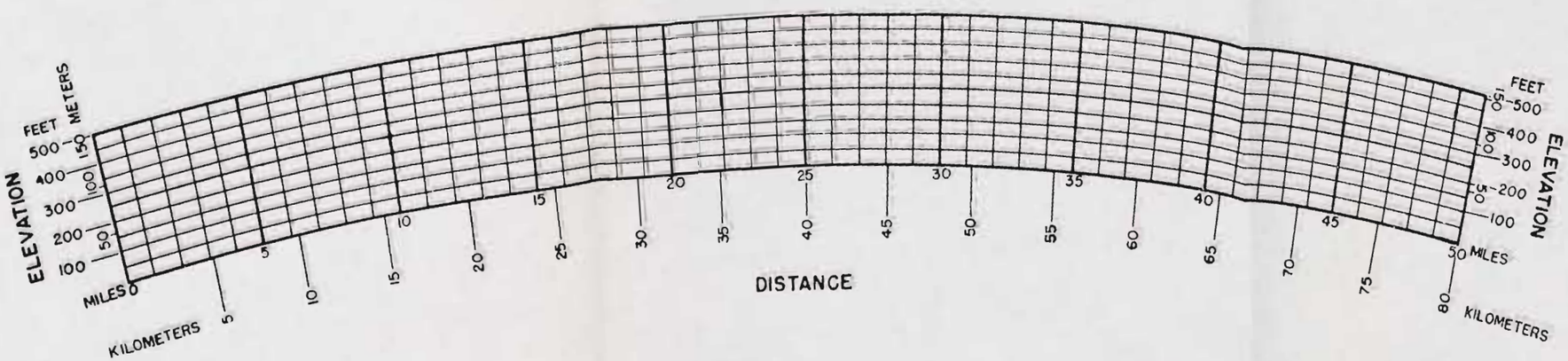
AWS: *American War (American Sta*

Figure 146. Resistor color codes.

GRAPHS FOR PLOTTING PROFILES FROM CONTOUR MAPS



THESE GRAPHS INDICATE THE CURVATURE OF THE EARTH,
CORRECTED FOR RADIO TRANSMISSION BY A FACTOR OF 4/3



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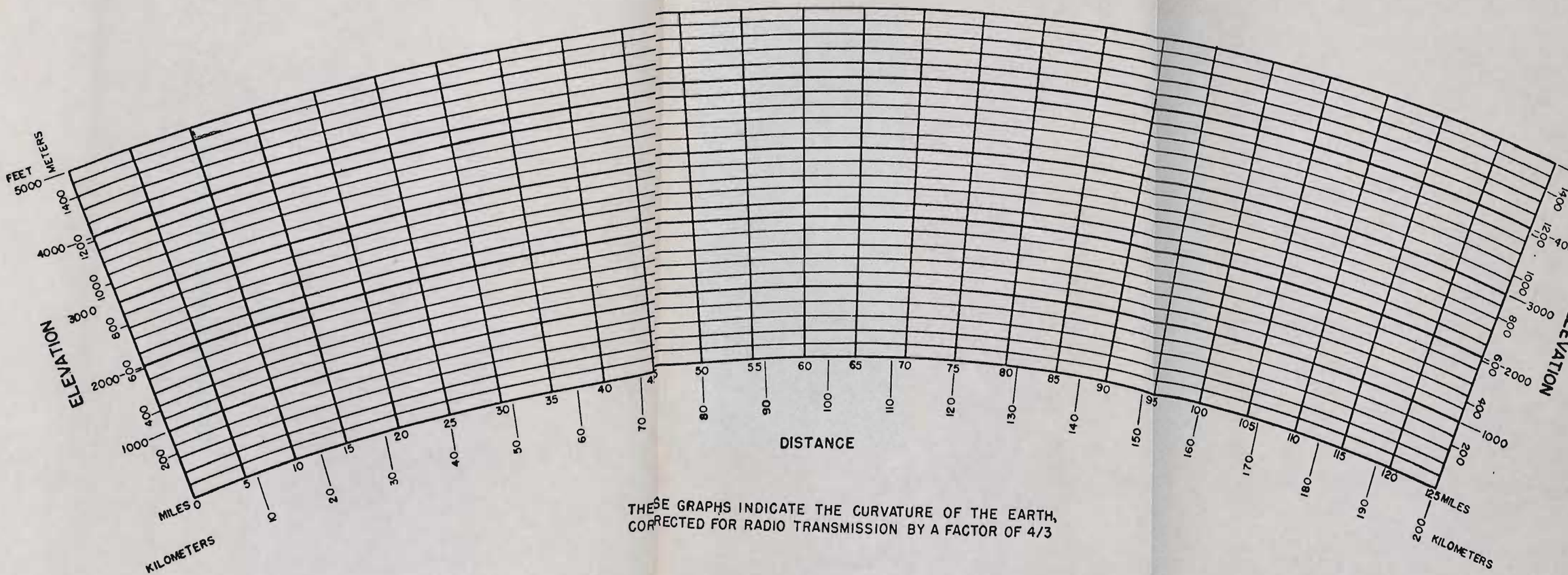
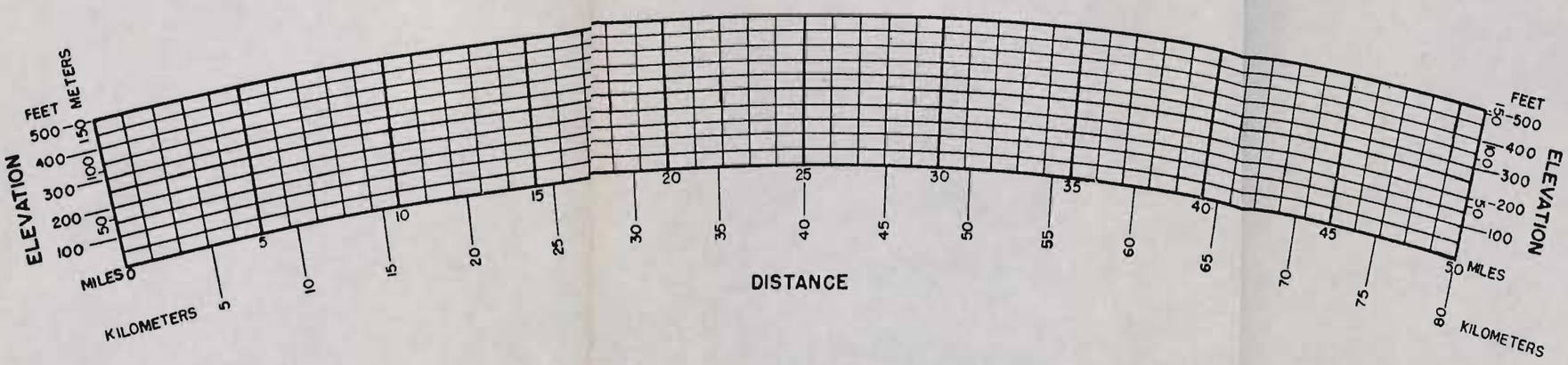
GRAPHS FOR PLOTTING PROFILES FROM CONTOUR MAPS

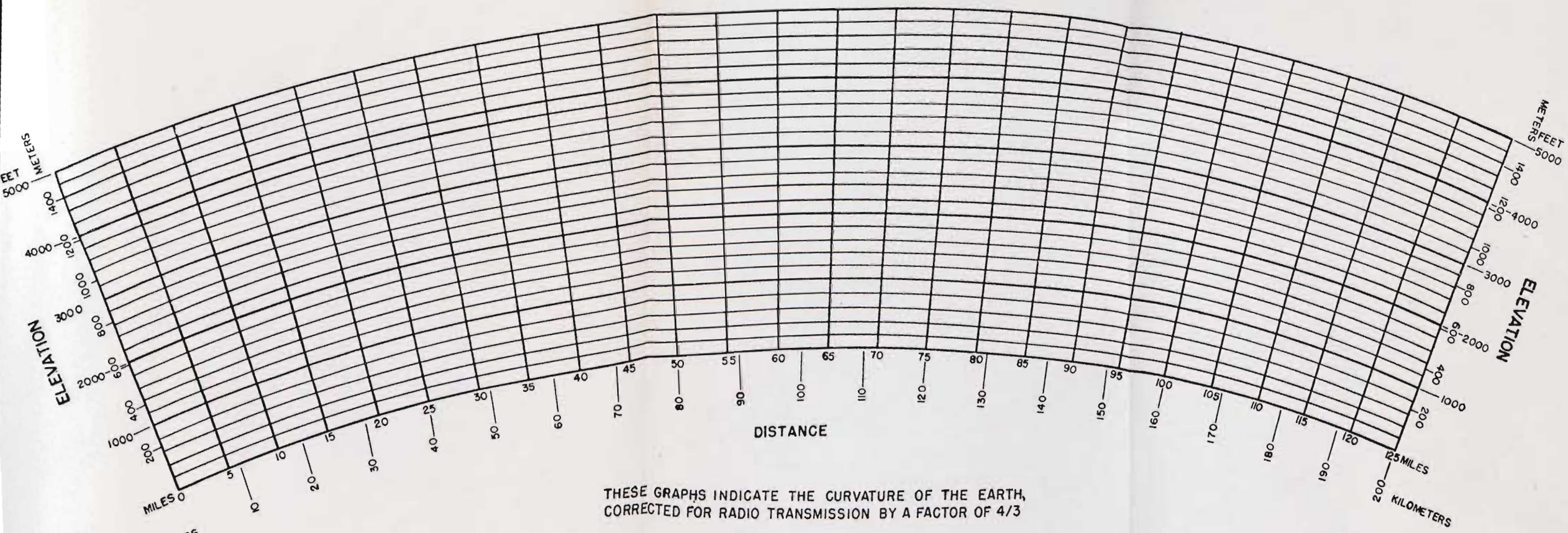


THESE GRAPHS INDICATE THE CURVATURE OF THE EARTH, CORRECTED FOR RADIO TRANSMISSION BY A FACTOR OF 4/3

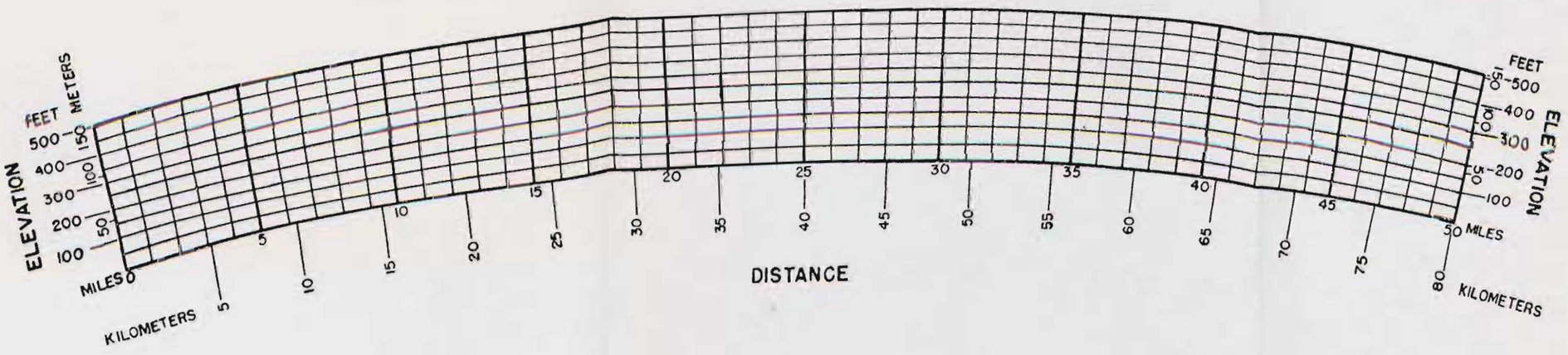


TL 16274

GRAPHS FOR PLOTTING PROFILES FROM CONTOUR MAPS

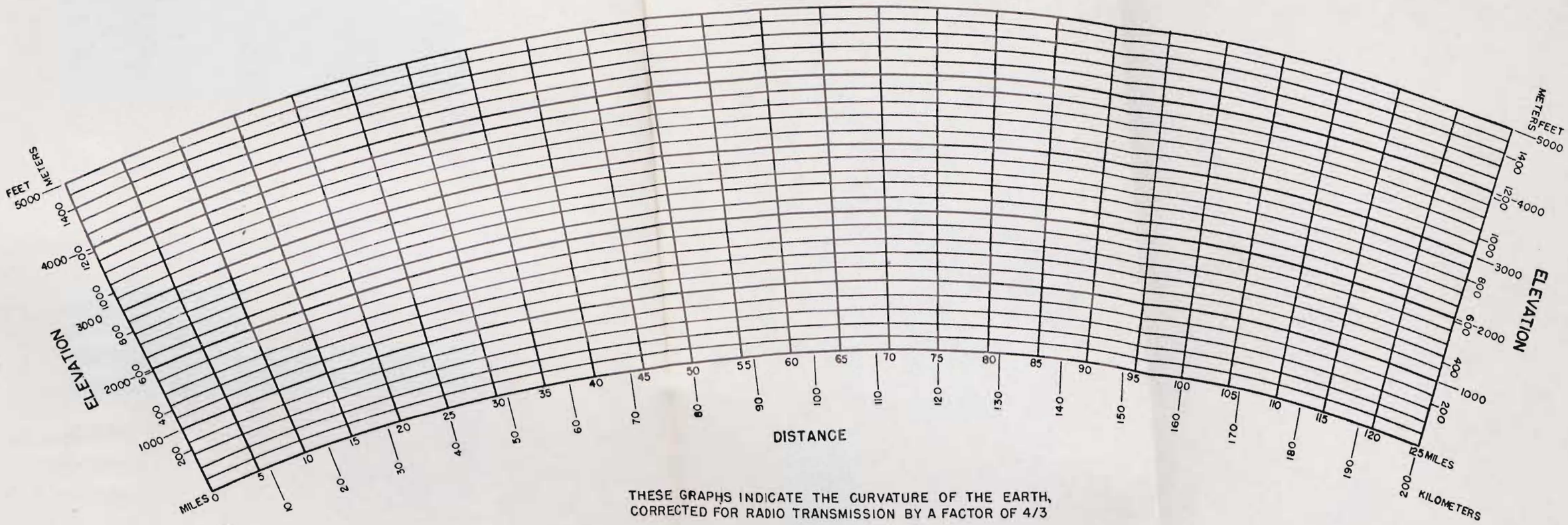


THESE GRAPHS INDICATE THE CURVATURE OF THE EARTH, CORRECTED FOR RADIO TRANSMISSION BY A FACTOR OF 4/3

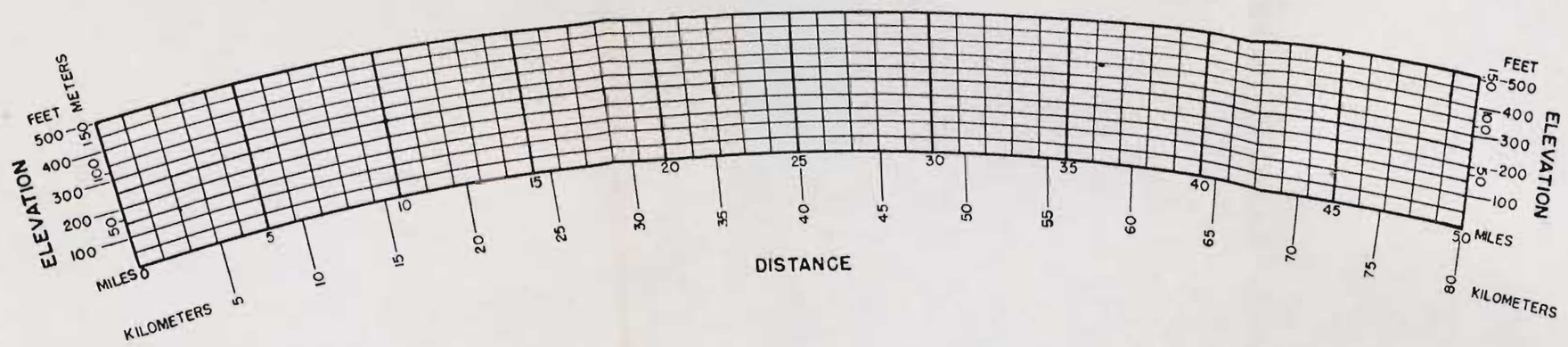


TL 16274

GRAPHS FOR PLOTTING PROFILES FROM CONTOUR MAPS



THESE GRAPHS INDICATE THE CURVATURE OF THE EARTH,
CORRECTED FOR RADIO TRANSMISSION BY A FACTOR OF 4/3



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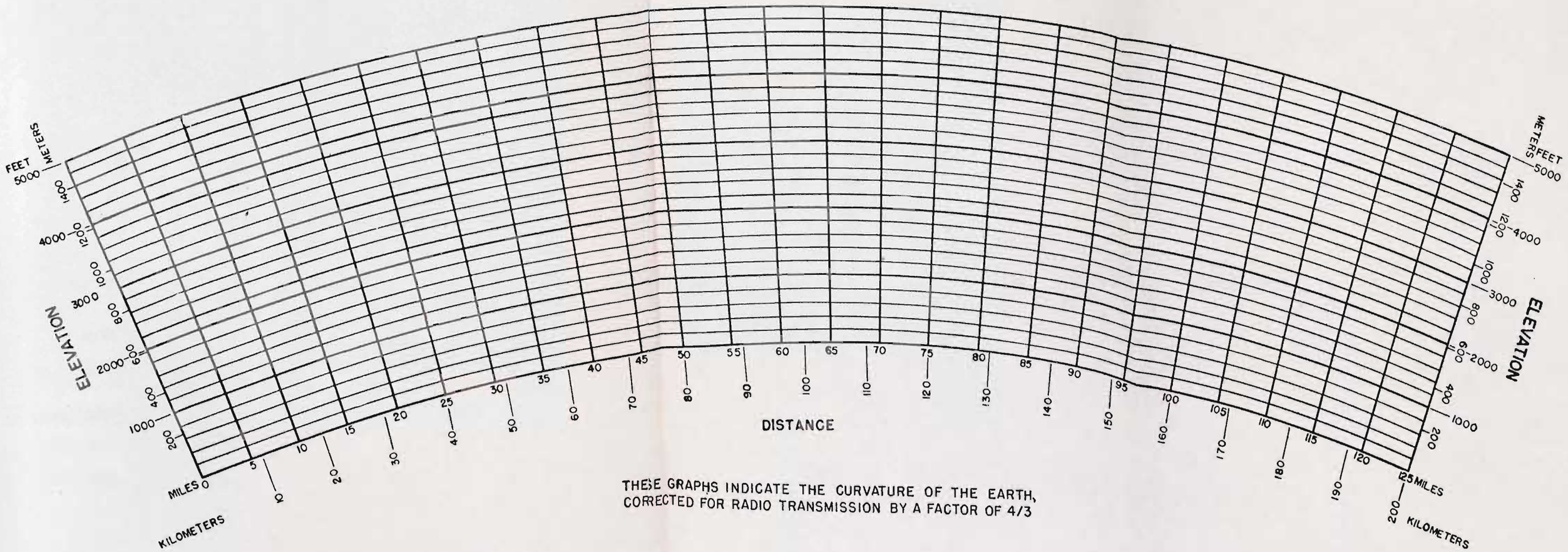
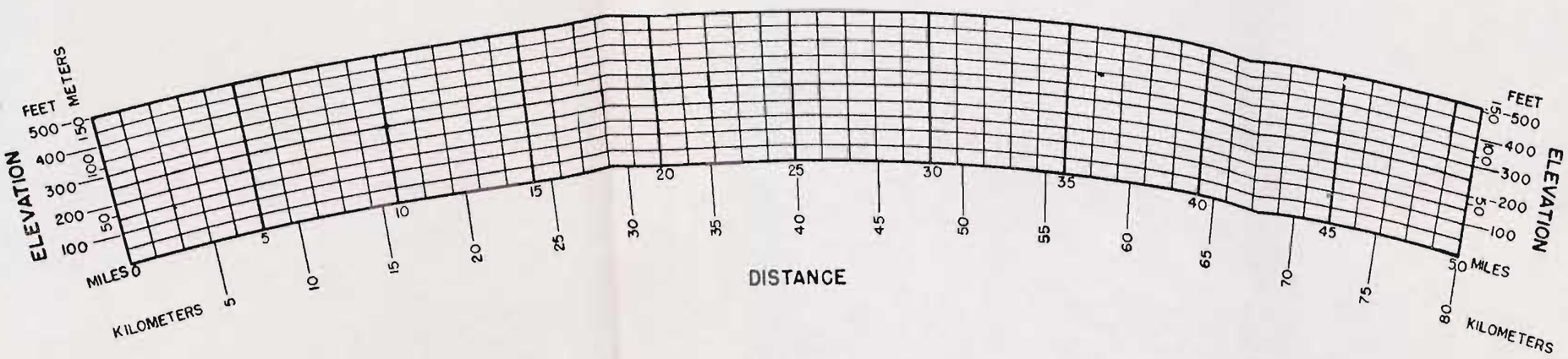
GRAPHS FOR PLOTTING PROFILES FROM CONTOUR MAPS



THESE GRAPHS INDICATE THE CURVATURE OF THE EARTH,
CORRECTED FOR RADIO TRANSMISSION BY A FACTOR OF 4/3



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