TM 11-600

WAR DEPARTMENT TECHNICAL MANUAL

RADIO SETS SCR-508-A, C, D, AM, CM, DM; SCR-528-A, C, D, AM, CM, DM; and AN/VRC-5

WAR DEPARTMENT • MAY 1947

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This manual supersedes TM 11-600, Radio Sets SCR-508-(*), SCR-528-(*), and SCR-538-(*), 25 March 1943; including C 1, 19 January 1944; and C 2, 20 January 1945

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For explanation of distribution formula, see TM 38–405.

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WARNING

HIGH VOLTAGE

is used in the operation of this equipment.

DEATH ON CONTACT

may result if operating personnel fail to observe safety precautions.

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, crow bars, 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—Meter, crystal, controls, tubes, coils, microphone, switches, capacitors, dynamotors, relays.
2. Cut—Cords, headsets, cables, wiring.
3. Burn—Cords, Technical Manuals, resistors, capacitors, coils, wiring, relays.
4. Bend—Panels, cabinet, mounting, mast sections, chassis.
5. Bury or scatter—All the above pieces after destroying.

DESTROY EVERYTHING

SAFETY NOTICE

Voltages as high as 650 volts are used in the operation of this equipment. These voltages are dangerous to life.

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

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

Be sure that high-voltage plate circuits are dead before performing preventive maintenance on this equipment. High-voltage capacitors in power supplies must be discharged manually before performing preventive maintenance operations.

When servicing the equipment, open the vehicular battery circuit. Shorting this battery circuit will cause a flash and severe burns unless the power is turned off.

High radio-frequency voltages may develop on the antenna of this radio set. *Do not touch the antenna while the set is turned on.* Radio-frequency burns may result.

WARNING

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



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 ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

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 breath 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 medical officer, 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. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. 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.

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 manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*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;

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

f. The resuscitation procedure is as follows:

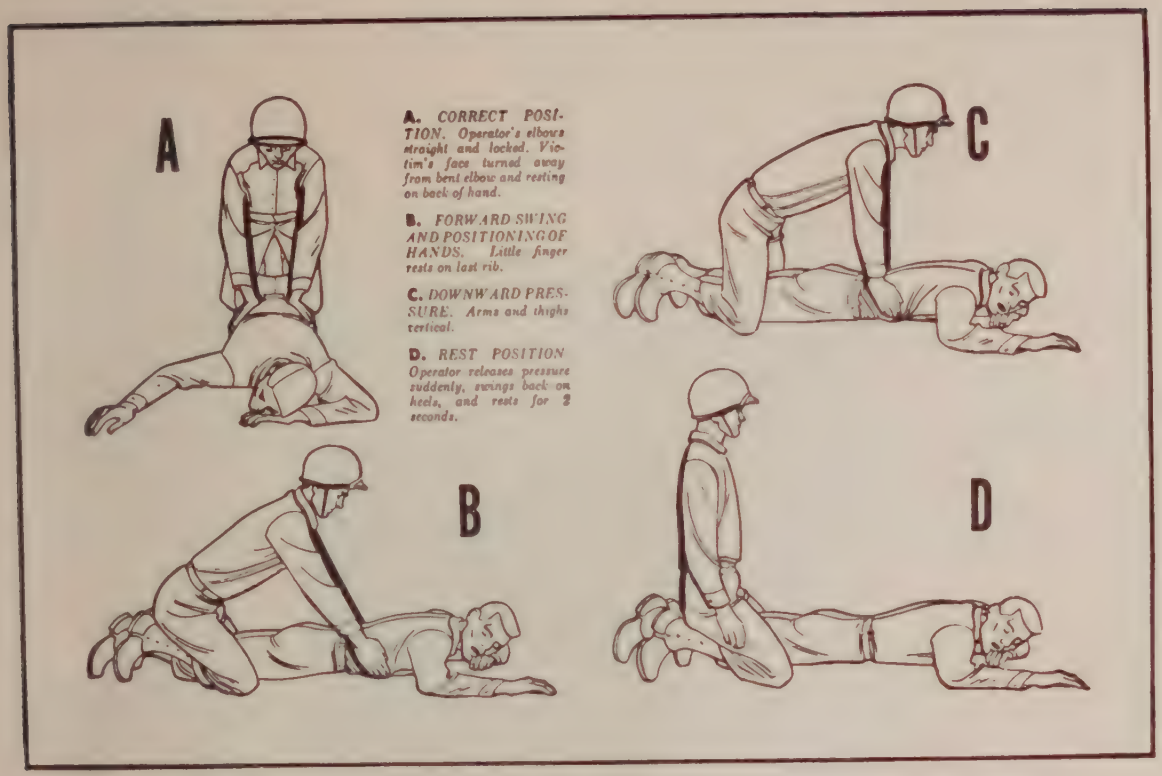
(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit on the heels.

(*3*) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

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

TL15338-D



seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

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

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. 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 must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

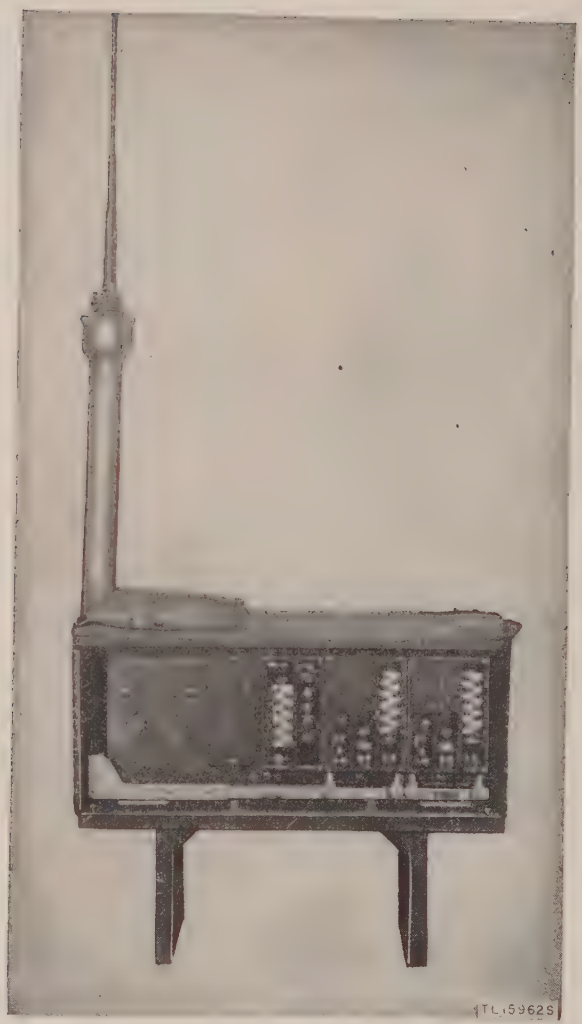


Figure 1. Radio Set SCR–508–(*).

This manual supersedes TM 11-600, Radio Sets SCR-508-(*), SCR-528-(*), and SCR-538-(*), 25 March 1943; including C 1, 19 January 1944; and C 2, 20 January 1945.

PART ONE

INTRODUCTION

Section I. DESCRIPTION OF RADIO SETS SCR–508–(*), SCR–528–(*), AND AN/VRC–5

1. General

a. Radio Sets SCR–508–(*), SCR–528–(*), and AN/VRC–5 provide frequency-modulated (f-m) radiotelephone facilities. The radio sets may be installed and operated in combat vehicles such as tanks, scout cars, half-tracks, and command cars, or any other authorized vehicles (fig. 1).

b. Radio Set SCR–508–(*) consists basically of Radio Transmitter BC–604–(*) and two Radio Receivers BC–603–(*) (fig. 2). The transmitter provides f-m, radiotelephone transmitting facilities for antiaircraft and antitank warning and control nets, for base stations at battalion command posts for fire control and fire-direction nets, and for intrabattalion communication. The receivers provide f-m radiotelephone reception facilities for car, platoon, company, battalion, and regimental commanders, and for staff officers and commanders in higher echelon.

c. Radio Set SCR–528–(*) consists mainly of one Radio Transmitter BC–604–(*) and one Radio Receiver BC–603–(*) (fig. 2).

d. Radio Set AN/VRC–5 is used for intercommunication with Radio Set SCR–508(*). It consists of Radio Receiver BC–603–(*) and Radio Transmitter BC–604–(*) mounted on Mountings FT–346 and FT–508, respectively.

e. Radio Sets SCR–508–A, SCR–508–C, and SCR–508–D are identical except that equipments marked with issue letters C and D include modifications. The same is true of Radio Sets SCR–528–A, C, and D.

f. Later models of Radio Sets SCR–508–(*) have been modified by the manufacturer and incorporate all or most of the first 10 modification work orders. The nameplates of the basic components of these equipments are marked with the letter M following the nomenclature of the equipment thus: Radio Receiver BC–603–(*)M. The radio sets are designated as Radio Sets SCR–508–AM, CM, and DM. The same is true of later models of Radio Sets SCR–528–(*). These modified equipments will be referred to in the manual as Radio Sets SCR–508–(*)M, and SCR–528–(*)M, whereas the SCR–508–A, C, and D models and SCR–528–A, C, and D will be referred to as the unmodified earlier models of Radio Sets SCR–508–(*), and SCR–528–(*), respectively.

g. Official nomenclature followed by (*) is used to indicate all models of the item of equipment included in this technical manual. Thus Radio Set SCR–508–(*) represents Radio Sets SCR–508–A, C, D, AM, CM, and DM.

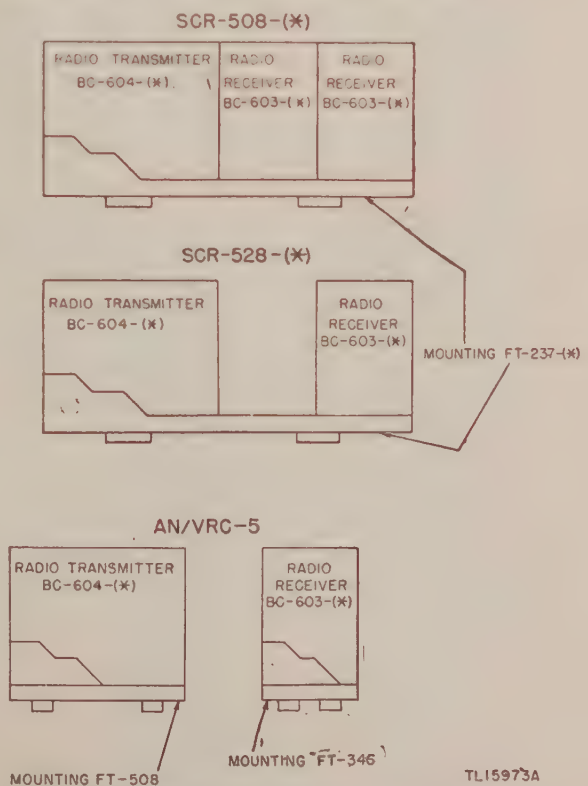


Figure 2. Radio Set SCR–508–(*), SCR–528–(*), AN/VRC–5, basic components.

2. Application of Equipment

a. A simple block diagram of a communication system using Radio Set SCR–508–(*) in each of two vehicles is shown in figure 3. Each radio station may transmit on any one of 10 channels and receive on any one of 20 preset channels. Radio Receiver BC–603–(*) may also be tuned manually to any frequency in the range 20 to 27.9 megacycles (mc). Two-way communication may be established between the stations by use of a single channel, or by use of two channels. Hence, each station may operate in the same or several tactical nets and in liaison channels according to the plan of combat operation. The antenna at each station is connected to the two radio receivers during stand-by periods and to the transmitter during transmission. An interphone system using the transmitter audio stages is provided for communication between vehicle members.

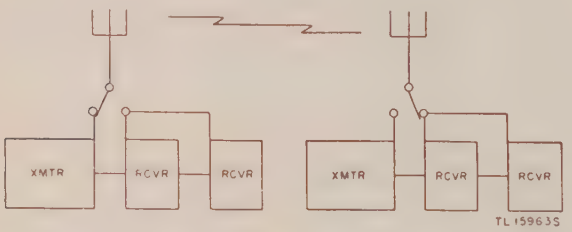


Figure 3. Radio Set SCR–508–(*), simple block diagram.

b. The block diagram of a communication system using Radio Set SCR–528–(*) is similar to the system using Radio Set SCR–508–(*). However, the number of preset receiving channels is reduced to 10 as only one receiver is provided.

c. Radio Set AN/VRC–5 is essentially the same as Radio Set SCR–528–(*), except that two mountings are used.

d. Figure 4 shows the location of the radio set in the frequency spectrums. This figure also shows other radio sets with which Radio Sets SCR–508–(*), SCR–528–(*), and AN/VRC–5 can communicate.

3. Technical Characteristics

a. Radio Transmitter BC–604–(*).

Frequency range:
10 preset channels....20.0 to 27.9 megacycles (mc) (80 channels).
Frequency range (Cont.)
Channel spacing.....100 kilocycles (kc)
Crystal frequency.....370.370 to 516.667 kc
Transmitter type.....f-m
Type of signal transmitted .....voice
Distance range.....10 to 15 mi †
Type of modulation.....phase modulator coi
Power input:
12-volt input.....20 amp
24-volt input.....12 amp
Nominal power output....30 w
Whip antenna.....10 ft long. Consists of Mast Sections MS–116, MS–117, and MS–118 mounted on Mast Base AB–15/GR.
Power supply.....12-v vehicular battery through Dynamotor DM–35–(*), or 24-v vehicular battery through Dynamotor DM–37–(*).
Weight .....67 lb
Nominal frequency deviation .....40 kc
Frequency multiplication..54
Interphone output.....3 w
Number of tubes.....8
V101, V102, V103. V105, V106, V107, and V108.....VT–164 or JAN–1619
V104 .....VT–165 or JAN–1624

b. Radio Receiver BC–603–(*).

Frequency range.....20.0 to 27.9 mc
Receiver type.....superheterodyne, f-m
Type of signal which can be received.....voice
Number of preset channels.10
Control of channels.....local only
Sensitivity .....1 microvolt (μv)
Intermediate frequency (nominal) .....2.65 mc
Bandwidth .....80 kc
Power output, speaker.....2 w
Power output, headset.....0.2 w
Call signal.....lamp
Noise suppression.....squelch
Power input:
12-volt input.....4 amp
24-volt input.....2 amp
Power supply.....12-v vehicular battery through Dynamotor DM–34–(*), or 24-v vehicular battery through Dynamotor DM–36–(*).
Antenna .....Uses same antenna as transmitter
Weight .....35 lb

† This value is an approximation, since the range will vary considerably according to terrain and atmospheric conditions.

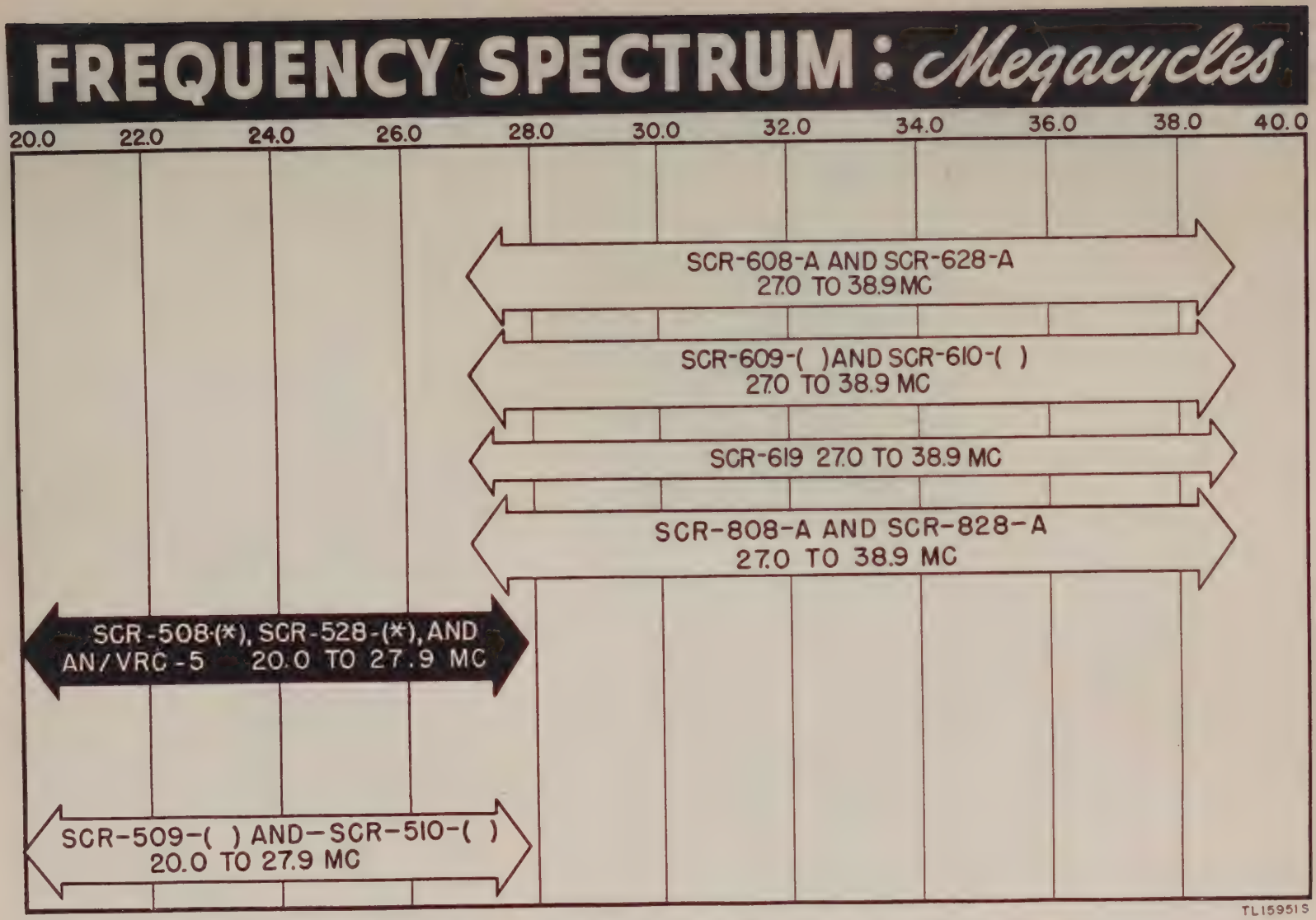


Figure 4. Frequency spectrum of Radio Sets SCR-508-(*), SCR-528-(*), and AN/VRC-5.

Number of tubes.....10

V1	VT-112 or JAN-6AC7
V2	VT-112 or JAN-6AC7
V3	VT-94 or JAN-6J5
V4	VT-209 or JAN-12SG7
V5	VT-209 or JAN-12SG7
V6	VT-112 or JAN-6AC7
V7	VT-90 or JAN-6H6
V8	VT-107-A or JAN-6V6GT
V9	VT-229 or JAN-6SL7GT
V10	VT-229 or JAN-6SL7GT

4. Table of Components

a. RADIO SET SCR–508–(*). Radio Set SCR–508–(*) is composed of a 12- or 24-volt basic unit and an installation unit. The basic unit is common to all installations. The installation unit varies and depends upon the type of installation. The table below is the Parts Control Lists listing of components of the radio set required for its installation in a personnel carrier half-track M3A1. These components, however, will vary from time to time. Figures 5 and 6 show the components actually provided in one instance where a radio set was ordered. The 12-volt basic unit, common to all 12-volt installations, is shown in figure 5 and a typical installation unit appears in figure 6.

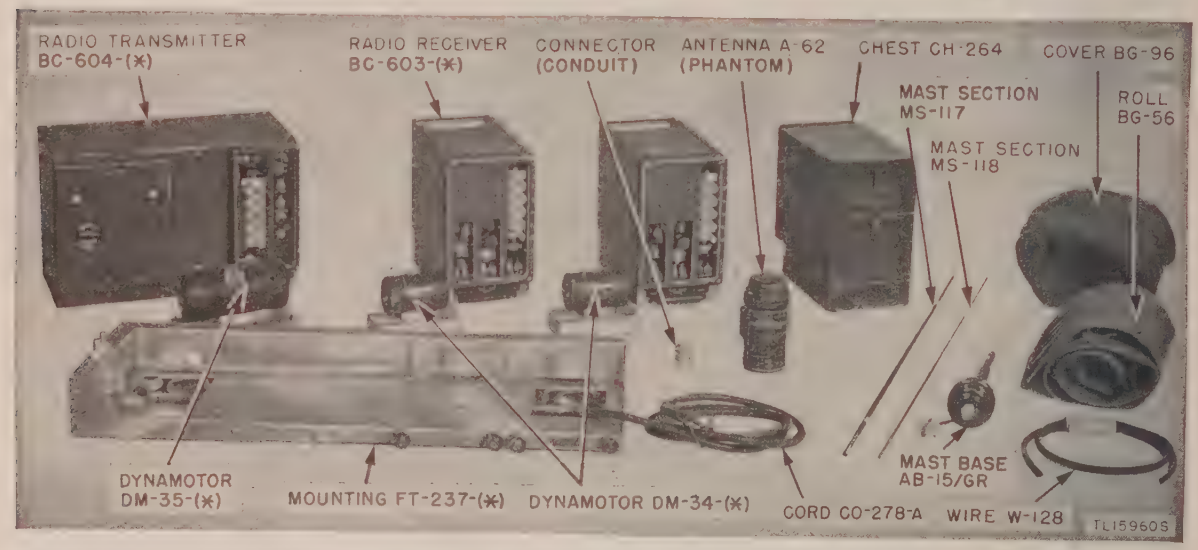


Figure 5. Radio Set SCR–508–(*), basic unit. (12-volt).

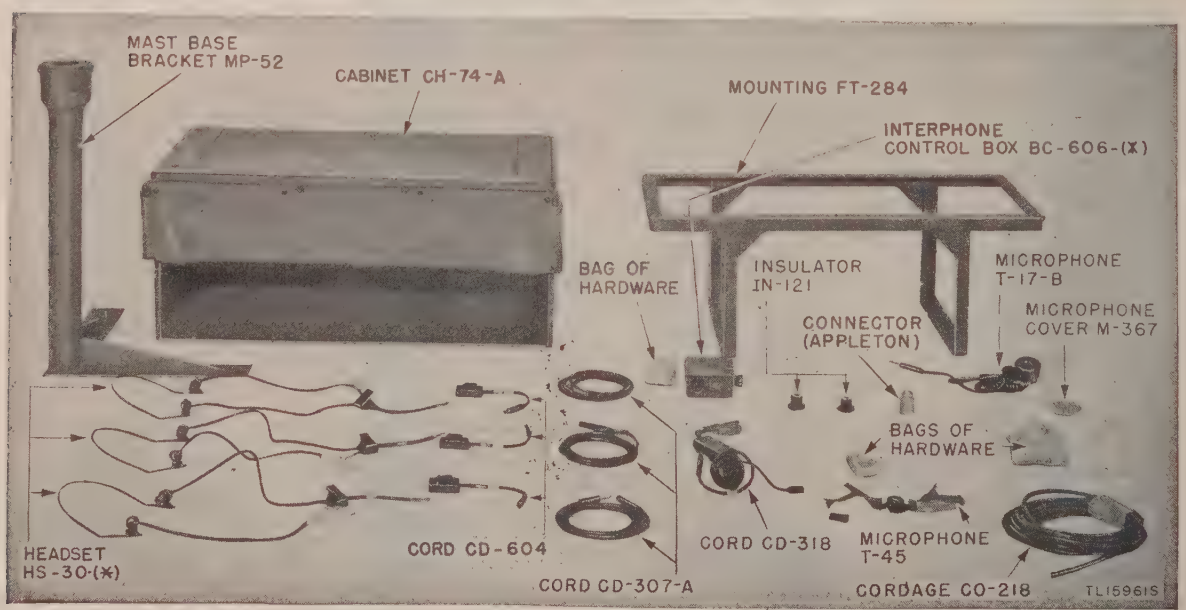


Figure 6. Radio Set SCR–508–(*), typical installation unit.

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu. ft.)	Weight (lb.)
Basic Unit (12-volt):						
Antenna A–62 (Phantom)	1	7	4	4	0.06	3
Mast Base AB–15/GR	1	15				2
Radio Receiver BC–603–(*)	2	11½	6¾	12½	0.5	35
Radio Transmitter BC–604–(*)	1	11½	10¼	18	1.2	67
Roll BG–56–A	1	2	4	42	0.18	1.7
Cover BG–96	1	12½	10½	32	2.2	3.3
Chest CH–264	1	11½	6⅞	11⅞	0.54	12
Dynamotor DM–34–(*)	2	4½	3	6½	0.05	4.7
Dynamotor DM–35–(*)	1	5½	4½	8¼	0.1	9.2
Mounting FT–237–(*)	1	5½	13	33⅝	1.37	44
Mast Section MS–117	2			39½		0.7
Mast Section MS–118	2			39⅝		0.8
Wire W–128	6 ft.			72		0.4
Connector (conduit)	1			1¾		0.3
Installation Unit:						
Interphone Control Box BC–606–H	1	4¼	2¼	4¼	0.06	1.8
Cabinet CH–74	1	18	16	36	5.9	92
Cordage CO–218	18 ft.			252		1.4
Mounting FT–284	1	5	12	33	1.12	26
Headset H–16–U	2					1.0
Cover CW–110–U	1					0.01
Mast Base Bracket MP–52	1	26				20
Microphone T–17	1					0.7
Microphone T–45	1					1.8
Chest Set TD–4	2					1
Bag of hardware	1					2
Connector (conduit)	1			1¾		0.3
TM 11–2721	1					0.3

Note. This list is for general information only. See appropriate publications for information pertaining to requisition of spare parts.

b. RADIO SET SCR–528–(*). Radio Set SCR–528–(*) is identical to Radio Set SCR–508–(*), except that Radio Set SCR–528–(*) has one Receiver BC–603–(*) instead of two. (See fig. 2.)

c. RADIO SET AN/VRC–5. Radio Set AN/VRC–5 is identical to Radio Set SCR–528–(*) except that Radio Set AN/VRC–5 has two separate mountings, FT–346 and FT–508, for the receiver and transmitter, respectively. (See fig. 2.) A typical installation of Radio Set AN/VRC–5 is illustrated in figure 7. Weights and dimensions of the mountings used in this set are shown in the following table.

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu. ft.)	Weight (lb.)
Mounting FT–346	1	3⅞	7	11¾	0.2	6
Mounting FT–508	1	4½	9½	19½	0.3	14.7

Note. This list is for general information only. See appropriate publications for information pertaining to requisition of spare parts.

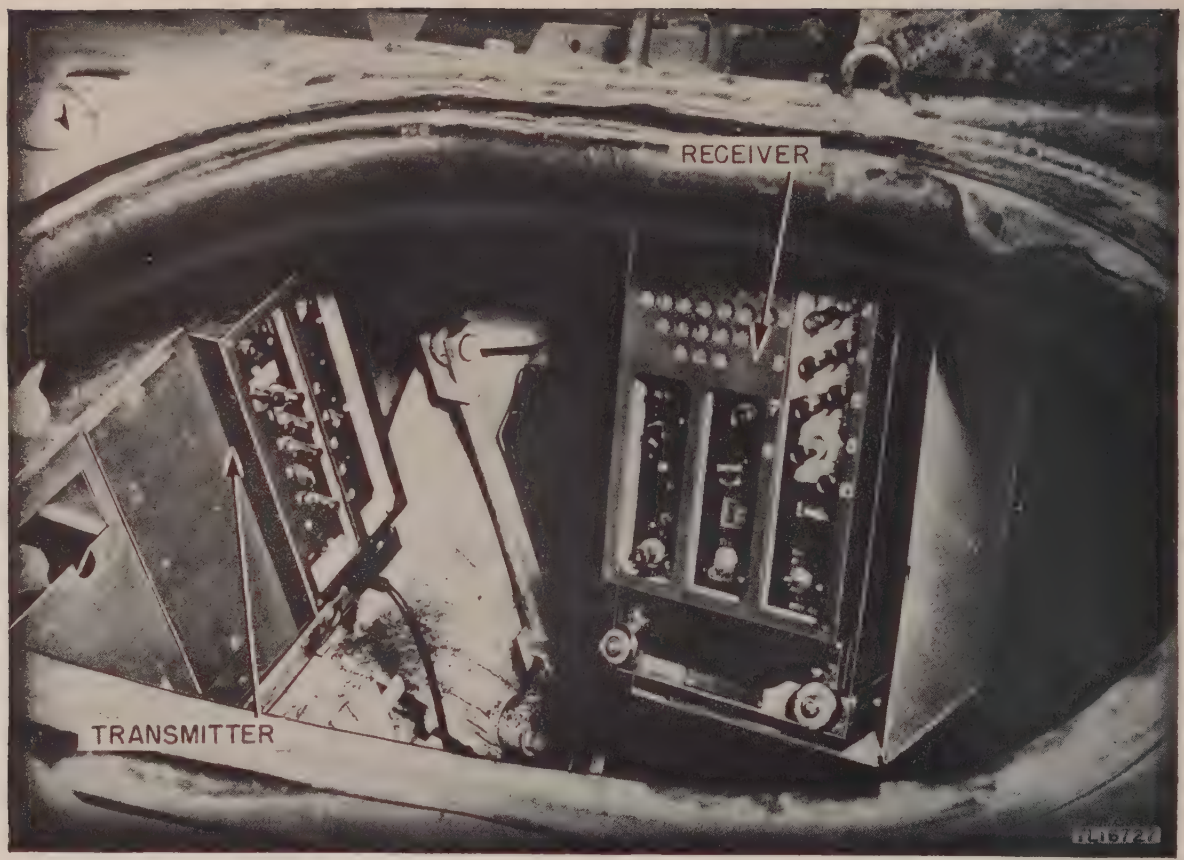


Figure 7. Radio Set AN/VRC–5, mounted in Twin 40–mm Gun Motor Carriage, M19.

5. Packaging Data

a. Radio Set SCR–508–(*) is packed in seven wooden boxes, six of which contain the components of the basic unit and one of which contains the installation unit. Radio Set SCR–528–(*) is packed in six boxes, or one less than required for the SCR–508–(*), since it includes one receiver instead of two.

b. Domestic and export packaging and packing are the same for both sets except that moistureproof and vaporproof barriers, desiccant, and waterproof box liners or bags are not required for domestic packing. The following table lists the dimensions, volume, and weight of the boxes containing Radio Set SCR–508–(*).

Note. Items may be packaged in a different manner from that shown, depending upon supply channels.

Radio Set SCR–508–(*)

Item	Outside dimensions (in.)	Cubic feet (approx.)	Gross weight (lb.)
Box No. 1	39 x 17 x 9½	3.7	83
Box No. 2	17½ x 14¾ x 12⅞	2	65
Box No. 3	17½ x 14¾ x 12⅞	2	65
Box No. 4	33 x 15½ x 16	4.7	129
Box No. 5	45 x 10½ x 6¾	2.8	70
Box No. 6	21 x 13⅜ x 13⅞	2.2	50
Box No. 7	40 x 26 x 25	14.2	248

c. Radio Set AN/VRC–5 is packed in approximately the same manner as Radio Set SCR–528–(*).

6. Radio Transmitter BC–604–(*)

This f-m transmitter operates over a frequency range of 20.0 to 27.9 mc and delivers a carrier power to the antenna of approximately 30 watts. Figure 8 is an oblique view of the trans-

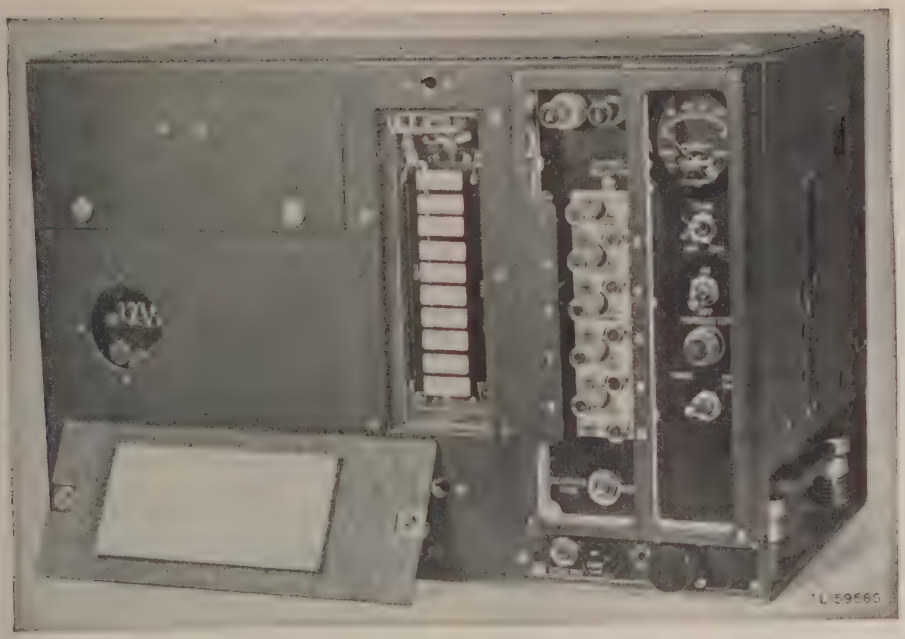


Figure 8. Radio Transmitter BC–604–(*), with crystal unit operating compartment open, oblique view.

mitter. A view of the right-hand end of the transmitter showing the various controls and access openings is shown in figure 9. The front panel contains 10 push buttons (fig. 10) by means of which any of 10 preadjusted transmitting channels may be immediately selected. The transmitter audio stages are used to modulate the r-f carrier, and are also used for interphone operation. The use of the transmitter as a radio transmitter or as an audio amplifier is controlled at the transmitter panel or from remote interphone control boxes. When the transmitter dynamotor is on, the receiver output is disabled. Audio modulation of the transmitter is heard as sidetone in all interphone headsets. Either a carbon or a magnetic microphone may be used with the transmitter. The magnetic microphone, however, is not generally used. The transmitter receives its power from a 12- or 24-volt dynamotor mounted in the transmitter. The top and bottom dust covers can be removed by turning the fasteners ¼ turn to the left and lifting the covers off the transmitter.

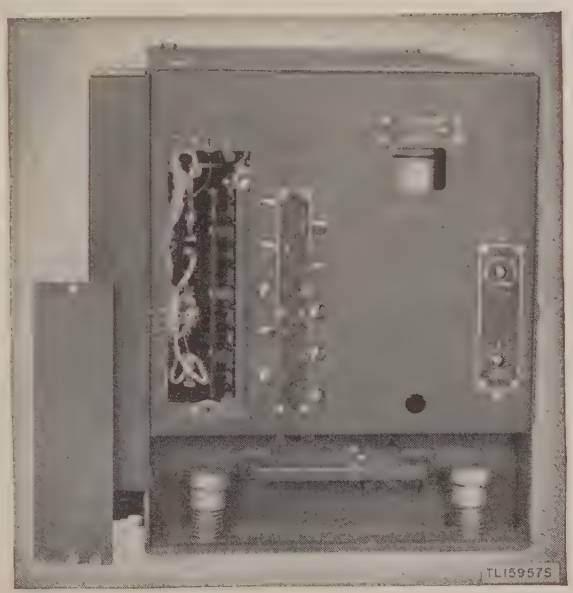


Figure 9. Radio Transmitter BC–604–(*), with cover plate removed, right-hand view.

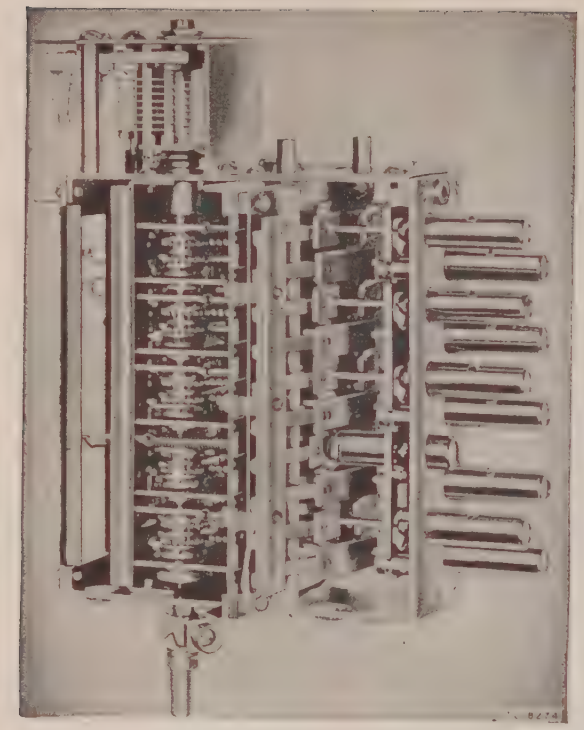


Figure 10. Radio Transmitter BC–604–(*), push-button assembly, left side view.

7. Radio Receiver BC–603–(*)

The receiver is of the superheterodyne type and is intended for reception of f-m signals within the range of 20.0 to 27.9 mc. The receiver can deliver an output of approximately 2 watts to its self-contained speaker or about 200 milliwatts to its headset circuits. A front view of the receiver is shown in figure 11 and an oblique rear view is shown in figure 12. The front panel contains 10 push buttons by means of which any one of 10 preadjusted receiving channels may be selected. (See fig. 13.)

The receiver is mounted on the right-hand side of Mounting FT–237. A disabling circuit grounds the output stage of the receiver when the transmitter dynamotor is on. The receiver output is also fed to the crew member interphone stations through the mounting. A squelch circuit is provided to eliminate noise when no signal is being received. In addition to the usual limiter circuits, a delayed automatic-volume-control (a-v-c) circuit is incorporated to limit the signal more efficiently prior to its application to the discriminator. The power for the receiver is supplied by a 12- or 24-volt dynamotor mounted in the receiver. The receiver dust cover may be removed by turning the fastener on the rear of the cover (fig. 12) ¼ turn to the left and sliding the cover off the rear of the receiver.

8. Dynamotor DM–34–(*) or DM–36–(*)

The two dynamotors that can be used for the operation of the receiver are identical except for the input voltage. Dynamotor DM–34–(*) operates from a 12-volt battery and Dynamotor DM–36–(*) operates from a 24-volt battery. Two views of the dynamotors are shown in figures 14 and 15.

The dynamotors are totally inclosed. Their armatures are dynamically balanced and are supported by two single-race ball bearings. Both dynamotors are shunt wound. The primary and secondary windings are wound in the same armature slots, but the two windings

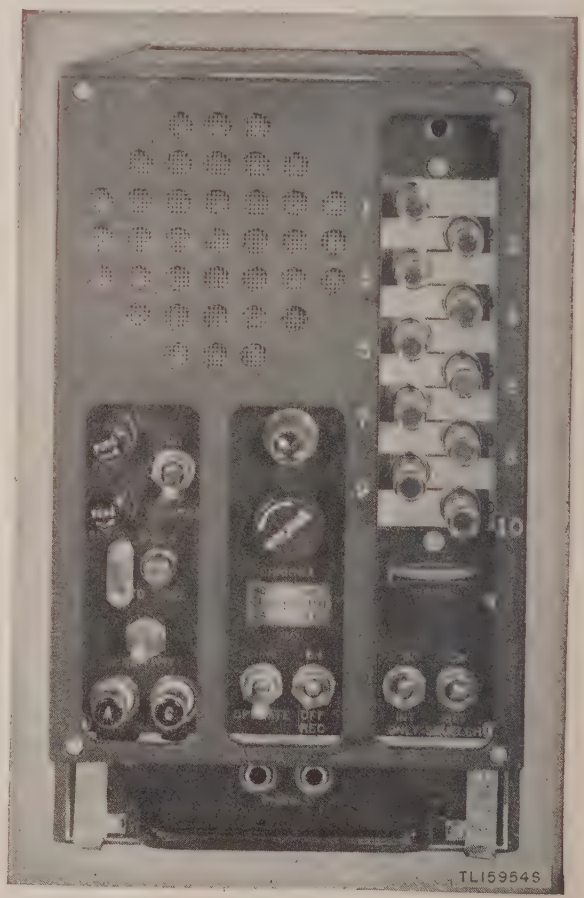


Figure 11. Radio Receiver BC–603–(*), front view.



Figure 12. Radio Receiver BC–603–(*), rear view.

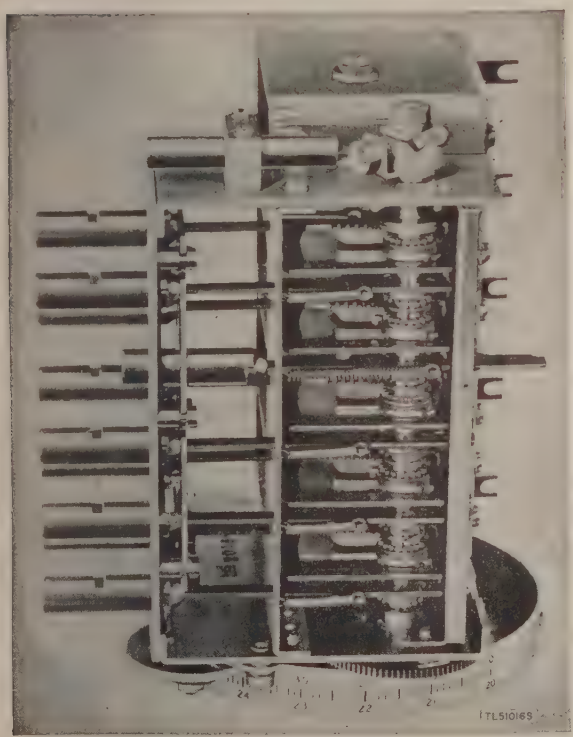


Figure 13. Radio Receiver BC–603–(*), push-button assembly, right side view.

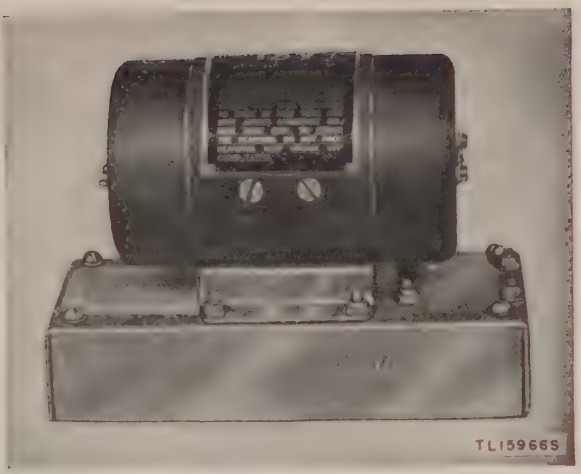


Figure 14. Dynamotor DM–34–(*) or Dynamotor DM–36–(*), side view.

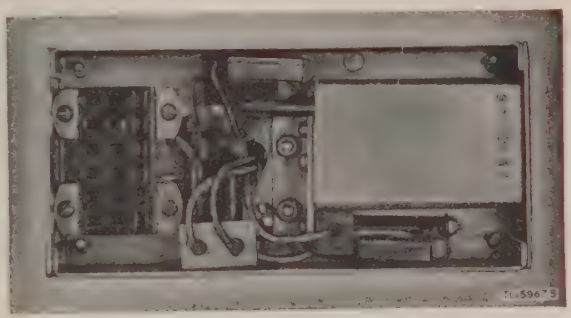


Figure 15. Dynamotor DM–34–(*) or Dynamotor DM–36–(*), bottom view.

are brought out to separate commutators mounted on opposite ends of the armature shaft. A multicontact jack on the base of each dynamotor is wired so as to make the necessary circuit changes in the receiver for 12- or 24-volt operation when the dynamotor is installed.

9. Dynamotor DM–35–(*) or DM–37–(*)

The two dynamotors that can be used for the operation of the transmitter are identical except for the input voltage. Dynamotor DM–35–(*) operates from a 12-volt battery and DM–37–(*) operates from a 24-volt battery. Two views of the dynamotors appear in figures 16 and 17. Except for screened breathing vents in the end covers, the dynamotors are totally inclosed. In later dynamotors, the screened holes have been omitted in order to reduce the entrance of dust or sand. This does

not affect the power rating of the dynamotor. Their armatures are dynamically balanced and are supported by two single-race ball bearings. Both dynamotors are compound wound. The primary and secondary are wound in the same armature slots; but the two windings are brought out to separate commutators mounted on opposite ends of the armature shaft. Each dynamotor is mounted on a base and provided with a multicontact connector so that it can be easily installed or replaced. Selection and installation of the proper dynamotor is the only step required to convert to operation on either supply voltage. The multicontact dynamotor jacks are wired so as to make all the circuit changes required in the transmitter for 12- or 24-volt operation when the proper dynamotor is installed.

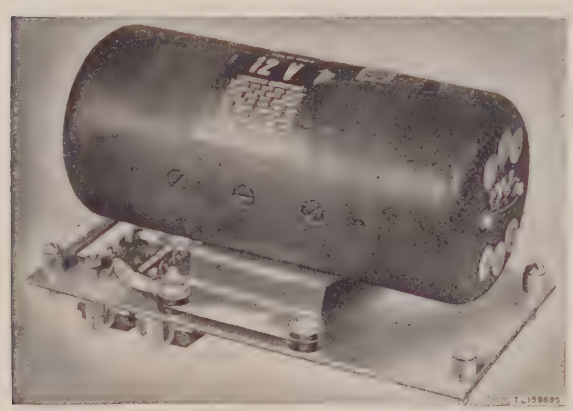


Figure 16. Dynamotor DM–35–(*) or DM–37–(*).

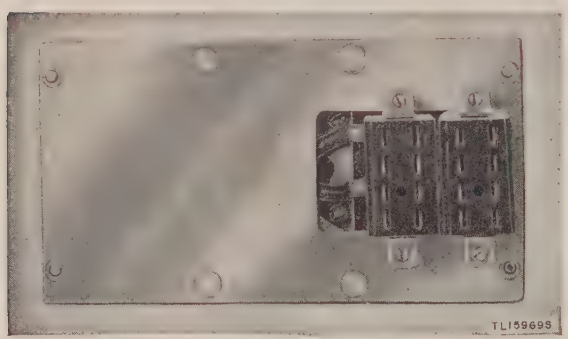


Figure 17. Dynamotor DM–35–(*) or DM–37–(*), subbase view.

10. Mounting FT–237–(*)

a. GENERAL. This mounting, a photograph of which is shown in figure 18, will hold:

(1) Radio Set SCR–508–(*); one Radio Transmitter BC–604–(*) and two Radio Receivers BC–603–(*).

(2) Radio Set SCR–528–(*); one Radio Transmitter BC–604–(*) and one Radio Receiver BC–603–(*). The transmitter must be installed in its allotted place at the left end of the mounting (fig. 19), but the receiver may be installed in either of the two right-hand positions. Each unit is secured to the mounting by thumbscrew clamps and may be quickly removed without tools. The dust covers are provided for protection of the unused receptacles. The dust covers should be screwed to the rear of the mounting, as shown in the photograph, when removed from the receptacles to be used. A reversible nameplate bearing the words BATTERY VOLTAGE—12V on one side and BATTERY VOLTAGE—24V on the other side is screwed to the front of the mounting near the right-hand end. To make sure that the correct dynamotor will be installed in the equipment, turn this plate so that it reads 24 volts if a 24-volt battery is being used as a power source, or 12 volts if a 12-volt battery is being used.

b. FASTENING OF MOUNTING. The mounting is secured to the vehicle frame or other support by suitable bolts passed through two heavy bedplates on the mounting. There are four bolt holes in each bedplate. Each bedplate supports the mounting through two sets of rubber shock absorbers. In addition, two rubber snubbers on each bedplate prevent excessive movement of the equipment on the mounting. Electrical bonding straps are connected across each rubber shock absorber so as to provide good (ground) connection to the bedplates.

c. TERMINALS. Two terminals are provided at the left end of the mounting. The antenna system is connected to the terminal designated TR for radio transmission and reception. A ground terminal is provided by a screw on the mounting or, on later mountings, by a ground binding post located near the antenna terminals. This terminal is generally used for grounding the sheath of coaxial cable CO–282. A door in the base plate of the mounting (fig. 20) permits access to battery fuse F401, and terminal strip TS401. One of the spare battery fuses is held in a clip on the under side of the door. The negative battery connection is

made at a screw on the under side of the mounting base plate. This screw is marked X on figure 20. Cordage from one or more remotely located interphone control boxes terminates at terminal strip TS401.

d. Interconnections Between Units. All connections between the transmitter and receiver units and the mounting are made through multicontact plugs and receptacles which are engaged when the units are secured to the mounting. The wiring between receptacles is inclosed in a trough along the rear and left end of the mounting.

Figure 21 shows the battery connections to the mounting. A bottom view of the mounting is shown in figure 22.

12. Mounting FT–346

Radio Receiver BC–603–(*), as a component of Radio Set AN/VRC–5, is mounted on Mounting FT–346. An oblique view and a bottom view of the mounting are shown in figures 23 and 24, respectively. The receiver is secured to the mounting by thumbscrew clamps and may be quickly removed without tools.



Figure 18. Mounting FT–237–(*).

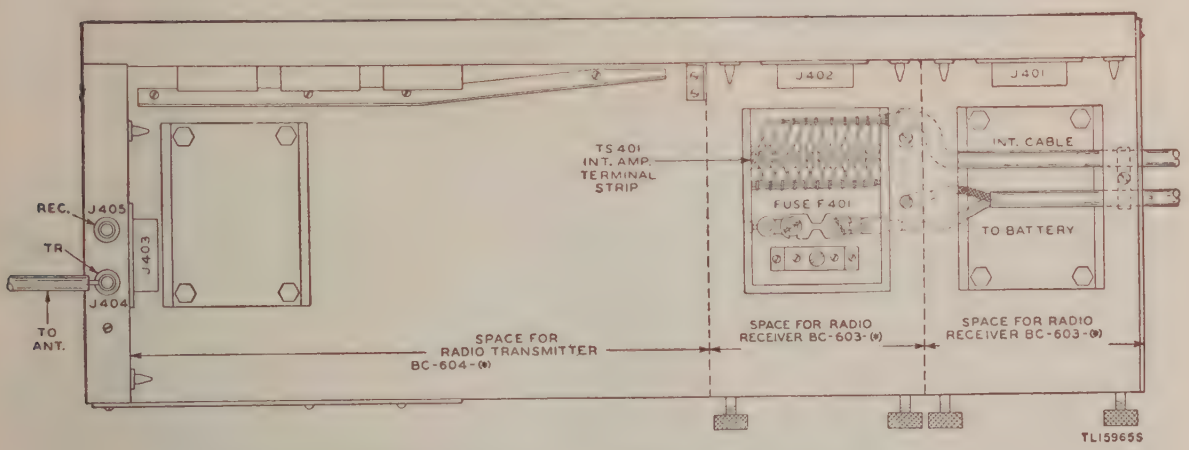


Figure 19. Mounting FT–237–(*), location of transmitter and receivers.

11. Mounting FT–508

Radio Set AN/VRC–5 is mounted on two separate mountings. This break-down is necessary because some vehicles have insufficient space to hold the equipment as a single unit on Mounting FT–237–(*). Radio Transmitter BC–604–(*) is installed on Mounting FT–508.

13. Antenna A–62 (Phantom)

a. Any antenna can be replaced by an equivalent electrical network consisting of a coil, a capacitor, and a resistor. If these elements are properly connected and adjusted, they can be used in place of the regular antenna to tune the transmitter without radiating a strong sig-

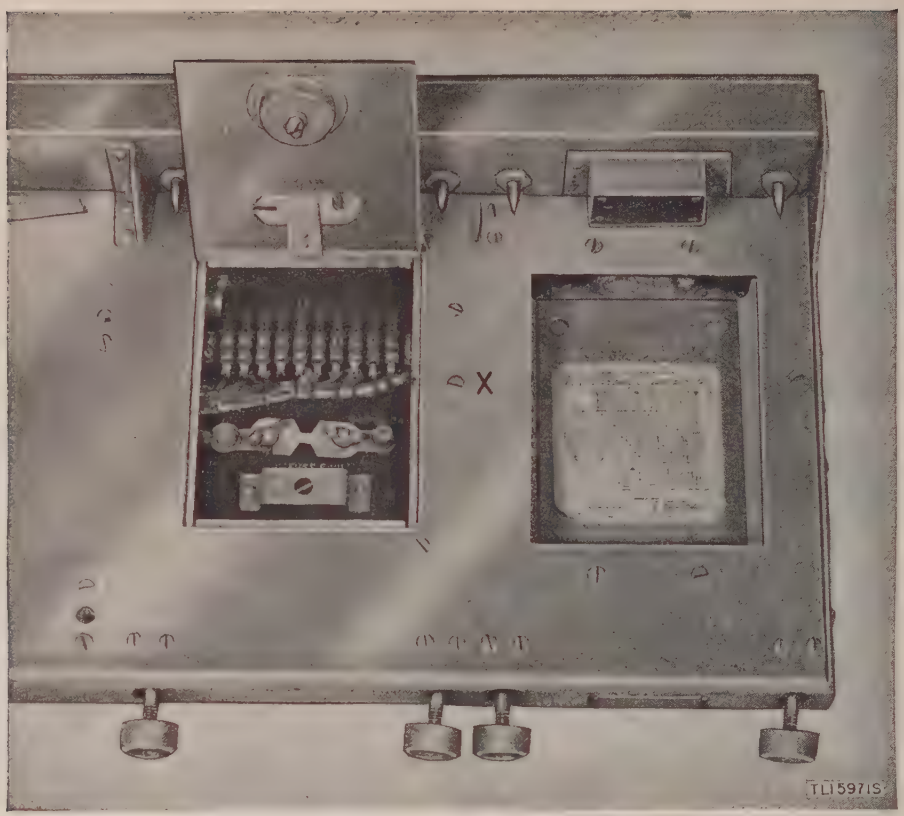


Figure 20. Mounting FT–237–(*), terminal box open.

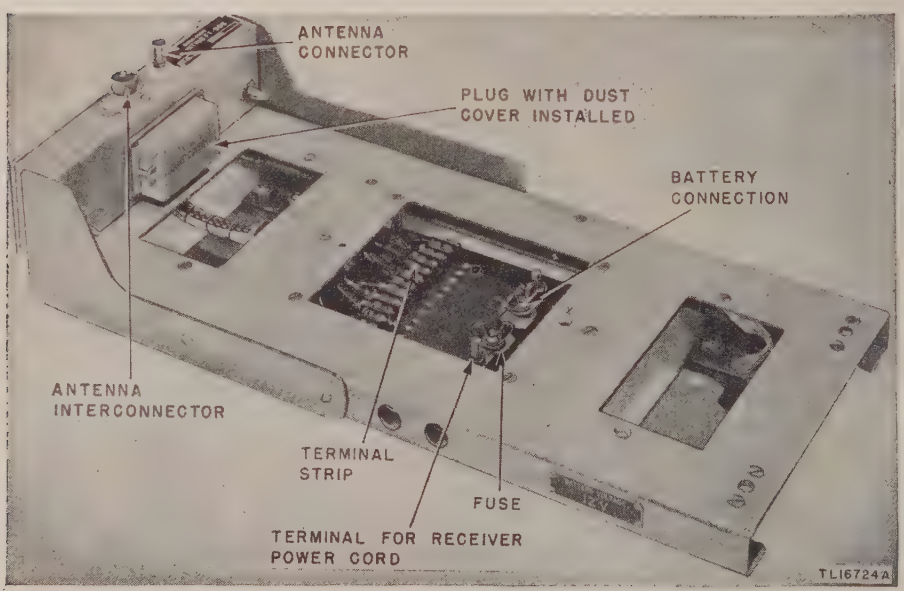


Figure 21. Mounting FT–508, showing battery connections.

nal. Antenna A–62 (Phantom) is provided for this purpose. (See figs. 25 and 26.) This phantom antenna consists of a variable inductance, a variable capacitor, and two fixed resistors in parallel, contained within a cylindrical metal container, approximately 6 inches high by 3 inches in diameter. The manufacturer's nameplate and circuit diagram are mounted on the outside of the container. A chained screw cap is the cover of the phantom antenna and can be removed for necessary adjustment by rotating it to the left. The chain prevents its being lost or misplaced. A metal bracket is included on the outside of the container to provide a flat side for ease in installation of the phantom antenna.

b. When the cap is removed, the control or adjustment panel of the phantom antenna is

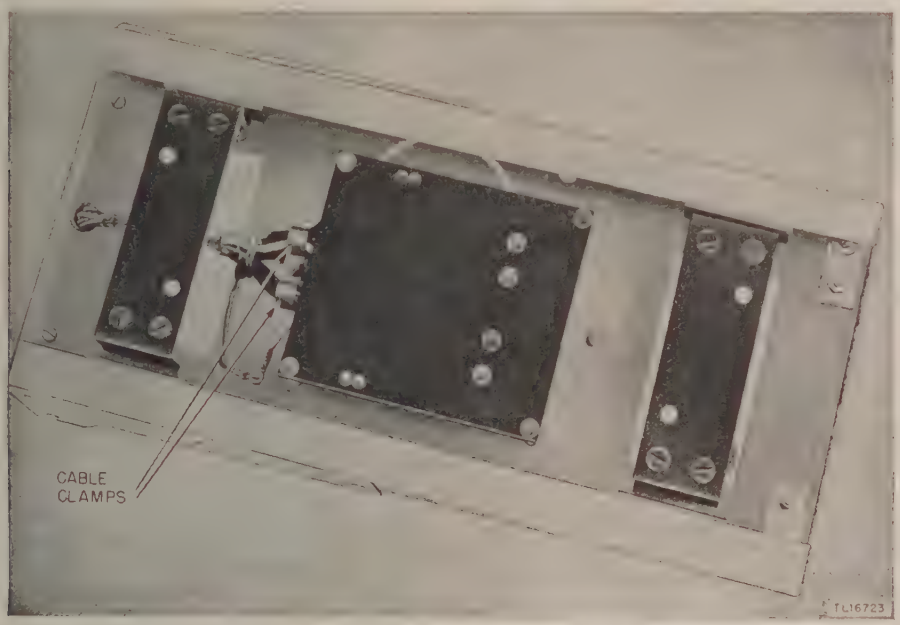


Figure 22. Mounting FT–508, bottom view.

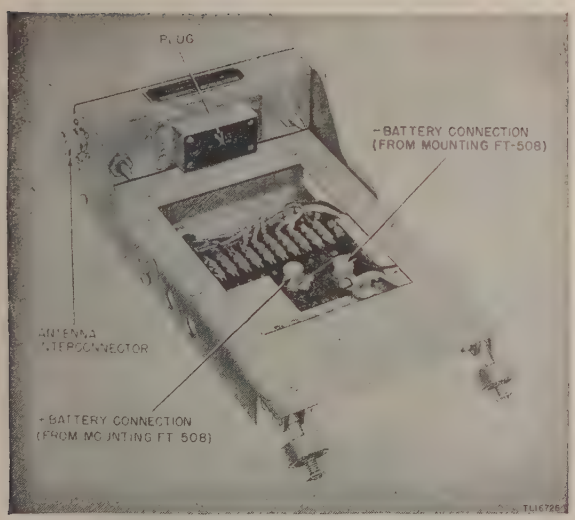


Figure 23. Mounting FT–346, oblique view.



Figure 24. Mounting FT–346, bottom view.

exposed. This panel is a metal disk which is the top or end plate of the chassis that holds the parts inside the container firmly so there will be a minimum of vibration. The adjustment points for the coil and capacitor are marked on the panel which also holds the resonance lamp and its jewel, the ANT binding post, and the GND binding post. There is a heavy ground clamp permanently connected to the GND post by means of a tinned copper braid.

c. The variable capacitor is a small, 19-plate, ceramic-insulated, end-mounted capacitor. The value of the setting is indicated by the position of the mark on the indicator disk (that moves with the rotation of the slotted shaft of the capacitor) and the relation of that mark to the dial scale stamped on the end plate or control panel. Adjustment of the capacitor, when necessary, is made by turning the shaft with a screwdriver until the desired results are obtained. Turning the slotted shaft towards the marking MAX increases capacity, and turning it toward MIN decreases capacity.

d. The hole marked DECREASE L is over the slotted end of a threaded shaft that tunes the coil. Turning the control to the right (in the direction indicated by the arrow) drives a metal slug, that is permanently attached to the inner end of the slotted shaft, out of the coil. This decreases the value of inductance. Turning this control in the opposite direction (to the left) increases the inductance value by retracting or lifting the slug upward into the coil.

e. The receptacle mounted to the left of the hole marked DECREASE L is threaded on the outside and has a contact pin in the center. It is a cable connector to be used when attaching a coaxial cable antenna lead to the phantom antenna.

f. Inside the container and behind (or under) the control panel (or end plate) are the parts already mentioned and two wire-wound, ceramic-covered, fixed resistors connected in parallel. Each resistor is 124 ohms in value, but because they are connected in parallel their total effective resistance in the circuit is 62 ohms.

g. Antenna A–62 (Phantom) will satisfactorily replace Mast Base AB–15/GR (MP–48 or MP–37) and the mast sections during tune



Figure 25. Antenna A–62 (Phantom), showing name plate and circuit label.

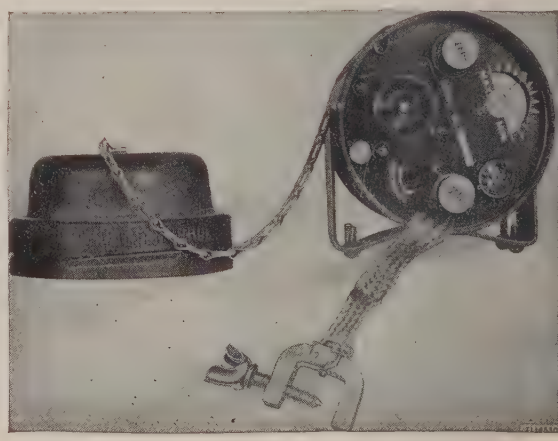


Figure 26. Antenna A–62 (Phantom), inside top view

up of the transmitter, but it will not replace the antenna lead-in from the mast base to the output terminals of the transmitter.

14. Antenna System

a. Mast Base AB–15/GR (fig. 27) is standard for Radio Sets SCR–508–(*) and SCR–528–(*). The mast base is lighter in weight and more flexible than earlier models. Mast Base MP–65 is used in some cases where a more rigid antenna is desired. A binding post is provided on the bottom of Mast Base AB–15/GR for wire lead-in connection. Figure 28 illustrates assembly of Mast Base AB–15/GR for use with wire lead-in. The binding post is threaded on an adapter socket. When the binding post is removed, a coaxial connector, Plug PL–259, may be connected to the adapter socket to provide termination for coaxial antenna cable. A clamp (item 15, fig. 29) is used, in conjunction with an I.E.T. lockwasher (item 14), to ground the shield of the cable. The I.E.T. lockwasher is placed between the lower insulator and the vehicle, providing the ground contact. Figure 29 illustrates the assembly of Mast Base AB–15/GR for use with coaxial cable.

b. Mast Base MP–48, MP–48–A, or MP–65 are substitutes for Mast Base AB–15/GR. Mast Base MP–48 is supplied with a coaxial connector, running up through its center, which connects to the upper part of the mast base in which the mast sections are inserted. The

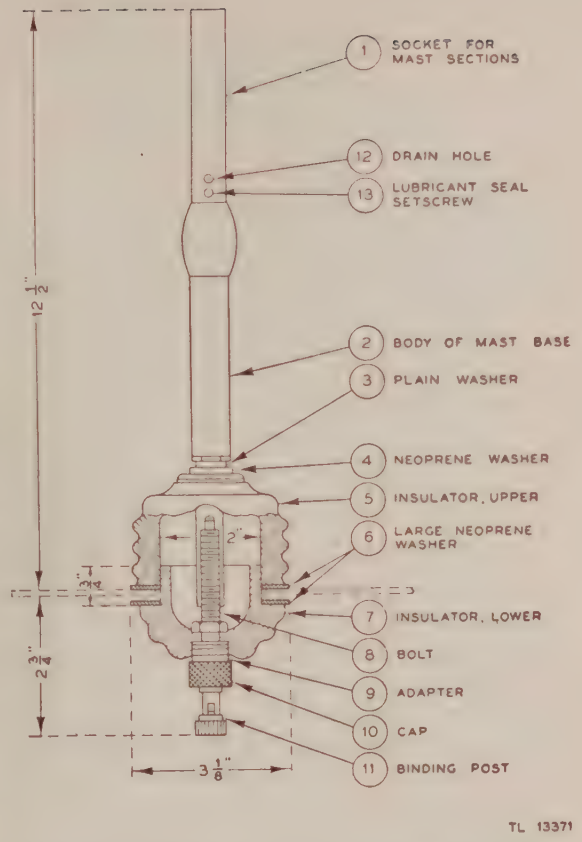


Figure 28. Mast Base AB–15/GR, assembly for Wire W–128 lead-in.

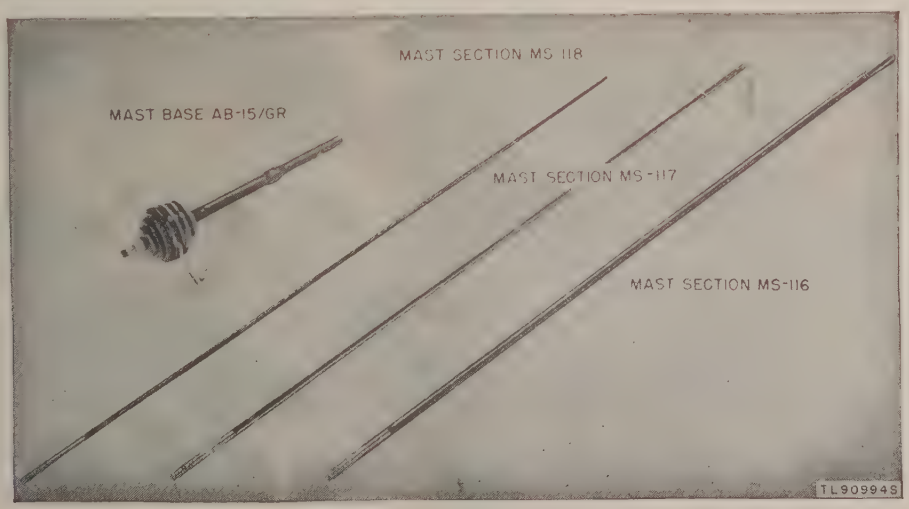


Figure 27. Antenna system.

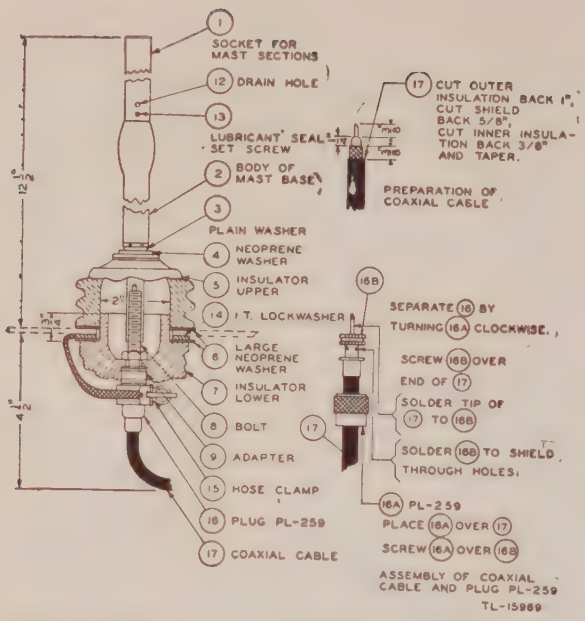


Figure 29. Mast Base AB–15/GR, assembly for coaxial lead-in.

connector is removed when wire lead-in is used. The wire is passed up through the mast base and secured by the same screws that secured the coaxial connector. When coaxial antenna is used, the center conductor is not removed. Mast Base MP–48–A is not supplied with a center conductor. When coaxial antenna lead-in is used with MP–48–A, Cord CD–689 is installed in the mast base to provide the center conductor. Figure 129 illustrates the assembly of the mast bases for each antenna combination used with Radio Sets SCR–508–(*) and SCR–528–(*).

c. Mast Sections MS–116, MS–117, and MS–118 are used with Mast Base AB–15/GR or MP–65. Three mast sections are used with all installations except where Mast Base Bracket MP–52, mounted on Cabinet CH–74–A, is used. When three sections are required, Mast Section MS–116 serves as the lowest section, Mast Section MS–117 fits into the top of Mast Section MS–116, and Mast Section MS–118 fits into the top of Mast Section MS–117. For a two-section antenna, Mast Section MS–117 is used as the lowest section and Mast Section MS–118 as the upper section. Mast Sections MS–51, MS–52, and MS–53 must be used with Mast Base MP–48 or MP–48–A.

d. When exact conformance with a standard installation is impossible, the following antenna installation principles should be followed. Three mast sections should be used in all installations, except with Mast Base Bracket MP–52, in which case two sections are used. The use of Mast Base AB–15/GR is preferable, with Mast Base MP–48–A as a second choice. Wire W–128, or equal, should be used for the lead-in when the length required is not greater than 46 inches with Mast Base AB–15/GR, or 58 inches with Mast Base MP–48–A. Shorter leads should be used if possible. All wire leads should be spaced away from metallic parts of the vehicle. If a longer lead-in must be used, it should be of coaxial Radio Frequency Cable RG–11/U or equal. This coaxial lead-in should always be between 8 and 10 feet in length. The antenna mast sections should be vertical, high, and as centrally located as practicable. They should not be closely parallel metallic parts. The TR binding post on Mounting MT–237–(*) should be used in connecting the antenna.

15. Roll BG–56

When the mast sections of the antenna are not in use, they are stored in Roll BG–56–A. Straps at one end and along the side fasten the roll. (See fig. 30.)

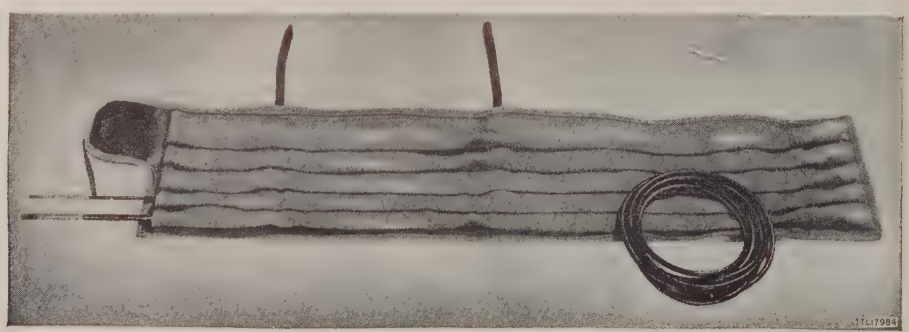


Figure 30. Roll BG–56–A and Wire W–128.

16. Headset HS–30–(*)

This headset is issued for use with Helmet M1 (Infantry) and others, and is a component of some installation units. Special soft rubber Inserts M–300 fit snugly into the ear cavities and exclude outside noises. The headband is a thin steel band that is adjustable to the contours of the operator's head. The clip on the headset cord should be attached to the operator's clothing to relieve the pull of the cord. (See figs. 31 and 32.)



Figure 31. Headset HS–30–(*).

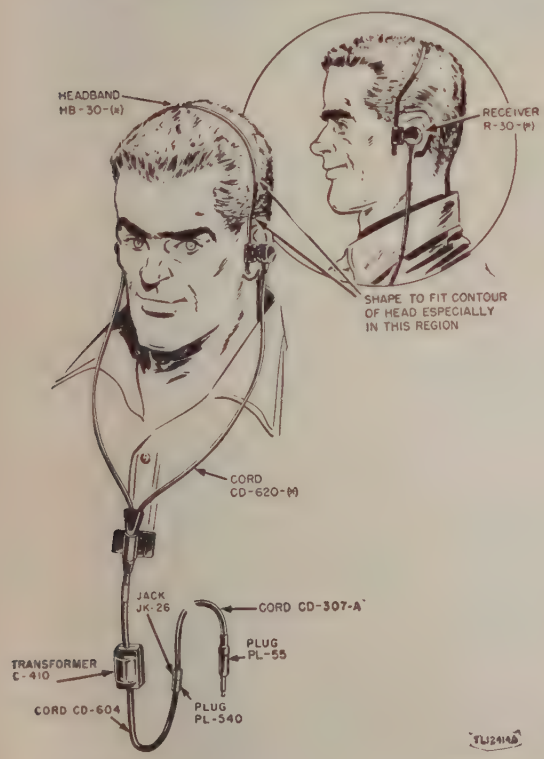


Figure 32. Headset HS–30–(*), in use.

Headset HS–30–(*) has a 250-ohm impedance. Cord CD–604, which contains a matching transformer, is used to match Headset HS–30–(*) to the 4,000-ohm output impedance of Radio Receiver BC–603–(*). Cord CD–604 connects to Jack JK–26 on Cord CD–307–A.

17. Headset H–16/U

Headset H–16/U is a component of some installation units. It is used in armored vehicles and can be worn under Helmet M1 (Infantry) and crash helmets used by the Infantry and Armored Forces. It consists of an adjustable headband, to fit the contour of the wearer's head, and two earcups (each containing a receiver unit, an impedance-matching transformer, and an ear insert). The headset has a total impedance of 8,000 ohms. (See figs. 33 and 34.)



Figure 33. Headset H–16/U, component parts.



Figure 34. Headset H–16/U, in position for operation.

18. Microphone T–17

Microphone T–17 is an antinoise, carbon-button hand microphone. Plug PL–68 on the microphone cord plugs into the microphone jack of the transmitter. If the set is used for radio communication, the microphone button controls the starting relay of the transmitter. (See fig. 35.)

19. Microphone T–45

Microphone T–45 is a small, single-button, carbon-type, differential microphone designed



Figure 35. Microphone T–17.

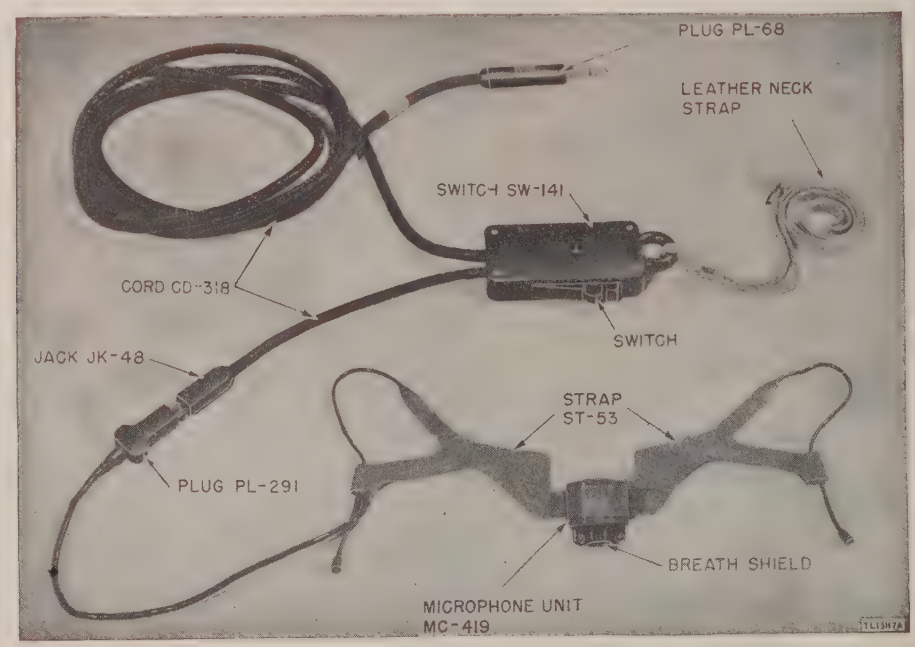


Figure 36. Microphone T–45 and Cord CD–318, component parts.

to be worn on the upper lip. It is held in place by face straps and adjustable ear loops, and is intended for use when an operator must have both hands free. The inherent design of the microphone reduces background noise, and allows speech to be reproduced clearly under all conditions. Plug PL–291 connects to the jack on Chest Set TD–4 or Cord CD–318, which contain the press-to-talk switch for this microphone. (See figs. 36 and 37.)



Figure 37. Microphone T–45, in use.

20. Chest Set TD–4

a. Chest Set TD–4 (fig. 38) is supplied, when available, for use in armored vehicles. The chest set is used in place of Cords CD–318 and CD–307–A to connect a headset and microphone to the radio set or interphone control box. Plug PL–291 on Microphone T–45 or T–30–(*) fits into the pin jacks on Chest Unit T–51, part of the chest set. Plug PL–54 on Headset H–16/U, or Cord CD–604 used with Headset HS–30–(*), fits into the remaining jack on the chest unit. The chest set has a retractile Cord CD–802 which is provided with Plugs PL–55 and PL–68 to connect the chest unit to the headset and microphone jacks on the radio set or interphone control box.

b. Jack JK–53 on Cord CD–802 fits over the four pins recessed in the chest unit and provides automatic disconnection of the cord when the operator must leave the vehicle quickly.

c. The microphone control press-to-talk switch is located on the chest unit, and has a spring-loaded HOLD-ON position, and a LOCK-ON position.

d. Adjustable Straps ST–24 and ST–25 are placed over the operator's shoulders to hold the chest unit in position.

21. Headset and Microphone Application and Substitution Charts

a. Application Chart.

Headset H–16/U is standard equipment for armored vehicles.

Headset HS–30–(*) is standard for open vehicles.

Chest Set TD–4 is standard for armored vehicles.

Cords CD–307–A and CD–318 are standard for open vehicles.

Microphone T–17 is supplied with each radio set to serve as a test microphone and as an alternate microphone for radio transmissions when the vehicle is stationary and greater intelligibility is desired.

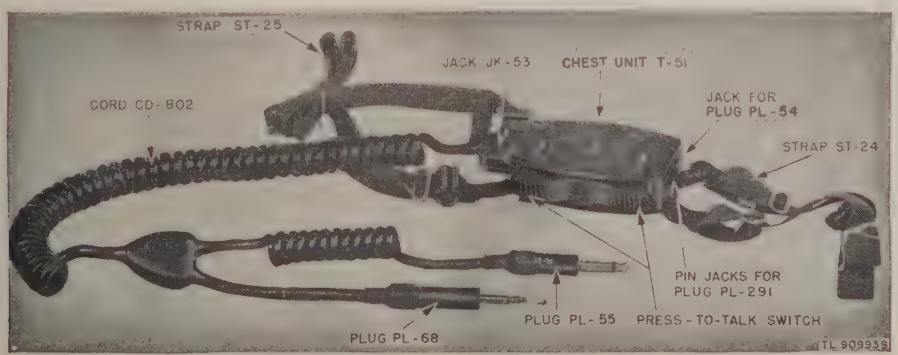


Figure 38. Chest Set TD–4.

b. SUBSTITUTION CHART.

Standard component	Substitute
Headset H–16/U..	Headset HS–30–(*) with Cord CD–604
Microphone T–45..	Microphone T–30–(*)
Chest Set TD–4...	Cord CD–307–A and Cord CD–318

22. Interphone Control Box BC–606–(*)

The interphone control box provides control and connection facilities for a microphone and a headset at a point remote from the radio equipment. Several control boxes may be connected in multiple, if desired. Interphone Control Box BC–606–H is a waterproof design. It has a spring-loaded RADIO-INT switch and requires Mounting FT–507 for installation on the vehicle. An oblique front view of Interphone Control Box BC–606–H is shown in figure 39.

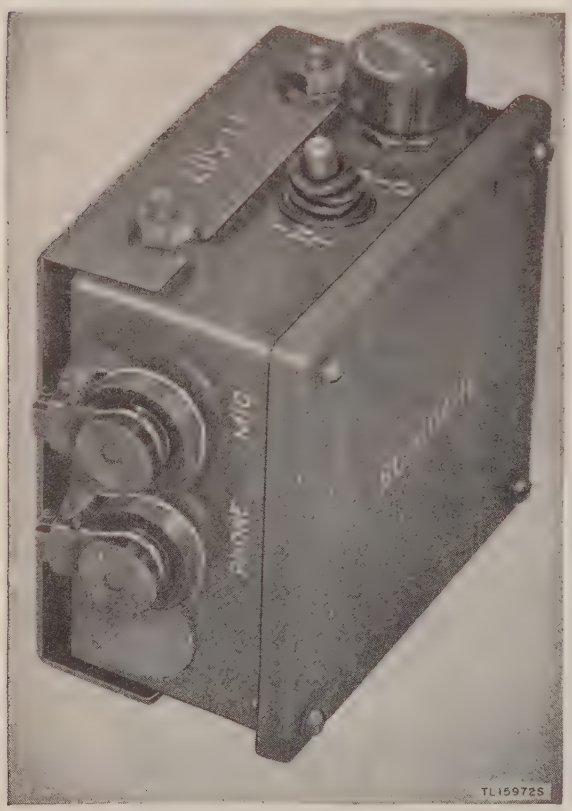


Figure 39. Interphone Control Box BC–606–H, with Mounting FT–507.

23. Cabinet CH–74–A

Cabinet CH–74–A is a protective housing to be used where the radio equipment is exposed to the weather. The cabinet is supported within the vehicle by Mounting FT–284–(*), Mounting FT–285–(*), or Frame FM–43, depending upon which vehicle is being used. Mounting FT–237–(*) is bolted in place in the cabinet. The top of the cabinet extends somewhat over the front of the radio equipment. A canvas cover assembly is provided for the front of the cabinet to inclose the radio equipment completely, if desired. The canvas cover may be rolled back over the top of the cabinet, or it may be supported by a bracket which telescopes into the top of the cabinet. The equipment should not be operated with the canvas cover closing the cabinet opening. (See fig. 6.)

24. Mast Base Bracket MP–52

Mast Base Bracket MP–52 serves to support an antenna and mast base about 2 feet above Cabinet CH–74–A. A mast base may be clamped to the cover plate of the bracket and the antenna lead may be brought down through insulating guides through the mast base bracket tube into the cabinet for connection to the radio equipment. The bracket is fastened to the cabinet by 12 bolts. (See fig. 6.)

25. Chest CH–264 (Fig. 5)

Chest CH–264 is a metal spare parts box for storage and transportation of tubes, headsets, microphones, etc., for the radio set. The box is divided into two compartments: The top compartment is packed with felt which is punched for holding tubes. This compartment is accessible by opening the top of the box. The bottom compartment is for microphones, headsets, etc., and is accessible by a door in the front of the chest. The metal box is identical to the case of Radio Receiver BC–603–(*) and provides for the mounting of the box on Mounting FT–237–(*) for Radio Set SCR–528–(*). For Radio Set SCR–508 it must be stowed elsewhere in the vehicle.

26. Cover BG–96 (Fig. 5)

Cover BG–96 is a canvas cover for the radio set, provided with three awning like ventilators for the dynamotors.

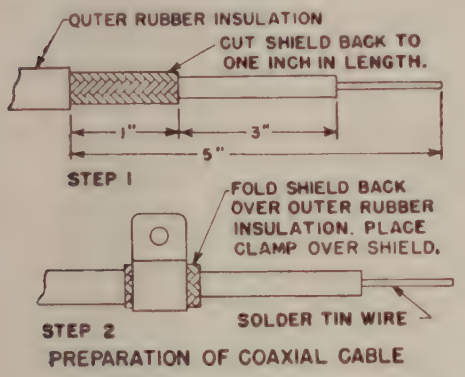
27. Cords and Cordage

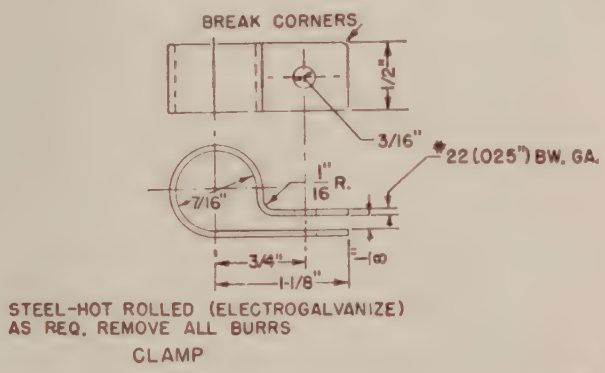
a. CORD CO–278–A (FIG. 5). Cord CO–278–A is used to connect Mounting FT–237–(*) to the storage battery. It consists of 8 feet of Cordage CO–212 to which connection terminals have been soldered. The inner conductor is connected to the positive side of the battery, and the outer conductor is grounded.

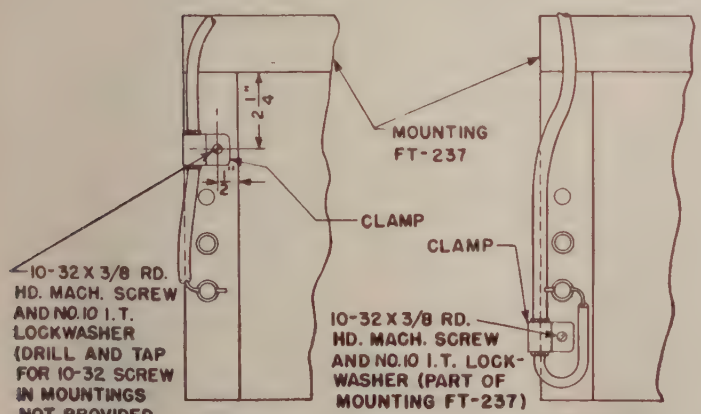
b. CORD CD–307–A (FIG. 6). Cord CD–307–A provides automatic disconnection of the operator's headset when he attempts to dismount from the vehicle without first removing his plug from the radio receiver. Plug PL–55 at one end of Cord CD–307–A plugs into the radio receiver or into a designated interphone control box. Plug PL–54 on Headset H–16/U, or on Cord CD–604 used with Headset HS–30–(*), is connected into Jack JK–26 at the other end of Cord CD–307–A. When any undue strain is placed on the cord, Plug PL–54 and Jack JK–26 separate. Cord CD–307–A is usually supplied in 65-inch lengths.

c. CORD CO–318–A (FIG. 36). Cord CO–318–A is a 7-foot cord assembly for connection between the short cord supplied with Microphone T–45 or T–30–(*) and the radio equipment or a remote control box. The assembly, which includes Switch SW–141–(*) as a push-to-talk switch for the microphone, is provided with a neck strap for its support. The neck strap is quickly detachable from the switch.

d. CORD CD–604 (FIG. 7). Cord CD–604 connects Headset HS–30–(*) to Cord CD–307–A. The cord contains an impedance matching transformer C410 to match the 250-ohm impedance of Headset HS–30–(*) to the 4,000-ohm output impedance of Radio Receiver BC–







NOTE;
USE METHOD A FOR RADIO SETS SCR-508 AND SCR-528 WHEN MOUNTING FT-237 CONTAINS REAR GROUND SCREW AND USE METHOD B WHEN MOUNTING FT-237 CONTAINS FRONT GROUND SCREW.

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Figure 40. Connection of coaxial cable to Mounting FT–237–(*).

603–(*). When Headset HS–30–(*) is to be connected to Cord CD–604, the case of the transformer is opened by removing the four screws in the flat side of the case. The terminals of Cord CD–620 on Headset HS–30–(*) are connected to the transformer by means of screws indicated by an arrow on the edge of the case. The case is then closed and the four screws replaced in the case.

e. CORD CD–786. Auxiliary Cord CD–786, is provided for making 13 connections conveniently to a receiver or transmitter which is to be used in such a way that it cannot be inserted in the mounting. One such use is the testing of a receiver on a bench. The cord consists of—

(1) A male plug for insertion in socket J401, J402, or J403 of Mounting FT–237–(*).

(2) A female receptacle for connection to plug PG1 of the receiver, or PG101 of the transmitter.

(3) A 6-foot length of cordage containing conductors to connect corresponding numbers in these two plugs. Terminals 1 and 2 of the plug are connected to corresponding numbers in the receptacle by 10-gage stranded wires. This constitutes the power connection and is suitable for carrying several amperes. A 22-gage twisted, shielded pair of stranded wires is used for terminals 4 and 5. The other terminals used are numbers 7, 8, 9, 10, 19, 20, 21, 22, and 25.

f. CORDAGE CO–212. Cordage CO–212 is composed of two concentric conductors and is used in making Cord CO–278–A. Cordage CO–212 is supplied in bulk lengths and is used to replace damaged Cords CO–278–A or when a longer cord is needed. The cordage is installed so that the inner conductor is positive and the outer conductor is at ground potential.

g. CORDAGE CO–213. Cordage CO–213 is a shielded seven-conductor, color-coded cable. It is supplied in bulk lengths and is used for interconnecting the desired number of Interphone Control Boxes BC–606(*) and Mounting FT–237–(*). Two of the conductors were at one time inclosed within an electrostatic shield. These conductors were used for the output of Microphone T–33.

h. CORDAGE CO–218 (FIG. 7). Cordage CO–218 is a shielded four-conductor, color-coded cable. It is used for extending to a remote radio control box (Interphone Control Box BC–606–(*)) at a distance from the radio set in half-track vehicles. One conductor is inclosed within an electrostatic shield. This conductor is used for the carbon microphone output.

i. RADIO FREQUENCY CABLE RG–11/U. This cable is a flexible two-conductor coaxial cordage which is intended for transmission of high-frequency (h-f) currents. It is used in all installations of Radio Set SCR–508–(*) and SCR–528–(*), where the distance between the binding post on Mounting FT–237–(*) and the mast base exceeds 40 inches, except when Mast Base Bracket MP–52 is used. The outer conductor should be grounded at both ends. Radio Frequency Cable WC–562 and Cordage CO–282 are substitutes. Figure 40 illustrates the method of terminating r-f cable at Mounting FT–237–(*). Figure 29 illustrates the application of r-f cable with Mast Base AB–15/GR. The application of r-f cable with Mast Bases MP–48 and MP–48–A is illustrated in figure 124.

28. Crystal Holders

A drawer is provided in Transmitter BC–604–(*) for storing 80 Crystal Holders FT–241–A, one for each of 80 channel frequencies. Each crystal holder contains a low-frequency (l-f) quartz crystal. Table I lists the channel number, crystal frequency, and output frequency of each of the 80 crystals. Crystal Holders FT–241–A for use in this transmitter are marked with the channel numbers 0 to 79 and the output frequency.

Table I

Channel	Crystal frequency (kc)	Output frequency (mc)
0	370.370	20.0
1	372.222	20.1
2	374.074	20.2
3	375.926	20.3
4	377.778	20.4
5	379.630	20.5
6	381.481	20.6
7	383.333	20.7
8	385.185	20.8
9	387.037	20.9
10	388.889	21.0
11	390.741	21.1
12	392.593	21.2

Channel	Crystal frequency (kc)	Output frequency (mc)
13	394.444	21.3
14	396.296	21.4
15	398.148	21.5
16	400.000	21.6
17	401.852	21.7
18	403.704	21.8
19	405.556	21.9
20	407.407	22.0
21	409.259	22.1
22	411.111	22.2
23	412.963	22.3
24	414.815	22.4
25	416.667	22.5
26	418.519	22.6
27	420.370	22.7
28	422.222	22.8
29	424.074	22.9
30	425.926	23.0
31	427.778	23.1
32	429.630	23.2
33	431.481	23.3
34	433.333	23.4
35	435.185	23.5
36	437.037	23.6
37	438.889	23.7
38	440.741	23.8
39	442.593	23.9
40	444.444	24.0
41	446.296	24.1
42	448.148	24.2
43	450.000	24.3
44	451.852	24.4
45	453.704	24.5
46	455.556	24.6
47	457.407	24.7
48	459.259	24.8
49	461.111	24.9
50	462.963	25.0
51	464.815	25.1
52	466.667	25.2
53	468.519	25.3
54	470.370	25.4
55	472.222	25.5
56	474.074	25.6
57	475.926	25.7
58	477.778	25.8
59	479.630	25.9
60	481.481	26.0
61	483.333	26.1
62	485.185	26.2
63	487.037	26.3
64	488.889	26.4
65	490.741	26.5
66	492.593	26.6
67	494.444	26.7
68	496.296	26.8
69	498.148	26.9
70	500.000	27.0
71	501.852	27.1
72	503.704	27.2
73	505.556	27.3
74	507.407	27.4
75	509.259	27.5
76	511.111	27.6
77	512.963	27.7
78	514.815	27.8
79	516.667	27.9

29. Code Designation of Component Parts

It is helpful to have in mind the method of numbering of the component parts used in the various units of these radio sets. Parts in the schematic and wiring diagrams and usually on the equipment units also are designated by a number preceded by one or more letters, for example, C25, C115, S201, etc. Reference numbers from:

1 to 99 are used for parts in Radio Receiver BC–603–(*).

101 to 199 are used for parts in Radio Transmitter BC–604–(*).

301 to 399 are used for parts in Interphone Control Box BC–606–(*).

401 to 499 are used for parts in Mounting FT–237–(*).

501 to 599 are used for parts in Dynamotor DM–35–(*), 12-volt (transmitting).

601 to 699 are used for parts in Dynamotor DM–37–(*), 24-volt (transmitting).

701 to 799 are used for parts in Dynamotor DM–34–(*), 12-volt (receiving).

801 to 899 are used for parts in Dynamotor DM–36–(*), 24-volt (receiving).

30. Differences in Models

a. Radio Receivers BC–603–(*)M and Radio Transmitters BC–604–(*)M have been modified so that when Radio Sets SCR–508–(*) and SCR–528–(*) are operated on interphone, Radio Receivers BC–603–(*)M are disabled. This modification, which prevents interference of interphone communication by incoming radio signals, is incorporated in later radio sets by



Figure 41. Siting radio set.

the manufacturer, and is also applied to the radio sets already in the field.

* *Note.* Only those equipments that are stamped with the letter M after the nomenclature on the nameplate have been so modified.

b. MWO SIG 11–600–6 modifies all sets to increase the power output of the interphone system in Radio Sets SCR–508–(*) and SCR–528–(*).

c. MWO SIG 11–600–8 modifies Interphone Control Boxes BC–606–A, B, C, D, E, F, and G to the electrical equivalent of Interphone Control Box BC–606–H. The modification improves the system operation of the radio set by requiring a definite operation on the part of the tank commander for radio communication.

d. MWO SIG 11–600–10 modifies all sets to prevent filament burn-out of Tubes JAN–1619 (VT–164) and JAN–1624 (VT–165).

e. See section XXI for details of these modifications.

f. See section XX for changes made during production before Modification Work Orders were applied.

Section II. INSTALLATION OF RADIO SETS SCR–508–(*), SCR–528–(*), AND AN/VRC–5

31. Siting (Fig. 41)

a. The signals from Radio Transmitter BC–604–(*) have a greater range if the antenna is high and clear of hills, buildings, cliffs, densely wooded areas, and other obstructions. Depressions, valleys, and other low places are poor for radio reception and transmission because the surrounding high terrain absorbs radio-frequency (r-f) energy. Weak or otherwise undesirable signals may be expected if the radio set is operated under or close to steel bridges, underpasses, power lines, or power units.

b. The most desirable locations for transmission and reception are hilltops, elevations, and slight rises in the ground. Flat terrain is also good. Normally, transmission over water is better than that over land.

32. Unpacking, Uncrating, and Checking

a. The main component contained in each box may be stenciled directly on the box, but in all cases a packing slip is inclosed in a moistureproof wrapper which is stapled to the box and protected by a heavy paper covering. Export packaging is shown by an orange band painted around the center of the box and a stripe painted across each end. Export packing is labeled *Packed with dehydrating agent. DO NOT OPEN UNTIL READY FOR USE.* An orange disk indicates that the box is only part of the shipment.

b. The boxes should be as close as possible to their final destination before unpacking. To unpack the boxes, first clip the two metal bands binding the box. With a nailpuller, remove the nails holding the top of the box and remove the top of the box. Do not remove the waterproofing seals until the parts are actually needed and a convenient place has been selected on which to lay the parts. To remove the waterproofing and moistureproofing barrier, if the equipment is packed for export, tear open the waterproof liner. If shears are available, cut off the heat-sealed edge so that the bag may be used again should the occasion arise. Remove the bags of silica-gel and carefully check the contents of the box against the packing list. Do not throw any packing away until it is certain that no parts are included which actually belong to the set. Packaging of the basic unit and a typical installation unit for Radio Set SCR–508–(*) are shown in figure 42. Note that only one receiver is shown whereas two receivers are actually supplied.

Caution: When removing waterproofing and other protective coatings, be careful not to damage vital parts of the radio set. Do not remove moistureproofing and fungiproofing coatings from any of the components.

33. Connections and Interconnections

Connections and interconnections between the various units of Radio Sets SCR–508–(*) and SCR–528–(*) vary according to the type of installation. For specific instructions see the TM 11–2700 series. Typical connections and interconnections between the various units of Radio Sets SCR–508–(*) and SCR–528–(*) are shown in figure 43.

All connections between the transmitter and receiver units and Mounting FT–237–(*) of Radio Sets SCR–508–(*) and SCR–528–(*)

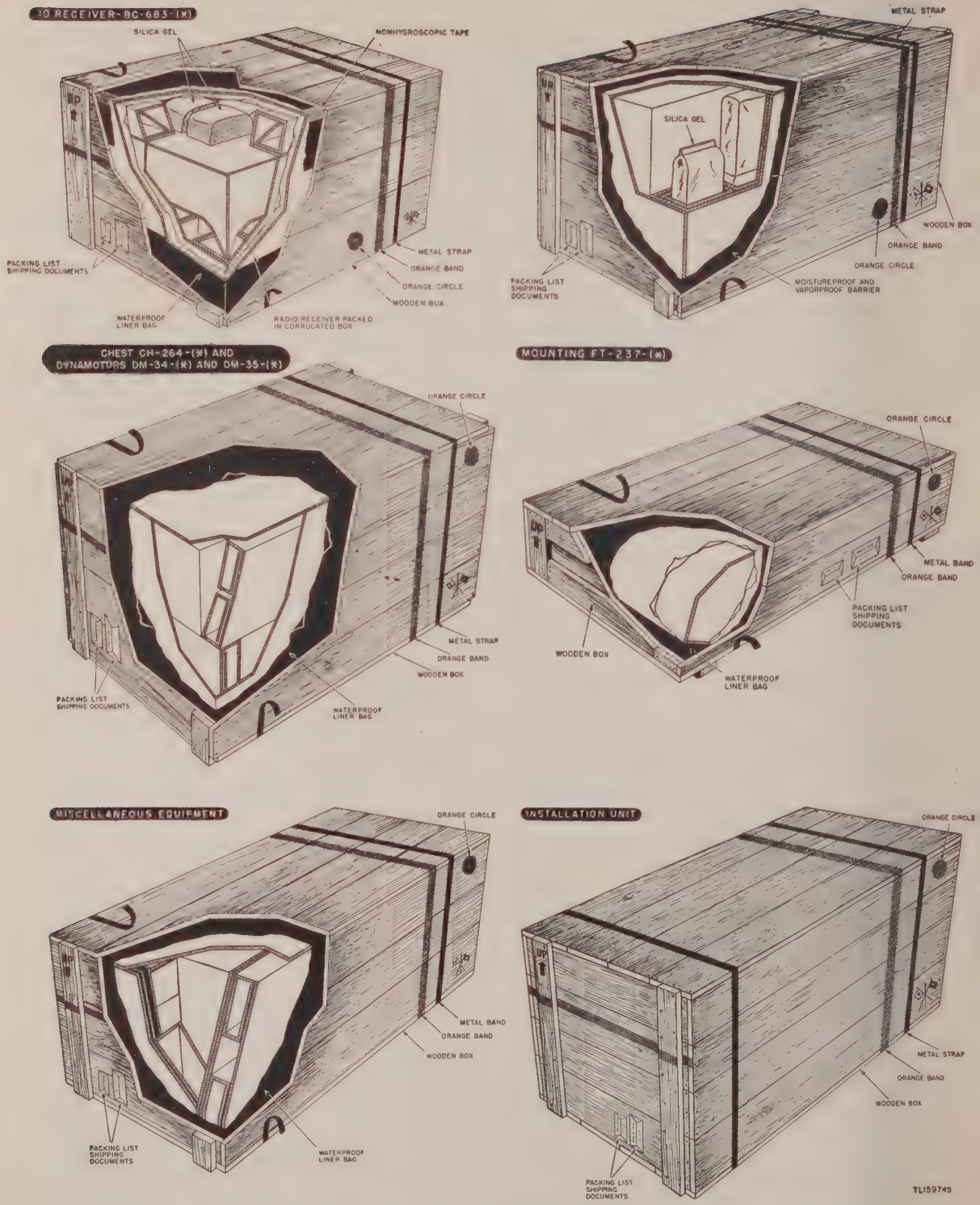


Figure 42. Radio Set SCR–508–(*), packaging.

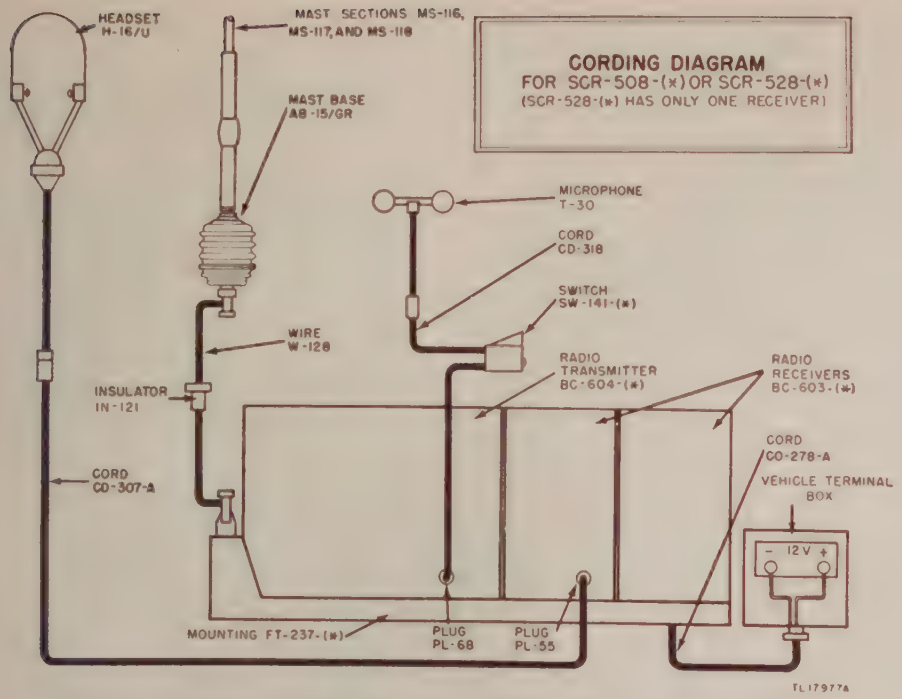


Figure 43. Radio Sets SCR–508–(*) and SCR–528–(*), cording diagram.

are made through multicontact plugs and receptacles, which are automatically engaged when the individual units are inserted in their proper positions on the mounting. The wiring between the receptacles on the mounting is installed in an inclosed trough running along the rear and left end of the mounting. Other cords and cordages used in joining the various units are described below.

34. Preparation of Cordage CO–213

The following procedure and figure will be found useful in preparing the interphone cordage.

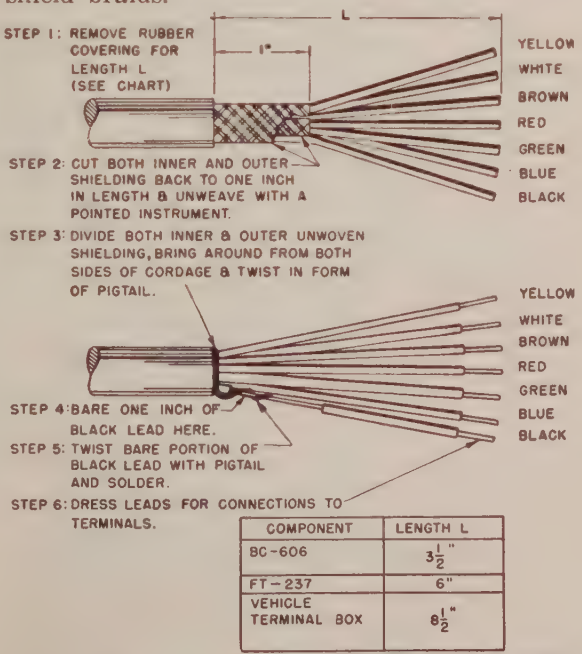
a. In cutting the rubber insulation of Cordage CO–213, be careful not to cut any strands of the copper shielding.

b. After Cordage CO–213 has been cut to proper lengths (par. 35*c*), prepare each end of every length for connection to the Interphone Control Boxes BC–606–(*) and to Mounting FT–237–(*) as follows (fig. 44):

(1) Strip back 3½ inches of the outer rubber and 2½ inches of the inner and outer shields, for connections to the interphone control boxes.

(2) Strip back 6 inches of the outer rubber and 5 inches of the shields for connections to Mounting FT–237–(*).

(3) Using a pointed instrument, separate the weave of the exposed 1-inch ends of the shield braids.



COMPONENT	LENGTH L
BC-606	3½"
FT-237	6"
VEHICLE TERMINAL BOX	8½"

Figure 44. Preparation of cordage CO–213.

(4) Strip about ½ inch of insulation from the black lead, at the point exposed by separation of the shields.

(5) Twist the wires of both shield braids around the exposed portion of the black lead and solder together, using a minimum of solder.

(6) Use the black lead for ground connection.

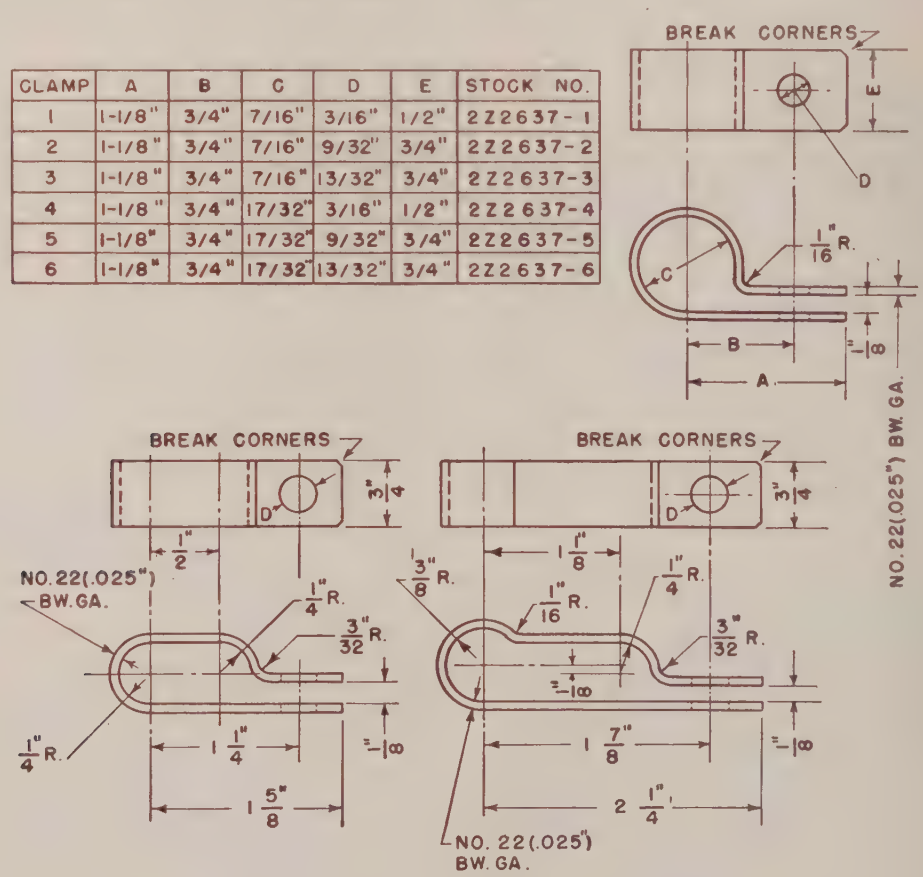
c. Prepare the ends of the cordage for connection to the vehicle terminal boxes in the same manner, except that 8½ inches of outer rubber, and 7½ inches of outer shielding are stripped back, and the shielded pair of red and green wires are taped. Solder the lugs, obtained from the vehicle terminal box, to the wires.

d. Clamps required for securing Cordage CO–213 or r-f cable are illustrated in figure 45.

35. Wiring of Interphone Cordage

a. In vehicles requiring interphone communication, it is generally preferable to interconnect as much of the equipment as possible *before* installation in the vehicle. This must be done, since in many cases the components are mounted in such positions that terminal strips inside the components will be inaccessible.

CLAMP	A	B	C	D	E	STOCK NO.
1	1-1/8"	3/4"	7/16"	3/16"	1/2"	2Z2637-1
2	1-1/8"	3/4"	7/16"	9/32"	3/4"	2Z2637-2
3	1-1/8"	3/4"	7/16"	13/32"	3/4"	2Z2637-3
4	1-1/8"	3/4"	17/32"	3/16"	1/2"	2Z2637-4
5	1-1/8"	3/4"	17/32"	9/32"	3/4"	2Z2637-5
6	1-1/8"	3/4"	17/32"	13/32"	3/4"	2Z2637-6



CLAMP	D	STOCK NO.
7	3/16"	2Z2637-7
8	9/32"	2Z2637-8
9	13/32"	2Z2637-9

CLAMP	D	STOCK NO.
10	9/32"	2Z2637-10
11	13/32"	2Z2637-11

TL-13319

NOTE:
TOLERANCES ± 1/32"

Figure 45. Cordage clamps.

b. Always refer to the TM 11–2700 manuals for the diagram of the wiring system to be used, since the wiring is not the same for all types of vehicles. Figures 126, 127, and 128 are examples of typical system wiring.

c. Select the proper direction from which Cordage CO–213 will emerge from Mounting FT–237–(*). Determine the lengths of all interphone cordage from the TM 11–2700 series manual. It is advisable to check exact lengths required by first locating the equipment in the vehicle and making actual measurements. This should be done to allow for production variations in the vehicle.

d. Prepare each length of every length of cordage as directed in paragraph 34. See figure 44 for the amount of insulation to be peeled back for connection to a particular component.

e. Open the hinged access door on Mounting FT–237–(*). Solder each lead of the length of the interphone cordage to terminal strip TS401, as indicated in the wiring diagram. The ends of the red and green leads of each length of the cordage are not to be connected. Tape the ends of these leads.

f. Secure the interphone cordage by means of the cordage clamps provided on the mounting.

g. If Interphone Control Box BC–606–A to G is used, remove the appropriate plug button from the box, and insert the interphone cordage.

h. If Interphone Control Box BC–606–H is used, first remove the proper knock-out from the box as indicated on the applicable installation figure. Disassemble the conduit connector and pass the packing nut, rubber insert, and body of the connector over the cordage in the order named. Place the rubber washer over the stem of connector, insert the cordage and connector through the hole in the box, and secure connector to the box with the bondnut.

i. Solder the cordage leads to the terminal blocks as indicated on the applicable diagram.

j. Secure the cordage end by means of the clamp provided on Interphone Control Box BC–606–A to G, or by means of the packing nut of the conduit connector used with Interphone Control Box BC–606–H.

k. Additional control boxes are wired in similar manner. When connection of interphone cordage to the vehicle terminal box is required, the terminal lugs are removed from the terminal block in the terminal box and soldered to the cordage leads.

36. Installation of Mounting FT–237–(*)

a. Remove the rear and left end dust covers from Mounting FT–237–(*), and make certain that all wires and parts are firmly in place.

b. Open the hinged door and make sure that fuse F401 is in place and that a spare fuse is in the clip on the hinged door. (See fig. 20.)

c. Determine whether the battery is 12 or 24 volts. The voltage rating on the red plate on the front of the mounting should coincide with the battery voltage.

d. Thoroughly brighten the contact areas around the mounting bolt holes on the vehicle and corresponding areas on the mounting to insure good contact when the mounting bolts are tightened. Install Mounting FT–237–(*) in the correct position with the holes in the two bedplates located over the mounting holes in the vehicle. *A good ground contact is essential, or the radio set will not function properly.* Use a toothed lockwasher, when available, between the screw head and the mounting, and between the nut and vehicle surface.

e. Cord CO–278–A connects the mounting to the vehicle terminal box to supply battery power to the radio set. Three sets of holes in the mounting give a choice of three directions from which Cord CO–278–A may emerge through the mounting to the battery. Protection of the cord is the determining factor in the choice of installation direction. Make the cleanest and shortest installation practicable.

f. The center conductor connects to the *positive* or ungrounded side of the terminal box. The outer conductor connects to the *negative* or grounded side of the terminal box. One end of the cord has smaller terminal lugs than the other end. Connect the smaller lugs to the mounting, with the lug on the center conductor connecting to fuse F401, and the lug on the outer conductor connecting to the ground screw on the mounting (marked X in fig. 20). Also see figure 19. Run Cord CO–278–A to the battery, using a sufficient number of clamps to prevent vibration.

Caution: Do not connect Cord CO–278–A to the vehicle battery terminal box until all equip-

ment has been completely installed and a check made for accidental ground or shorts in the mounting. Make sure that the polarity is correct.

37. Installation of Radio Transmitter BC–604–(*)

a. Remove the top dust cover from the transmitter by loosening the four fasteners on the top. Each fastener is loosened by turning it ¼ turn to the left.

b. Loosen the two fasteners of the crystal storage drawer located in the upper left-hand corner of the front panel and pull the drawer outward (fig. 46). Inspect thoroughly, making certain that all wires and connections are firmly in place, all tubes intact, and that there are no loose parts. See the tube location diagram, figure 47. Place all crystal holders which are not installed in the crystal oven, in the crystal storage drawer.

c. Place the dynamotor in the upper left-hand side of the transmitter. Make sure that the voltage rating on the dynamotor is the same as the vehicle battery voltage. Engage the female plug on the dynamotor with the male plug on the transmitter. Press the unit firmly into place and tighten the four screws of the dynamotor mounting.

d. Replace the top dust cover and tighten

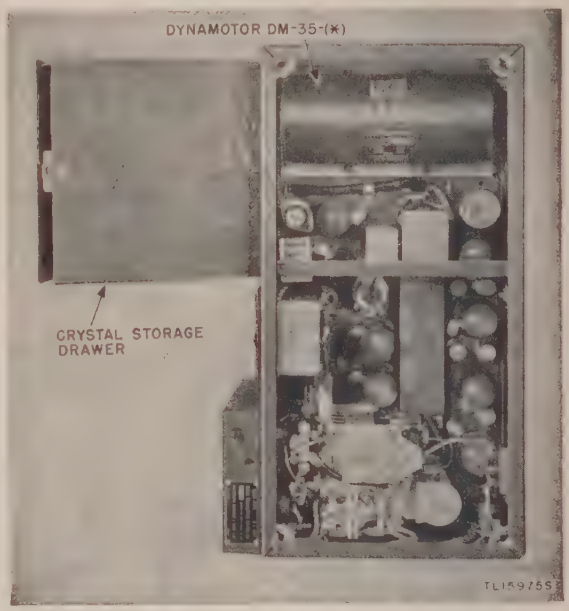


Figure 46. Radio Transmitter BC–604–(*), dynamotor installation.

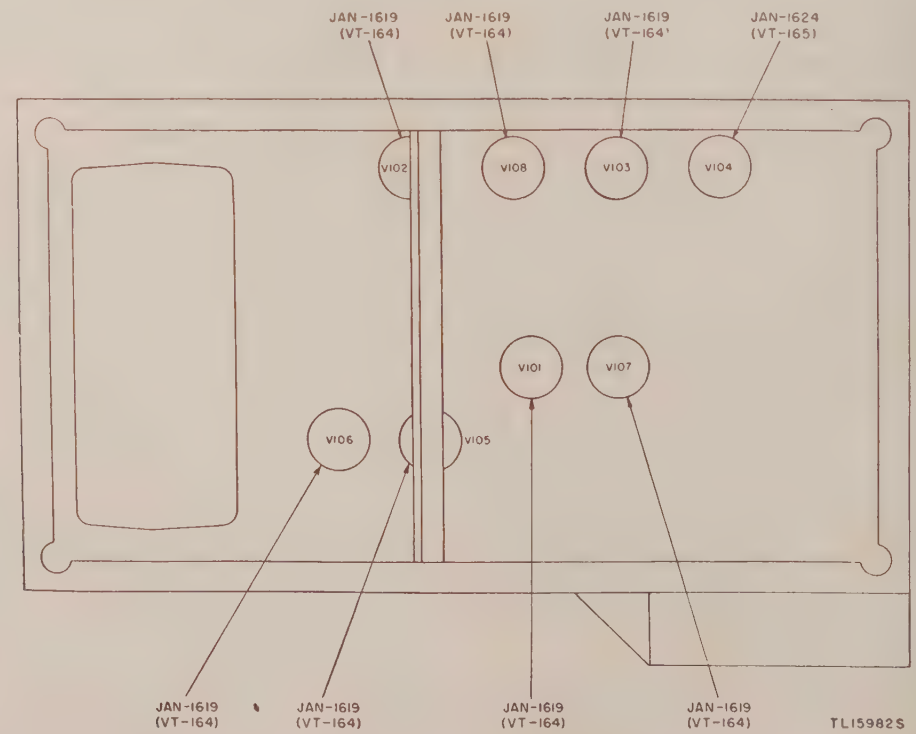


Figure 47. Radio Transmitter BC–604–(*), tube location diagram.

the four fasteners. Push the crystal storage drawer all the way in and tighten its two fasteners.

c. Place the transmitter on the mounting base with the push buttons toward the front of the mounting. Slide the transmitter to the left until the transmitter plug firmly engages the receptacle on the end of the mounting. The guides and tapered pins on the mounting properly aline the transmitter as it is pushed into place. The two thumbscrews at the right-hand end of the transmitter may then be pressed down to engage the threaded holes in the mounting and firmly turned to the right to lock the transmitter in place.

38. Installation of Radio Receiver BC–603–(*)

a. Remove the dust cover from each receiver used, by turning the fastener, at the back of the cover, to the left. Slide the cover from the chassis, and inspect the parts and wiring. See the tube location diagram, figure 48.

b. Place the receiver dynamotor in its place at the rear of the unit. Make sure that the voltage rating on the dynamotor is the same as the battery voltage. Engage the male plug in the dynamotor unit securely with the female plug on the radio unit. Securely tighten in place the screws which are provided, replace the dust cover, and tighten the fasteners.

c. Place the receiver, or receivers, in position by sliding them on the mounting from the front, to engage the receptacle at the rear of the mounting. The tapered pins position the receiver properly. Engage the cupped edges of the two thumbscrews on the mounting with the hold-down brackets and tighten the thumbscrews. If two receivers are used (Radio Set SCR–508–(*)), their positions in the spaces

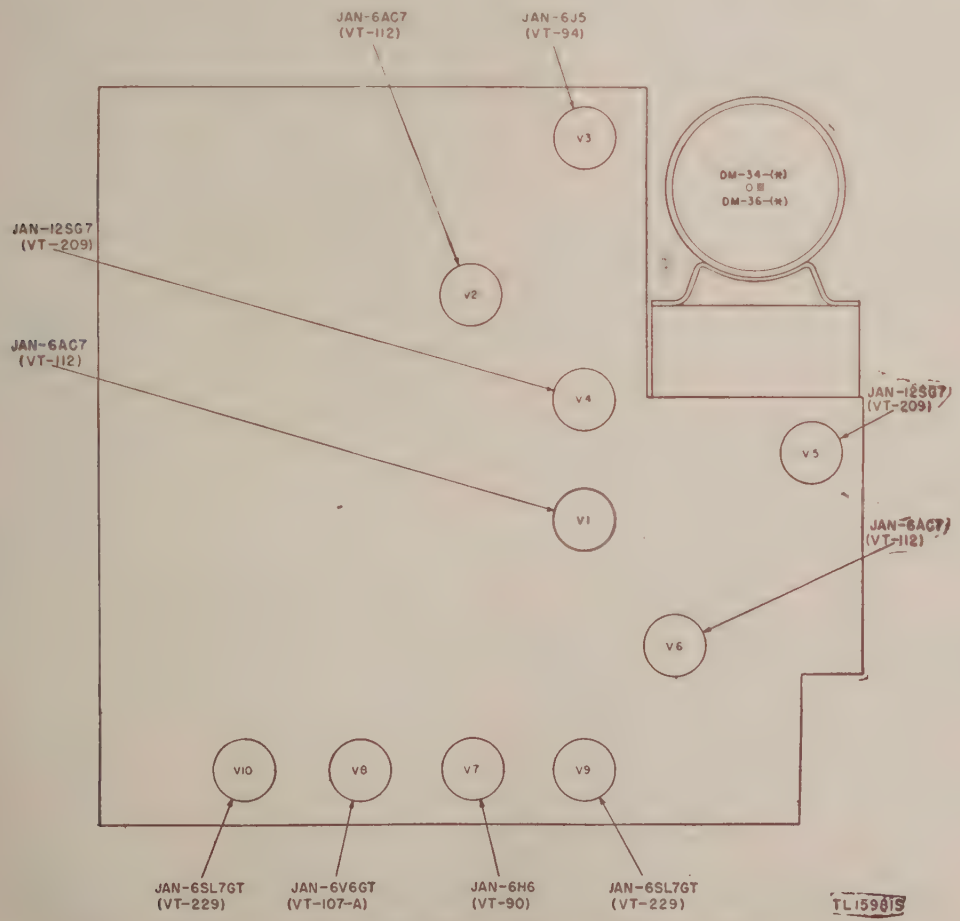


Figure 48. Radio Receiver BC–603–(*), tube location diagram.

provided on the mounting are interchangeable. Where only one receiver is used, install at the right-hand side of the mounting. This will allow sufficient space between units to insert a small screwdriver for adjustment of the METER SWITCH (right-hand end of the transmitter).

39. Installation of Interphone Control Boxes

a. Install each interphone control box in its required location as indicated on the installation figure in the TM 11–2700 series. As previously explained, it is desirable to wire interphone cordage to the boxes before installation.

b. Complete connections of interphone cordage to the vehicle terminal box if required. Use conduit connector on the cordage to secure it firmly in terminal box knock-out hole.

c. Check for accidental ground or shorts in the wiring and then connect Cord CO–278–A to the vehicle battery terminal box, carefully observing proper polarity. Use a conduit connector on Cord CO–278–A to secure it firmly in the vehicle terminal box knock-out hole.

40. Installation of Chest CH–264

The chest mounts in the same manner as a receiver, and should be placed in the center position on the mounting when Radio Set SCR–528–(*) is used. When Radio Set SCR–508–(*) is used, the chest is stowed elsewhere in the vehicle.

41. Installation of Antenna

a. Remove the blank cover over the hole in the top left front corner of Cabinet CH–74–A. Mount Mast Base Bracket MP–52 over the hole with the screws and lockwashers furnished in the top of the cabinet.

b. Remove the cover plate from the top of Mast Base bracket MP–52. Place the upper insulator, item 5 (with neoprene washer, item 6, cemented to it) over hole in the cover plate of Mast Base Bracket MP–52. (See fig. 28.) Place the small neoprene washer, item 4, over item 5 and place the plain washer, item 3, over item 4. Insert body of the mast base, item 2, through items 3, 4, 5, and 6, and hole in cover plate. Insert bolt, item 8, into item 2 from under side of the cover plate, and turn item 2 clockwise until the mast base is tightened securely.

c. Cut a 53-inch length of Wire W–128. Strip back ½ inch on each end. Tin ends of exposed wire. Secure one end of wire to binding post on bottom of mast base. Route wire down through Mast Base Bracket MP–52 and replace cover plate. Secure other end of Wire W–128 to the TR binding post of Mounting FT–237–(*). Coaxial cable must not be used. When passing Wire W–128 through the side of the vehicle, chests, etc., always insert an insulating bushing, such as IN–101 or IN–111, in the hole to protect the wire. The wire should be run and supported in such a way that it is protected from damage and will not be subject to chafing due to vibration.

d. Screw Mast Section MS–118 into the top Mast Section MS–117, and Mast Section MS–117 into Mast Base AB–15/GR.

e. The antenna may be tied down when the vehicle is in motion, in order to clear overhead power lines and obstructions. When the vehicle is stationary, the antenna may be tied down for reasons of concealment. Remember, however, that *range and signal strength are reduced* when the antenna is tied down. For maximum range and signal strength, release the antenna. The antenna may be tied down by the use of Rope RP–5, an insulator such as IN–86 or IN–87, and a short piece of flat metal. Drill holes in each end of the metal piece, slip it over the threaded part of a mast section ferrule, and assemble the joint. Tie down to a convenient point on the vehicle with the insulator placed close to the antenna mast.

Note. The radiating system, which includes the antenna and ground circuit, must be of such dimensions that the circuits of the transmitter and the receiver can be resonated at the authorized frequencies. Normally, the *ground* connection for the antenna system will be made through the contact between the mounting and the frame of the vehicle. Where there is no direct connection to the frame or where the connection is unsuitable, bond it to frame through short lengths of braided copper strap, ½ inch wide. Make certain that there is good electrical contact at both ends of the straps and allow sufficient slack to permit free movement of the unit in the shock mounting.

Antenna and ground connections differ somewhat for each type of vehicle. Use the TR binding post on Mounting FT–237–(*) for the antenna connection. For specific installation

instructions on all types of vehicles using these sets, see the TM 11–2700 series.

42. Installation of Antenna A–62 (Phantom)

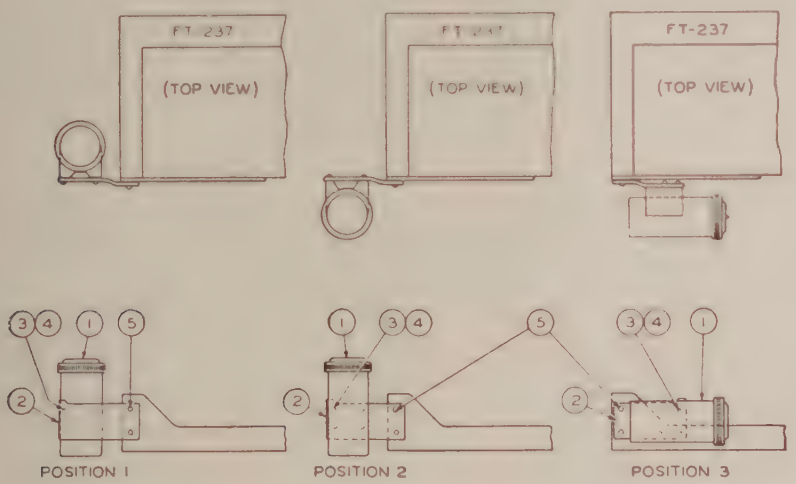
Standard methods of installing Antenna A–62 (Phantom) have been developed and are indicated in figure 49.

a. The following items are required for each installation:

Article	Quantity
Wire W–128	2 ft.
Antenna A–62 (Phantom) including 4 screws, machine, 6–32 x ½ in. and 4 washers, lock No. 6 std...	1
Bracket, steel, for Antenna A–62 (Phantom) which includes 2 screws, machine, 10–32 x ⅝ in. ..	1

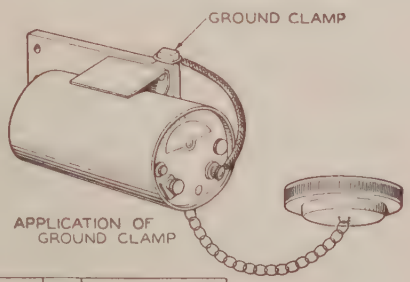
b. Applicable positions for installation of Antenna A–62 (Phantom):

Vehicle	Applicable position
Medium Tank M4A3	1
Tank Recovery Car M32	3
Flame Thrower M42	3
Light Tank M24	1
LVT (A)–4 and –5	3
LVT–4	3
Scout Car M3A1	3
Light Armored Car M8	3
Armored Utility Car M20	3
Truck, ¾-ton, weapons carrier	3
Truck, ¾-ton, 4 x 4, carry-all	3
Truck, ¾-ton, 4 x 4, command reconnaissance	3
Multiple Gun Motor Carriages M13, M14, and M16	3
Cargo Carrier M29	3
Truck, ¼-ton, 4 x 4	3



NOTE:

1. FOR REQUIRED POSITIONS FOR THE VARIOUS INSTALLATIONS OF ANTENNA A-62 (PHANTOM) REFER TO CHART OF APPLICABLE POSITIONS FOR INSTALLATION OF ANTENNA A-62 (PHANTOM).
2. FOR ALL POSITIONS OF ANTENNA A-62 ATTACH THE GROUND CLAMP TO THE TIP OF THE BRACKET.
3. WHEN INSTALLING BRACKET ② ON MOUNTING FT-237 USE A LONGER SCREW ⑤ AND THE ORIGINAL TOOTH-TYPE LOCKWASHERS.



QUAN REQ	NAME OF ITEM	ITEM NO	REMARKS
2	RD HD MACH SCR #10-32 X 5/8"	5	FURN WITH ②
4	LOCKWASHER #6 STD	4	FURN WITH ①
4	RD HD MACH SCR #6-32 X 1/2"	3	FURN WITH ①
1	BRACKET	2	PER SC-A-7765
1	ANTENNA A-62 (PHANTOM)	1	

TL11912

Figure 49. Installation of Antenna A–62 (Phantom) on Mounting FT–237–(*).

Note. When Antenna A–62 (Phantom) is installed in position 3, the bulge of Cover BG–96 cover the phantom antenna. In positions 1 and 2, the zipper on the left end of Cover BG–96 cannot be completely closed.

c. To make the installation, proceed as follows: Refer to *b* above and determine the correct position for the particular vehicle involved. Positions in this paragraph refer to positions 1, 2, and 3 shown in figure 49. Remove the two screws and lockwashers from the left front corner of Mounting FT–237–(*) and secure the bracket (with the antenna attached) to Mounting FT–237–(*), using the original lockwashers and two 10–32 x 5/8-inch screws provided.

d. When desired, disconnect the standard antenna lead-in from the antenna binding post on either Mounting FT–237–(*) or Radio Transmitter BC–604–(*), whichever is applicable for the particular installation, and connect one end of the 2-foot length of Wire W–128 to the binding post. Remove the cover from the antenna and connect the other end of the 2-foot length of Wire W–128 to the antenna binding post marked ANT. The ground clamp, connected to the binding post marked GND, must be fastened securely to the tip of bracket.

43. Installation of Radio Set AN/VRC–5 in Twin 40–MM Gun Motor Carriage M19

a. INTERCONNECTIONS. Four interconnections are necessary to install Radio Set AN/VRC–5: between the transmitter mounting and the battery; between the transmitter mounting and the antenna; between the mountings; and between the transmitter mounting and the interphone control box. All connections between the transmitter and its mounting and the receiver and its mounting are made automatically during installation. When installing, route all cabling through the cable clamps on each mounting near the terminal strips. This relieves the strain on the terminal strips and connections.

b. BATTERY CONNECTION. Cord CO–278 at the vehicle terminal box connects the storage battery in the vehicle and Mounting FT–508. Cord CO–278 is a shielded, single-conductor cable. One end of the shield is connected to

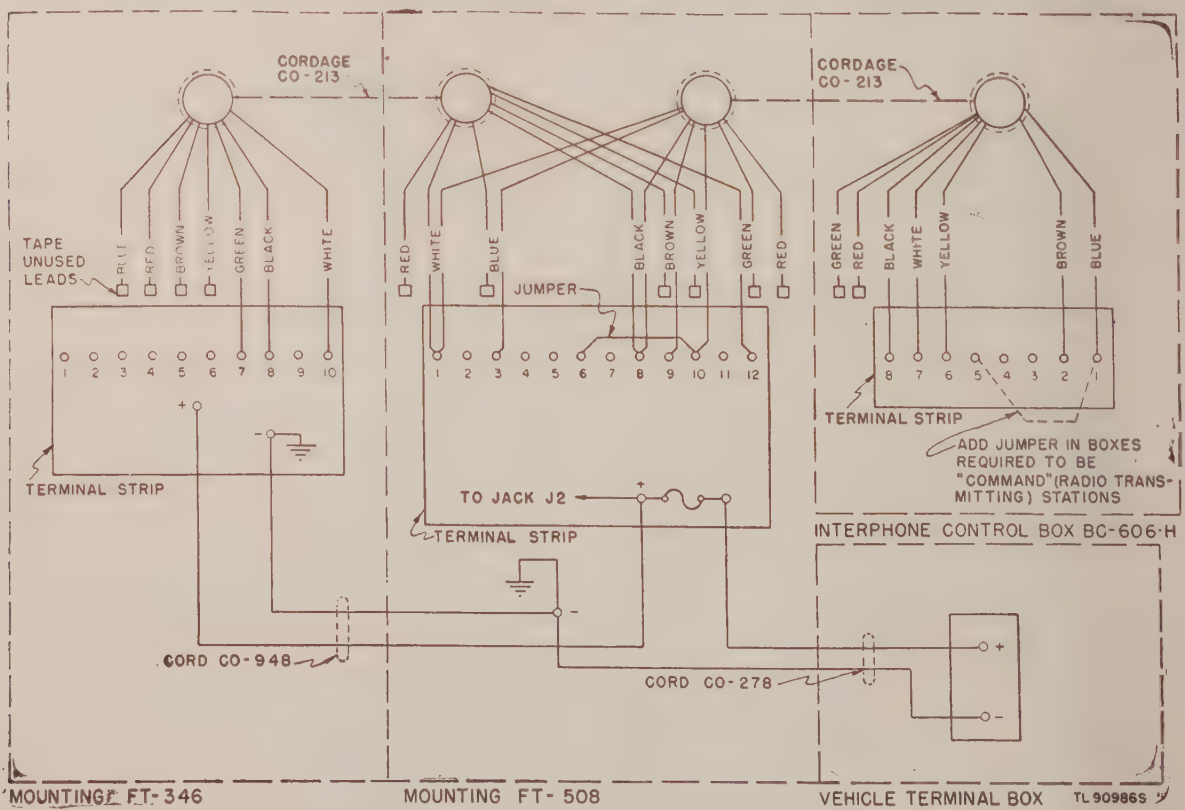


Figure 50. Radio Set AN/VRC–5, connection diagram.

the ground side of the terminal box; the other end is grounded to the mounting frame. The lead is connected to the battery connection terminal in the terminal box, and to the fuse on Mounting FT–508. The fuse connection is made so that the fuse is always in the circuit between the radio set and the battery. (See fig. 21.) The receiver is indirectly connected to the battery by connecting Cord CD–948 between the mountings. The cord is composed of a single and a double lead. The single lead is connected to the ground, or minus-terminal on the receiver mounting, and to the ground on the transmitter mounting. The double lead is connected to the plus-terminal on the receiver mounting, and to the fuse on the transmitter mounting. The lead is connected to the side of the fuse opposite the battery input. This is to provide fuse protection for the receiver mounting.

c. MOUNTING INTERCONNECTIONS. The two mountings are connected together (using Cordage CO–213) as indicated in figure 50. Also follow the color code shown in figure 50. The coaxial antenna connectors are connected with coaxial cable. For this, r-f Cable RG–11/U is used. Use the right-angle coaxial connector to make the connection to the transmitter mounting. Connection with the actual antenna is made through the antenna binding post on the transmitter mounting. Use Wire W–128 for this purpose. Cordage CO–213, coded as shown in figure 50, connects the transmitter mounting to Interphone Control Box BC–606–(*).

d. MOUNTING RECEIVER AND TRANSMITTER. The receiver may now be installed on its mounting. Set it on the front of the mounting and push it until it rests firmly against the back. Then raise the holding screws and tighten them over the hooks on the receiver. The transmitter is put into place by sliding it from the right to the left side of the mounting. Tighten the transmitter mounting screws on the right side of the transmitter case.

e. INTERPHONE. Using Cordage CO–213, connect Interphone Control Box BC–606–(*) as shown in figure 50. The physical location of the interphone box will depend on the type of installation. See the TM 11–2700 series.

f. SPARE PARTS CHEST. Spare Parts Chest CH–264 is furnished with Radio Set AN/VRC–5. Its physical location will also depend on its type of installation. (See the TM 11–2700 series.)

g. COVERS CW–116/VRC–5 AND CW–117/VRC–5. Cover CW–116/VRC–5 (19 inches wide, 13⅝ inches deep, 12 inches high) and Cover CW–117/VRC–5 (7 inches wide, 13⅝ inches deep, 12 inches high) are protective cloth hoods for Radio Transmitter BC–604–(*) and Radio Receiver BC–603–(*), respectively. They are made of No. 8 canvas duck material, especially designed for vehicular installations. The covers are not only water-repellent and splashproof, but they also shield the equipment against mildew. By unsnapping the lift-the-dot fasteners and pulling up the flaps on the front of the covers, operation of the sets may be carried on with little inconvenience.

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

44. Radio Transmitter BC–604–(*) Controls (Fig. 51)

a. ANTENNA AND GROUND BINDING POSTS. These posts, marked A and G respectively, are mounted above the push buttons. The binding posts are provided for test purposes and normally are not used in transmitter operation. They are, however, used in some installations to shorten the length of the lead-in.

b. CHANNEL SELECTOR PUSH BUTTONS. To accomplish bush-button tuning, press one of the 10 push buttons. When a push button is pressed, the following operations are performed: The proper oscillator crystal is connected into the circuit; all variable tuning capacitors are set to their appropriate values; and the proper antenna trimmer capacitor is connected into the circuit.

c. RECEIVER TUNE-OPERATE TOGGLE SWITCH. This switch, in the RECEIVER TUNE position, permits the transmitter to emit a weak signal which is picked up by the receiver so that presetting operations can be monitored in the headset or in the loudspeaker. When the switch is in the OPERATE position, the transmitter operates normally under the control of the microphone switch.

d. PANEL METER. The panel meter is controlled by the toggle switch under it marked TUNE-ANT CUR, and by the inset screw-type switch marked METER SWITCH on the right side of the transmitter housing. With the toggle switch thrown to TUNE, operating the METER SWITCH causes the meter to indicate relative total screen and plate current for all tubes, or individual relative grid current in each r-f stage except the oscillator. With the toggle switch thrown to ANT CUR, relative antenna current is indicated.

e. TRANSMITTER ON-OFF SWITCH. This toggle switch controls the battery supply to the filaments and the control circuits. The pilot lamp under the switch lights when the set is turned on.

f. RADIO-INTERPHONE SWITCH. When this switch is in the INTERPHONE position, all crew members of a vehicle such as a tank, where an interphone system is required, can communicate with each other by using the audio stages of the transmitter as an interphone amplifier. When the switch is thrown to the RADIO position, the intercommunication system is inoperative unless placed in operation by Interphone Control Box BC–606–(*) at a remote station. This switch is normally kept in the RADIO position.

g. MICROPHONE JACKS. The microphone jacks are mounted below the panel. The MIC CARB jack provides for a carbon microphone and the MAGNETIC jack for a magnetic or dynamic type of microphone.

h. FUSE. A fuse is inserted into a screw type receptacle to the left of the microphone jacks. This fuse protects the high-voltage circuit.

i. TANK-OTHER USE SWITCH. This switch is located at the left of the fuse, in the space formerly occupied by the high-voltage spare fuse. When the switch is in the TANK position, the carbon microphone circuit is made relatively insensitive in order to avoid picking up the noise in a tank. The OTHER USE position, which makes the carbon microphone more sensitive, is used in quiet locations.

j. CRYSTAL STORAGE COMPARTMENT. This compartment, in the upper left corner of the front panel, contains a removable drawer which provides space for storing 80 crystal holders.

k. CRYSTAL OVEN. The crystal oven, protected by a coverplate, is to the left of the push buttons. In this compartment are the crystal receptacle strip which mounts 10 crystal holders, one for each channel; the thermo-

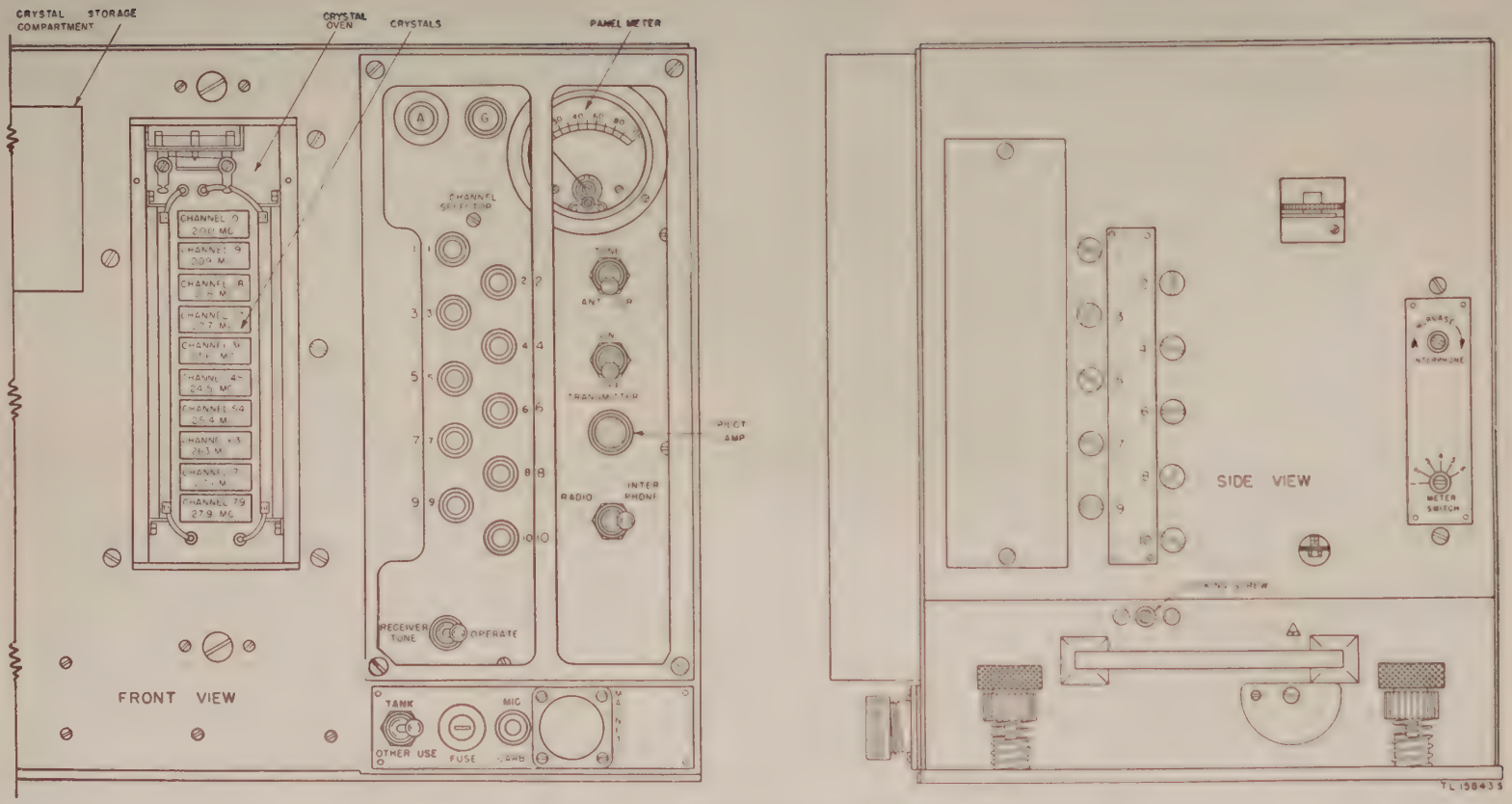


Figure 51. Radio Transmitter BC–604–(*), front and right side views.

static switch for automatic heat control within the compartment; and two heating resistors.

l. ANTENNA TRIMMER CONTROLS. The controls located behind the holes numbered 1 to 10 are the adjustments of the antenna trimmer capacitors. These capacitors are individually adjusted for each channel during presetting operations.

m. ANTENNA COUPLING CONTROL. The square opening provides access to a knurled finger wheel by means of which the antenna coupling can be adjusted.

n. POWER-AMPLIFIER TANK COIL ADJUSTMENT. The circular opening provides access to a toothed wheel used in adjusting the slug in the p-a tank coil.

o. INCREASE SIDETONE CONTROL. The INCREASE SIDETONE (or INTERPHONE on some transmitters) adjusting screw varies the volume to the sidetone and interphone circuits.

p. GANGED CAPACITOR TUNING CONTROL. This control is located below the handle on the right side of the chassis. The control is adjusted during presetting operations and can be turned by means of the pin which projects from the face of the control disk, or the screwdriver slot at the center of this disk.

q. GANGED CAPACITOR LOCKING SCREW. This screw, located below the antenna trimmer controls, can be reached when the ganged capacitor tuning control is rotated to its maximum clockwise position.

45. Radio Receiver BC–603–(*) Controls (Fig. 52)

a. REC ON-OFF SWITCH. This switch controls the battery voltage to the dynamotor and filament circuit.

b. TUNE-OPERATE SWITCH. When the switch is in the OPERATE position the receiver operates normally. When the switch is in the TUNE position, an intermediate-frequency (i-f) oscillator is made operative. This oscillator is used in tuning and alining the receiver.

c. RADIO & INT-INT ONLY SWITCH. This switch is in the headphone circuit. When it is in the RADIO & INT position, the headphones are connected to both the receiver and interphone output circuits. When this switch is in the INT ONLY position, the headphones are disconnected from the receiver and left connected to the interphone output circuit.

Note. Because of modifications, this switch must always be left in the RADIO & INT position.

d. SQUELCH ON-OFF SWITCH. This switch turns the squelch circuit on or off. The squelch circuit eliminates the noise in the receiver output when no carrier is being received.

e. SENSITIVITY CONTROL. The SENSITIVITY control is used in conjunction with the squelch circuit in the receiver. When the SQUELCH switch is ON, the SENSITIVITY control varies the gain of the r-f and i-f stages by controlling their bias. When the SQUELCH switch is OFF, the receiver sensitivity is restored to maximum and cannot be adjusted.

f. SPEAKER ON-OFF SWITCH. In the OFF position, the built-in loudspeaker is removed from the audio output circuit.

g. VOLUME CONTROL. The VOLUME control varies the audio output of the receiver.

h. TUNING CONTROL. This control provides manual tuning when all the channel selector push buttons are released and the PUSH TO TUNE button is depressed. In later receiver models, the PUSH TO TUNE button can be kept in a depressed position by means of the EMERGENCY LOCK.

i. CHANNEL SELECTOR PUSH BUTTONS. The 10 channel selector push buttons automatically tune the receiver to any one of the 10 preset operating channels. When a push button is pressed, the ganged tuning capacitors are rotated to a preset position.

j. LOCKING SCREW. A locking screw for the channel selector push-button mechanism is accessible through a hole in the upper right corner of the panel when the receiver tuning dial marked CHANNEL MC is turned to its extreme h-f position.

k. CALL SIGNAL LAMP. The CALL SIGNAL lamp is used in conjunction with the squelch circuit. The lamp is illuminated when a signal is received, if the SQUELCH switch is ON and the SENSITIVITY control has been adjusted to prevent operation of the squelch circuit by received noise.

l. FUSES. A fuse and its spare are located to the left of the SPEAKER switch. This fuse protects the low-voltage circuit.

m. A AND G TERMINALS. These terminals

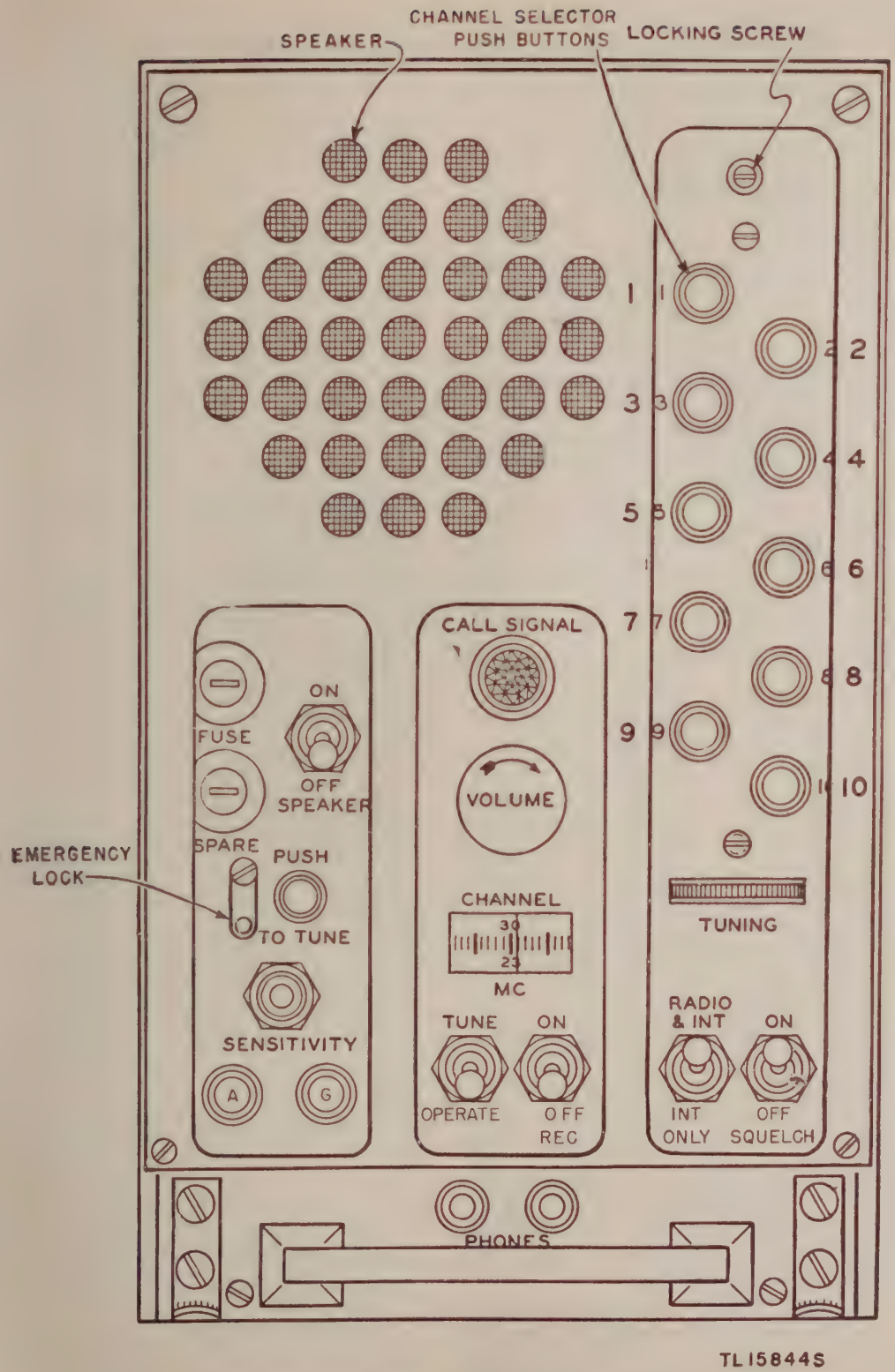


Figure 52. Radio Receiver BC–603–(*), front view.

are auxiliary antenna and ground connections. They are used for test purposes only.

n. PHONES JACKS. The two phone jacks marked PHONES provide audio output to two pairs of headphones.

Section IV. OPERATION

46. General

a. Do not attempt to operate the equipment until it has been preset. (See pars. 188 and 189.)

b. Allow 10 to 15 minutes for the set to warm up before attempting to preset it.

c. If at all possible, the battery should be under charge while operating the set. If the battery is not being charged, keep transmissions as brief as possible.

47. Operation of Radio Tranmitter BC–604–(*)

a. Place the transmitter switches at the following positions:

(1) RECEIVER TUNE-OPERATE at OPERATE.

(2) RADIO-INTERPHONE at RADIO.

(3) TUNE-ANT CUR at ANT CUR.

(4) TRANSMITTER ON-OFF at OFF.

(5) The RADIO-INT switches on all interphone control boxes must be in the RADIO position.

b. Turn the TRANSMITTER ON-OFF switch to ON. The pilot lamp on the front panel of the transmitter should glow, indicating that voltage is being applied to the filaments. Approximately 5 seconds are required for the tube filaments to heat.

c. Plug the microphone into the MIC CARB jack. Depress a push button and turn the transmitter on by depressing the microphone button. *A push button should always be depressed before starting the transmitter.* The dynamotor in the transmitter should start. *Never start the dynamotor by means of the TRANSMITTER ON-OFF switch.* If the transmitter is working properly, the panel meter will indicate antenna current.

Caution. The transmitter dynamotor has been constructed for intermittent operation and, therefore, should never be left running for more than 5 out of every 20 minutes. Continuous operation will cause serious damage to the dynamotor. Also, *do not operate the transmitter without an antenna.*

d. Turn the transmitter off when no further transmissions are to be made by placing the TRANSMITTER ON-OFF switch at the OFF position.

48. Operation of Radio Receiver BC–603–(*)

a. Set the receiver switches at the following positions:

(1) REC ON-OFF at OFF.

(2) TUNE-OPERATE at OPERATE.

(3) SQUELCH OFF-ON at OFF.

(4) RADIO & INT-INT ONLY AT RADIO & INT.

(5) SPEAKER OFF-ON at ON.

(6) Turn the SENSITIVITY control completely clockwise.

b. Turn the REC ON-OFF switch to ON. Approximately 15 seconds are required to heat the vacuum-tube filaments. The receiver dynamotor is built for continuous operation and may be left running for long periods.

c. Turn the VOLUME control fully clockwise. A high noise level in the loudspeaker indicates that the receiver is operating.

d. Throw the SQUELCH switch to ON and turn the SENSITIVITY control counterclockwise to a point just where the noise ceases and the CALL SIGNAL lamp goes out. The squelch control is now set properly; a received signal will light the CALL SIGNAL lamp and will be heard in the loudspeaker.

e. Turn the SPEAKER switch to OFF and note that this switch does not affect headset operation.

f. Turn the receiver RADIO & INT-INT ONLY switch to INT ONLY; this opens the headset circuits and prevents the receiver output from being heard in the headset. *Reset this switch at the RADIO & INT position.* In later modified models of the radio set, whenever the transmitter or interphone amplifier dynamotor is started, the output of the receiver is disabled. The receiver is not disabled when the TUNE-OPERATE switch is in the TUNE position.

g. Depressing any one channel selector push button automatically tunes the receiver to its associated preset channel.

h. The TUNING adjustment is supplementary to the selector push buttons and provides manual tuning. Manual tuning to any desired channel is accomplished by *releasing* all selector push buttons and adjusting the TUNING control while depressing the PUSH TO TUNE button. Manual tuning is facilitated by throwing the TUNE-OPERATE switch to TUNE and adjusting the TUNING control to the transmitter frequency desired. The proper TUNING control setting is indicated by a beat note. When the tuning is correct, restore the TUNE-OPERATE switch to OPERATE.

i. To turn off the receiver, place the REC ON-OFF switch at OFF.

49. Interphone Operation Using Interphone Control Box BC–606–H or Earlier Modified Models

a. All interphone boxes are wired similarly except the one used by the commander.

b. Insert a headset plug into any one of the interphone boxes, place the RADIO & INT-INT ONLY switch on the receiver to RADIO & INT, vary the VOLUME control on the box and observe that the noise in the headset varies in volume.

c. Throw the transmitter RADIO-INTERPHONE switch to INTERPHONE, starting the transmitter dynamotor. Depress the switch of the transmitter microphone, and speak into it. The speaker's voice should be heard in the headsets both at the interphone station and at the receiver. The VOLUME control at the interphone box varies the volume of the signal in its headset, but the VOLUME control on the receiver has no effect on either headset.

d. Vary the SIDETONE control on the right side of the transmitter. This should control the volume in all headsets.

e. The r-f section of the transmitter is blocked and only the audio circuits are in use when the interphone system is put into operation by:

(1) Placing the transmitter RADIO-INTERPHONE switch at INTERPHONE.

(2) Leaving the interphone control box RADIO-INT switch in its released INT position and pressing the button of its microphone.

Note. When unmodified models of Interphone Control Box BC–606–A to G are used, leave the RADIO-INT switch in the RADIO position since placing it in the INT position will put the interphone system into operation and prevent radio transmission. To improve system operation, Interphone Control Box BC–606–A to G are modified by MWO SIG 11–600–8. After modification, the circuit functioning of Interphone Control Box BC–606–A to G is electrically the same as Interphone Control Box BC–606–H.

f. Plug the microphone into any crew member's interphone box. Leave the RADIO-INT switch in INT position. Depress the button of the microphone and talk into it. Speech should be heard in the receiver and all interphone headsets. Hold the RADIO-INT switch in the RADIO position and depress the microphone button. There will be no antenna current indicated on the panel meter.

g. Insert the microphone plug into the MIC jack at the commander's interphone control box. Leave all RADIO-INT interphone control box switches at INT, depress the microphone button, and talk into the microphone. Speech should be heard in the receiver and all interphone headsets. Hold the commander's RADIO-INT switch in the RADIO position and depress the microphone button. Antenna current should be indicated on the panel meter.

h. Summing up, with the receiver RADIO & INT-INT ONLY switch in the normal RADIO & INT position, the output of the receiver and audio output of the transmitter is applied to all the headsets. Whenever the transmitter dynamotor is energized, whether for radio or interphone operation, the output of the receiver is disabled and only the audio output of the audio section of the transmitter is applied to the headsets. All vehicle members can communicate with each other over the interphone system. Only the commander and the operator at the transmitter can carry on radio communication. In some installations, more than one interphone control box is wired as a command box. In addition, operation of any crew member's microphone during radio transmission will interrupt the transmission and return the system to interphone.

Note. The transmitter RADIO - INTERPHONE switch is normally kept in the RADIO position. The selection of radio or interphone transmission is made at the commander's interphone control box.

50. Operating Precautions

a. TRANSMISSION CONDITIONS. (1) The operating range depends upon the terrain, enemy interference, and radio noise. The equipment may be expected to operate 5 to 7 miles except under the worst conditions (as in tunnels, among skyscraper buildings, or over a high hill); but careful selection of elevated spots may extend the range to 15 or 20 miles. Communication over ranges in excess of this are due to very careful choice of operating locations at both ends of the radio circuits; not to exceptionally powerful radio transmitters.

(2) The vehicle may be hidden in bushes or trees without materially reducing the range if the antenna does not actually touch leaves or branches.

(3) Crackling, indistinct or noisy signals indicate borderline conditions and the operator should not expect to operate over much longer distance without loss of communication. Improved reception may be obtained by stopping the vehicle motor while receiving. However, the vehicle battery will not stand use of the transmitter for extended periods without charging.

(4) Avoid use of the equipment under or near power lines, telegraph lines, overhead steel bridges, electrical equipment, or other obstacles suspected to be a source of electrical interference, as they absorb the signal or increase the radio noise.

(5) Radio noise is always present to some extent. The portion due to natural causes cannot be reduced; but man-made noise may be reduced by moving away from the cause; or, if the cause is the vehicle's ignition system, inspecting the suppression system for loose, short-circuited, or broken connections.

b. OVERHEATING. If the entire equipment is mounted in a tightly inclosed restricted space without adequate ventilation, there is danger of overheating after extended periods of operation. Take reasonable care to operate the equipment for as short intervals as practicable under such conditions. Do not run the transmitter dynamotor for more than 5 out of every 20 minutes.

c. LOW TEMPERATURE OPERATION. The following information is provided to improve low temperature operation.

(1) If shock mounts become excessively brittle and break, fasten the radio set down solidly using any suitable support or spacers.

(2) Use Microphone Cover CW–110/U on Microphone T–17–(*).

(3) Use Cover BG–96 to provide protection against snow and ice to reduce heat losses.

(4) If operational difficulty is experienced, thoroughly clean all existing lubricant from surfaces of the push-button mechanism and manual tuning control, using solvent, dry-cleaning (SD), and relubricate as described in section VIII. Refer to paragraph 87*d* for dynamotor operation at extremely low temperatures.

(5) Do not subject the equipment to severe mechanical shock at any time, and especially after long periods of storage.

(6) Handle cords and cables with care to prevent cracking or breaking. Learn the flexing capabilities of the particular cords in the set and handle them accordingly. When an installation is to be made at temperatures approaching —65° F., the cables should be kept in a warm location, and uncoiled and prepared for installation.

(7) Allow equipment to warm up if possible, before attempting operation. Prevent heat loss by keeping openings on Cover BG–96 closed as much as possible.

d. RECEIVER. Be sure that the SENSITIVITY control is properly adjusted when using the squelch circuit. Improper adjustment of this control will result in seriously reducing the range of the set. If there is any doubt whatever about use of the squelch, turn it OFF and reduce the receiver output volume sufficiently to prevent fatigue on long stand-by periods but not enough to prevent hearing a signal.

c. TRANSMITTER. (1) Always press a channel selector push button before starting the dynamotor by operating the microphone control switch or by throwing the RECEIVER TUNE-OPERATE switch to RECEIVER TUNE.

(2) Operation of the transmitter filaments for long periods without application of plate voltage tends to evaporate the active material from their surface and reduce their useful life. Therefore, the TRANSMITTER ON-OFF switch should be OFF if the transmitter is not to be used for an extended period.

(3) Do not operate the transmitter without an antenna. Either the mast antenna or the phantom antenna must be used.

f. MICROPHONE TECHNIQUE. The radio sets have been designed to work under noisy conditions around the operator such as occur in a tank or other noisy vehicle. Microphone T–45 and T–35–(*) have noise reducing features for use in tanks, etc. It is important, in order to obtain best operation from the equipment, that the operator using a microphone such as a Microphone T–17–(*) hold it in a nearly verticle position and with the lips just touching the surface. It is not necessary to shout when using any microphone; but loud speech is necessary in order to make the speech power at the microphone of a higher level than the surrounding noise. Each word should be completed before starting the next and a slight emphasis should be placed on all sibilants, such as C, S, and Z, and terminal consonants such as T and G. Speak slowly. Although the equipment has been designed to eliminate as much as possible the effects of noises, the above instructions will aid materially in obtaining satisfactory communication with the remote station, especially under poor receiving conditions.

g. NET OPERATION. In net operation each set in the net must be accurately tuned to the same frequency. Tune all sets within the net under substantially the same conditions. The positions and lengths of the antennas, the temperatures, and the battery terminal voltages must be fairly uniform. See FM 24–18 for a complete discussion of net operation.

51. Operation of Antenna A–62 (Phantom)

a. GENERAL. When adjusted during manufacture, the inductance is set at 1.35 mh as indicated by a white line inside the case directly under the L adjusting screw; and the variable capacity is set at 39 micromicrofarad (mmf). These original adjustments are usually correct for all standard installations. Small adjustments of either L or C may be necessary for some installations to compensate for differences in vehicular structure or antenna position. Once the phantom antenna has been adjusted for a particular installation, it should be unnecessary to make any further adjustments. To use the phantom antenna it is only necessary to disconnect the standard antenna lead-in from the antenna binding post on Mounting FT–237–(*), or Radio Transmitter BC–604–(*) and connect a 2-foot length of Wire W–128 between this post and the ANT binding post on the phantom antenna.

b. ADJUSTMENT CHECK. (1) Operate the radio transmitter using the phantom antenna. Observe whether or not any readjustment of the antenna trimmer capacitors is necessary to obtain maximum antenna current indications on the transmitter panel meter. If no appreciable change in the settings is required, the phantom antenna is working correctly.

(2) If the setting of the antenna trimmer capacitors on the transmitter must be changed appreciably to obtain maximum antenna current, the phantom antenna must be readjusted.

c. ADJUSTMENT PROCEDURE. (1) Make sure that the transmitter is tuned to the standard vehicular antenna. This usually involves depressing the transmitter push buttons one at a time and adjusting the corresponding antenna trimmer capacitor for a maximum ANT CUR reading. If necessary, retune the transmitter antenna circuit using the mast antenna and the procedure in paragraph 188*c*.

(2) Disconnect the vehicular antenna and connect the phantom antenna. Change the C adjustment in the phantom by one scale division in either direction.

(3) Operate the transmitter and check the tuning of the antenna trimmer capacitors. If further readjustment is necessary, repeat steps (1) and (2) above.

(4) If the correct adjustment cannot be found by adjusting the capacitor alone, set it at the arrow mark on the dial, and turn the adjusting screw marked INCREASE L in either direction, two or three complete turns.

(5) Repeat steps (1), (2), and (3) above.

(6) By repeating steps (1), (2), (3), and (4) above, a proper combination of L and C can be obtained.

(7) No further changes should be necessary unless the installation is changed.

Section V. EQUIPMENT PERFORMANCE CHECK LIST

52. Purpose and Use of Check List

a. GENERAL. The equipment performance check list (par. 53) will help the operator determine whether the radio set 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 the operator can take. Check items 1 to 13 before starting (before turning the equipment on), items 14 and 15 when starting, items 19 to 28 during operation, and items 29 and 30 when stopping (when turning the equipment off). Items 19, 21, and 27 of this 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 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 the operator can make without turning the equipment in for repairs. When reference is made in the table to part five it indicates that the trouble cannot be corrected during operation and that trouble shooting by an experienced repairman is called for. 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.

e. ITEMS 1 TO 13. Items 1 to 13 should be checked each time the equipment is put into operation.

f. ITEM 21. Item 21 shows correct meter readings on the radio transmitter when it is properly tuned and in operation.

Note. All readings are correct for input voltages of 12 or 24 volts. If the input voltage is greater, slightly higher readings may be expected. The corrective measures listed in the last column are to be performed if the readings for the various tests do not agree reasonably with the chart.

g. ITEMS 16 TO 28. These items represent general operating characteristics of the radio set. The operator must become familiar with the characteristics of the set during normal operation; he must use that knowledge as a basis for recognizing changes in audible and visible indications, such as absence of sidetone, lack of dynamotor noise, and poor or no meter readings, when the set is not operating properly. By becoming familiar with the operation of the receiver, the operator will know the normal position of the VOLUME control. This will aid in an approximate determination of the sensitivity and amplification of the receiver.

h. ITEMS 29 AND 30. Items 29 and 30 are checked whenever the station is taken out of operation. Any abnormal indications at this time are probably caused by trouble in the set and should be corrected before the next expected period of operation.

53. Equipment Performance Check List

	Item No.	Item	Action or condition	Normal indications	Corrective measures
			Radio Receiver (fig. 52)		
PREPARATORY	1...	Headset	Headset plugged into PHONES jack		
	2...	Loudspeaker	SPEAKER ON-OFF switch in ON position		
	3...	SQUELCH ON-OFF switch	In OFF position		
	4...	RADIO & INT-INT ONLY switch ...	In RADIO & INT position		
	5...	TUNE-OPERATE switch	In OPERATE position ..		
			Radio Transmitter (fig. 51)		
PREPARATORY	6...	Microphone (if used)	Microphone plugged into CARBON MIC jack ...		
	7...	Antenna	Standard antenna connected unless radio transmission is not authorized and phantom antenna is used		
	8...	RECEIVER TUNE-OPERATE switch	In OPERATE position ..		
	9...	TUNE-ANT CUR switch	In ANT-CUR position ...		
	10...	RADIO-INTERPHONE switch ..	In RADIO position		
			Interphone Control Box (fig. 39)		
PREPARATORY	11...	Headset	Headset plugged into PHONE jack		
	12...	Microphone	Microphone plugged into MIC jack		
	13...	RADIO-INT switch.	In released INT position. If using unmodified models of interphone Control Box BC-606-A to G, place the RADIO-INTERPHONE switch at RADIO		

Radio Receiver

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	14...	REC ON-OFF switch	Turn to ON position	Dynamotor starts and runs	Check fuses. See part five.

Radio Transmitter

START	15...	TRANSMITTER ON-OFF switch	Turn to ON position	Pilot lamp lights.	Check fuse and pilot lamp. See part five.

Radio Receiver

EQUIPMENT PERFORMANCE	16...	VOLUME control...	Rotate clockwise	Noise output is heard in speaker and in all head sets. CALL SIGNAL lamp lights	Check position of RADIO & INT-INT ONLY switch. Check lamp and tube V10. See part five.
	17...	Squelch circuit	Turn SQUELCH ON-OFF switch to ON position. Rotate SENSITIVITY control to left from its full clockwise position ..	CALL SIGNAL lamp goes out as noise output stops	Check tube V9. See part five.
	18...	Manual tuning	All channel selector push buttons released. SQUELCH ON-OFF switch at OFF. PUSH TO TUNE button held depressed. TUNING control rotated	Noise varies and a signal may be received. If signals are received, a beat note will be heard with the TUNE-OPERATE switch at TUNE. The CALL SIGNAL lamp should be on	See part five.
	19...	Push-button tuning.	Depress same channel selector push button on receiver and transmitter. Place transmitter RECEIVER TUNE-OPERATE switch to RECEIVER TUNE. Place receiver TUNE-OPERATE switch in TUNE position ..... Repeat for remaining channels	A beat note should be heard	Readjust presetting Check tube V10. See part five

EQUIPMENT PERFORMANCE

Item No.	Item	Action or condition	Normal indications	Corrective measures
20...	Radio CHANNEL SELECTOR push buttons	After 3 seconds, depress a CHANNEL SELECTOR push button, press the transmitter microphone button, and talk into the microphone ...	Transmitter dynamotor starts and panel meter deflects. (If the phantom antenna is used, the neon lamp should glow.) Sidetone should be heard in all headsets.	Check to see that crystal is installed in channel being used. Check tubes and meter readings given below. See part five.
		Repeat for remaining channels		
21...	**Meter readings**	TUNE-ANT CUR switch at TUNE. Microphone button depressed. METER SWITCH in position:	Meter reads:	
		No. 1 (Tripler grid)	20-30	Check tube V103.
		No. 2 (First r-f grid) ...	25-40	Try another crystal. Check tubes V107 and V101.
		No. 3 (Rectifier grid) ...	20-25	Check tube V102.
		No. 4 (Doubler grid)	25-40	Check tube V108.
		No. 5 (P.A. grid)	15-20	Check tube V104.
		No. 6 (Total plate and screen)	55-65	Check battery under load. See part five.
22...	RADIO-INTERPHONE switch ..	In INTERPHONE position. Depress button and talk into microphone ..	Dynamotor starts. Speech should be heard in all headsets. (Replace switch to RADIO position.)	See part five.
23...	RECEIVER TUNE-OPERATE switch	One CHANNEL SELECTOR push button depressed. RECEIVER TUNE-OPERATE switch in RECEIVER TUNE position. TUNE-ANT CUR switch in ANT CUR position ...	Transmitter dynamotor starts. No ANT CUR reading. The receiver can pick up a beat note on the same channel with the receiver TUNE-OPERATE switch in the TUNE position. Replace RECEIVER TUNE-OPERATE switch in OPERATE position	See part five.

Radio Transmitter (contd.)

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	24...	TANK-OTHER USE switch	Microphone button depressed and microphone spoken into. TANK-OTHER USE switch snapped from one position to other	Headset response louder in OTHER USE position than in TANK position.	See part five.
	25...	SIDETONE control.	Varied slightly	Headset response varies	See part five.

Interphone Control Box

EQUIPMENT PERFORMANCE	26...	VOLUME control ..	Rotate while receiver output is heard in headset.	Volume varies ..	See part five.
	27...	RADIO-INT switch.	Left released in INT position. Microphone button depressed and microphone spoken into ..	Speech heard in all the headsets of the radio set. No ANT CUR reading	See part five.
			Held in RADIO position. Microphone button depressed and microphone spoken into	Speech heard in all the headsets of the radio set. ANT CUR reading on panel meter ..	

Radio Set SCR-508-(*) and SCR-528-(*)

EQUIPMENT PERFORMANCE	28...	Disabling circuit ...	With the receiver output heard in the headsets, start the transmitter dynamotor by placing the transmitter RECEIVER TUNE-OPERATE switch in RECEIVER TUNE position; or by placing the RADIO-INTERPHONE switch at INTERPHONE; or by placing the RADIO-INTERPHONE switch at RADIO and pressing the microphone button	The receiver output is not heard when the transmitter dynamotor starts	See part five. *Note.* If the radio set is not modified in accordance with MWO SIG 11-600-4 or 9, and is not provided with disabling circuits to prevent the receiver output from interfering with interphone conversation, the receiver can only be disabled when the transmitter RECEIVER TUNE-OPERATE switch is at OPERATE and the transmitter is placed on the air by depressing the button on the local microphone or on the commander's microphone (the interphone control box switch in the RADIO position).

Radio Receiver

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STOP	29...	REC ON-OFF switch	Turn to OFF position ...	Receiver dynamotor stops	

Radio Transmitter

STOP	30...	TRANSMITTER ON-OFF switch	Turn to OFF position ...	Pilot lamp goes out	

PART THREE

MAINTENANCE INSTRUCTIONS

Section VI. PREVENTIVE MAINTENANCE TECHNIQUES

54. 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 equipment operating at top efficiency. Preventive maintenance is of utmost importance. A system of radio communication depends upon the readiness and operating efficiency of each item of equipment when it is needed. It is vitally important that radio operators and repairmen maintain their 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 IX are higher echelon maintenance.

55. Description of Preventive Maintenance Techniques

a. GENERAL. (1) Most of the electrical parts used in the radio set require routine preventive maintenance. Some parts require more maintenance than others. Some require maintenance of a different kind. Because hit-or-miss techniques cannot be applied, definite and specific instructions are needed. This section of the manual contains these specific instructions to guide personnel assigned to perform the six basic maintenance operations: 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 Feel operation is inapplicable to Radio Sets SCR–508–(*), SCR–528–(*), and AN/VRC–5.

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

b. INSPECT. Inspection is the most important operation in preventive maintenance. A careless observer will overlook evidences of minor trouble. Although these defects may not at the moment interfere with performance of the equipment, valuable time and effort can be saved if they are corrected *before* they lead to major break-downs. To be able to recognize the signs of a defective set, make every effort to become thoroughly familiar with indications of *normal* functioning. Inspection consists of *carefully* observing all parts of the equipment, noticing their color, placement, state of cleanliness, moisture accumulations, 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 and binding posts. Parts, connections, and joints should be free from dust, corrosion, and other foreign matter. In tropical and high-humidity locations, look for fungus growth, mildew, and moisture accumulations.

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

c. 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 IX for details of moistureproofing and fungiproofing.

d. LUBRICATE. Lubrication refers to the application of grease or oil to the bearings of motors or rotating shafts. It may also mean the application of a light oil to door hinges or other sliding surfaces on the equipment. When lubrication is required, see section VIII.

56. Vacuum Tubes

Note. Do not work on tubes immediately after shut-down. Severe burns may result from contact with 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. Tubes with loose plate caps or envelopes should be replaced if possible.

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

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

(4) Be careful when removing a tube from its socket, especially if it is a high-power tube. Never jar a warm tube. Always remove connections to grid caps and plate caps.

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

c. ADJUST (A). Adjust loose tube connector clips. Do not flatten tube connector clips during adjustment. Flattened clips do not make adequate contact with surface of tube cap. If clip is made of thin metal, it can be adjusted by gently compressing it with the fingers. If it is made of heavy-gauge metal, suitable pressure can be applied with a pair of long-nose pliers.

d. CLEAN (C). (1) Clean the tubes, if necessary. Tubes operated at high voltages and with exposed plate and grid connection must be kept free from dirt and dust because of possible leakage between grid and plate terminals. In contrast, tubes operating at low voltages and not having exposed grid and plate caps do not require frequent cleaning. However, do not permit dirt to accumulate on low-voltage tubes.

(2) Remove dust and dirt from glass or metal envelopes with a clean, lint-free, dry cloth. If proper care is used, grid and plate caps may be cleaned with a piece of No. 0000 sandpaper by wrapping the paper around the cap and gently rubbing the surface. Excessive pressure is not needed. It is not necessary to grip the cap tightly. Wipe the cap with a clean dry cloth.

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

(4) Wipe off moisture with a clean dry cloth.

57. Capacitors

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

(2) Thoroughly inspect the case of each

large fixed capacitor for leaks, bulges, and discoloration.

(3) Inspect plates of variable capacitors for dirt, dust, or lint. Examine the movable set of plates for signs of damage or misalinement 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). Tighten loose terminals, mountings, and connections on capacitors, when necessary. Do not break the bushing or damage the gasket.

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

(2) Clean plates of variable capacitors with a small brush or pipe cleaner, removing all dust and lint. Dust, if present, may cause arcing.

d. LUBRICATE (L). See section VIII.

58. Resistors

a. GENERAL. Various types of resistors are used in the radio set. The connections to the various resistors are either of pigtail or solder-lug type.

b. INSPECT (I). Inspect coating of 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. Inspect leads and all other connections for corrosion, dirt, dust, looseness, and broken strands in connecting wires. Check security of all mountings. Do not attempt to move resistors with pigtail connections, because there is danger of breaking the connections at point where they enter body of resistor. Such defects cannot be repaired.

c. TIGHTEN (T). Tighten resistor connections and mountings whenever they are loose. If a resistor remains loose, vibration may break the connection or damage the body.

d. 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. Wipe them with a dry cloth. However, if the dirt deposit is unusually hard to remove, use dry-cleaning solvent (SD).

(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 V.

59. Fuses

a. GENERAL. Fuses used in the radio set are of two kinds: those with a glass case and those without a case. The glass fuses are easily removed for inspection. See that the fuse ends and holding clips on large fuses are kept clean and tight. If they are not, arcing and burning will occur and make replacement of complete holder necessary. The strip type fuse can be removed only after the two screws that hold it have been taken out. Fuses should be thrown away when they blow.

b. INSPECT (I). Inspect fuse caps for evidence of burning, charring, and corrosion; fuse clips for dirt, loose connections, and loss of tension.

c. TIGHTEN (T). Tension of fuse clips may be increased by pressing sides closer together. If necessary, use a pair of pliers to adjust tension.

d. CLEAN (C). Clean fuse ends and fuse clips with emery cloth. Wipe them with a clean cloth. When using a file to remove deep pits on the clips, fuse ends, or contacts, always finish up with crocus cloth to leave a smooth contact surface. As a final step wipe the surface with a clean dry cloth.

60. Bushings and Insulators

a. DESCRIPTION. (1) Insulated bushings are used in the high-voltage and r-f circuits. They are constructed of ceramic material with a glazed surface. Because an insulator is no better than its surface, deposits of foreign substances on the surface will reduce the insulation value of the bushing. Therefore, it is important that all bushings used in high-voltage circuits be inspected frequently.

(2) Insulated bushings are used as supports for high-voltage tube sockets, for high-voltage terminals of capacitors, and for tank coils.

They are used as mountings for resistors in high-voltage circuits and as supports for panels which mount other parts. The condition of insulated bushings that are used solely as panel supports is not too critical, but the condition of bushings used as high-voltage insulators is extremely important.

b. INSPECT (I). (1) Inspect physical condition of insulated bushings. They should be clean without cracks or chips. A highly glazed insulator may develop fine-line surface cracks where moisture and dust will accumulate and eventually form a leakage for a high-voltage flash-over.

(2) As a rule, the bushings are held in position with nuts screwed onto the threaded conductors. These can be replaced very easily. If replacement is not possible because of a shortage of supplies, clean the defective bushing frequently and thoroughly with dry-cleaning solvent (SD). Sometimes it is difficult to see dust on a glazed surface. A satisfactory check can be made by sliding a clean finger across the bushing.

c. TIGHTEN (T). The procedure to use in tightening loose bushings is self-evident, but observe one precaution: *Avoid forcing the nuts or screws down too tight.* If excessive pressure is exerted on bushings, damage or breakage is almost certain. If threads on bushing stud bolts are stripped so that they cannot be tightened, replace entire bushing.

d. CLEAN (C). Insulated bushings are easily cleaned. Never use abrasive materials because they destroy the glazed finish, thus permitting moisture to be absorbed. A clean cloth is usually satisfactory. If deposits of grime or dirt on the surface of a bushing are hard to remove, use dry-cleaning solvent (SD). After the surface has been cleaned with solvent, carefully polish it with a dry cloth. Otherwise, a thin film of the solvent will be left which may impair the effectiveness of the bushing as a high-voltage insulator.

61. Relays

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

a. INSPECT (I). (1) Inspect relay for defects. Contacts may be examined with the aid of a flashlight and mirror.

(2) Check mechanical action of 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 screws or to break the parts they hold.

c. CLEAN (C). (1) *Relay exterior.* Brush exterior with a soft brush. If connections are dirty, remove the leads and clean them. Replace carefully.

(2) *Relay contacts.* (*a*) Before removing covers of relays, see that all apparatus is free from dust, dirt, or other foreign matter which might fall into relay contacts.

(*b*) Remove loose dust or lint from relay and relay contacts with a soft-bristle brush.

(*c*) Inspect relay contacts thoroughly. If they are dirty, burned, pitted, or corroded, service them as follows ((*d*) through (*g*) below).

Note. The brown discoloration found on silver or silver-plated contacts is silver oxide and is a good conductor. It should not be removed unless the contacts must be cleaned for some other reason. It may be removed at any time either by burnishing or with a cloth moistened with carbon tetrachloride.

(*d*) To clean contacts, insert a clean flat blade in the burnishing tool (Tool, switchboard, contact burnisher, WECo 265C, Signal Corps stock No. 6R41065C). Keep the blade clean by frequent wiping with a lint-free cloth moistened with carbon tetrachloride. To burnish normally-open contacts, press them together with the orange stick (or suitable substitute) or operate the relay manually to give a slight pressure against the blade of the burnisher. At the same time move the blade back and forth two or three times or as often as necessary to brighten the contacts. Avoid excessive burnishing. When too much of the contact metal is removed, the contact follow is destroyed and readjustment is necessary. When burnishing normally closed contacts, the tension of the springs themselves will usually sup-

ply enough pressure against the burnisher. If the spring tension is heavy, lift one of the springs away sufficiently to insert the burnisher.

(*e*) If burnishing does not eliminate contact trouble use carbon tetrachloride to clean contact surfaces more thoroughly. Dip the flat end of a clean toothpick into carbon tetrachloride. Then, holding the contacts slightly separated, deposit the liquid on the contacts without rubbing. Use the flat end of another toothpick to deposit more carbon tetrachloride on the contact to flush away dirt loosened by the first application. Again do not rub. Be careful to keep carbon tetrachloride from all insulating materials. When the contacts are thoroughly dry, burnish them ((*d*) above) to remove all deposit or residue. Always burnish contacts after cleaning with carbon tetrachloride.

(*f*) Contact points which are badly pitted or built up may be reconditioned as follows: Remove the build-ups with a fine-cut point file (or in emergencies crocus cloth). Burnish the pits with the ball-point burnisher blade furnished with the switchboard contact burnishing tool. If the pit is small, place the ball point of the burnisher in the pit and rotate the barrel of the tool between the thumb and finger, at the same time applying slight pressure. If the pit is large, move the ball point of the burnisher over the surface of the pit with a circular motion. After removing build-ups and cleaning pits, again burnish the contacts with a flat blade of the contact burnisher. Always be careful to avoid excessive removal of the contact metal. Otherwise contact follow and separation requirements will be affected and readjustment will be necessary.

Caution: Never use highly abrasive material, such as sandpaper or emery cloth, to clean relay contacts.

(*g*) Relay pole faces and armature faces must be cleaned occasionally. These are the surfaces of the core and armature which touch each other when the relay operates. Need for cleaning is indicated by a tendency to stick during operation. Clean with a burnisher and carbon tetrachloride, or use the following method: Insert a strip of hard-finish bond paper between the armature and the core. Ligntly press the armature against the core and withdraw the paper. Repeat with clean paper until it shows no evidence of dirt.

Caution: Do not use paper to clean relay contacts. Minute burrs on the contact surface may retain fine shreds of paper and cause faulty contact.

62. Switches

a. INSPECT (I). (1) Inspect 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 pressing switch button and noting freedom of movement and amount of spring tension.

(2) Examine the ganged switches to see that they are properly lubricated and that the contacts are clean. Inspection is visual. Do not pry 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 visible. Switch action should be free. Wiping action of contacts usually removes any dirt at point of contact.

b. CLEAN (C). Clean exterior surfaces of switches with a stiff brush, moistened with dry-cleaning solvent (SD).

c. LUBRICATE (L). See section VIII.

63. Rheostats and Potentiometers

a. INSPECT (I) . (1) Inspect the mechanical condition of the rheostats. The arm should be keyed tightly to the shaft, and the shaft should turn easily in the bushing which supports it.

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

(3) Examine the insulating body of the rheostat 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.

c. CLEAN (C). (1) Clean exposed contact surfaces of rheostat and connections whenever they are dirty or corroded.

(2) Remove grease and dirt from rheostat parts with carbon tetrachloride.

(3) If contact surfaces are corroded, clean them with crocus cloth.

(4) Clean contact surface of the arm by inserting a strip of crocus cloth between the arm and the rheostat winding and drawing cloth back and forth.

(5) Clean body of rheostat or potentiometer with a brush or cloth.

64. Terminal Blocks

a. INSPECT (I). (1) Inspect terminal blocks for cracks, breakage, dirt, loose connections, and loose mounting screws.

(2) Carefully examine connections for mechanical defects, dirt, and corrosion.

b. TIGHTEN (T). Tighten loose screws, lugs, and mounting bolts. When tightening screws, be sure to select a screwdriver of correct size. Do not exert too much pressure. Tighten loose connections.

c. CLEAN (C). Clean terminal blocks, when they require it, with a dry brush. When necessary use a cloth moistened with dry-cleaning solvent (SD). Thoroughly wipe block with a cloth and then brush it to remove any lint.

65. Multiple Connectors

Multiple connectors and plugs are used to connect receiver and transmitter to Mounting FT–237–(*) and to connect dynamotors to their respective units.

a. INSPECT. (I). Inspect female ends of the connectors for corrosion and collected dust. Inspect mountings for cracks and loose connections. Inspect male ends for loose and broken pins and for proper spring in banana plugs.

b. CLEAN (C). Clean male and female ends of connectors with a brush moistened in carbon tetrachloride. Remove corrosion with No. 0000 sandpaper. Wipe with a clean cloth.

66. Cords and Cables

The cables in the radio set are the life lines of the equipment. Closely observe condition of cabling. Operating equipment in all kinds of weather, and moving it on all kinds of roads, punishes cabling severely.

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

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

c. CLEAN (C). Clean connections on cables when they are dirty or corroded. Clean corroded connectors with No. 0000 sandpaper. Clean entire surface of connector. Make no attempt to remove individual prongs from cable plugs.

67. Meters

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

a. INSPECT (I). Inspect leads and connections of 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, dampen the cloth with dry-cleaning solvent (SD). Clean dirty connections with a small brush dipped in dry-cleaning solvent (SD), or with a small piece of cloth dipped in solvent.

d. ADJUST (A). Normally, meters in the radio set should indicate zero when equipment is turned off. Before deciding that a meter needs readjusting, tap the meter case *lightly* with the tip of one finger. This will help the needle to overcome the slight friction which sometimes exists at bearings and prevents an otherwise normal unit from coming to rest at zero. If adjustment is needed, insert the tip of a suitable screwdriver into 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 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.

68. Pilot Lamps

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

a. INSPECT (I). Inspect pilot-lamp 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 connections are dirty or corroded, clean them before soldering.

(2) Screw loose lamps tightly into their sockets.

69. Jacks and Plugs

Jacks require very little attention, and then only at infrequent intervals. Occasionally it will be necessary to tighten the mounting nut, clean contacts, or increase spring tension. Remove dirt with a brush and carbon tetrachloride. 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 sure to keep all soldered connections intact. To clean dirty or corroded telephone-type plugs, use paste metal polish (Signal Corps stock No. 6G1516). After cleaning, use carbon tetrachloride to remove all remaining traces of polish. Finish off with a clean dry cloth.

70. Dynamotors

Dynamotors are essentially the same type of mechanism as motors. They are inspected and lubricated in the same manner. The dynamotors in the radio set operate with carbon brushes which mount in the motor frame and ride against a segmented commutator. Brushes and commutators require the following preventive maintenance.

a. INSPECT (I). (1) Inspect brushes and commutators at regular intervals. Brushes should be long enough to make firm contact with the commutator. See that brush springs have adequate tension and are in firm contact with brushes. Be sure brush caps are tight and that commutators are clean and smooth. See that covers and straps are in place.

(2) The maintenance of brushes and the cleaning of commutators are both important tasks. The operating life of the average brush is approximately 1,000 hours, but it will vary to some extent, depending upon climatic conditions.

b. CLEAN (C). **Caution:** The dynamotors generate 230 and 600 d-c volts. Always clean commutators after power has been removed from dynamotor.

(1) Remove end plate or brush-cover straps. Press a piece of canvas, folded to exact width of commutator, against commutator and turn armature by hand.

(2) If commutator has been burned or pitted, hold a piece of No. 0000 sandpaper against commutator and turn it by hand. *Never* use emery cloth. Its abrasive material is a conductor which may become imbedded in slots between commutator bars, causing short circuits in the armature.

(3) If necessary, use cloth moistened in carbon tetrachloride to remove caked dirt and grease.

(4) Polish commutator with a canvas cloth and wipe with clean dry cloth.

(5) Clean brushes with clean dry cloth. *Do not* use carbon tetrachloride. This solvent re-

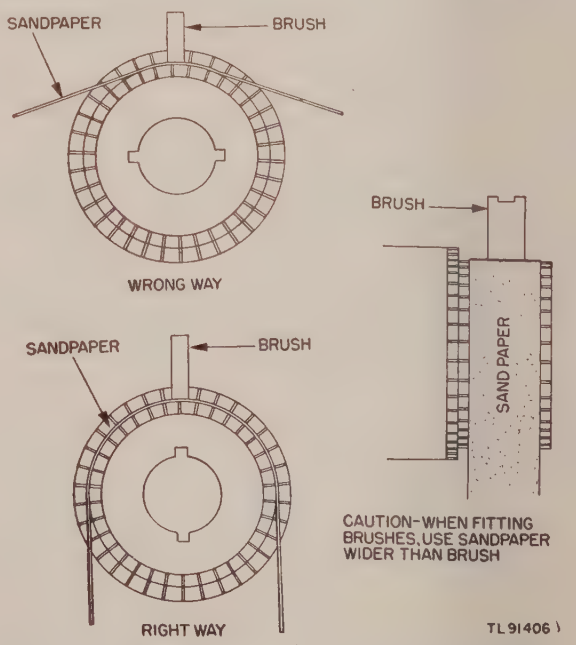


Figure 53. Correct and incorrect methods of fitting a brush.

acts chemically with materials commonly used in brushes, reducing their life.

c. ADJUST. If new brushes are installed or old brushes need fitting, proceed as follows:

(1) Cut a strip of No. 0000 sandpaper slightly wider than the brush.

(2) Place brush in its holder.

(3) Under the brush place the sandpaper with its *sanded surface next to the brush.* Make sure that the sandpaper contacts at least half of the circumference of the commutator. (See fig. 53.)

(4) Pull the sandpaper in the direction of commutator rotation following the curvature of the commutator.

(5) Lift the brush clear of the sandpaper and return the sandpaper to its original position. Repeat this operation as often as necessary to obtain a satisfactory seat. Do this for all brushes.

d. LUBRICATE. See section VIII.

71. Cabinets, Chassis, and Mountings

The cabinets which house the various components of the radio set are constructed of sheet steel, coated with paint.

a. INSPECT (I). Inspect outside and inside of each cabinet thoroughly, paying strict attention to every detail. Check ventilator mountings, panel screws, and zero settings of meters. Examine pilot-lamp covers for cracks and breaks. Inspect 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 scratched, rusted, or chipped.

Caution: Take care when handling spunglass air filter; try to keep small glass splinters from entering the fingers.

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

72. Headset, Microphone, and Loudspeaker

These auxiliary items of equipment are essential to the radio set. Operators must therefore give them the same care as the radio itself.

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 for proper operation.

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

c. LUBRICATE (L). See section VIII.

73. Coupling Shafts and Control Knobs

Capacitors, switches, and resistors in the set are controlled through coupling shafts which connect these items to control knobs on the front panels. Keep these shafts and control knobs tight at all times. Tighten these items whenever they are found loose.

74. Gears

a. INSPECT (I). Inspect the teeth of the gears for dirt or corrosion. Check antibacklash gears for proper operation by varying panel tuning controls.

b. CLEAN (C). If gears are dirty, clean them with a pipe cleaner or small brush dipped in dry-cleaning solvent (SD).

c. LUBRICATE (L). See section VIII.

Section VII. ITEMIZED PREVENTIVE MAINTENANCE

75. Introduction

For ease and efficiency of performance, preventive maintenance on the radio set 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 the specific 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. These general instructions are not repeated in this section. When performing preventive maintenance, see section VI if more information is required for the following items. Perform all work with the power removed from the equipment. After preventive maintenance has

been performed on a given day, put the equipment into operation and check it for satisfactory performance. (See par. 53.)

76. Preventive Maintenance Tools and Materials

The following preventive maintenance tools and materials will be needed:

Common hand tools.
Clean cloth.
No. 0000 sandpaper.
Crocus cloth.
Fine file or relay burnishing tool.
Paste metal polish (Signal Corps stock No. 6G1516).
Dry-cleaning solvent (SD).
Contact burnishing tool.
Canvas cloth.
Carbon tetrachloride.

Note. Gasoline will not be used as a cleaning fluid for any purpose. Solvent, dry cleaning, is available as a cleaning fluid through established supply channels.

77. Item 1, Exterior of Radio Set (Fig. 54)

Operations:

ITC	Cabinets.
ITC	Jacks.
IT	Pilot lamp.
IT	Control knobs.
IC	Meter.
IC	Binding posts.
ITC	Cords and cables.
ITC	Fuses.

78. Item 2, Interior of Radio Transmitter (Fig. 55)

Preliminary step: Remove the transmitter from the mounting and take off the dust cover.

Operations:

ITC	Capacitors.
ITC	Resistors.
ITCA	Tubes and sockets.
IC	Cords and cables.
IC	Relays.
ITC	Fuses.
ITC	Coils.
ITC	Bushings and insulators.
ITC	Terminal blocks.
ITCL	Switches.
ITCA	Meter.
ITC	Pilot lamp.
ITL	Couplings.
ICL	Gears.
ITC	Rheostats and potentiometers.

79. Item 3, Interior of Radio Recever (Fig. 56)

Preliminary step: Remove the receiver from the mounting and take off the dust cover.

Operations:

ITC	Capacitors.
ITC	Resistors.
ITCL	Switches.
ITCA	Tubes and sockets.
IT	Speaker.
ITC	Rheostats and potentiometers.
ITC	Terminal blocks.
ITC	Bushings and insulators.
ICL	Gears.
ITC	Fuse.
ITC	Coils.
IC	Relays.
IC	Cords and cables.

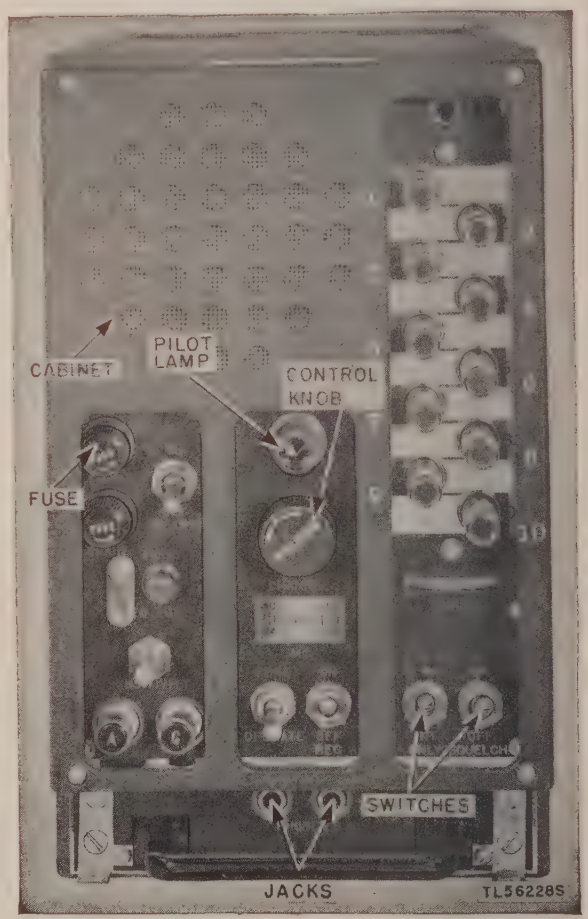


Figure 54. Radio Receiver BC–603–(*), typical preventive maintenance items, front view.

80. Item 4, Antenna Mast and Base

Operations:

IC	Insulator.
I	Mounting.
ITC	Mast sections.

81. Item 5, Headset and Microphone

Operations:

ITC	Cords and plugs.

82. Item 6, Battery and Supply Cables

Operations:

ITC	Cables and connections.

83. Item 7, Mounting (Fig. 57)

Operations:

ITC	Mounting.
IC	Multiple connectors.
ITC	Power cables.
ITC	Terminal blocks.
ITC	Fuses.
IT	Grounding straps across the rubber feet of the mounting.
IT	Captive bolts.

84. Item 8, Dynamotors

Preliminary steps: Remove the dynamotors from the receiver and transmitter chassis.

Operations:

IC	Dynamotor housing.
IC	Commutators and brushes.
IC	Plugs and connectors.
L	Bearings.

85. Preventive Maintenance Check List

The following check list is a summary of the preventive maintenance operations to be performed on the radio set. The 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. 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).

Item No.	Operations	Item	When performed			
			Before operation	Daily	Monthly	Echelon
1	ITC	Exterior of radio set.	..	X	..	1st
2	ITCAL	Interior of radio transmitter	..	..	X	2d
3	ITCAL	Interior of radio receiver	..	..	X	2d
4	ITC	Antenna mast and base	X	X	..	1st
5	ITC	Headset and microphone	..	X	..	1st
6	ITC	Battery and supply cables	X	X	..	1st
7	ITC	Mounting	..	..	X	2d
8	ICL	Dynamotors	..	..	X	2d

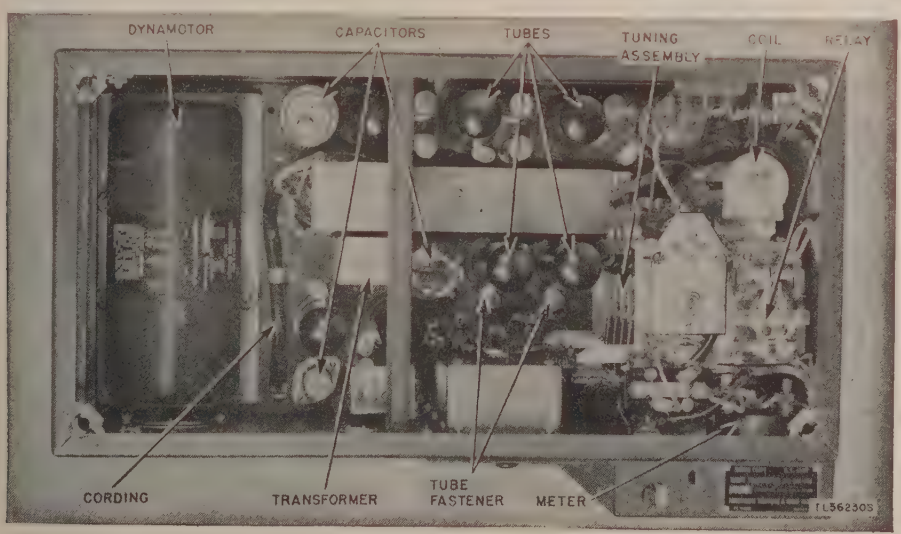


Figure 55. Radio Transmitter BC–604–(*), typical preventive maintenance items, top view.

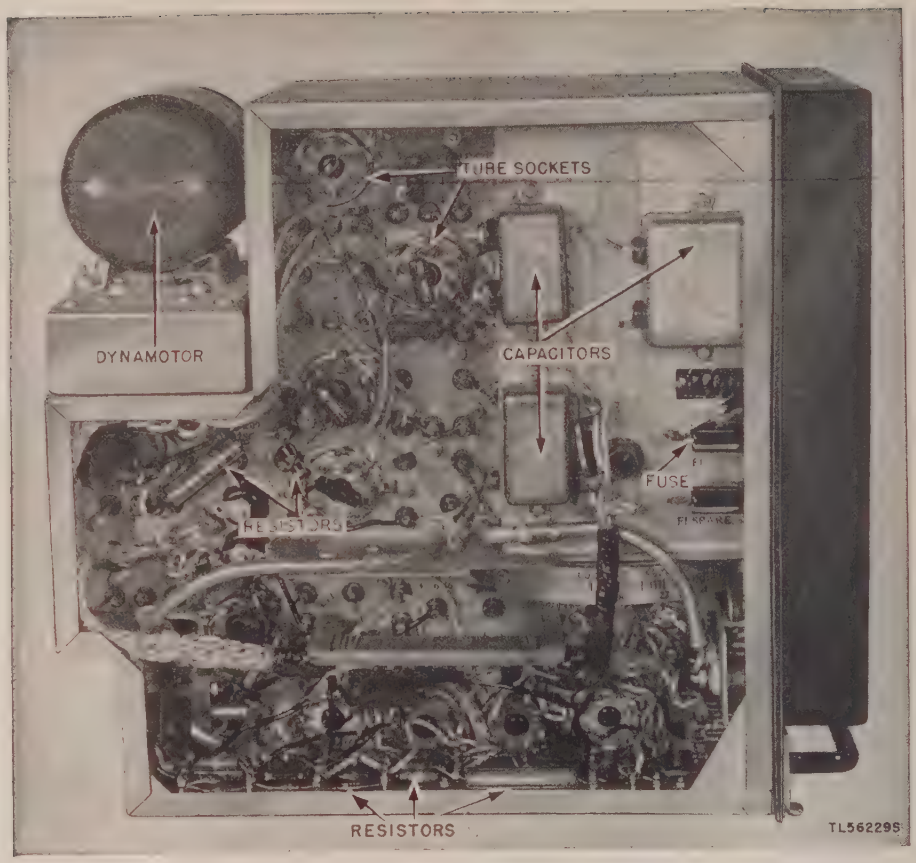


Figure 56. Radio Receiver BC–603–(*), typical preventive maintenance items, left side view.

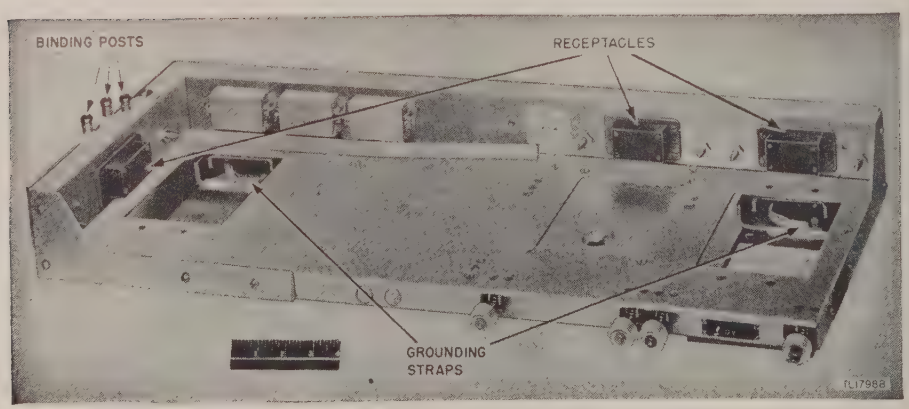


Figure 57. Mounting FT–237–(*), typical preventive maintenance items.

Note. X indicates when operations are to be performed.

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

* The Feel operation does not apply to Radio Sets SCR-508-(*), SCR-528-(*), and AN/VRC-5.

Section VIII. LUBRICATION

Note. A War Department Lubrication Order is not issued on Radio Sets SCR-508-(*), SCR-528-(*), and AN/VRC-5.

86. Recommended Lubricants

Symbols	Standard nomenclature
PL-SPECIAL	Oil, Lubricating, Preservative, Special
GL	Grease, Lubricating, Special
WB	Grease, General Purpose, No. 2
SD	Solvent, Dry Cleaning

87. Detailed Lubrication Instructions

a. GENERAL. (1) The location of the parts of Radio Sets SCR-508-(*), SCR-528-(*), and AN/VRC-5 are shown in figures 58, 59, 60. The type of lubricant to be used, and the interval and specific instructions for each part are given in the lubrication chart (par. 88).

(2) Gasoline will not be used as a cleaning fluid for any purpose. When the unit is overhauled or repairs made, parts should be cleaned with dry-cleaning solvent (SD).

(3) Carbon tetrachloride will be used as a cleaning fluid only in the following cases: On electrical equipment where inflammable solvents cannot be used because of fire hazard, and

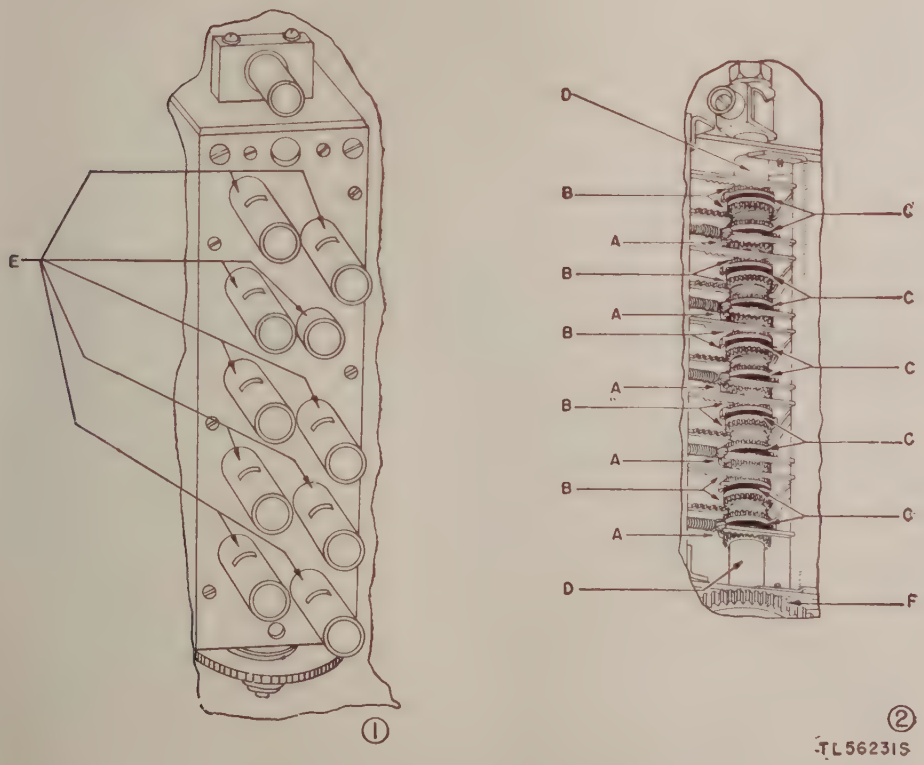


Figure 58. Lubrication of radio receiver.

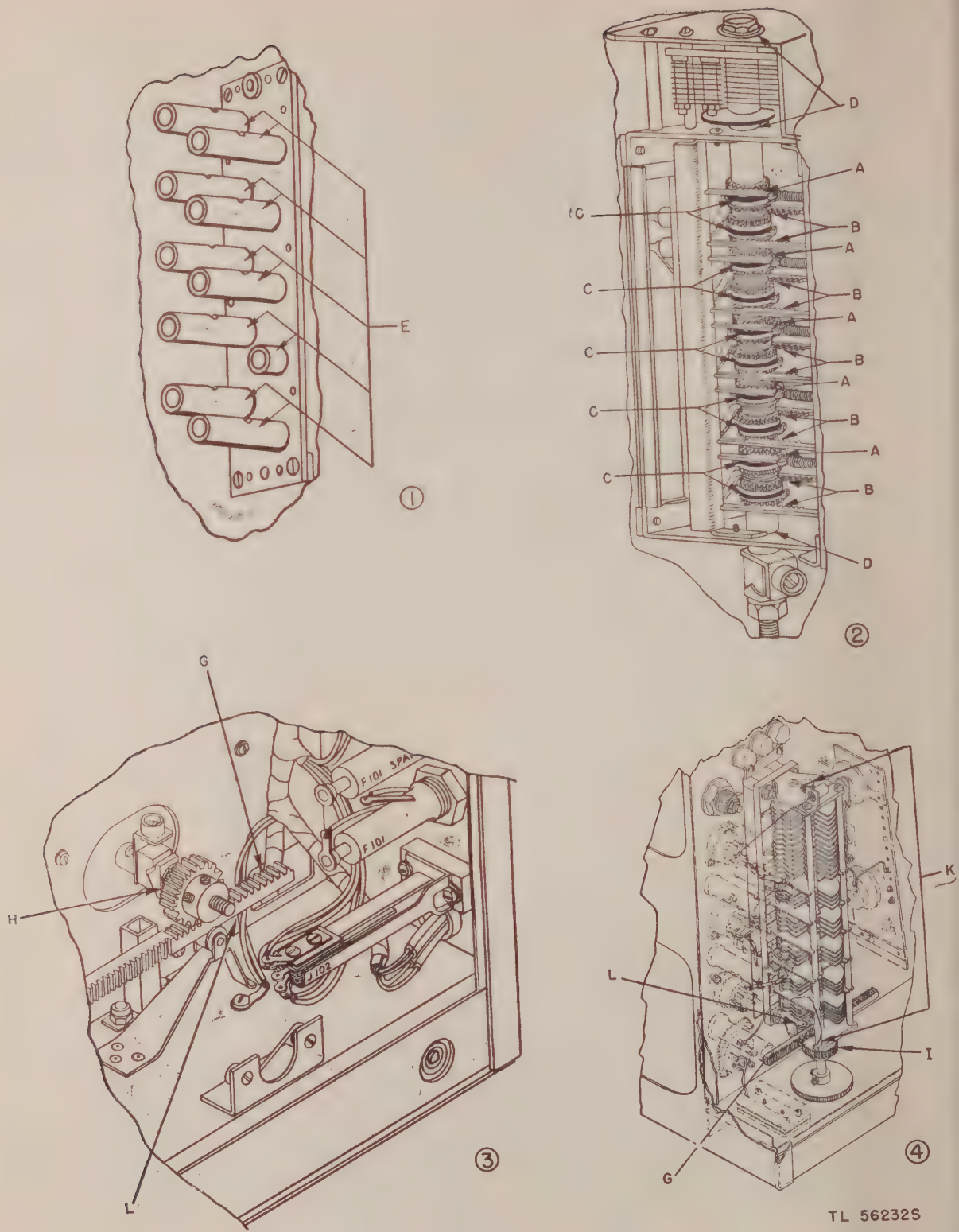


Figure 59. Lubrication of radio transmitter.

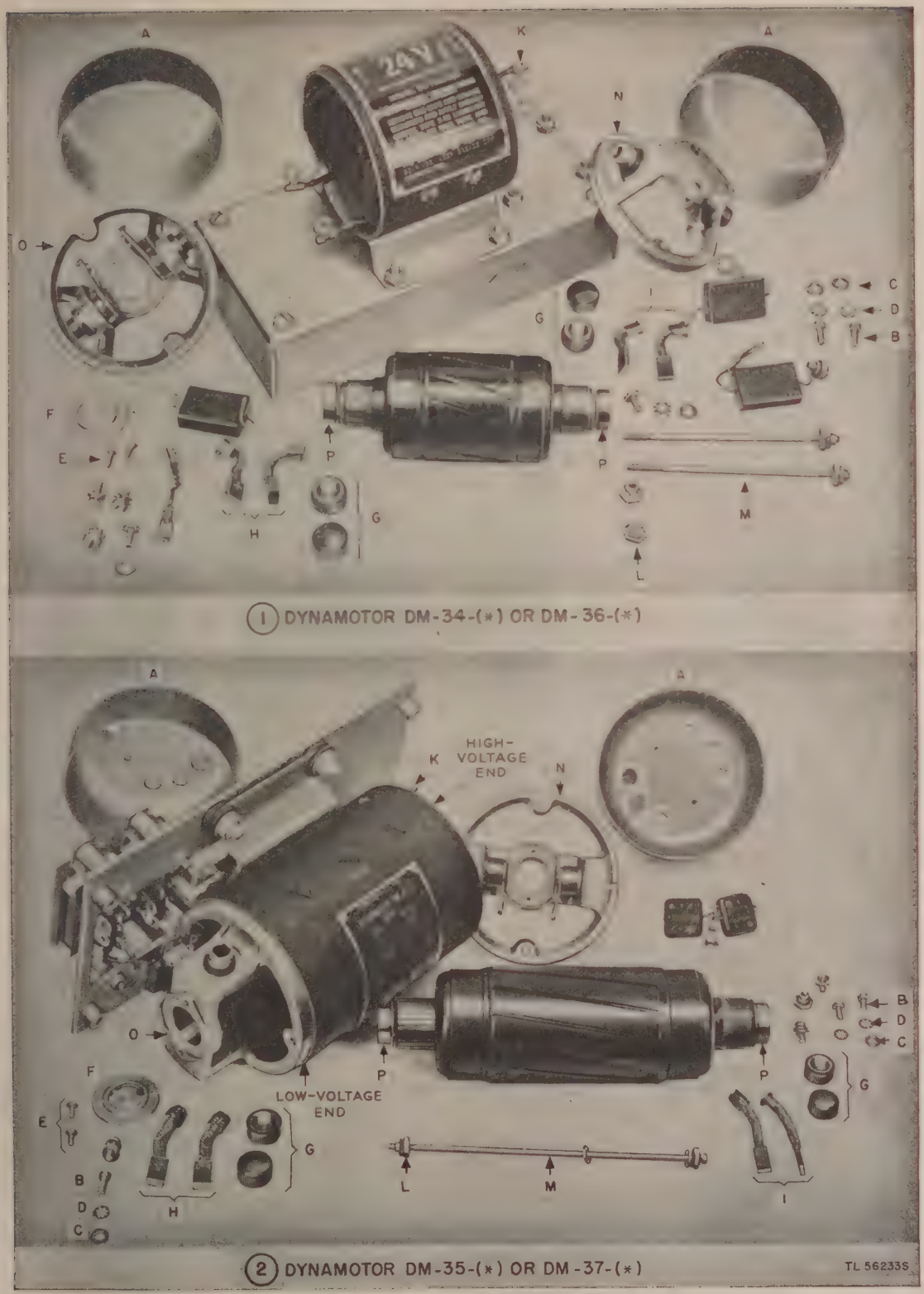


Figure 60. Dynamotors DM-34-(*), 35-(*), 36-(*), 37-(*), exploded view.

for cleaning electrical contacts including relay contacts, plugs, commutators, etc.

(4) Apply special preservative lubricating oil (PL-special) sparingly to springs and loops of all helical springs to prevent wear and rust.

Note. Intervals given are maximums for normal 8-hour day operation. For abnormal conditions or activities, intervals should be shortened to compensate.

b. RADIO RECEIVER BC–603–(*). Remove the cover plate and expose the push-button assembly. Wipe clean with lint-free cloth moistened with dry-cleaning solvent (SD), followed by a dry cloth. Lubricate as outlined in lubrication chart. (See par. 88.)

c. RADIO TRANSMITTER BC–604–(*). Follow the same procedure given for the receiver, including removing the bottom cover on the transmitter casing, exposing the main gang capacitor. Lubricate as outlined in the lubrication chart. (See par. 88.)

d. DYNAMOTORS DM–34–(*), DM–35–(*), DM–36–(*), and DM–37–(*). (1) *Armature bearings* (fig. 60). To lubricate the bearings, disassemble the dynamotor as described in paragraph 175. With a small bristle brush and cloth remove all old and hardened grease. Knead general purpose grease No. 2 (WB) into the space between inner and outer races. Wipe off excess grease, do not pack bearing housing; reassemble.

Caution: Never add oil of any type to a moving part that is lubricated by grease. Do not get oil or grease on the commutator or brushes.

(2) *Lubrication and inspection after disassembly by higher echelon.* Semiannually, or more often if conditions warrant, disassemble the dynamotor and remove the armature as outlined in paragraph 176. (See fig. 60.) *Do not remove bearings from shaft.* Thoroughly clean the bearings by immersing them, mounted on the armature shaft, in a shallow pan of dry-cleaning solvent (SD). A small bristled brush will greatly aid the cleaning operation. Always use clean solvent for final rinsing of the bearing. Allow to dry naturally before attempting to reapply lubricant. Neither compressed air nor temperature above 212° F. should be used in an attempt to accelerate drying. Do not allow the solvent to come in contact with the commutators or armature windings. If accidentally splashed, wipe off immediately. Rotate bearing by hand, applying a slight pressure on the outer race to simulate the load. Inspect for loose shaft fit and defects, such as binding or excessive wear as indicated by extreme wobble between inner and outer races. Defects may be caused by dirt or other material, cracked or defective races, a chipped or flattened ball, or hardened grease. Exchange dynamotors having defective or worn bearings for new dynamotors. New dynamotors may be obtained by requisition or in exchange for like unserviceable equipment, through normal supply channels. Bearings found good should be lubricated with general purpose grease No. 2 (WB). The balls and races should be thoroughly coated, but do not pack the bearings or bearing housing. Fill the bearings about two-thirds full. Wipe off excess lubricant, as it tends to spread to brushes, commutators, and windings, thus damaging them.

(3) *Preparing dynamotor for operation at extremely low temperatures.* Lubricants exposed to freezing temperatures may become stiff causing the equipment to operate sluggishly or even fail to operate completely.

Caution: Do not change adjustments of the equipment in an effort to overcome sluggish operation due to cold-stiffened lubricants. Machines adjusted when lubricants are stiff go out of adjustment as the machine warms up. The armature should be removed and the bearings cleaned thoroughly as outlined above to remove all traces of heavy grease. Allow to dry and lubricate with special lubricating grease (GL).

88. Lubrication Chart

Figure and item	Name of part	Lubricant	Interval	Method and quantity
Fig. 58....	RADIO RECEIVER BC–603–(*), PUSH-BUTTON ASSEMBLY			
A....	Push-button racks, and gears.	PL–SPECIAL..	M*.....	Push each button in and apply 1 or 2 drops to push-button racks, and gears.
B....	Gear-shaft racks, and gears.	PL–SPECIAL..	M.....	1 or 2 drops to gear-shaft racks, and gears.
C....	Gear-shaft friction washers, and spacers	PL–SPECIAL..	M.....	1 drop between friction washers, spacers, and gears.
D....	Gear-shaft bearings	PL–SPECIAL..	M.....	1 or 2 drops to each bearing.
E....	Push-button plungers	PL–SPECIAL..	M.....	Apply light film to push-button plungers.
F....	Manual tuning drive gear ..	GL.....	M.....	Apply thin film to gear teeth.
Fig. 59 ① and ② ..	RADIO TRANSMITTER BC–604–(*), PUSH-BUTTON ASSEMBLY			
A....	Push-button racks, and gears.	PL–SPECIAL..	M.....	Push each button in and supply 1 or 2 drops to push-button racks, and gears.
B....	Gear-shaft racks, and gears.	PL–SPECIAL..	M.....	1 or 2 drops to gear-shaft racks, and gears.
C....	Gear-shaft friction washers, and spacers	PL–SPECIAL..	M*.....	1 drop between friction washers, spacers, and gears.
D....	Gear-shaft bearings	PL–SPECIAL..	M.....	1 or 2 drops to each bearing.
E....	Push-button plungers	PL–SPECIAL..	M.....	Apply light film to push-button plungers.
Fig. 59 ③ and ④ ..	RADIO TRANSMITTER BC–604–(*), MAIN GANG CAPACITOR			
G....	Gang capacitor gear rack ...	GL.....	M.....	Apply light film to rack teeth.
H....	Gang capacitor drive gear ..	GL.....	M.....	Apply light film to gear teeth.
I....	Gang capacitor shaft gear ..	GL.....	M.....	Apply light film to gear teeth.
K....	Gang capacitor bearings	PL–SPECIAL..	M.....	1 or 2 drops to each bearing.
L....	Gang capacitor gear rack roller guide bearings	PL–SPECIAL..	M.....	1 drop to each gear rack roller guide bearing.
Fig. 60....	DYNAMOTORS, DM–34, DM–35, DM–36, and DM–37			
P....	Armature shaft bearings ...	WB.....	M.....	Knead lubricant into space between inner and outer bearing races, wipe off excess. (See par. 175 for disassembly.)

* Monthly.

Section IX. WEATHERPROOFING OF EQUIPMENT

89. General

a. When equipment is operated in highly humid climates, excessive failure of parts and decreased operating efficiency are usually caused by the accumulated effects of moisture, rather than by inferior parts. Rapid temperature changes accompanied by fog, rain, dew, or high humidity promote such failures.

b. The effects of moisture on resistors, capacitors, coils, chokes, transformer windings, terminal boards, and insulating strips can be recognized in the form of corrosion, low insulation resistance, flash-overs, and cross-talk. Moisture also accelerates fungus growth which increases these effects.

90. Reducing Failures

a. A moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. The treatment consists of applying a film of moisture- and fungi-resistant varnish to all susceptible parts of the equipment. This film provides a nonwetting surface. Equipments which have been treated have been marked with the letters MFP and the date of treatment. Equipments not marked should be examined, and if treatment has not been applied, the equipment should be returned to third or higher echelon maintenance units for treatment.

b. TB SIG 13 contains a detailed description of this treatment.

c. Re-treatment may be required after a period of use. Need for this re-treatment is indicated by excessive failures or by the effects listed in paragraph 89*b*.

91. Treating Radio Transmitter BC–604–(*)

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

b. DISASSEMBLY. (1) Remove all side plates.

(2) Remove box containing spare crystal holders (do not treat crystals).

(3) Remove crystal holders from oven.

(4) Remove the dynamotor. Unscrew the four holding screws and lift the dynamotor out.

Note. Do not treat the dynamotor.

(5) Remove the push-button assembly. (See par. 173*b* (3)).

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

d. MASKING. (1) Mask the front of the meter.

(2) Mask all jack openings and contacts where microphones plug in.

(3) Mask the socket for the dynamotor.

(4) Mask the contacts of the meter switch and switch S104.

(5) Mold paper around the variable capacitor assembly (C106, C152, C156, C115, C113, and C119, including the trimmers located under the capacitor assembly) and fasten the paper in place with masking tape.

(6) Mask the contacts of relay S102.

e. DRYING. Place units in the drying oven and bake for 2 to 3 hours at a temperature of 160° F.

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

f. VARNISHING. (1) Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, Signal Corps stock No. 6G1005.3, or equal) to all exposed elements within the units. Allow each coat to air-dry for 15 or 20 minutes before applying the next coat.

(2) Brush varnish on those portions not reached by the spray.

(3) On the meter, brush the back portion of the bakelite case, the seal around the zero-setting adjustment, and the glass face.

(4) 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.

g. REASSEMBLY. (1) Remove all masking tape, being careful not to peel varnish from near-by areas.

(2) Reassemble the transmitter and test its operation.

h. MARKING. Mark the equipment MFP with the date of treatment near the nameplate.

Example: MFP 22 March 1946.

92. Treating Radio Receiver BC–603–(*)

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

b. DISASSEMBLY. (1) Remove all side plates.

(2) Remove the dynamotor. Unscrew the four holding screws and lift the dynamotor out.

Note. Do not treat the dynamotor.

(3) Remove front panel and speaker.

(4) Remove tape from around hook-up wire in the wiring of the set.

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

d. MASKING. (1) Mask the push-button assembly.

(2) Mask the phone jacks and other contacts.

e. DRYING. Same as in paragraph 91*e*.

f. VARNISHING. Same as in paragraph 91*f*.

g. REASSEMBLY. (1) Remove all masking tape, being careful not to peel varnish from near-by areas.

(2) Recable the wiring where tape was removed and cover with fresh tape.

(3) Reassemble the receiver and test its operation.

h. MARKING. Mark the equipment MFP with the date of treatment, near the nameplate.

Example: MFP 22 March 1946.

93. Treating Mounting FT–237–(*)

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

b. DISASSEMBLY. (1) Remove side plates so as to expose internal wiring.

(2) Lift the latch cover and tighten all screws and wingnuts.

c. CLEANING. Same as paragraph 92*c*.

d. MASKING. Mask the front faces of the base plugs.

e. DRYING. Same as in paragraph 91*e*.

f. VARNISHING. Same as in paragraph 91*f*.

g. REASSEMBLY. Replace the side plates.

h. MARKING. Same as 92*h*.

94. Treating Antenna A–62 (Phantom)

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

b. DISASSEMBLY. (1) Unsnap the spring retainer ring.

(2) Remove assembly from case.

(3) Tighten all binding post knobs.

c. CLEANING. Same as paragraph 92*c*.

d. MASKING. Cover the following components with masking tape as shown in figure 61.

(1) Tuning capacitor plates and bearings, item A.

(2) Threads on screw plug, item B.

(3) Male prong on antenna connector, item C.

(4) Contacts on ground clamp, item D.

e. DRYING. Same as in paragraph 91*e*.

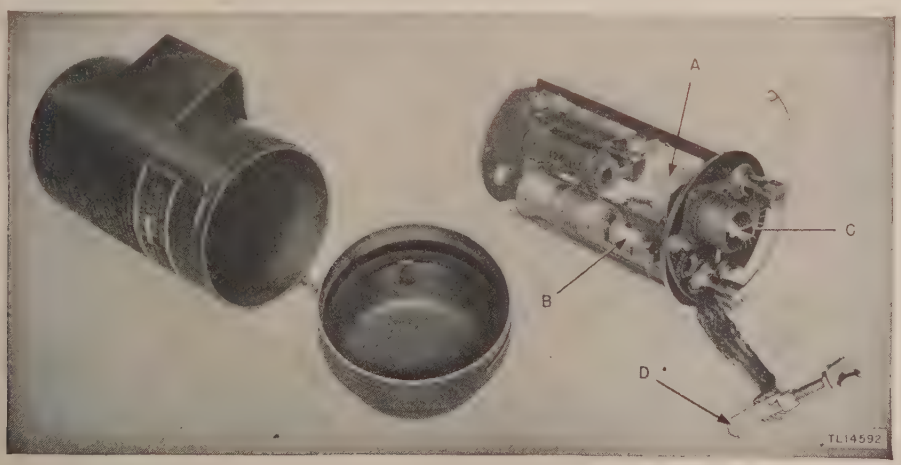


Figure 61. Antenna A–62 (Phantom), showing method of masking.

f. VARNISHING. (1) Same as in paragraph 91*f*.

(2) Coat the inside surface of the metal container of Antenna A–62 (Phantom).

g. REASSEMBLY. (1) Remove all masking tape, being careful not to peel varnish from near-by areas.

(2) Reassemble the antenna and test its operation.

h. MARKING. See paragraph 92*h*.

95. Treating Equipment After Repairs

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

PART FOUR

AUXILIARY EQUIPMENT

Section X. REMOTE CONTROL AND INTERPHONE EXTENSION EQUIPMENT

96. Remote Control Equipment RC–261

Remote Control Equipment RC–261 is now available for use with Radio Sets SCR–508–(*) and SCR–528–(*). This equipment replaces Remote Control Unit RM–29–( ) which is no longer available. Remote Control Equipment RC–261 provides for remote operation of and voice communication over voice-operated radio sets on a preset frequency and with a preset adjustment of the volume control for distances up to ½ mile from the radio set. For complete information about the equipment see TM 11–2632.

97. Interphone Extension Kit RC–298

Interphone Extension Kit RC–298 is used in conjunction with the normal interphone system of various tanks to provide communication to an external interphone box. This installation makes possible communication between the crew of the vehicle and persons outside, using only the equipment installed in the vehicle. The interphone extension kit is made up of an external interphone box mounted on the outside of the vehicle, a switchbox mounted near the tank co-driver's position, and the necessary hardware and cordage to make the installation. For complete details refer to TB SIG 192.

PART FIVE

REPAIR INSTRUCTIONS

Section XI. THEORY OF RADIO TRANSMITTER BC–604–(*)M

98. Simplified Block Diagram (Fig. 62)

The transmitter uses the phase-modulation type of frequency modulation through the use of a nonlinear reactance coil. It has a frequency range of 20.0 to 27.9 mc divided into 80 channels of 100 kc each. The signal path is shown in figure 62. A complete schematic diagram is shown in figures 112 and 113.

a. CRYSTAL OSCILLATOR. The output frequency of crystal-controlled oscillator V107 is the same as the crystal frequency. The gang-tuning control, operated by the push-button selector, selects any one of up to ten preselected crystals and connects it to the oscillator.

b. FIRST R-F AMPLIFIER. First r-f amplifier V101 amplifies the output of the crystal oscillator, and also acts as a buffer to prevent the variations which take place in the nonlinear coil modulator from being impressed on the crystal oscillator. The output of the first r-f amplifier is fed to the nonlinear coil modulator circuit.

c. NONLINEAR COIL MODULATOR CIRCUIT. The nonlinear coil modulator circuit uses a nonlinear inductor to produce phase modulation (effectively frequency modulation) in the transmitter. This circuit does not use a vacuum tube. The output of the nonlinear coil modulator circuit is coupled to the rectifier stage.

d. RECTIFIER STAGE. Rectifier V102 rectifies the output from the nonlinear coil modulator, using only the positive voltage kicks. The plate circuit of the rectifier is tuned to the ninth harmonic of the crystal frequency. The output from the rectifier is inductively coupled to the doubler stage.

e. DOUBLER STAGE. Doubler V108 doubles the frequency impressed on its grid circuit, since the plate circuit is tuned to twice the frequency of the grid circuit. The output frequency from the doubler is 18 times that of the crystal. The output from the doubler is inductively coupled to the tripler stage.

f. TRIPLER STAGE. Tripler V103 triples the frequency impressed on its grid circuit, since the plate circuit is tuned to three times the frequency of its grid circuit. Thus, the output frequency from the tripler is 54 times that of the crystal. The output from the tripler is capacitively coupled to the power-amplifier stage.

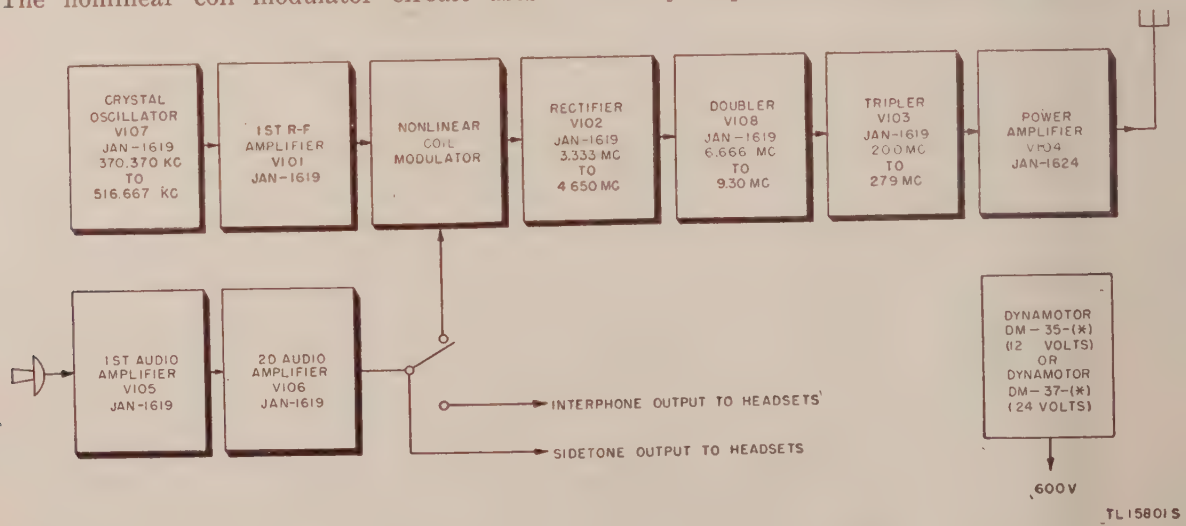


Figure 62. Radio Transmitter BC–604–(*), block diagram.

g. POWER-AMPLIFIER STAGE. Power amplifier V104 amplifies the power applied to its grid circuit and delivers approximately 30 watts of r-f power to the antenna circuit. Its output frequency is the same as its input frequency, 20.0 to 27.9 mc. The output of the power amplifier is transformer coupled to the antenna circuit.

h. FIRST AUDIO AMPLIFIER. First audio amplifier V105 amplifies the audio voltage from a carbon or a magnetic microphone. The voltage outputs from these two microphones are made equal in value through the use of a step-up transformer in the magnetic microphone circuit, and an attenuation network in the carbon microphone circuit. The output from the first audio amplifier is applied to the second audio amplifier.

i. SECOND AUDIO AMPLIFIER. Second audio amplifier V106 amplifies the audio signal and applies it either to the nonlinear coil modulator circuit for modulating the transmitter, or to the interphone output circuit for interphone communication, depending upon the type of operation selected. When the output is coupled to the nonlinear coil, the amplification of the second audio amplifier is reduced since very little power is required for modulation of the transmitter. When the a-f circuits are being used for interphone service, the r-f circuits are disabled. A small amount of audio output from V106 is caused to pass through the headsets. This is called sidetone. It enables the crew to hear all that goes out from the transmitter, and provides the speaker with the normal sensation of hearing himself talk.

j. POWER SUPPLY. High voltage for the transmitter is supplied by Dynamotor DM–35–(*) when the vehicle battery supply is 12 volts. Dynamotor DM–37–(*) is used for 24-volt operation.

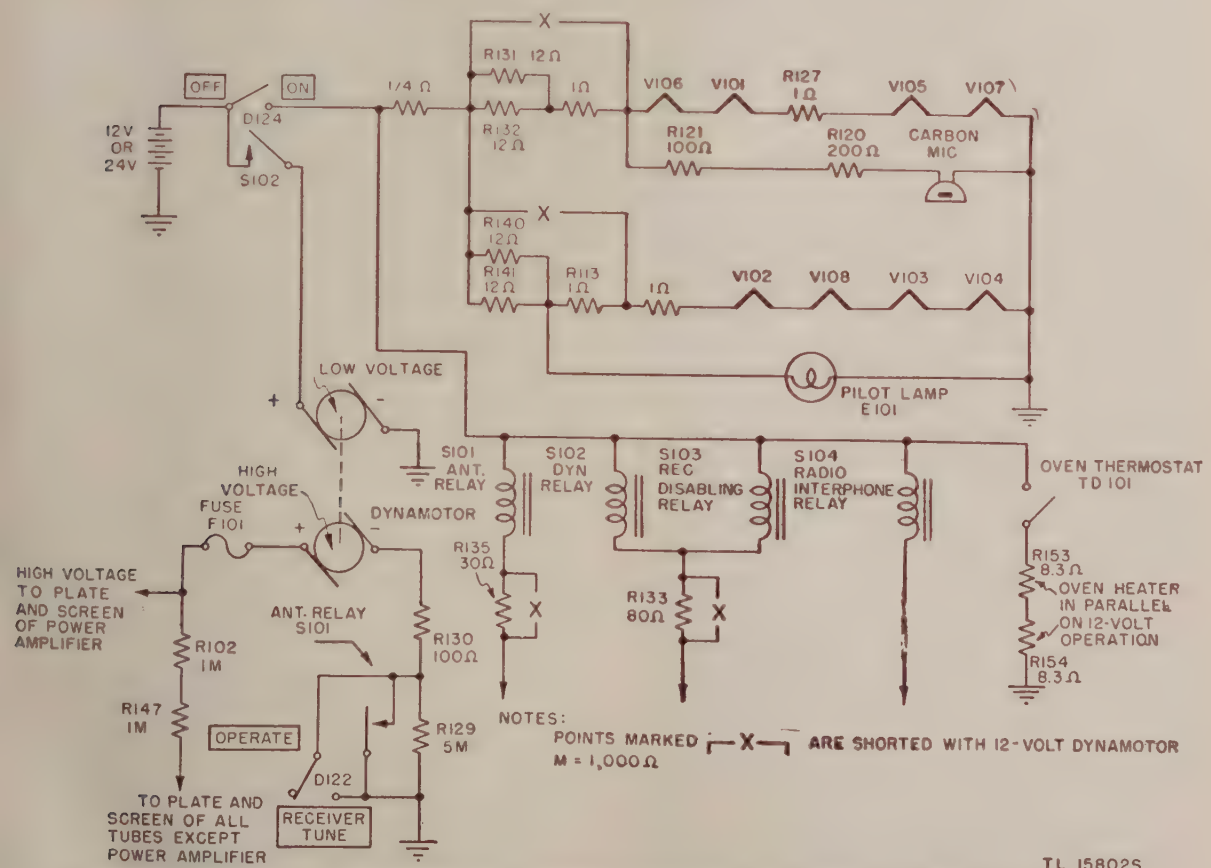


Figure 63. Radio Transmitter BC–604–(*), functional diagram of low voltage and dynamotor circuits.

99 Low-Voltage and Dynamotor Circuits (Fig. 63)*

a. Figure 63 shows a simplified circuit diagram of the low-voltage and dynamotor circuit of the transmitter. When the ON-OFF switch is placed in the ON position, the battery supply voltage is applied to the filament circuits pilot lamp, the microphone circuits, one side of the relay circuits, and to the oven heaters if the oven thermostat is closed. Resistors R131 and R132 in one filament circuit and resistors R140 and R141 in the other filament circuit provide a 12-volt drop when a 24-volt battery is used. The voltage drop across the ¼-ohm and 1-ohm resistors in the two filament circuits limits the voltage drop across each filament to 2.5 volts. The pilot lamp is connected across one string of filament circuits so that it will operate at 12 volts even when the battery supply voltage is 24 volts.

b. The crystal oven is maintained at a constant temperature by oven heaters R153 and R154 which are connected in parallel on 12-volt operation, and in series on 24-volt operation. These heaters are turned on and off by thermostat TD101.

c. When the contact of relay S102 is closed, battery voltage is applied to the dynamotor. Each dynamotor pin jack is provided with strapping so that the circuit change for either 12- or 24-volt operation is automatically accomplished when the appropriate dynamotor is plugged in. The high voltage output of the dynamotor, approximately 600 volts, is applied through fuse F101 to the plate and screen circuits of the power amplifier when antenna relay S101 is operated. Resistors R102 and R147 reduce the voltage to approximately 400 volts for the plate and screen circuits of the remainder of the tubes.

d. The current drawn by all of the stages in the transmitter flows through resistor R130, causing a 15- to 20-volt drop across this resistor. This voltage is used as fixed bias on some of the stages. The dynamotor current also flows through resistor R129 when antenna relay S101 is open and the RECEIVER TUNE-OPERATE switch is in the OPERATE position. This current flow through resistor R129 develops approximately 200 volts, which is used as grid-blocking bias for the transmitter. Therefore, when antenna relay S101 is not operated, the transmitter is inoperative. A detailed discussion of relay circuits is given in paragraph 112.

100. Crystal Oscillator (Fig. 64)

a. The crystal oscillator generates a voltage at a frequency varying from 370.37 kc to 516.667 kc, depending on the crystal in the circuit. Any one of 10 crystals is connected into this circuit by depressing the appropriate push button. The output from the crystal oscillator drives the first r-f amplifier.

b. The first requirement for an oscillator is stability. At the lower frequencies, the simplest way to obtain stability is through the use of a crystal-controlled oscillator. The transmitter uses an oscillator circuit whose frequency of oscillation is controlled by means of a CT cut crystal. In order to minimize the effect of temperature changes upon the frequency of oscillation of the crystal, a crystal oven is used. This is a compartment on the front of the transmitter for holding the 10 crystals which are in use. Along either side of this compartment is a heating element, operated from the storage battery, and at the top is a thermostatic switch. This switch closes the circuit to the heaters when the temperature in the oven drops below 70° F., and opens when the temperature has risen to approximately 110° F. Through this range of temperatures there is practically no change in the frequency of the crystal.

c. Tube JAN–1619 (V107), a beam power tetrode, is used in a modified Pierce circuit. Since high plate voltages will damage the crystal in a Pierce oscillator, parallel resistors R118, R157, and R158, bypassed by capacitor C104, are used to drop the plate supply voltage to 100 volts or less. Parallel tuned circuit C105 and L102, connected between these resistors and the plate, is resonant at approximately 1,200 kc, much higher than the crystal frequency. Resistor R138 is a voltage-dropping and decoupling resistor for the screen which is bypassed by capacitor C146.

d. Since capacitor C104 is only 500 mmf, a small r-f potential will appear across it. This

* The schematic and functional diagrams in this manual have been revised in accordance with the latest Modification Work Orders issued. The theory section is based on these revised schematics.

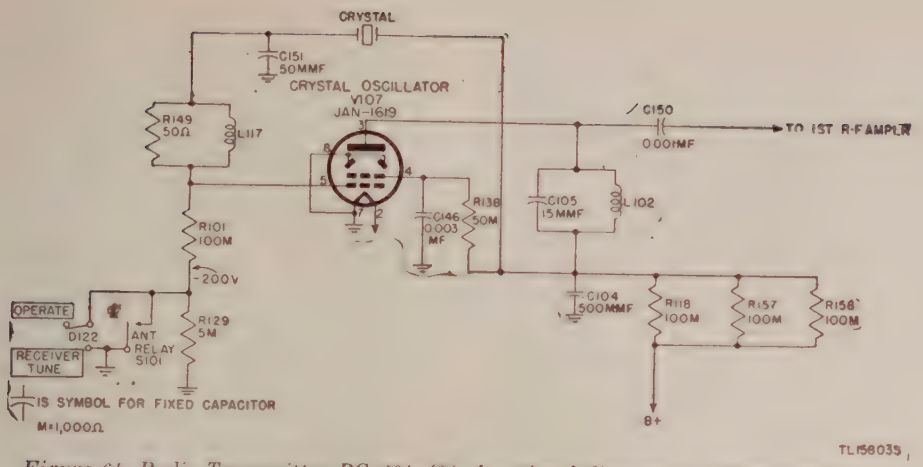


Figure 64. Radio Transmitter BC–604–(*), functional diagram of crystal oscillator.

potential is used to maintain oscillations in the crystal which is connected from this point to grid through a parasitic suppressor network consisting of resistor R149 and choke coil L117. Capacitor C151 is connected between the grid and filament to increase the grid-filament capacitance. In Pierce circuits designed for higher frequencies this capacitor is often omitted since the interelectrode capacitance within the tube is sufficient for this purpose. The plate tank circuit, capacitor C105 and inductor L102 in parallel, is proportioned to increase the excitation on the grid of V101 with increase in frequency.

e. The grid-bias resistor R101 returns to ground through resistor R129, except when antenna relay S101 is operated or when RECEIVER TUNE-OPERATE switch D122 is set at RECEIVER TUNE. The voltage drop across R129, which is connected to the dynamotor negative high-voltage lead, supplies enough bias (about 200 volts) to prevent the tube from oscillating. (This same bias voltage is similarly applied to all r-f stages in the transmitter.) When this resistor is short-circuited by the contacts of antenna relay S101 or RECEIVER TUNE-OPERATE switch D122, the cut-off bias is removed permitting the circuit to oscillate. Operating grid bias is developed across resistor R101 by the flow of grid current.

f. Coupling capacitor C150 is connected between the plate circuit of the crystal oscillator and the grid circuit of the following stage (the first r-f amplifier). It serves both as a coupling capacitor for coupling the r-f voltage from the crystal oscillator, and as a blocking capacitor to prevent the d-c plate voltage from being applied to the following grid.

101. First R–F Amplifier (Fig. 65)

a. The primary purpose of this stage is to isolate the crystal oscillator from the modulator circuit. In addition it amplifies the crystal oscillator output and excites the circuit containing the nonlinear coil at the oscillator frequency.

b. The first r-f amplifier uses Tube JAN–1619 (V101), a beam power tetrode, in a class C circuit. The output of the crystal oscillator is coupled to the grid of V101 by capacitor C150. The grid is returned to ground through resistors R139, R106, R130, and R129. The filament is in series with resistor R127 and the filaments of the first audio amplifier and crystal oscillator. The voltage drop across this circuit provides approximately 8.25 volts bias. Additional fixed bias is obtained by connecting the grid circuit to the negative side of resistor R130, which carries the total output current of the power supply. A small amount of bias is also obtained from the negative charge built up on capacitor C150 by the flow of grid current on the positive peak of each cycle. This voltage appears across the series chain consisting of grid leak resistor R139, metering resistor R106, and bias resistor R130. Resistor R129 is shorted during transmission. With meter switch D125 in its No. 2 position, and TUNE-ANT CUR switch D121 in the TUNE

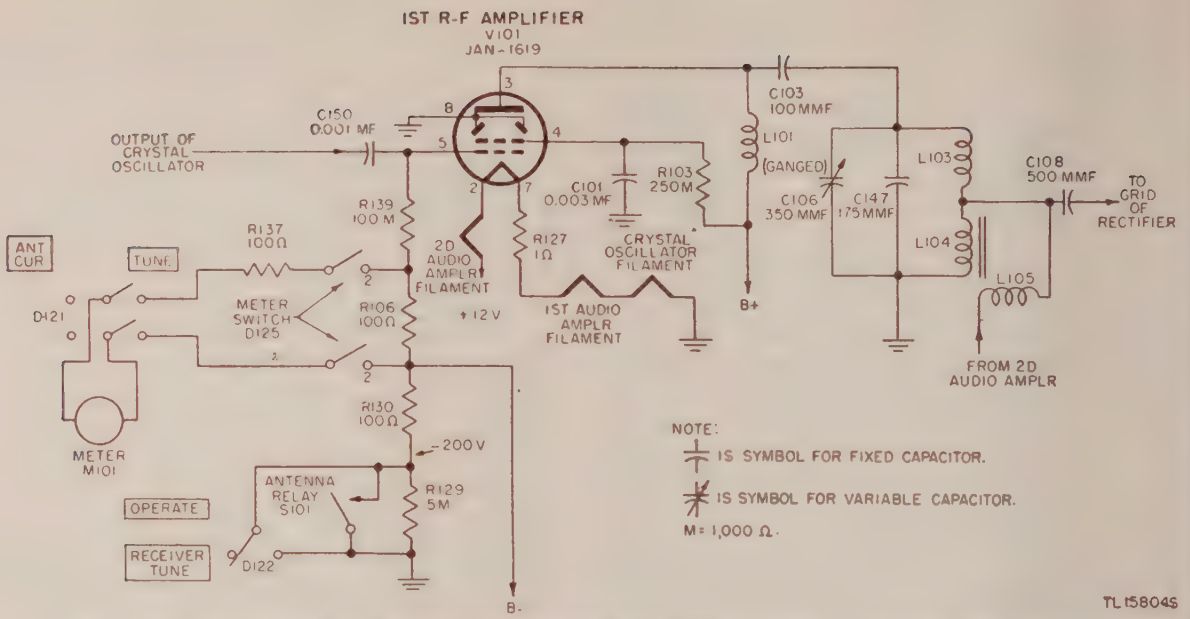


Figure 65. Radio Transmitter BC-604-(*), functional diagram of first r-f amplifier and modulator.

position, the operation of the grid circuit may be checked on panel meter M101. R137 is a meter multiplying resistor. Resistor R129 is connected into the circuit when the transmission is to be discontinued. The voltage drop across this resistor is sufficient to prevent operation of the first r-f amplifier.

c. Resistor R103 is the screen voltage-dropping resistor. Capacitor C101 filters the screen voltage. The plate is series fed through r-f choke L101. Blocking capacitor C103 prevents this voltage from being shorted to ground through coils L103 and L104. This capacitor also couples the output of the first r-f amplifier to the modulator circuit which consists of C106 (the largest section of the ganged capacitors), fixed capacitor C147, coil L103, and nonlinear coil L104. The modulator circuit is resonant to the crystal frequency and may properly be considered as part of the plate circuit of the first r-f amplifier. It will be considered in detail in the following paragraph. When a crystal is connected in the oscillator circuit by depressing a push button, the ganged tuning mechanism is also tuned, resonating the tuned circuits in the transmitter to the newly selected frequency.

102. Nonlinear Coil Modulator

a. The nonlinear coil phase modulates the output of the first r-f amplifier in accordance with the audio voltage that is applied across it.

b. The modulator circuit consists of coil L103 in series with nonlinear coil L104, paralleled by capacitors C106 and C147. (See fig. 65.) A part of the r-f output of the first r-f amplifier appears across L103, and part across L104. In addition to the r-f current flowing through L104, the output of the second audio amplifier is applied through r-f choke L105 to L104.

c. The nonlinear coil (L104) is a spiral of wire wound around a small circular core of

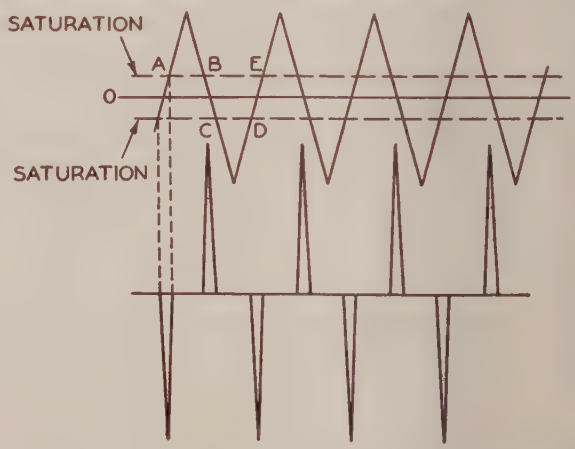


Figure 66. Voltage pulses developed across a nonlinear coil.

permalloy ribbon. Because of this permalloy material, the core reaches saturation with small values of r-f current applied to it. If a sine-wave voltage is applied across the coil, the current through the coil increases from zero to some value such as A (fig. 66), there is a rapid building up of flux until the core becomes saturated. While the current increases from the value indicated by A through its maximum value and decreases to a value indicated by B, there is no change of flux, since the core remains saturated during this period of current change. As the current decreases below the saturation point B to zero value, there is a rapid change of flux in the opposite direction. As the current increases from zero in the opposite direction to C, the flux continues the rapid change and the core again reaches saturation. As the current continues its increase from C to its maximum value and decreases to a value indicated by D, there is again no change of flux, since the core is saturated during this period of current change. As the current decreases below the saturating value and increases to E, there is again a rapid change of flux. This change of flux continues cycle after cycle. An electromotive force (emf) is induced only by a changing flux, the value of this emf depending on the rapidity of the change of that flux. Consequently, no emf is induced during that period of the cycle between A and B, C and D, etc., since there is no change of flux during these periods. However, during the intervals between B and C, D and E, etc., there is a very rapidly changing flux, resulting in the induction of a pulse of voltage of high amplitude during those intervals. Each of the voltage pulses occurs exactly 90° after the current peaks. Since this 90° phase difference is constant with each cycle when an unmodulated r-f voltage is applied, there is no change in frequency. The voltage pulses alternate in polarity each half cycle and are evenly spaced in time. However, as has been pointed out previously, in addition to the r-f currents flowing through L104, the audio output currents also flow through it.

d. Figure 67 shows how phase modulation may be produced by passing combined r-f carrier and audio signal currents through L104. A, figure 67, represents the carrier current, at the crystal frequency, through L104 without a modulating signal. An a-f signal is shown in figure 67. When two sinusoidally varying currents flow in the same circuit, the resultant current is the sum of the two. The sum of the currents in A and B, figure 67, is shown in C, figure 67. As can be seen in this figure, the r-f current no longer goes through its zero value at the same time interval as the original r-f current. Instead the interval is different for each cycle.

e. D, figure 67, shows how these combined currents act to produce sharp voltage pulses that occur at different frequencies at different instants of the a-f cycle. The variation in the level of the r-f current causes coil L104 to saturate at varying points of the r-f cycle. Note that at times the positive voltage pulses are exactly 360° apart, while at other times they are more or less than 360° apart. It is evident that the a-f voltage has acted to produce a variation in the frequency at which these pulses of voltage occur. It is further evident that any variation of the a-f voltage will shift the phase of these pulses with respect to the r-f voltage in a way that will give a frequency deviation which is proportional to the rate of change in the audio cycle.

f. There are two controlling factors in the rate of change of the audio cycle, the first of which is the amplitude. If the amplitude is increased, the rate of change is increased. The second is the frequency of the audio signal. If the audio frequency is increased, the rate of change will likewise be increased. As a result, this type of modulation has a rising characteristic because the frequency of the audio signal as well as its amplitude will determine the carrier deviation. The term *rising characteristic* means that if the amplitude of the modulating audio signal is maintained at a constant value, and the frequency of the audio signal is increased, the amount of deviation will be increased. Thus, this type of phase modulation is not exactly identical to frequency modulation, but very similar. Filter circuits in the audio section of the transmitter lower the output of these circuits as the audio frequency increases. In this manner the rising characteristic is reduced and the phase modulation is converted into frequency modulation.

g. Summing up, the nonlinear coil delivers pulses of voltage which are used to drive the

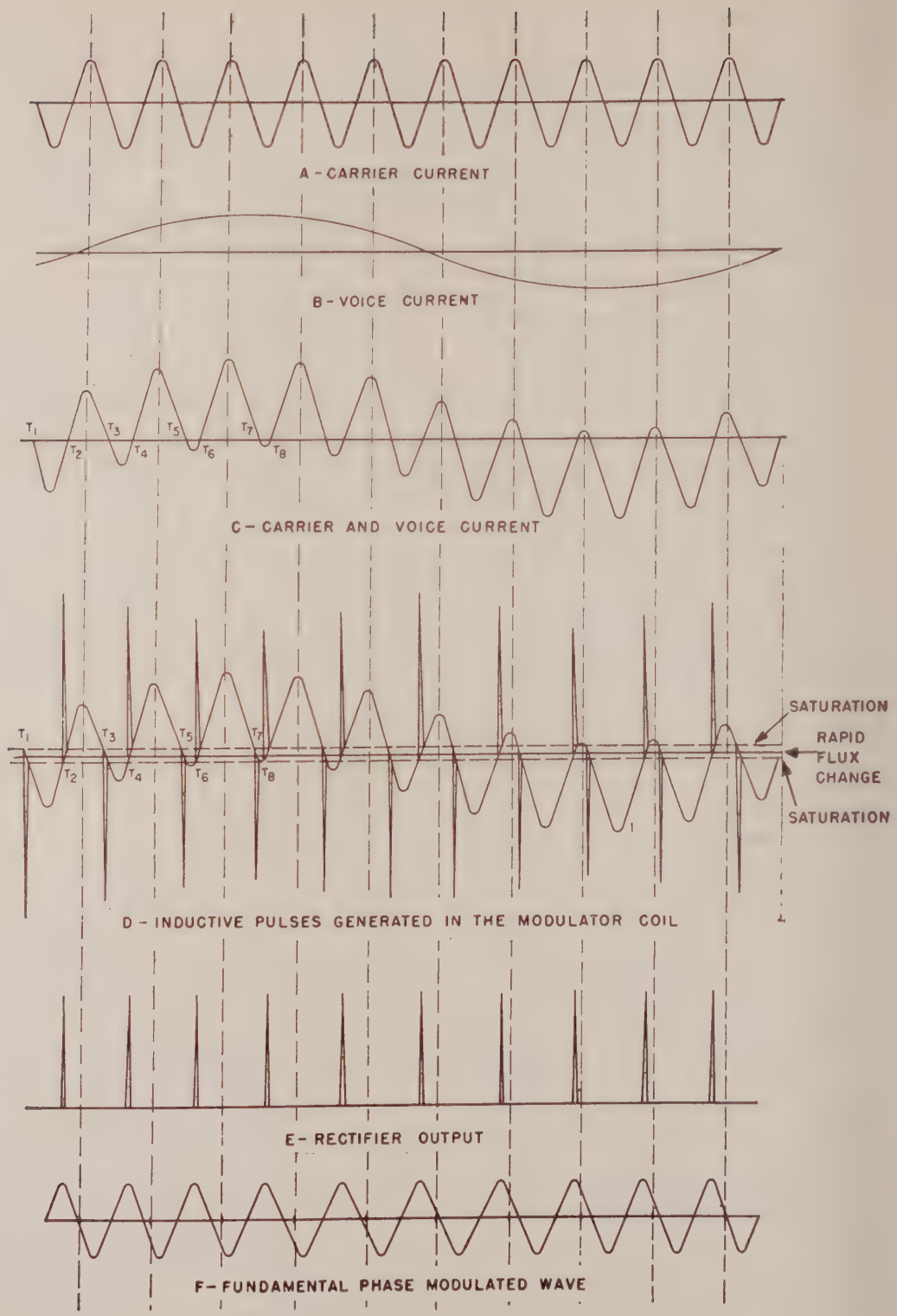


Figure 67. Development of phase modulated wave by use of nonlinear modulator coil.

following rectifier stage. If there is no audio modulating signal, these pulses occur at the crystal frequency. If a modulating signal is applied, the frequency of the pulses will vary or deviate with the modulation, first on one side and then on the other side of the crystal frequency. The amount of this deviation is proportional to both the amplitude and frequency of the audio signal. Since the audio signal is decreased in amplitude as it increases in frequency, the deviation of the pulses is almost directly proportional to the amplitude of the a-f signal. The output of the nonlinear coil modulator is applied to the rectifier by coupling capacitor C108.

103. Rectifier (Fig. 68)

a. The function of the rectifier circuit is to produce a carrier frequency that is varying above and below the resting frequency in accordance with the modulation.

b. The rectifier stage uses Tube JAN–1619 (V102), a beam power tetrode. Generally speaking, this stage is not a rectifier but a class C amplifier acting as a harmonic generator. It is called a rectifier because it accepts only the positive pulses from nonlinear coil L104. The plate and screen voltages are lower than they are in the first r-f amplifier. These reduced voltages are obtained by using a voltage-divider circuit consisting of resistors R119, R105, and R142, connected between B-plus and ground. Plate voltage is taken from the junction of resistors R119 and R105. Screen voltage is taken from the junction of resistors R105 and R142. The voltage divider makes the plate and screen voltage more independent of the plate and screen current than will a simple resistor, such as is used in the crystal oscillator and first r-f stages. Capacitor C109 filters the screen supply. Capacitor C154 bypasses the plate supply.

c. The filament of V102 is in series with the filaments of the doubler, tripler, and power amplifier (p-a) stages. The p-a filament is returned to ground. Since there is a 2.5-volt drop across each filament, the center of the filament of V102 is 8.75 volts positive with respect to ground. This voltage drop is part of the bias of this stage. In addition to this bias there is also the fixed bias across resistor R130, which carries the total output current of the power supply. A third type of bias is developed by the flow of grid current caused by the positive voltage pulses from L104. The grid return is through resistors R104, R110, and R130. This resistance is sufficient to allow the grid current to charge grid capacitor C108 and maintain it at a fairly constant negative potential. The relative amount of grid current is indicated on meter M101 when the meter switch is in the No. 3 position and the TUNE-ANT CUR switch is in the TUNE position. The voltage across resistor R129 is used to block V102 when the transmitter is to be used as an interphone amplifier, or during the idle

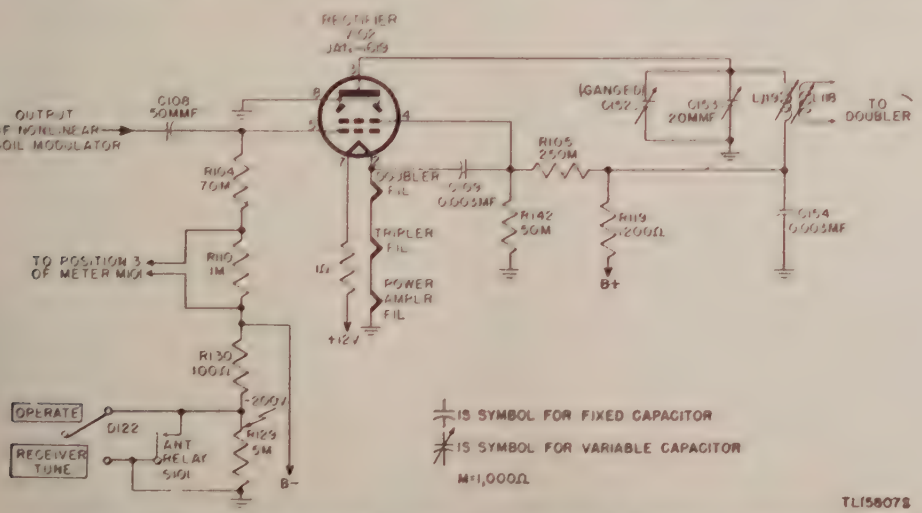


Figure 68. Radio Transmitter BC–604–(*), functional diagram of rectifier.

period when the dynamotor is coasting to a stop. The total grid bias is several times the cut-off value. Therefore, only the positive voltage pulses from L104 are amplified by V102.

d. The rectifier output is shown in E, figure 67. These pulses are converted into a sine wave (F, fig. 67) by the flywheel action of the tuned-plate load circuit consisting of ganged tuning capacitor C152, trimmer capacitor C153, and slug-tuned, plate load coil L119. This circuit is tuned to the ninth harmonic of the fundamental frequency. Plate bypass capacitor C154 places the lower end of L119 at r-f ground potential.

104. Doubler (Fig. 69)

a. This stage uses Tube JAN–1619 (V108), a beam power tetrode, in a class C circuit to amplify and double the output of the rectifier. The output of this stage is 18 times the crystal frequency.

b. The voltage appearing across the rectifier plate load coil L119 is inductively coupled to the tuned-grid circuit consisting of coil L118, capacitor C156 (one section of the ganged capacitors), trimmer capacitor C157, and bypass capacitor C155. This circuit, together with the rectifier plate circuit, forms a double-tuned filter which is highly selective to the ninth harmonic of the crystal frequency. Bias for the grid is secured in the same manner as for the rectifier and first r-f stages. The voltage drop across the filaments of the doubler, tripler, and power amplifier furnishes 6.75 volts bias. The voltage drop across resistor R130 is also used as part of the total grid bias. Enough excitation is applied to the grid to cause the flow of grid current during positive alternations. The voltage drop across grid resistors R144, R143, and R130, due to grid current, also serves as bias for the grid. The relative amount of this grid current is indicated on panel meter M101 when the meter switch is in position 4 and the TUNE-ANT CUR switch is in the TUNE position. Also, during the time that resistor R129 is not shorted out of the circuit, the blocking bias across it will disable the doubler.

c. A voltage divider, consisting of series resistors R145 and R150, is connected from the

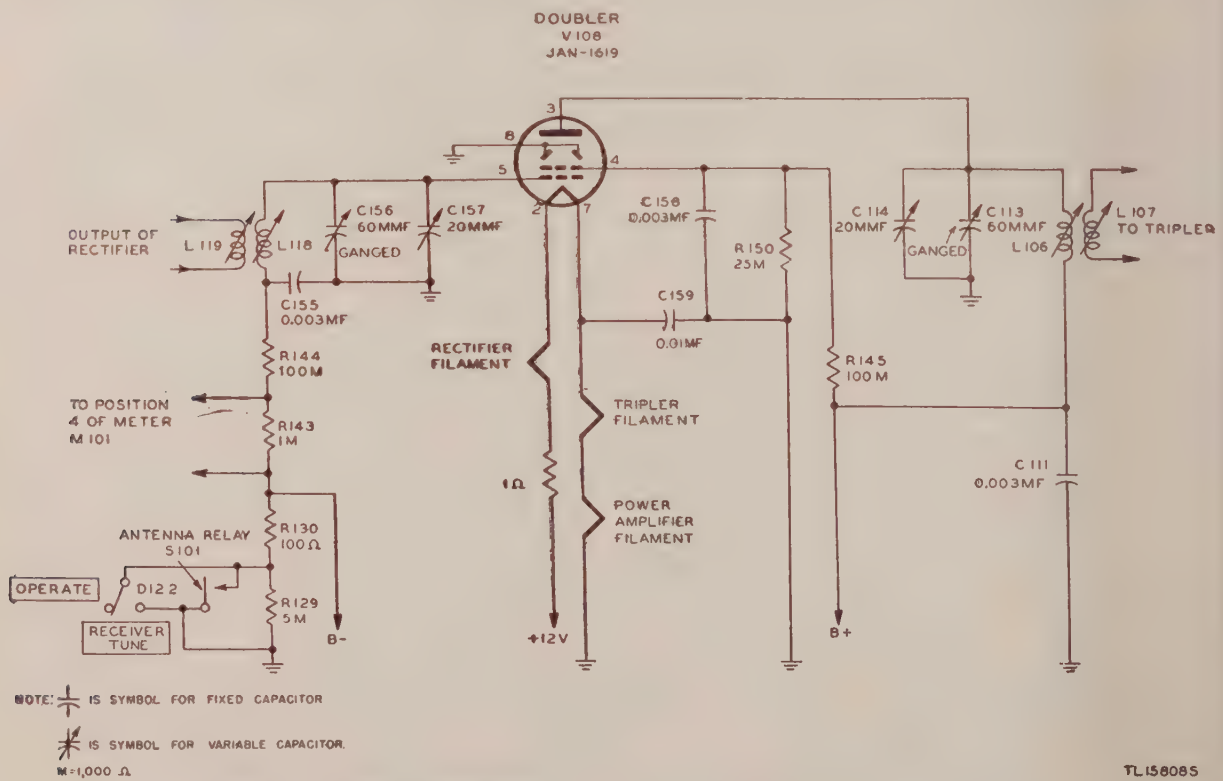


Figure 69. Radio Transmitter BC–604–(*), functional diagram of doubler.

plate supply to ground. The entire voltage across these resistors is applied to the plate. The screen voltage is taken from the junction of resistors R145 and R150, and is filtered by capacitor C158. Capacitor C159 bypasses the filament. The plate circuit consists of the primary of r-f transformer L106, capacitor C113 (one section of the ganged capacitors), trimmer capacitor C114, and bypass capacitor C111. As previously noted, the grid input circuit is coupled to the output circuit of the rectifier and both circuits are tuned to the ninth harmonic of the crystal oscillator. The plate circuit of the doubler is tuned to twice this frequency. This gives a frequency in the plate circuit 18 times that of the crystal oscillator, and also gives a deviation 18 times whatever deviation is set up in the modulator circuit. The doubler plate circuit is inductively coupled to the tripler by L107.

105. Tripler (Fig. 70)

a. The tripler stage multiplies the frequency three times. This is sufficient to give a frequency deviation of plus or minus 50 kc. The output of this stage is 54 times the crystal frequency.

b. The tripler circuit is similar to those already described in that it uses Tube JAN–1619 in a class C operated circuit. Tube voltages closely correspond with those in the doubler. Grid bias is somewhat higher in order to allow plate current to flow for a shorter period of time than in the doubler. The principal difference is in the plate circuit. Instead of using a transformer for coupling into the following stage, a single tuned circuit is used so that the oscillatory circuit is common to both the plate circuit of the tripler and the grid circuit of the p-a stage. This tuned circuit

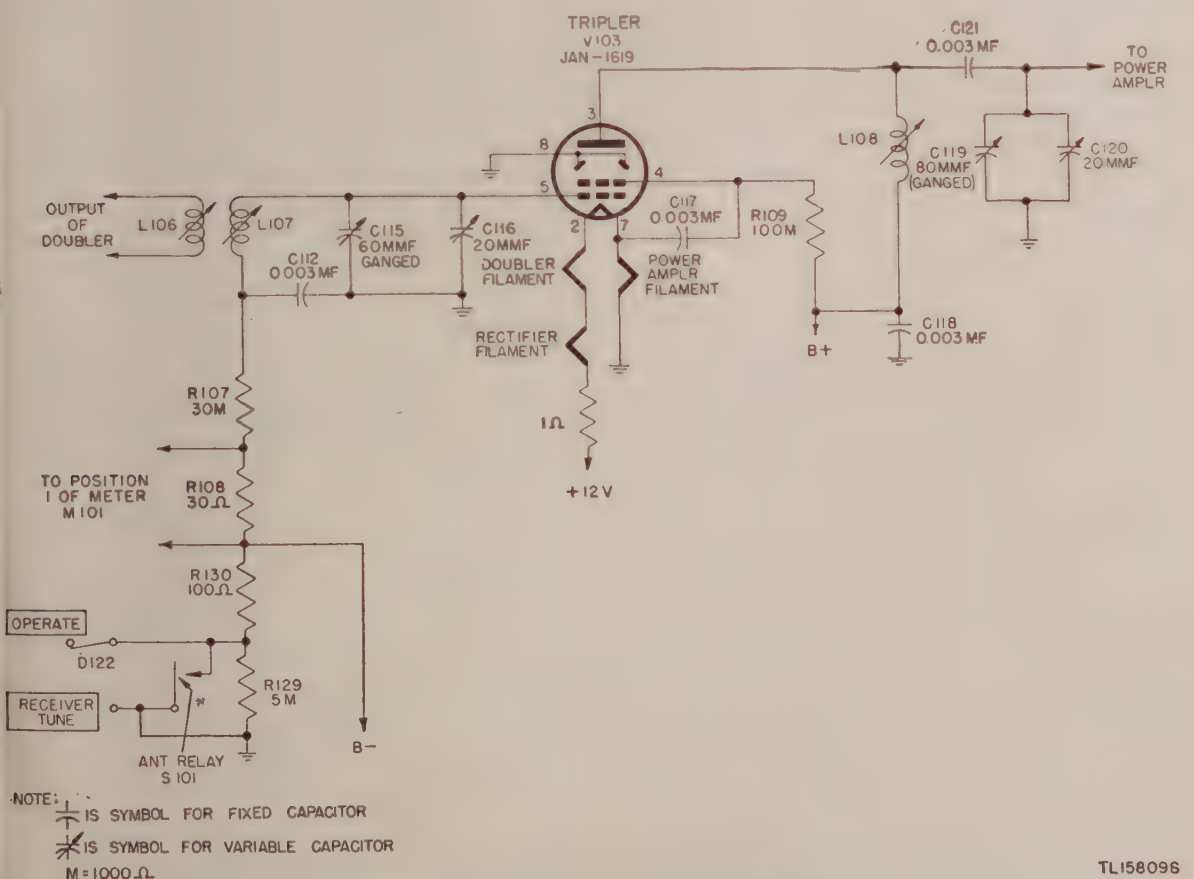


Figure 70. Radio Transmitter BC–604–(*), functional diagram of tripler.

consists of coil L108, C119 (one section of the ganged tuning capacitors), trimmer capacitor C120, blocking capacitor C121, and bypass capacitor C118. Screen voltage is lowered by dropping resistor R109 bypassed by capacitor C117.

c. The grid input circuit consists of the secondary L107 of the r-f transformer whose primary is connected in the plate circuit of the doubler, C115 (one section of the ganged tuning capacitors), trimmer capacitor C116, and bypass capacitor C112. Grid bias for the tripler and doubler are both derived in the same manner, partly from the filament, partly from R130, and partly from the flow of grid current through the grid resistors (in case of the tripler, R107 and R108). The voltage drop produced by the flow of grid current through resistor R108 is indicated by meter M101 when meter switch D125 is in its No. 1 position and the TUNE-ANT CUR switch is in its TUNE position. The voltage that appears across resistor R129, when it is not short-circuited by the antenna relay or RECEIVER TUNE-OPERATE switch, is used to block the grid of the tripler during periods of nontransmission.

d. The grid input circuit is tuned to 18 times the frequency of the crystal. Since the plate circuit is tuned to three times the frequency of the input circuit, the r-f output of the tripler is 54 times the frequency of the crystal. The output of the tripler is coupled through capacitor C121 to the grid of V104.

106. Power Amplifier (Fig. 71)

a. The power amplifier amplifies the output of the tripler stage and delivers 30 watts of r-f power to the antenna.

b. The output of the tripler stage is coupled by capacitor C121 to the power amplifier. This stage uses Tube JAN–1624 (V104), a beam power tetrode, in a class C circuit. V104 is rated to be operated with higher plate voltages and has higher power output than the tubes used in the previous r-f stages.

c. Grid bias is obtained in the same manner as for the tripler and doubler. The bias derived from the filament circuit is relatively small since one side of the filament of the power amplifier is grounded. Other sources of bias are the drop in grid resistor R111 due to the flow of grid current, the fixed bias due to the drop across resistor R130, and the blocking bias across resistor R129 when the complete r-f section of the transmitter is made inoperative. In order to make doubly certain that the power amplifier is inoperative during the

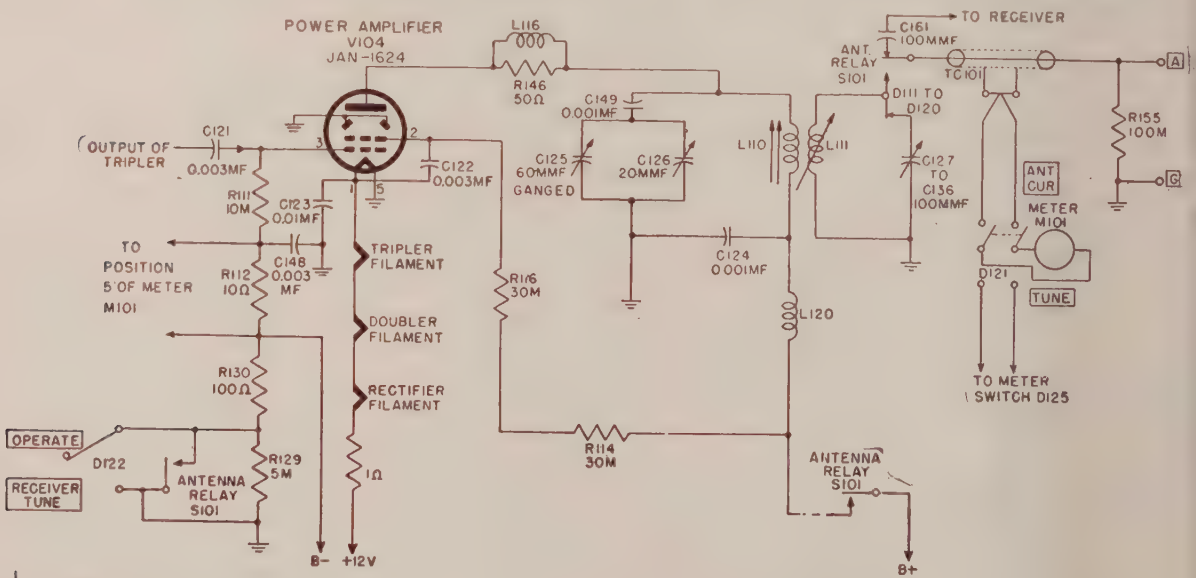


Figure 71. Radio Transmitter BC–604–(*), functional diagram of power amplifier.

period of nontransmission, one of the contacts on antenna relay S101 breaks the plate and screen circuit. The relative amount of grid current flowing is indicated by meter M101 when meter switch D125 is in its No. 5 position and the TUNE-ANT CUR switch is in its TUNE position.

d. The screen is fed through series dropping and decoupling resistors R114 and R116 which are bypassed by capacitor C122. The plate is series fed through r-f choke L120 and coil L110. Capacitor C124 bypasses plate r-f currents to ground. Parasitic suppressor network L116 and R146 eliminates undesired h-f oscillations. The output of the power amplifier, 54 times the crystal frequency, is coupled to the antenna through a tuned transformer circuit. The primary winding L110 is tuned by capacitor C125 (one section of the ganged capacitors), and trimmer capacitor C126. Capacitor C149 keeps high d-c voltage from the tuning and trimmer capacitors. Proper tuning over the entire frequency range is accomplished by adjustment of the copper slug in coil L110 (varied by means of a control accessible from the right side of the transmitter) and trimmer capacitor C126.

e. The secondary, or antenna winding L111 of the coupling transformer is tuned by means of a separate tuning capacitor for each channel. These capacitors, numbered C127 to C136, are selected by switches D111 to D120, actuated by the push-button mechanism. The setting of the individual antenna-tuning capacitors, and the coupling between coils L110 and L111 are adjusted by means of controls accessible through openings in the right side of the transmitter. The purpose of this variable coupling is to match the output impedance of the power amplifier to the impedance of the antenna over the desired frequency range. Antenna relay S101, in addition to functions previously described, transfers the antenna from the receiver to the transmitter. Receiver noise, caused by static charges which may accumulate on the antenna, is reduced by the combined action of static leak resistor R155 and series capacitor C161 in the antenna lead to the receiver.

f. Relative antenna current is indicated by switching meter switch D121 to the ANT CUR position. In this position, the meter is connected directly across thermocouple TC101. A short coaxial line (approximately 3 inches in length) is connected between the antenna terminal, marked A on the panel and a contact of the antenna relay. A bare wire is connected in parallel with the outer conductor (or shield) of this coaxial line. Because of the loss in the line there is an r-f potential drop between the two ends of the shield (and bare wire). A portion of this voltage is tapped off from the bare wire conductor by means of an adjustable slide-wire tap, and fed to the heater element of the thermocouple. The heating of the thermocouple develops a d-c voltage which is applied to the panel meter thus giving a relative indication of the r-f potential drop along the line; this drop is proportional to the antenna current.

107. Microphone Circuit (Fig. 72)

a. GENERAL. The transmitter is designed to operate with either a carbon or a magnetic type microphone. Magnetic Microphone T–33–(*) has the advantage of ruggedness and broad frequency response characteristics, but has the disadvantage of low-voltage output. Carbon button Microphone T–17–(*) has the advantage of a greater voltage output. A second type of carbon unit is throat Microphone T–30–(*) which has the advantages of freeing the operator's hands, reducing background noise, and permitting the wearing of a gas mask. A third type of carbon microphone that may be supplied is Microphone T–45–(*). This is a single-button carbon microphone worn on the upper lip. It has the same advantages as Microphone T–30–(*). When the magnetic microphone is used, its output is applied to the first audio amplifier through step-up transformer T101. Because the output from the carbon microphone is so much higher than that from the magnetic microphone, the level of the former must be reduced before applying it to the amplifier.

b. CARBON MICROPHONE INPUT CIRCUIT. The d-c voltage for the carbon microphone is obtained from the 12-volt supply through dropping resistors R121 and R120. Resistor R121 also serves as an audio filter in conjunction with capacitor C140, which has a large value of capacitance and thus bypasses undesired a-f currents to ground. Sound waves striking

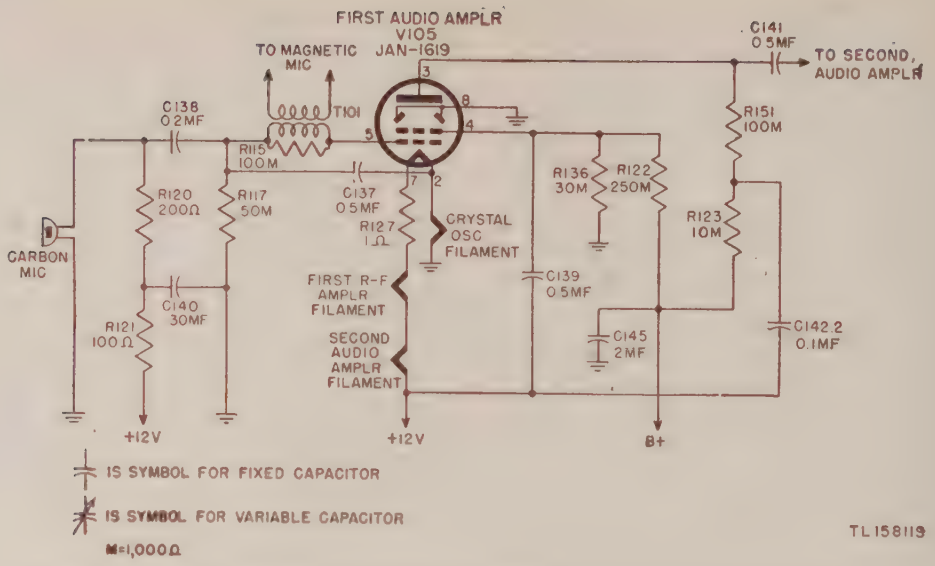


Figure 72. Radio Transmitter BC–604–(*), functional diagram of first audio amplifier.

the diaphragm of the microphone vary its resistance and cause a pulsating current flow through resistor R120 and the microphone, resulting in a pulsating voltage across resistor R120. The audio, or a-c component of this voltage, appears across voltage-divider network C138 and C137 which return to ground through the crystal oscillator filament. Since the reactance of C138 is two and one-half times that of C137, most of the voltage drop appears across C138. Therefore, only a small portion (approximately one-third) of the audio voltage developed across R120 appears across C137 which is paralleled by resistor R117. The audio signal present across C137 is fed to the grid of the first amplifier tube through the secondary of T101 and resistor R115. The grid circuit constants are designed to discriminate against noise above and below the 200–3,000 cycle per second range.

c. TANK–OTHER USE SWITCH. The carbon microphone input circuit is made relatively insensitive in order to avoid picking up the noise in a tank. Some of the later transmitters have a switch marked TANK-OTHER USE. If the transmitter is used in a quiet location this switch may be set at OTHER USE, which interchanges capacitors C137 and C138 to make the carbon microphone more sensitive (fig. 113). That is, the voltage drop across C138 is applied to the first amplifier. In this condition it is possible to provide adequate voice input by talking in a normal tone into the carbon microphone. Operation of the magnetic microphone is not affected by this switch.

d. MAGNETIC MICROPHONE INPUT CIRCUIT. The audio signal from the magnetic microphone is coupled to the grid of the first audio amplifier through step-up transformer T101 which is loaded by resistor R115. The lower end of T101 is bypassed to ground through capacitor C137.

108. First Audio Amplifier (Fig. 72)

a. A two stage audio amplifier is used in the transmitter to furnish power for modulation and also for interphone use when that type of operation is desired. The first audio amplifier receives the audio signal from either the magnetic or carbon microphone, amplifies the signal, and applies it to the grid of the second audio amplifier. Provision is also made so that microphones located at a distance from the transmitter may be connected into the input circuit of the first audio amplifier. The output of the second audio amplifier may be connected to the nonlinear coil to modulate the transmitter and is always connected to the remote circuits for interphone use.

b. The first audio amplifier uses Tube JAN–1619 (V105), in a class A circuit. The center of the first audio amplifier filament is 3.75 volts above ground, thus providing sufficient

bias for this type of operation. The grid circuits have already been discussed in paragraph 104. Plate voltage is obtained through plate load resistor R151 and filter resistor R123. Plate a-f currents are bypassed to the filament circuit through capacitor C142.2. The B-plus supply is bypassed by capacitor C145. Screen-grid voltage is obtained from the junction of resistors R136 and R122 which form a voltage divider between B-plus and ground. Capacitor C139 bypasses audio screen currents to the filament circuit. The amplified signal voltage developed across the first audio amplifier plate load resistor R151 is applied to the grid of the second audio amplifier tube through blocking capacitor C141.

109. Second Audio Amplifier (Fig. 73)

a. The purpose of the second amplifier is to develop the a-f voltage necessary to modulate the transmitter and to supply sidetone to all the headphones. During interphone operation, the a-f output is supplied only to the headphones.

b. The output of the first audio amplifier (V105) is applied to second amplifier Tube JAN–1619 (V106), which is operated class A. About 10.75-volt bias is supplied by the voltage drop across the filaments of the crystal oscillator, the first audio amplifier, and the first r-f amplifier. This bias is higher than that used in the first audio amplifier since higher plate and screen voltages are used in the second audio amplifier stage.

c. The grid is returned to ground by series resistors R125 and R124. Capacitor C142.1 connects the junction of these resistors to the filaments. The input signal appears across R125 in series with the parallel combination of R124 and C142.1. The filament side of C142.1 is very close to audio ground potential. This grid circuit arrangement attenuates the higher audio frequencies to a greater degree than it does the lower audio frequencies. At higher audio frequencies, the reactance of C142.1 decreases, thus decreasing the impedance of the grid circuit of V106 and hence the impedance of the load on V105. As a result, at the higher audio frequencies, a smaller signal voltage is applied to the grid of the

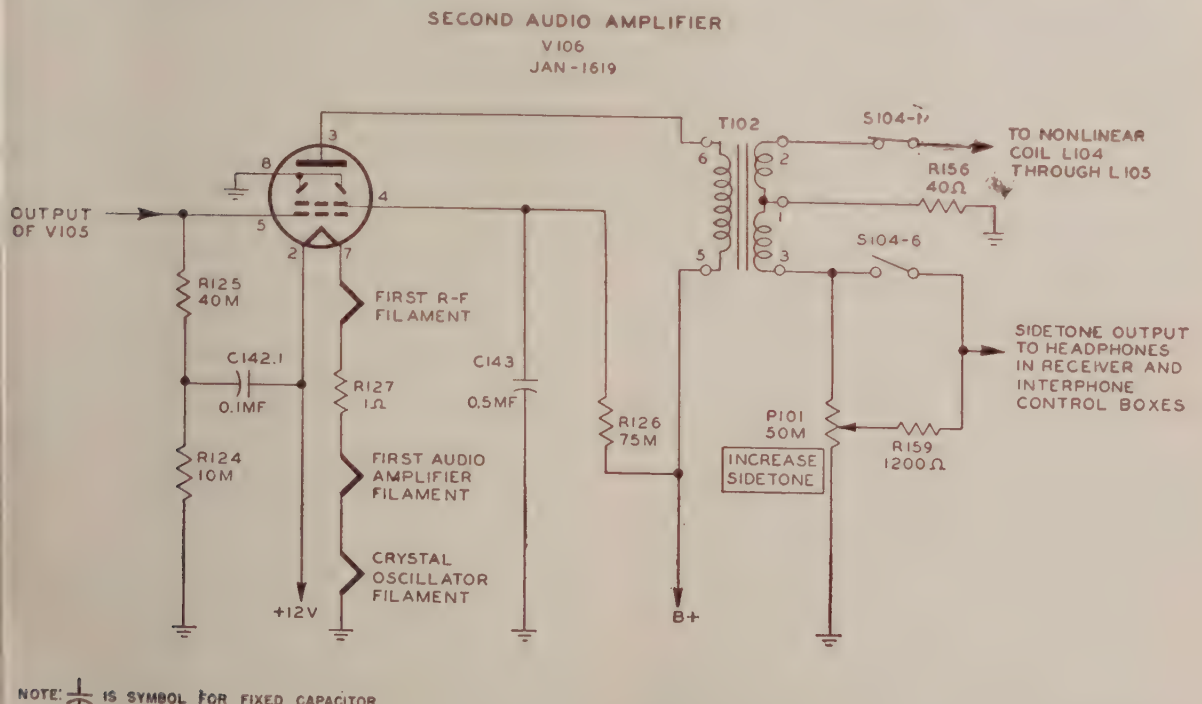


Figure 73. Radio Transmitter BC–604–(*), functional diagram of second audio amplifier.

second audio amplifier. The output of this stage, which is fed through r-f choke L105 to nonlinear coil L104 (fig. 65), therefore has a falling characteristic. When this is combined with the rising characteristic exhibited by nonlinear coil L104 (par. 102*f*), a slightly rising characteristic results. This produces what is termed as pre-emphasized frequency modulation, which is more effective in eliminating interference than pure frequency modulation.

d. Screen voltage for the second amplifier is fed through isolating and dropping resistor R126 bypassed by capacitor C143. Plate voltage is obtained through the primary winding of transformer T102. The secondary has two series-connected windings. A small modulating voltage, developed across the smaller winding (1–2), is applied to nonlinear coil L104 through r-f choke L105 and contact 1 of S104 when the RADIO-INTERPHONE switch is in the RADIO position. Resistor R156 places the center tap 1 of T102 near ground potential. The greater portion of the output is developed across the larger winding (1–3), which is paralleled by load resistor R156 in series with INCREASE SIDETONE potentiometer P101. During transmission, with the RADIO-INTERPHONE switch in the RADIO position, the contacts of relay S104-6 are open, and the output of P101 is fed through resistor R159 to the headphones in the receiver and interphone control boxes. This output, called sidetone, is varied in volume by INCREASE SIDETONE potentiometer P101, accessible on the right side of the transmitter. When the RADIO-INTERPHONE switch is in the INTERPHONE position, the contacts of S104-1 are open, interrupting the output to the nonlinear coil, and the contacts of S104-6 are closed, thus applying the entire output of winding (1–3) to the various headphones. The full output is required for satisfactory interphone operation. Note that the output of the second audio amplifier is always connected to every headphone.

110. Power Supply (Fig. 125)

The high voltage (approximately 600 volts) for the transmitter is obtained from either Dynamotor DM–35–(*), designed to operate from a 12-volt storage battery, or Dynamotor DM–37–(*), which operates on 24 volts. Each dynamotor is mounted on a base and provided with a connector of such type that installation or replacement is accomplished by removing the complete assembly. They are totally inclosed except for the screened, ventilating holes in the end covers in some cases. Each dynamotor has two bearings of the single-ring, ball-bearing type containing sufficient lubricant for long periods of operation. All iron and steel parts subject to corrosion are treated with lacquer or other means to repel moisture. The dynamotors are compound-wound and, therefore, have good voltage regulation. The primary (motor winding) and secondary (generator winding) are wound in the same armature slots, but terminate at separate commutators at opposite ends of the armature shaft. Capacitors C501, C502, and C503 (on the 12-volt set), and C601, C602, and C603 (on the 24-volt set), connected across the commutators, serve as r-f bypass capacitors for the armature windings. Capacitors C503 and C603 are eliminated on later models. As previously indicated, each dynamotor terminal pin jack is provided with appropriate strapping so that the circuit change for either 12- or 24-volt operation is automatically accomplished when the dynamotor is plugged in.

Note. The design of these dynamotors is based on an average duty cycle of 5 minutes on and 15 minutes off. Accordingly, the transmitter should not be operated continuously over long periods.

111. Metering Circuits (Fig. 113)

a. When TUNE-ANT CUR switch D121, on the front of the transmitter, is placed in the ANT CUR position, panel meter M101 (in conjunction with thermocouple unit TC101) indicates the current flowing in the antenna circuit and, therefore, can be used for adjusting the antenna-trimming capacitors. When switch D121 is in the TUNE position, the meter is connected to a 6-position switch located on the right side of the transmitter and marked METER SWITCH. By means of this switch and associated meter, an indication of the grid current flowing in all the r-f stages except the crystal oscillator can be obtained. Five meter switch positions have already been discussed in connection with the stages to which they pertain. The No. 6 position of the

meter switch has not as yet been considered. In this position, the total plate and screen-grid current in the transmitter is indicated by placing the meter across normal biasing resistor R130 which is connected between the high-voltage negative lead and ground. Because of the relatively high current in this circuit, an additional 30,000-ohm meter multiplier resistor R134 is placed in series with the meter. An arbitrary scale of 0–100 is used, and it serves the purpose of indicating relative current for tuning and alignment purposes.

b. The numbered positions of the METER SWITCH and the circuit to which the meter is connected are as follows:

Switch position	Circuit
1	Tripler grid
2	First r-f grid
3	Rectifier grid
4	Doubler grid
5	P-a grid
6	Total plate and screen current

112. Control Circuits of Radio Set SCR–508–(*)M (Fig. 111)

a. GENERAL. A schematic diagram of the control circuits in a typical installation of Radio Set SCR–508–(*) is shown in figure 111. This figure incorporates all the changes specified in the first 10 Modification Work Orders. The following discussion is based on the assumption that these modification work orders have been complied with. Figure 110 shows the original control circuits before any of the modification work orders have been applied. The horizontal and vertical dimensions of the drawing are shown by numerals and letters, to facilitate location of related component parts. The letter and figure in parentheses following each circuit symbol are used, as on a road map, to find each circuit component in the diagram. The left side of the drawing contains the power control circuits, the center portion shows the signal control circuits, and the right side shows the remote control circuits embodied in two interphone control boxes.

b. POWER SUPPLY CONTROL. (1) The 12- or 24-volt vehicle battery, indicated by —BATTERY (A, 1) and +BATTERY (A, 9), is connected to Mounting FT–237–(*). The —BATTERY connection is grounded. Power is available through fuse F401 at TRANSMITTER ON-OFF switch D124 (C, 8) of the radio transmitter and at REC ON-OFF switch D1 (N, 7) of the radio receiver. When a receiver switch, D1, is closed, the receiver vacuum tube cathodes (P, 4 for the lower receiver) are heated and the receiver dynamotor starts. The 12-volt heater connections are shown by the solid lines in jack J701 (Q, 5), and the 24-volt connections are shown by the dashed lines to jack J801 (Q, 6). The output of either or both receivers, as desired, is available at the receiver jacks, J1 and J2 (K, 21), and at the command station control box jack, J301 (K, 29) and crew member station control box jack, J301 (E, 28) when RADIO & INT-INT ONLY switch D2 at each receiver (K, 19) is at RADIO & INT. The output volume is adjusted by VOLUME control P1 (K, 15) on each receiver. Each interphone control box is also provided with a VOLUME control P301 (E, 29) to permit individual adjustment of the signal level at the command and crew member stations.

(2) TRANSMITTER ON-OFF switch D124 (C, 8), when switched to ON, connects the battery to the transmitter filaments (L, 4), lights the pilot lamp E301 (K, 4), and applies voltage to the dynamotor relay S102 (D, 7), receiver disabling relay S103 (D, 7), thermostat TD101 (E, 7), antenna relay S101 (G, 6), interphone relay S104 (H, 6), and the microphone circuit (D, 14).

c. TRANSMITTER MICROPHONE PUSH-BUTTON CONTROL. (1) With RECEIVER TUNE-OPERATE switch D122 (D, 17) set to OPERATE and RADIO-INTERPHONE switch D123 (J, 3) set to RADIO, pressing the transmitter microphone push-to-talk switch completes the circuit between the tip and sleeve connections of carbon microphone jack J102 (D, 2) and causes the following to take place:

(a) Energizes dynamotor relay S102 (D, 7) and closes its contacts (B, 6) to start the transmitter dynamotor.

Note. The contact diagram beside the relay winding symbol shows the *released* position of the contacts, and the parentheses inclose the location of the contacts in the diagram. Likewise, the parentheses beside the relay contact symbol at (B, 6) indicate the location of the actuating winding.

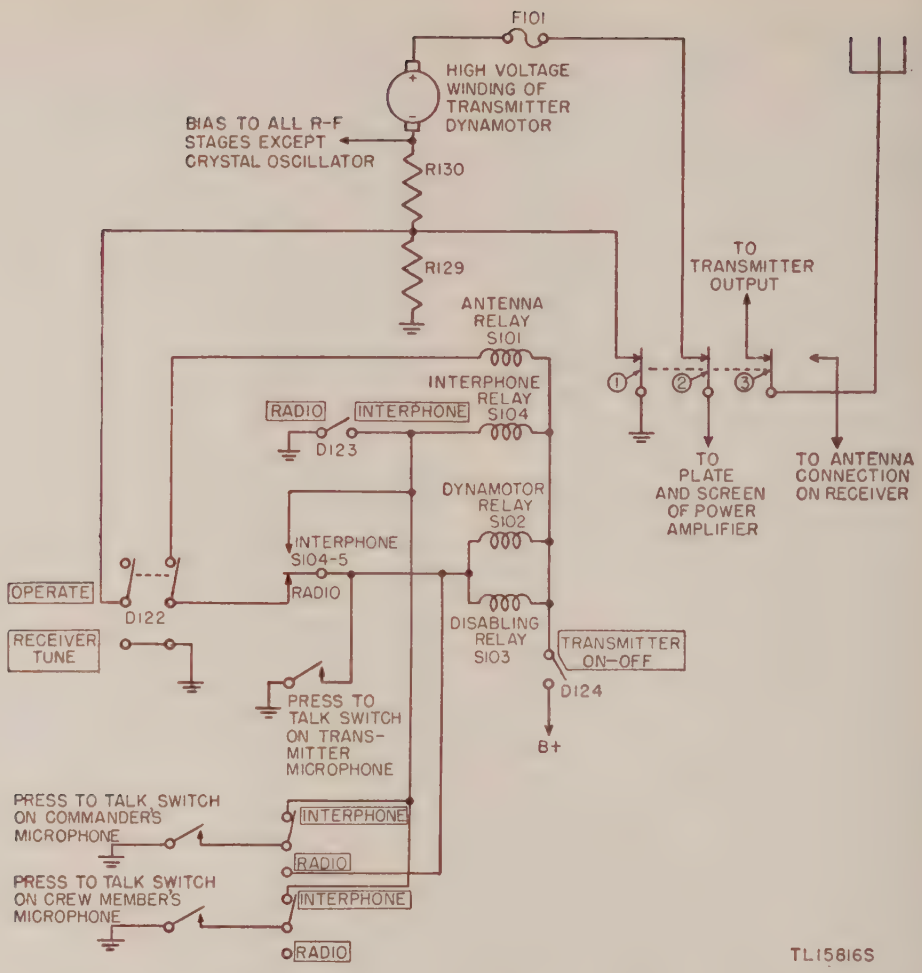


Figure 74. Radio Set SCR–508–(*)M, simplified diagram of control circuits including changes through MWO SIG 11–600–10.

(b) Energizes receiver disabling relay S103 (D, 7) and closes its contacts (O, 24) to short-circuit the output of both receivers when receiver TUNE-OPERATE switch D5 (J, 20) is in the OPERATE position.

(c) Energizes antenna relay S101 (G, 6) and transfers the antenna from the receiver to the transmitter through the contacts (I, 17) of S101. Two other sets of contacts allow plate and screen voltage to be applied to the power amplifier (V104) and remove the cut-off bias from the crystal oscillator and r-f stages. Figure 74 shows this more clearly. With the TRANSMITTER ON-OFF switch at ON, operation of the transmitter microphone press-to-talk switch operates relays S102, S103, and S101 as discussed above. Antenna relay S101 is shown in the operated position. The antenna is connected to the transmitter through contact 3. The plus side of the high voltage winding of the transmitter dynamotor is connected through fuse F101 and contact 2 of antenna relay S101 to the plate and screen of the power amplifier. Contact 1 of S101 shorts out resistor R129, thus removing the voltage drop across it which was used as blocking bias for all the r-f stages.

(2) Audio signals entering the radio transmitter at J102 (D, 12) (fig. 116), modulate the carrier wave in modulation coil, L104 (F, 21), as previously described. Sidetone is furnished by the lower winding of T102 (F, 19) through INCREASE SIDETONE control P101 (E, 21) to jacks J1 and J2 on each receiver

and to jack J301 at the remote control stations.

(3) In the above discussion it was assumed that the circuit between the tip and sleeve connections of J102 (D, 2) was completed by pressing the switch on carbon Microphone T–17–(*), T–30–(*), or T–45–(*), inserted into J102 at the transmitter. The same effect is obtained by plugging magnetic Microphone T–33–(*) into Jack J101 (D, 2) and pressing its switch to close a connection between terminals A and B of jack J101. If Microphone T–33–(*) is used, speech enters the transmitter at terminals C and D of J101 (F, 11).

(4) When the microphone button is released, the actuating voltage is removed from the relays and their armatures are released. Although the battery voltage has been removed, the dynamotor armature will tend to coast for some time. Under this condition, the dynamotor will continue to generate a voltage which falls off as the dynamotor slows down. Should the transmitter be allowed to remain in its operating condition during this period, it will continue to emit a carrier wave which in turn will cause interference in the associated receiver and those near-by. In order to overcome this condition, the transmitter is made inoperative by antenna relay S101 at the instant the microphone push button is released. This is accomplished by the following three actions: First, by removing the antenna from the transmitter (fig. 74); second, by removing the plate and screen-grid voltage from the power amplifier; and third, by applying a high negative blocking voltage to the crystal oscillator grid, thus preventing it from operating. The blocking voltage for the crystal oscillator is obtained from resistor R129. When contact 1 of antenna relay S101 is opened, the short is removed from R129 and dynamotor current flows through this resistor developing a high voltage. The negative end of R129 is connected to the grid of the oscillator and the voltage across R129 is sufficient to make the oscillator inoperative (fig. 113).

d. RECEIVER TUNE-OPERATE SWITCH. RECEIVER TUNE-OPERATE switch D122 (D, 16) enables the transmitter to be used for presetting the receiver. The OPERATE position of this switch permits normal operation of the transmitter. When the switch is in the RECEIVER TUNE position, dynamotor relay S102 and disabling relay S103 are energized (fig. 74). Antenna relay S101 is isolated from the remainder of the control circuit and remains de-energized. Resistor R129 is shorted by a contact on the RECEIVER TUNE-OPERATE switch, thus removing the cut-off bias voltage from the grid of the oscillator. The transmitter microphone push button has no control over the circuits. Thus, all transmitter stages except the power amplifier are placed in operation by throwing the RECEIVER TUNE-OPERATE switch to the RECEIVER TUNE position. Under this condition, stray fields from the operating r-f stages of the transmitter produce a signal at the input of the receiver. If the receiver is tuned to the same frequency as the transmitter, the transmitter carrier may then be used for tuning the receiver. Unless the transmitter is modulated, however, no audio component will appear at the receiver output. In addition, to obtain audio output at jack J1 or J2, the receiver TUNE-OPERATE switch D5 (P, 20) must be in the TUNE position (fig. 116). When this switch is in the OPERATE position, operation of disabling relay S103 shorts out the audio input to V8.

e. RADIO-INTERPHONE SWITCH. (1) The operation of the radio transmitter is under direct control of the transmitter microphone push-to-talk switch. However, the use of the transmitter as a radio transmitter, or the use of the a-f amplifier section of the transmitter as an interphone amplifier, is accomplished by multiple contact interphone relay S104 (H, 6).

(2) Interphone relay S104 has a cylindrical iron core which rotates when energized and, in doing so, opens and closes the wafer switch contacts shown in figure 111. In this figure the relay is shown in its unenergized position. Relay S104 is controlled at the transmitter by RADIO-INTERPHONE switch D123 (J, 3), or remotely by the interphone control boxes at the command and crew member stations.

(3) When relay S104 is energized, its contacts perform the following:

(a) Contact S104-1 (G, 20) opens the audio lead from transformer T102 to phase modulator coil L104.

(b) Contact S104-2 is no longer used.

(c) Contact S104-3 (H, 15) was used to close the circuit to the magnetic microphones

(Microphone T–33–(*)) at the remote control stations in early, unmodified transmitters. Contact S104-3 serves no purpose in later transmitters and modified transmitters.

(d) Contact S104-4 (D, 18) closes the talking circuit to the ring contact or jack J302 on the crew member interphone control box. Note that the ring contact of jack J302 on the command station interphone control box is permanently connected to the talking circuit. When the system is wired as shown in figure 123, the ring contact on the crew member's interphone control box is wired to the same terminal (terminal 9) on TS401 as the ring contact of the command station interphone control box. Contact S104-4 then does not perform any functions.

(e) Contact S104-5 (C, 18) closes the control circuit to the microphones at the remote control stations. Antenna relay S101 (fig. 74) remains unenergized, but dynamotor relay S102 and disabling relay S103 are actuated by the remote control microphones. Hence the r-f section of the transmitter is disabled, but the audio section still functions for interphone use.

(f) Contact S104-6 (E, 21) increases the sidetone output to the headsets during interphone operation by making use of the full potential drop across INCREASE SIDETONE potentiometer P101.

(g) Contact S104-7 (I, 6) removes the short circuit across part of the winding of the S104 relay energizing coil, placing this part of the winding in series with the other part of the winding. The series connection is used to reduce current flow, since only a relatively small value of current is required to hold this relay in the closed position as compared with the current required to operate it initially.

113. Remote Control Circuits of Radio Set SCR–508–(*)

Interphone Control Box BC–606–(*) provides control and connection facilities for a microphone and a headset at a point remote from the radio equipment. The control boxes also permit interphone conversation between the personnel in the vehicle, which may be a tank. The a-f circuits of the transmitter are used as an amplifier during interphone conversation. Several control boxes may be connected in multiple, if desired. The actual method of connecting the interphone boxes is not always the same since the radio set is installed in many different types of vehicles, each requiring an installation suited to its own needs. The TM 11–2700 series Technical Manuals specify the exact wiring diagram for each vehicle.

114. Remote Control Circuits of Radio Set SCR–508–(*)M Including Modifications

a. A typical installation is shown in figure 111. One interphone control box is used by the commander at the command station. The other control box is placed at a crew member station. Several crew member station control boxes are usually, but not always, connected in parallel.

Note. The following discussion and the circuits shown in figure 111 are based on Interphone Control Box BC–606–H or earlier models with tank commander's box modified and interphone system wiring changed in accordance with MWO SIG 11–600–8.

Figures 119 and 120 shows the schematic diagrams of models A through G and model H, respectively. For details of modification and system rewiring to make system operation with Interphone Control Boxes BC–606–A to G or H identical, refer to MWO SIG 11–600–8 and figure 121.

b. When the RADIO-INTERPHONE switch (J, 3) is at RADIO, interphone relay S104 is released and the circuits are ready for radio transmission. The interphone control boxes are provided with a spring loaded RADIO-INTERPHONE switch (M, 30) which always remains in the INTERPHONE position when released. This eliminates the possibility of tank commanders inadvertently talking over the radio while intending to use the interphone, when the tank commander's control switch is unintentionally left in the RADIO position. Operation of the microphone press-to-talk switch at the command or crew member station operates interphone relay S104. (See figs. 74 and 111.) The manner in which this relay changes the functions of the transmitter to that of an amplifier has already been discussed. Dynamotor relay S102 and disabling relay S103 are energized through the operated contact of S104–5. The R contact of command station microphone jack J302 (J, 28) is connected in parallel with the R contact of transmitter microphone jack J102 (D, 12). The R contact of the crew member station microphone jack J302 (D, 28) is

also connected to the R contact of J102 through the operated contact of S104–4. In some wiring systems given in the TM 11–2700 series, relay contact S104–4 is not used and the R contact of the crew member's interphone control box is wired in parallel with the R contact of the command station interphone control box. The headphones of the command station and the crew member stations are permanently in parallel and receive the full output of INCREASE SIDETONE potentiometer P101 through the operated contact of S104–6. Thus, for interphone operation, there is no difference between the command station and the crew member station control boxes.

c. For radio operation, however, there is a difference. With the command station's RADIO-INTERPHONE switch manually held in the RADIO position, operation of the command station microphone press-to-talk switch energizes dynamotor relay S102 and disabling relay S103. The interphone relay remains unenergized. Since the lead to the RADIO contact of the crew member station RADIO-INTERPHONE switch is not connected, only the command station control box can remotely use the transmitter for radio transmission.

d. In an emergency, personnel at crew member stations can interrupt radio transmission by pressing their microphone press-to-talk buttons.

115. Remote Control Circuits of Radio Set SCR–508–(*)M Using Five-Wire Universal Interconnection System

a. Additional system improvements are shown in figures 122 and 123, which also incorporate the modifications indicated in paragraph 114. The improvements are in simplification of wiring and reduction of number of circuits required. Circuit functions using wiring method of figures 122 and 123 are similar to paragraph 114.

b. In armored vehicles produced prior to 1946 only five slip-ring circuits are available to extend the remote control circuits between the rotatable turret and the hull. In these vehicles, both command station and remote station boxes could not be placed on the opposite side of the slip rings from the radio set. In addition, when command and remote station boxes were located adjacently at a distance from the radio it was necessary to run separate interphone cordage cables to each, since the cordage leads from each box connect to different terminals on TS401 and TS301. In wiring the interphone cordage great care had to be taken to prevent error in wiring due to variation in color coding of each cable at each strip.

c. Figures 122 and 123 illustrate wiring systems which correct these deficiencies. Note that the microphone ring circuit for command and remote stations is connected to the same terminal on TS401. The color coding of interphone cordage is identical for command or remote station boxes. A jumper wire connected between terminals No. 1 and No. 5 on TS301 makes a command station of any of the boxes, and completes the circuit to the transmitter dynamotor relay when the RADIO-INT switch is held at the RADIO position. Interphone cordage for command or remote stations may be connected exactly in parallel either at TS401 in Mounting FT–237–(*), at TS301 in interphone control boxes, or at the terminal block in the vehicle terminal box.

d. A remote station can be changed to a command station simply by adding the jumper wire in the box desired to be changed, without changing any other connections. A command station can be changed to a remote station by removing the jumper in that box. Any number of boxes may be command stations wherever located in the vehicle, since the five slip-ring circuits are now sufficient to provide all required functions.

e. Interphone Control Box BC–606–H is required for the five-wire system, or Interphone Control Box BC–606–A to G with modifications per MWO SIG 11–600–8 applied to each box used as a command station. Remote station boxes do not require modification.

116. Remote Control Circuits of Radio Set SCR–508–(*) Before Modification

a. Figure 110 illustrates functional circuits with the method of vehicle interphone wiring used prior to publication of MWO SIG 11–600–8. Note that the interphone cordage leads of the remote station and command station are connected to different terminals on terminal strips TS401 and TS301.

b. In this system, selection of radio or inter-

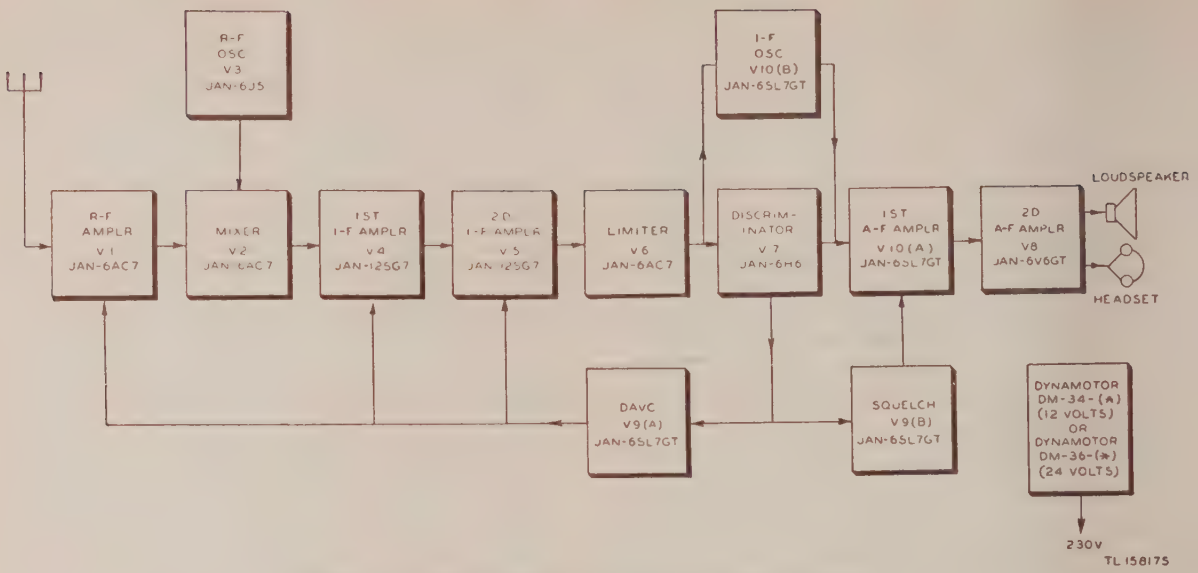


Figure 75. Radio Receiver BC–603–(*), block diagram.

phone transmission can be made at the command station by means of the RADIO-INT switch on Interphone Control Box BC–606–A to G. With the switch at RADIO position, operation of the command station microphone press-to-talk switch then energizes dynamotor relay S102, starting the dynamotor and permitting audio modulation of the radio transmitter through the microphone ring circuit, connected to terminal 9 on TS401.

c. For interphone communication the RADIO-INT switch is placed at the INT position, energizing the coil of transmitter radio-interphone relay S104, and changing the function of transmitter for interphone operation as previously discussed.

d. At the remote, or crew member's station the normal position for the RADIO-INT switch is at the RADIO position, in order to permit operation of the radio transmitter by the commander. The crew members can communicate over the interphone system by placing the switch at the INT position. The radio-interphone relay S104 is then energized and the microphone ring circuit is completed by relay contact S104–4.

e. When the crew member RADIO-INT switch is at RADIO the crew members' microphones are not connected in the circuit. The crew members receive radio and interphone signals in their headsets, if the RADIO & INT-INT ONLY switch on Radio Receiver BC–603–(*) is at the RADIO & INT position.

f. When the switch on the command station box is at RADIO position, crew members at the remote station can interrupt in emergencies and communicate over the interphone system by placing the RADIO-INT switch on the box at the INT position. This energizes the radio-interphone relay. *The switch must be returned to the RADIO position at conclusion of the message.*

Section XII. THEORY OF RADIO RECEIVER BC–603–(*)M

117. Simplified Block Diagram (Fig. 75)

The receiver uses ten tubes in a superheterodyne circuit capable of receiving f-m signals. It has a frequency range of 20.0 to 27.9 mc. Any one of 10 preset frequencies within this range may be selected automatically by operation of the appropriate push button, or the entire range may be covered by means of the manual-tuning control. A block diagram showing the signal path is shown in figure 75. A complete schematic diagram is shown in figures 115 and 116.

a. R-F Amplifier. The r-f signal picked up by the antenna is amplified by r-f amplifier, V1. It increases the sensitivity, selectivity, and image rejection ratio of the receiver.

b. MIXER. Mixer stage V2 mixes the output of the r-f amplifier with the signal from the r-f oscillator to produce the intermediate frequency. This frequency is 2.65 mc and is equal to the difference between the r-f signal frequency and the r-f oscillator frequency.

c. R-F OSCILLATOR. R-F oscillator V3 generates an r-f signal which is fed to the mixer. The frequency of the r-f oscillator is controlled by a variable capacitor that is ganged with the capacitors in the r-f amplifier and mixer stages. The frequency of the r-f oscillator is 2.65 mc higher than the frequency to which the r-f amplifier is tuned.

d. FIRST I-F AMPLIFIER. First i-f amplifier V4 amplifies the i-f signal and excites the second i-f amplifier.

e. SECOND I-F AMPLIFIER. For a very weak input signal, second i-f amplifier V5 acts as an amplifier, building up the signal received from the first i-f amplifier and passing it on to the limiter stage. For strong signals, the second i-f amplifier acts as a peak limiter.

f. LIMITER. Limiter V6 is used to remove amplitude modulation from the r-f signal. The amplitude modulation represents most of the noise content of the f-m carrier.

g. DISCRIMINATOR. Discriminator V7 converts the f-m signal into an audio signal. This audio signal is coupled to the first audio amplifier. The discriminator also operates the delayed automatic volume control (davc) and squelch circuits.

h. FIRST A-F AMPLIFIER. First a-f amplifier V10(A) amplifies the output from the discriminator and drives the second a-f amplifier.

i. SECOND A-F AMPLIFIER. Second a-f amplifier V8 further amplifies the a-f signal and feeds it to a loudspeaker or headset as determined by the switches on the control panel.

j. I-F OSCILLATOR. I-F oscillator V10(B) generates a 2.65 mc signal when the receiver TUNE-OPERATE switch is in the TUNE position. This signal mixes with the output of the limiter stage to produce an a-f beat note which is amplified by the first and second a-f amplifiers and then applied to the loudspeaker or headset. The i-f oscillator facilitates rapid and accurate setting of the 10 push buttons.

k. DELAYED AUTOMATIC VOLUME CONTROL. This stage V9(A) controls the voltage gain of the r-f amplifier and first and second i-f amplifier. Control voltages for the d-a-v-c circuit are provided by the discriminator circuit.

l. SQUELCH STAGE. Since the gain of f-m receivers is very high, atmospheric static is greatly amplified, causing a high degree of noise when no f-m signal is being received. The purpose of squelch stage V9(B) is to block the first a-f amplifier when no signal is being received and thus keep noise from being heard in the loudspeaker and headset.

m. POWER SUPPLY. The receiver obtains its B-plus supply from either a 12-volt Dynamotor DM–34–(*) or a 24-volt Dynamotor DM–36–(*).

118. R–F Amplifier (Fig. 76)*

a. The r-f amplifier amplifies the signal to which it is tuned and drives the following stage. The frequency of the input signal ranges from 20.0 to 27.9 mc. A tuned r-f stage tends to eliminate image response, increase selectivity, and improve sensitivity.

b. When antenna switching relay S101 in the transmitter is in its unenergized position, the r-f signal picked up by the antenna is fed through capacitors C161 (in the transmitter) and C401 (in the mounting) and impressed across the primary winding of antenna coupling transformer L32. Static leak resistor R155, in conjunction with series capacitor C161 (both in the transmitter), reduces receiver noise caused by static charges. Transformer L32 inductively couples the input signal to the control grid of r-f amplifier V1. This stage uses Tube JAN–6AC7, a high-gain pentode, in a class A circuit.

c. Tuning capacitor C1.2 is ganged to the other variable tuning capacitors in the r-f circuits and can be varied by either the selector push-button or manual TUNING control. Correct tuning over the entire frequency range is obtained by varying the inductance of the secondary (iron-core tuned) and varying trimmer capacitor C1.1. The r-f voltage developed across the secondary of L32 is impressed between the grid and cathode of the r-f amplifier tube. Capacitor C35 provides an r-f path from the lower end of L32 to ground.

d. Grid bias is obtained from the voltage

* The radio receiver theory section is based on circuit diagrams which have been modified in accordance with the latest modification work orders issued.

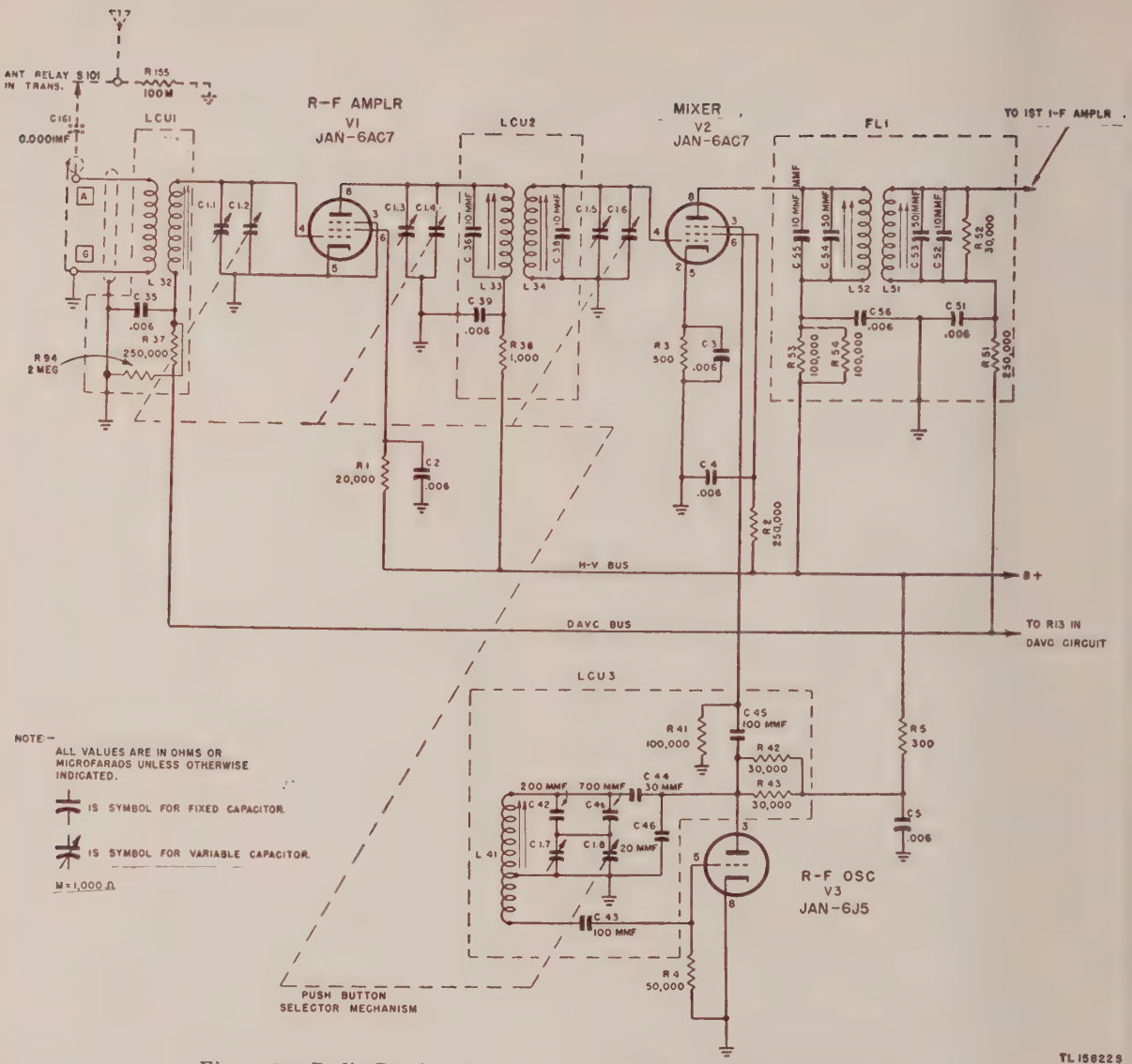


Figure 76. Radio Receiver BC–603–(*), functional diagram of r-f circuits.

divider, R94 and R37, one end of which is tied to the d-a-v-c bus. A variable amount of fixed bias is also applied to the d-a-v-c bus. Capacitor C35 and resistor R37 also prevent r-f feedback to the other stages. Screen voltage is obtained through dropping and decoupling resistor R1 which is bypassed to ground by capacitor C2. Plate voltage is fed through R38 and primary winding L33. Decoupling resistor R38 and plate circuit bypass capacitor C39 form an r-f filter which reduces undesirable coupling through the high d-c voltage source.

e. The output of V1 is coupled to the control grid of mixer V2 through the tuned transformer of band-pass filter unit LCU2. Primary L33 and secondary L34 are separately tuned by ganged capacitors C1.4 and C1.6, respectively. These capacitors are varied by the push-button selector mechanism. Capacitors C36 and C38 provide temperature compensation. Trimmer capacitors C1.3 and C1.5 and the tuning slugs permit adjustment of the tuning range.

119. R–F Oscillator (Fig. 76)

a. The r-f oscillator generates an r-f volt-

age that is heterodyned in the mixer with the signal from the r-f amplifier to produce the i-f frequency.

b. The r-f oscillator V3 uses Tube JAN–6J5 in a modified, shunt-fed Hartley circuit. The tank circuit is tuned to resonance by slug-tuned inductor L41, variable capacitors C1.7 and C1.8, and fixed capacitors C44, C46, C42, and C41. Tuning capacitor C1.8 is ganged to the main tuning capacitor assembly. Adjustment of the range over which the oscillator operates is accomplished by varying the inductance of the oscillator coil L41 and trimmer capacitor C1.7. The oscillator is always tuned to a frequency that is 2.65 mc higher than the frequency of the r-f amplifier.

c. Fixed capacitors C42, C44, and C46 are a part of the tuned circuit and are of the temperature compensating type. Capacitor C41 serves as a series padder to insure proper tracking. Capacitor C44 prevents the d-c plate voltage from shorting to ground through the coil. Energy from the tuned circuit is fed to the grid through C43 which prevents the d-c grid voltage from shorting to ground through the coil. The rectified grid current flowing through grid leak resistor R4 provides grid bias.

d. Resistor R5 and capacitor C5 form a filter to prevent r-f current from being fed to the B-plus lead. The plate is shunt-fed through the parallel resistor combination R42 and R43. The r-f oscillator signal is fed to the mixer suppressor grid through capacitor C45 which prevents the oscillator plate voltage from appearing on the suppressor grid. The output signal also appears across R41 which provides grid bias and a d-c return for the mixer suppressor grid.

120. Mixer (Fig. 76)

a. The mixer stage receives two signals: the 20.0- to 27.9-mc output of the r-f amplifier stage; and the 22.65- to 30.55-mc r-f voltage generated in the r-f oscillator. These two signals are heterodyned to produce the 2.65-mc i-f signal which is the frequency difference between the r-f received signal and the r-f oscillator signal.

b. The mixer stage uses Tube JAN–6AC7 (V2) which is operated almost class B. The bias developed across resistor R3, due to the flow of plate and screen current, is sufficient to bias the tube near the cut-off point. C3 is a bypass capacitor.

c. Plate voltage for this stage is obtained through decoupling and dropping resistors R53 and R54, in parallel, and coil L52. Capacitor C56 bypasses one end of the plate circuit to ground. Screen-grid voltage is fed through decoupling and dropping resistor R2 which is bypassed by C4.

d. Resistor R41 completes the circuit from the mixer suppressor grid to the cathode. Since the suppressor grid is driven positive by the signal from the r-f oscillator, there is a flow of rectified current to this grid, through R41, and back to the cathode. The rectified current develops a d-c bias voltage across R41.

121. First I–F Amplifier (Fig. 77)

a. The first i-f amplifier amplifies the output of the mixer and partly controls the sensitivity of the receiver.

b. The 2.65-mc i-f signal from the plate of the mixer is inductively coupled to the first i-f amplifier Tube JAN–12SG7 (V4) by filter unit FL1. The transformer in FL1 has slug-tuned primary and secondary windings. Capacitors C55 and C52 provide temperature compensation. Capacitors C54 and C53 are fixed tuning capacitors. The coupling of the double-tuned transformer is designed to provide a wide band-pass characteristic. Resistor R52 broadens the band pass and provides a flat-topped response characteristic.

c. The i-f signal appearing across the secondary of the transformer in FL1 is applied between the control grid and cathode of the first i-f amplifier by direct connection to the grid and through bypass capacitor C51 to the cathode. This stage is biased for class A operation. Grid bias is obtained from the d-a-v-c bus through decoupling resistor R51, which, together with capacitor C51, forms an r-f filter. The bias is made up of the d-a-v-c voltage plus the voltage across resistor R24 and SENSITIVITY control potentiometer P2. Since V4 is a variable-mu tube, its amplification factor decreases as the bias is increased. The gain of this stage is therefore dependent upon the received signal level and the setting of SENSITIVITY control P2.

d. Screen voltage is filtered by screen-drop-

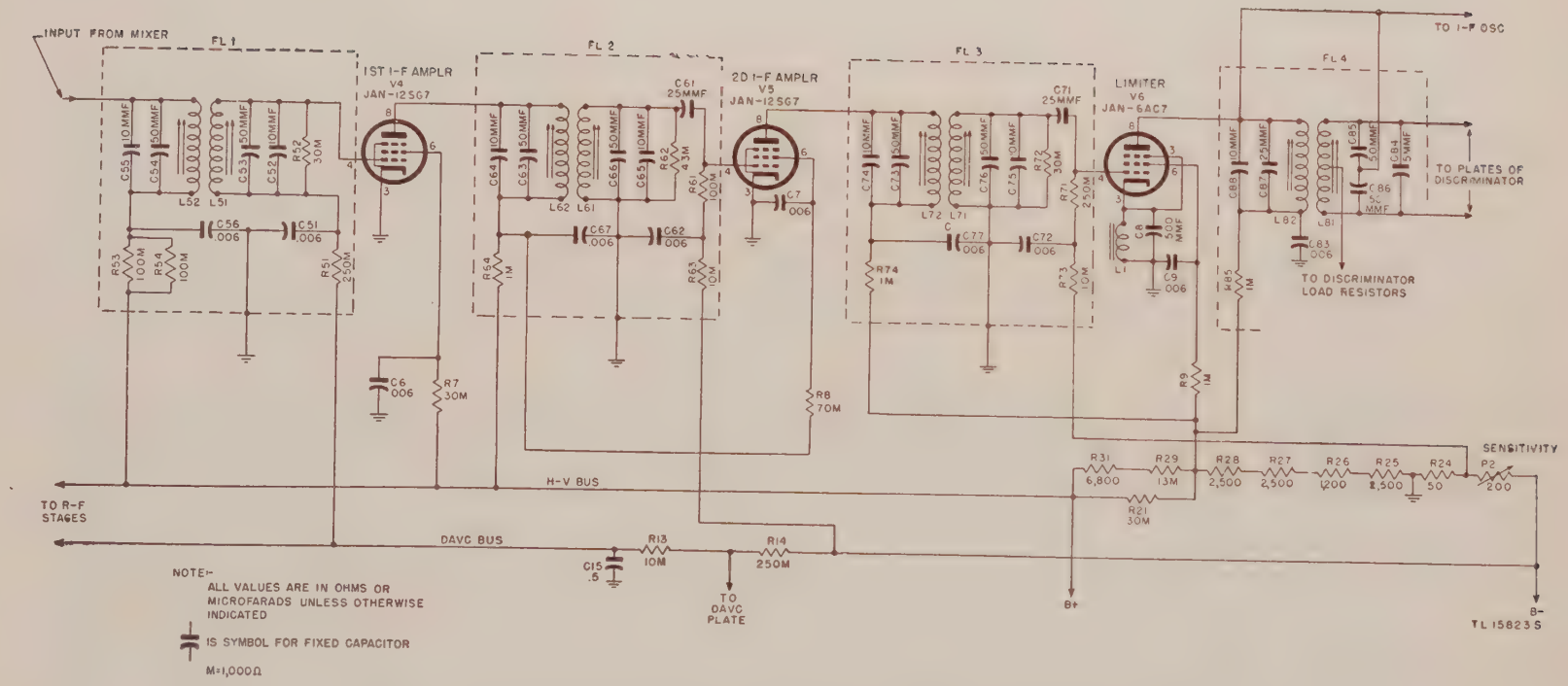


Figure 77. Radio Receiver BC–603–(*), functional diagram of i-f and limiter circuits.

ping and decoupling resistor R7 which is bypassed by capacitor C6. Decoupling resistor R64 and plate circuit bypass capacitor C67 form an r-f filter for the plate voltage.

e. The amplified i-f signal across the tuned plate circuit of V4 is coupled by the tuned transformer windings L62 and L61 of FI2 to the input of second i-f amplifier V5. Both windings have adjustable iron cores to permit alinement. The primary winding is resonated by fixed capacitor C63 and its temperature compensator C64. The secondary is tuned by fixed capacitor C66 and its temperature compensator C65. Resistor R62 provides a flat-topped frequency response characteristic.

122. Second I–F Amplifier (Fig. 77)

a. The second i-f amplifier amplifies the normal output of the first i-f amplifier and functions as an auxiliary peak limiter on strong signals. It limits its output voltage to a value that can be effectively handled by the following limiter stage.

b. The second i-f ampifier uses Tube JAN–12SG7 (V5) which operates class A for signals of normal strength. When strong signals are received, the positive voltage swings overcome the fixed bias which is fed through R63 and R61. Grid current is drawn, charging capacitor C61. The added d-c potential, or charge on C61, bucks out the signal voltage across L61 and the grid does not follow the positive swing of the signal. Since the grid controls the plate-current flow, the plate current does not increase as the input signal swings more positive but appears flat-topped on a plate-current, grid-voltage graph.

c. Another method of describing the circuit action for strong positive signal swings is that the signal voltage across L61 is applied to the voltage divider consisting of C61 and the grid-cathode impedance of the tube. Since the grid-cathode impedance is extremely low when grid current is drawn, practically all of the signal voltage appears across C61 and only a negligible portion appears across the grid-cathode impedance. As the input signal becomes more positive, the voltage drop across the grid-cathode impedance remains approximately constant. The plate current, therefore, also remains constant.

d. When the negative alternation of the input signal is applied across L61, the grid begins to swing negative. The charge across C61 is maintained because of the high time constant of R61, R63, C61, and C62. This charge adds to the negative signal voltage across L61 and drives V5 to cut-off in much less time than the signal alone could do it. In addition, low plate and screen voltage allows the tube to be cut off by a small amount of bias or negative signal voltage.

e. The clipping action of strong signals is duplicated on the succeeding cycles. The output of the second i-f amplifier, therefore, never exceeds a certain magnitude, the strongest positive and negative peaks being clipped off. Amplitude modulation, produced by interference, is thus eliminated from the signal. The clipping action results in flat-topped pulses of plate current, but this is of no consequence since the frequency variations are unaffected. These pulses of current, when flowing through the tuned plate circuit of the second i-f amplifier, cause sine wave voltages to be produced across coil L72. This is due to the flywheel effect of the tuned circuit.

f. To sum up the limiter action of the second i-f amplifier on strong signals, the positive signal peaks are clipped in the grid circuit and the negative peaks are clipped in the plate circuit because of plate current cut-off.

g. It is impossible to design a limiter that will function efficiently over extremely wide ranges of input signal strength. A limiter that is effective on weak signals will overload on strong signals, and its output will gradually decrease as the input signal strength increases. If it is designed to limit only the stronger signals, not only will amplitude modulation on weak signals remain, but the combination of strong limited signals and weak unlimited signals in the output will constitute another form of amplitude modulation. This difficulty is overcome in the receiver by using the second i-f amplifier as an auxiliary limiter in cascade with the following limiter stage V6. The limiter works well on small signals, and when the value of the signal input begins to reach a level which would overload the limiter, the second i-f amplifier begins to act as a peak limiter. In so doing, the second i-f stage cuts down the signal to a value which the limiter handles very efficiently.

h. Capacitor C62 and resistor R63 form an r-f filter network which prevents unwanted r-f signals from feeding back through the d-a-v-c bus to other stages. The screen obtains its voltage through R8 which is bypassed by C7. Reduced plate voltage, required for limiting action, is obtained from the voltage divider network through dropping and decoupling resistor R74 bypassed by capacitor C77.

i. The amplified signal at the plate of the second i-f amplifier is coupled to the limiter stage by the slug-tuned transformer in FL3. Capacitors C74 and C75 are temperature compensating capacitors for the fixed tuning capacitors C73 and C76, respectively. Bypass capacitor C77 furnishes the plate r-f return. Resistor R72 provides a flat-topped frequency response characteristic.

123. Limiter (Fig. 77)

a. The limiter is used to remove amplitude variations from the output of the second i-f amplifier and to provide an input voltage to the discriminator that is constant in amplitude.

b. The i-f signal from the secondary of the transformer in FL3 is applied to the grid of limiter Tube JAN–6AC7 (V6) through C71. When normal or strong signals are received, V6 limits the input in a manner similar to that described for the second i-f amplifier when it acts as a peak limiter. The charge built up on capacitor C71 due to grid current flow is maintained by the large grid resistors R71 and R73. These resistors return to ground through the negative end of the B-plus supply voltage divider where a fixed grid bias is obtained from the voltage drop across R24. Decoupling resistor R73 and filter capacitor C72 prevent r-f feedback.

c. If a very weak signal, which has a high degree of amplitude modulation (noise) is received, it will not be completely limited by the second i-f amplifier or limiter. To remove such amplitude modulation, a second type of limiting, feedback limiting, is used in addition to the peak or overload limiting circuit in V6. The feedback voltage is obtained by the use of choke L1 and capacitor C8 in the cathode circuit. The impedance of C8 is low for r-f and high for a-f; therefore the i-f carrier is not affected by this circuit. When the signal does not overload the limiter, low-frequency amplitude variations (noise) in the plate circuit will not be bypassed by C8 but will be forced to flow through choke L1. The audio current in choke L1 develops a reactive voltage between the cathode and ground. This reactive voltage opposes the amplitude variations which are present on the grid, thus removing these low-frequency amplitude variations from the weak signals.

d. As a result of the limiting actions in both the grid and cathode circuits, the output is comparatively free from amplitude modulation. At frequencies below the audible range, the cathode choke L1 represents negligible impedance and does not affect the bias of the tube. These slower variations are removed by d-a-v-c action if the signal is strong enough to overcome the delay voltage on the d-a-v-c diode plate.

e. To insure that the negative peaks will reach cut-off, low screen and plate voltage is applied from the junction of R28 and R29 on the voltage divider. Decoupling resistor R9 and screen capacitor C9 form an r-f filter for the screen supply lead. Decoupling resistor R85 and plate circuit bypass capacitor C83 perform the same function for the plate supply lead. The limiter plate load is resonated to the intermediate frequency and consists of L82, C87, and C88.

f. The voltage divider is described in paragraph 125.

124. Discriminator (Fig. 78)

a. PURPOSE. The function of the discriminator is to convert the frequency modulation, present in the intermediate frequency, into a signal that varies in amplitude at an audio rate. Since the carrier and i-f currents are increasing and decreasing in frequency at a rate determined by the frequency of the original audio modulating signal, the discriminator output will be almost an exact replica of the original modulating voltage.

b. CIRCUIT DESCRIPTION. The discriminator stage consists of twin diode Tube JAN–6H6 (V7), each section of which is used as a half-wave rectifier, and associated tuned and load circuits. (See fig. 78.) L82 is inductively coupled to the secondary winding L81 which is paralleled by temperature compensating capacitor C84 and the series capacitors C85 and C86.

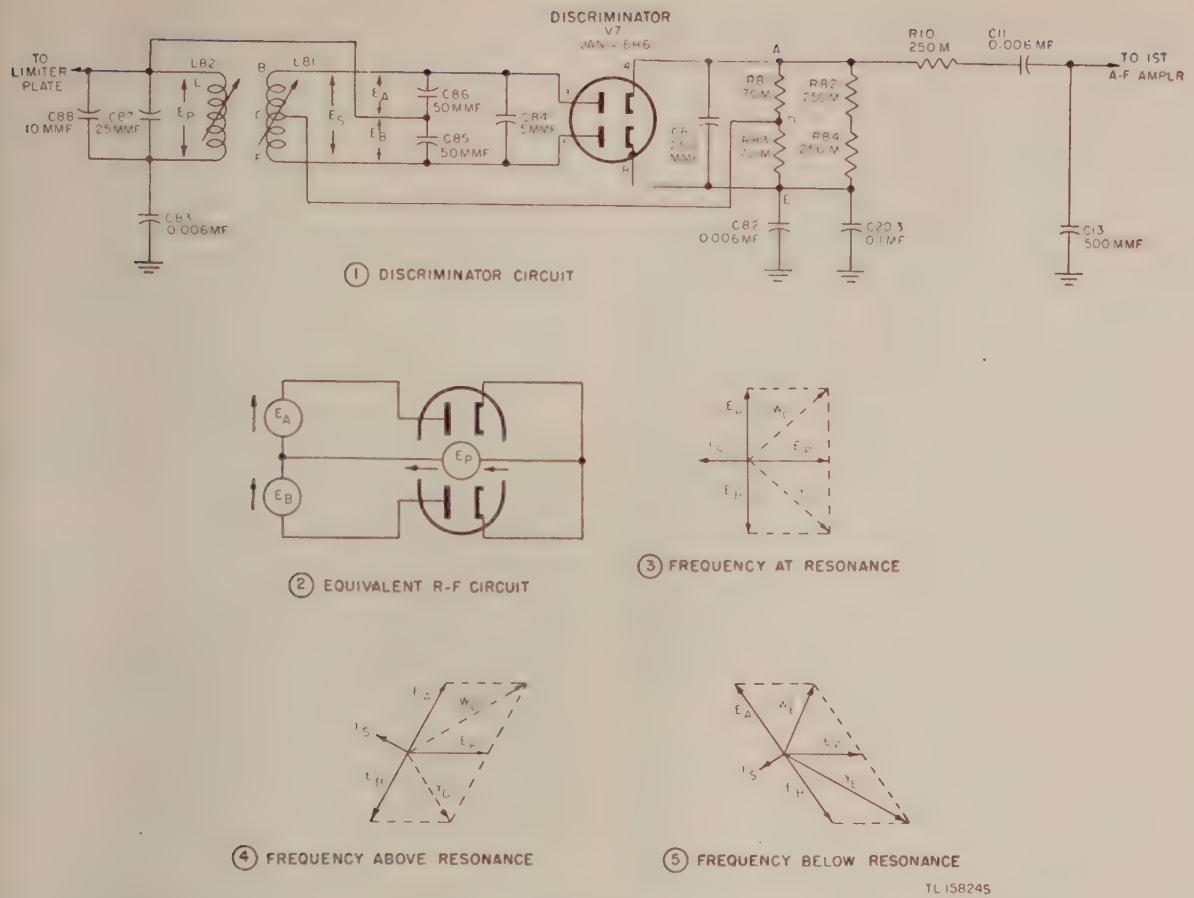


Figure 78. Radio Receiver BC–603–(*), functional and vector diagrams of discriminator circuit.

The junction of C85 and C86 is connected to the top of L82. The top and bottom ends of inductor L81 are connected to plates 3 and 5 of V7. Cathode 8 is bypassed to ground through capacitors C82 and C20.3. It is also connected to the junction of resistors R83 and R84. Cathode 4 is connected to the junction of resistors R81 and R82. Resistors R81 and R83 form the discriminator load. The junction of these resistors is returned to the center tap of inductor L81. The junction of resistors R82 and R84 is returned to a point on the voltage divider that is approximately 24 volts above ground. Resistors R82 and R84 have no effect upon the circuit operation of the discriminator. They are placed in the circuit to satisfy design requirements of the d-a-v-c circuits. Capacitor C81 bypasses r-f currents around the cathode resistors. The output of the discriminator is applied to the grid of the first a-f amplifier through resistor R10 and capacitor C11.

c. Applied R-F Voltages. When the primary and secondary circuits are tuned to resonance, the r-f voltages applied to each diode consist of the primary voltage E_P and an induced secondary voltage which is 90° out of phase with E_P. The signal voltage across the primary L82 is shown as E_P. (See fig. 78①.) The induced voltage across the secondary L81 is shown as E_S.

(1) Voltage E_S is developed across capacitors C85 and C86 in series and is shown as E_B and E_A. Since C85 and C86 are very closely matched, their junction is at the same voltage as the midpoint of the voltage across the secondary tuned circuit. The induced voltage E_A across C86 is impressed on one diode (terminals 3 and 4 of V7). The return path is through capacitors C81, C20.3 (paralleled by C82), C83, primary tuned circuit C88, C87, L82, and back to the junction of C85 and C86. The other half of the induced secondary voltage E_B (de-

veloped across C85) is impressed on the other diode (terminals 5 and 8 of V7). The return is through C20.3 and C82 in parallel, C83, primary tuned circuit C88, C87, L82, and back to the junction of C85 and C86.

(2) In addition to these induced secondary voltages, the primary voltage E_P is also impressed on these two diodes. The junction of C85 and C86 connects directly to the plate of limiter V6. The primary voltage E_P is developed from this point to ground. Thus E_P is impressed across a circuit consisting of C86, then the diode (terminals 3 and 4 of V7), then C81, and then C82 in parallel with C20.3 to ground. The path through the other side of V7 is through C85, through terminals 5 and 8 of V7, and C20.3 in parallel with C82 to ground. These are all r-f paths.

(3) From the above description, it is seen that each diode path has impressed on it the primary voltage E_P and the induced secondary voltage developed across either C85 or C86. These r-f voltages are effectively applied to the twin diodes in series, as shown in figure 78②.

d. Resultant Diode Plate Voltages At Resonant Frequency. The phase relations between these voltages are an extremely important factor in the discriminator action. The induced voltage in the secondary winding L81 is 180° out of phase with the primary voltage E_P. This induced voltage is small but causes a large current to flow in the series circuit formed by the secondary tuned circuit, when the circuit is resonant. At series resonance the induced voltage and the secondary current are in phase, since the inductive and capacitive reactances cancel; therefore, the secondary current and the primary voltage E_P are 180° out of phase. In flowing through the reactances of the secondary tuned circuit, the current builds up a large resonant voltage E_S which appears across the circuit. (See fig. 78①.) Disregarding resistance, the voltage across a capacitor lags the current through it by 90°. Therefore, the voltages E_A and E_B, across capacitors C86 and C85, respectively, are 90° out of phase with the primary voltage E_P. The voltage E_A across C86, however, leads the primary voltage E_P by 90°, whereas the voltage E_B across C85 lags E_P by 90°. The resultant voltage at *each* diode plate at resonance is the *vector* sum of two voltages ($E_P + E_A$, or $E_P + E_B$) which are practically 90° apart. Figure 78③ shows the phase relations between these voltages when the circuits are tuned to resonance and E_P (primary voltage) is shown as the zero (angle) vector. E_A and E_B are shown equal in all cases, but the difference in length between the lines marked E_P and E_A (or E_B) and the exact angles between them are not important. They represent values convenient for illustration. This diagram shows that W_C (the vector sum of E_P and E_A) is equal in length to Y_C (the vector sum of E_P and E_B) *at resonance.*

e. Resultant Diode Plate Voltages Above Resonant Frequency. When the *frequency* of E_P is changed, the tuned circuit consisting of L81, C86, C85, and C84 is no longer in resonance. If the frequency is *higher,* the net reactance of the secondary tuned circuit is *inductive* and the secondary *current* I_S will lag the secondary induced voltage. Since the voltage across a capacitor is 90° behind the current, the voltage across C85 and C86 will therefore lag behind the value at resonance. Thus the lines or vectors marked E_A and E_B will be shifted also, resulting in the condition shown in figure 78④. The two vectors W and Y are unequal and the difference is proportional to the change in frequency from that at resonance. Here the vector marked W_D is longer than Y_D.

f. Resultant Diode Plate Voltages Below Resonant Frequency. Similarly, if the impressed frequency is *lower* than the resonant frequency, the net reactance of the secondary tuned circuit will be *capacitive* and the secondary current I_S will lead the secondary induced voltage. Thus the vectors corresponding to E_A and E_B are shifted as shown in figure 78⑤. Here again the vectors are unequal and again the difference is proportional to the frequency difference from resonance. In this case the vector marked W_E is shorter. In both these cases (above or below resonant frequency) the voltage in one half of the secondary approaches closer to being *in phase* with the primary voltage, while the voltage in the other half comes closer to *phase opposition.* If carried far enough, one half of the secondary voltage would add directly to E_P, resulting in the value of the voltage which is applied to one diode. The voltage in the other half of the secondary would subtract directly from E_P, making the

resultant applied to the other diode.

g. AUDIO FREQUENCY OUTPUT. (1) The W resultant (vector sum of E_P and E_A) is impressed on one diode and the Y resultant (vector sum of E_P and E_B) is impressed on the other diode. These voltages are represented as signal generators in figure 78②. Each half of discriminator V7 acts as a diode rectifier. During the positive portion of the signal applied to the upper plate (fig. 78①), the electron path is A,B,C,D,A. During the positive portion of the signal applied to the lower plate, the electron path is E,F,C,D,E. R81 and R83 are the load resistors.

(2) As indicated previously, the resultant diode plate voltages W and Y are of equal amplitude at the resonant frequency. This causes equal currents to flow through diode load resistors R81 and R83. However, the diodes are so connected that the voltages developed across these resistors oppose or buck each other. Consequently, at resonance the output voltage which is taken across the series combination of resistors R81 and R83 is the difference between two equal and opposite voltages, or zero. Capacitor C81 is a low-impedance shunt for intermediate frequency but presents a high impedance to a-f. C20.3 is an a-f bypass capacitor.

(3) When the frequency of the r-f signal voltage shifts upward, the resultant r-f voltages applied to the two diodes become unequal in magnitude, as already discussed. The unequal plate voltages cause increased current through one diode section and decreased current through the other. Accordingly, the voltage drop across R81 is greater than that across R83. Under this condition there is a potential difference across points AE (fig. 78①) so that discriminator output voltage is present.

(4) When the frequency of the r-f signal voltage shifts downward, the resultant r-f voltage applied to diode plate pin 5 is greater than that applied to diode plate pin 3. As a result, the voltage drop across R83 is greater than that across R81. Discriminator output is present but reversed in polarity as compared with the discriminator output voltage when the r-f signal voltage is above the resonant frequency.

(5) Since the frequency of the r-f signal voltage and the i-f signal swings above and below the resonant frequency at an *audio* rate, the net voltage across resistors R81 and R83 varies at this *audio* frequency. The amplitude of the audio signal is proportional to the frequency deviation of the r-f signal voltage (frequency difference between E_P and the resonant or resting frequency).

(6) The audio signal is coupled to the first a-f amplifier through resistor R10 and capacitor C11. Capacitor C13 bypasses part of the higher frequency audio voltages to ground, thus making the high frequencies relatively weaker than the low frequencies. This h-f deemphasis compensates for the h-f pre-emphasis used in the transmitter.

(7) Thus the output of the discriminator is an a-f voltage whose amplitude is proportional to the extent of frequency deviation of the transmitted r-f signal and whose frequency is proportional to the rate of deviation of the r-f carrier. After correction by C13 the resultant a-f voltage is a reproduction of the original a-f modulating voltage.

125. Voltage Divider (Fig. 79)

a. The voltage divider shown connected across the dynamotor serves three general functions:

(1) It provides the reduced positive voltages for the second i-f, limiter, d-a-v-c, and squelch circuits.

(2) It provides negative grid bias for the r-f and i-f amplifiers and the limiter.

(3) It constitutes a bleeder across the d-c high-voltage source to discharge the filter capacitors after the power supply is turned off.

b. The network, consisting of parallel-series resistors R21, R29, and R31, in series with resistors R28, R27, R26, R25, R24, and SENSITIVITY control P2 (provided the SQUELCH control is in the ON position), is connected across the high-voltage dynamotor through filter chokes. Resistors R95 and R96 are included in later receivers. The junction points between the various resistors give voltages which are progressively less positive, going from R31 to the junction of R24 and R25, which point is grounded. The voltage becomes progressively more negative in going from the ground point through R24 and P2. The voltage developed across R24 furnishes a small negative bias for the limiter. The negative grid

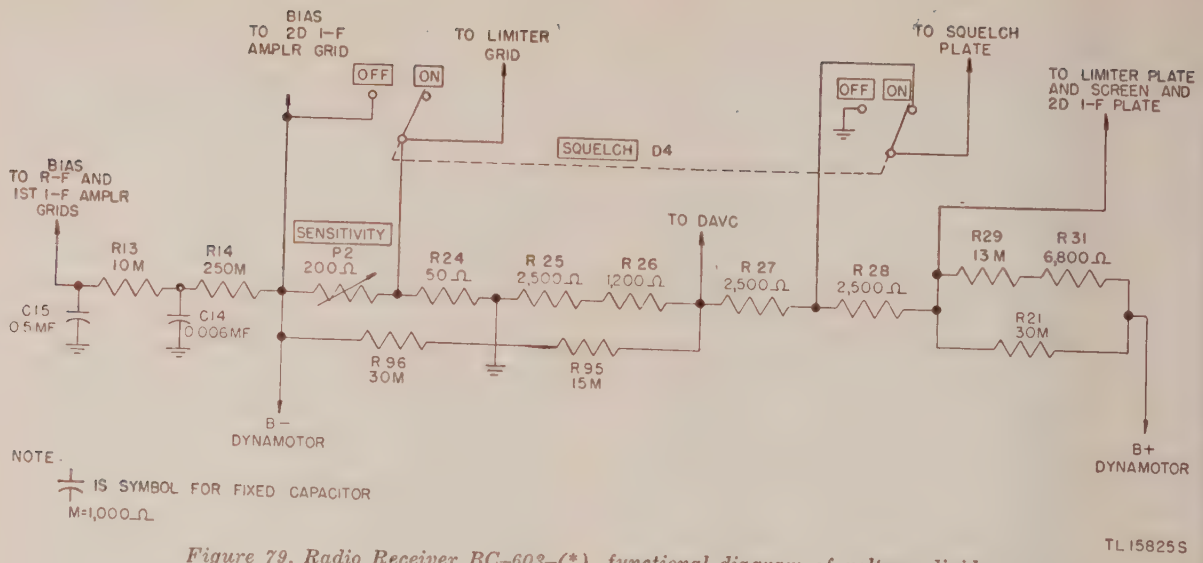


Figure 79. Radio Receiver BC–603–(*), functional diagram of voltage divider.

bias for the r-f and i-f amplifiers consists of that obtained across P2 and R24 plus the additional bias voltage furnished by the d-a-v-c resistor R14 described in paragraph 128. The bias is varied by means of the SENSITIVITY control P2 (when the SQUELCH switch D4 is switched to ON); this, in turn, controls the gain of the variable-mu type r-f and i-f amplifier tubes. C14, C15, and R13 filter the bias voltage.

126. First A–F Amplifier (Fig. 80)

a. The first a-f amplifier uses one triode section of Tube JAN–6SL7GT (V10(A)) in a class A circuit to amplify the weak a-f signal from the discriminator and apply it to the second a-f amplifier.

b. The a-f voltage developed across the discriminator load resistors, R81 and R83 in series, is fed to the grid of the first a-f amplifier V10(A) through series resistor R10 and series coupling capacitor C11. This voltage is impressed between grid and ground, since parallel capacitors C82 and C20.3 place the lower end of R83 at a-f ground. Capacitor C12 places the lower end of grid return resistor R11 at a-f ground and capacitor C20.2 performs the same function for R12. There is no a-f drop across R17. Capacitor C13 bypasses the higher audio frequencies, thus decreasing the high-frequency response. Also, C13, in conjunction with R10, acts as an r-f filter which prevents the r-f voltages present across the discriminator bypass capacitor C81 from appearing on the grid of V10(A).

c. Resistor R12 furnishes cathode bias for this stage. Since it is not bypassed, there will be a small amount of negative feedback. This negative feedback is incorporated in the circuit primarily to reduce the gain; however, it also reduces distortion.

d. The grid return is completed through grid leak R11 and the squelch circuit resistor R17 to one side of R12. As described below in paragraph 129, R17 is the plate load of the squelch tube. When the SQUELCH switch D4 is ON, the d-c voltage developed across R17 biases V10(A) to cut-off in the absence of a carrier signal. Capacitor C20.2 bypasses audio signals to ground and prevents them from flowing through the bleeder network. When the SQUELCH switch is turned OFF, the junction of R17 and R12 is grounded. The squelch is then inoperative and no bias voltage is developed across R17.

e. The plate of V10(A) connects through load resistors R18 and R19 to positive high voltage which is bypassed to ground by C16. The 2-megohm resistor R19 is shunted by CALL SIGNAL neon lamp E1 which, when lighted, has an impedance of about 200,000 ohms. When a signal is received during squelch operation, there is no bias voltage developed across R17. Hence current flows in the plate

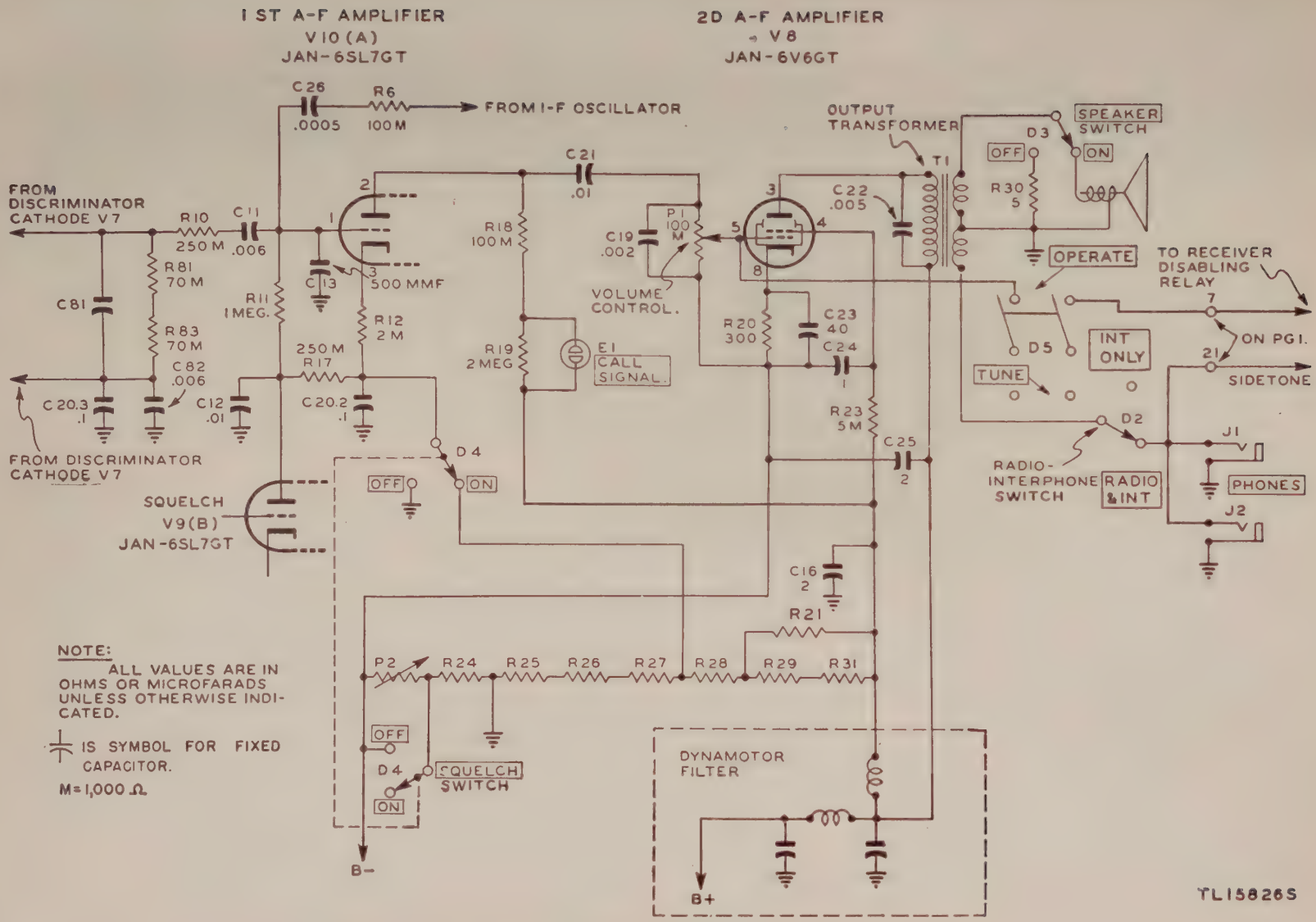


Figure 80. Radio Receiver BC-603-(*), functional diagram of a-f circuits.

circuit of V10(A) and develops a voltage across R19. This voltage causes the neon lamp to light and, in doing so, it lowers the total plate load by shunting R19. Thus, with the squelch on, the neon lamp indicates that a signal is being received, since it is only then that plate current flows in the first a-f amplifier, provided, of course, that SENSITIVITY control P2 is adjusted so that the squelch will not be tripped by noise alone.

f. A beat voltage from the i-f oscillator for presetting purposes is applied to the grid of V10(A) through R6 and C26 as described in paragraph 130.

127. Second A–F Amplifier (Fig. 80)

a. The second audio amplifier amplifies the output of the first audio amplifier and supplies audio voltage to the speaker and all the headphones.

b. The output of the first a-f amplifier is fed through d-c blocking capacitor C21 and impressed across VOLUME control P1 which controls the audio voltage applied to the grid of second a-f amplifier Tube JAN–6V6GT (V8). The lower end of P1 is bypassed to ground through the dynamotor filter capacitors. Capacitors C19, connected across the VOLUME control, reduces the amplification of the higher audio frequencies and prevents the possibility of picking up and amplifying unwanted i-f currents. Resistor R20 provides cathode bias for class A operation and is bypassed by capacitor C23 to avoid negative feedback. The junction of P1 and R20 is connected to B— but no additional bias is provided since the negative voltage at this point is applied to both the grid and cathode circuits.

c. Screen voltage is obtained from the plate power supply circuit through screen resistor R23 and filtered by screen bypass capacitor C24. The plate is connected through the primary winding of the output transformer T1 to the power supply and is bypassed to the cathode circuit at this point by capacitor C25. Capacitor C22, connected across the primary winding of transformer T1, reduces the amplification of the higher audio frequencies.

d. The secondary of output transformer T1 consists of two windings, one for the speaker and one for the headphones. When the SPEAKER switch D3 is in the ON position, the speaker is connected to the receiver output. When the SPEAKER switch is OFF, the speaker is disconnected and resistor R30 is connected across the speaker winding of output transformer T1. This resistor is connected in the circuit when the speaker is removed to maintain a constant load on the output transformer and to prevent the output of the headphone circuits from increasing.

e. The remaining winding of T1 connects to RADIO & INT-INT ONLY switch D2. This switch, in the RADIO & INT position, connects in turn to the PHONES jacks J1 and J2. The return circuit to this winding is completed through ground from J1 and J2. The audio output at J1 and J2 is also fed through pin 21 on PG1 to all the headphones in the radio set. Sidetone from audio output transformer T102 in the transmitter is also applied to J1 and J2 through pin 21 of PG1.

f. Disabling relay S103 in the transmitter connects pin 7 on PG1 to ground whenever transmitter dynamotor relay S102 is energized. If TUNE-OPERATE switch D5 is in the OPERATE position, the grid of the second a-f amplifier is grounded thus disabling the output of the receiver. In this manner, incoming messages and noise picked up by the receiver are prevented from adding to and interfering with the interphone conversation of crew members. When the TUNE-OPERATE switch is in the TUNE position, the circuit is opened so that the disabling relay in the transmitter has no effect on the receiver.

Note. See section XXI for details of this switch before changes made by MWO SIG 11–600–9.

128. Delayed Automatic Volume Control (Fig. 81)

a. It is important that the signals reaching the discriminator be of uniform amplitude. To accomplish this, peak limiting is provided in second i-f amplifier V5, and both peak and feedback limiting are proivded in limiter stage V6. In addition, the d-a-v-c circuit is used to take care of the variations below the a-f range which are too slow to be handled by the feedback limiter and too small for the overload limiter. The d-a-v-c circuit reduces the sensitivity of the receiver on strong incoming signals. To prevent this circuit from operating

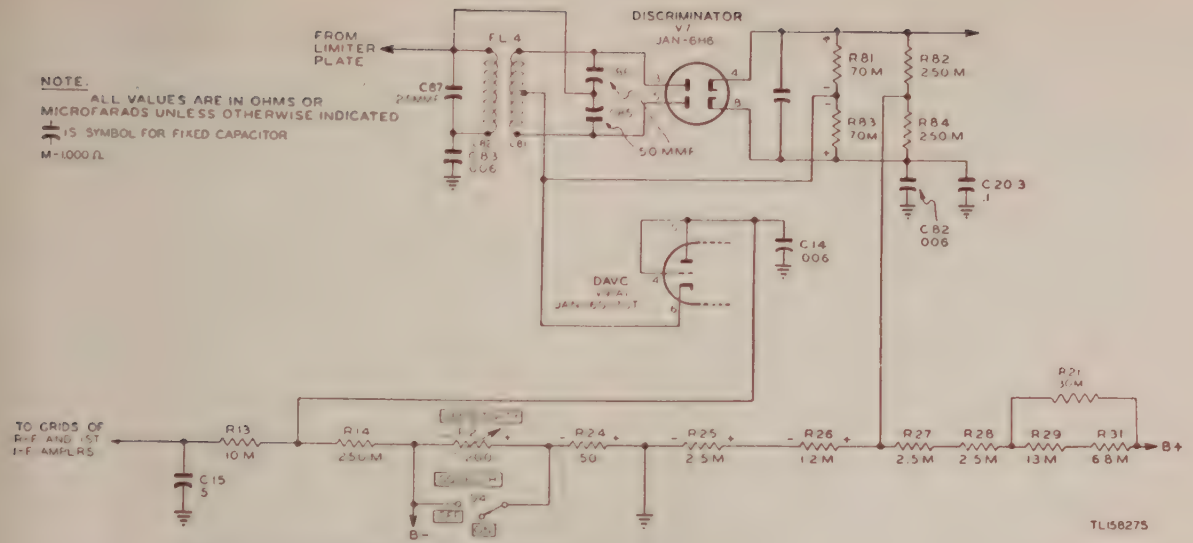


Figure 81. Radio Receiver BC-603-(*), functional diagram of d-a-v-c circuits.

on weak signals and reduce the gain when it is needed most, a delay bias is provided.

b. The d-a-v-c uses one triode section of Tube JAN-6SL7GT (V9(A)), connected as a diode. The cathode of V9(A) is connected through R81 and R82 in parallel with R83 and R84 to the junction of R26 and R27 on the voltage divider. The plate is tied to grid and connected through R14 to B—. Thus the plate is biased negative with respect to cathode by the voltage across P2 (when the SQUELCH switch is ON), R24, R25, and R26. This bias is constant for a given setting of SENSITIVITY control P2. Note, however, that the d-c voltage developed across R81 and R83 by discriminator action is introduced in series with that obtained from the voltage divider. This discriminator voltage varies with signal strength and opposes the bias obtained from the voltage divider. Therefore, the resultant bias is the difference between the fixed bias obtained from the voltage divider and the variable d-c voltage developed across the discriminator network. Isolating resistors R82 and R84 permit connecting discriminator loads R81 and R83 in parallel without short-circuiting the a-f voltages present across them.

c. The i-f voltage developed across tuned circuit C87 and L82 appears between the plate of the limiter V6 and ground. The limiter plate is connected directly to the junction of C85 and C86. Since this junction point is at the same r-f potential as the center tap of L81, which is connected to the cathode of V9(A), the plate of the limiter is effectively connected to the cathode of V9(A), as far as r-f voltages are concerned. The return circuit from the plate of V9(A) is through C14 to ground. The i-f voltage is thus impressed across d-a-v-c tube V9(A).

d. When the signal is too weak to overcome the bias (delay bias) applied to the d-a-v-c tube, there is no current flow through the tube and consequently no d-c voltage drop across R14. Only the fixed bias obtained from R24 and P2 is applied to the grids of the r-f and first i-f amplifiers through filter network R13, C14, and C15.

e. When the signal level increases and the negative peak voltage exceeds the delay bias, the diode will conduct, charging C14. A negative charge builds up across C14, causing current flow through resistor R14. The voltage drop across R14 is in series with, and adds to, the fixed bias across R24 and P2. In this manner, as the signal strength increases and causes the d-a-v-c tube to conduct, a progressively increasing negative bias is applied to the variable-mu type r-f and first i-f tubes, decreasing their amplification and thereby tending to maintain a constant input to the limiter.

129. Squelch Circuit (Fig. 82)

a. The squelch circuit is designed to block first a-f amplifier tube V10 when no signal is

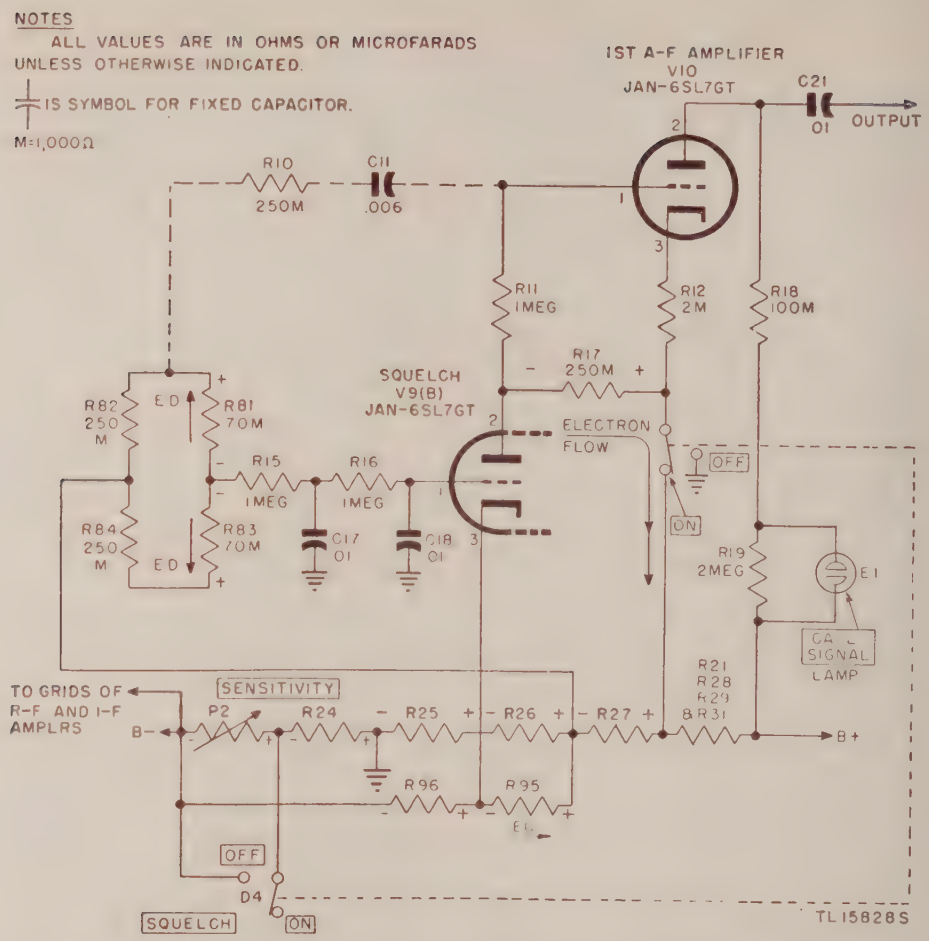


Figure 82. Radio Receiver BC–603–(*), functional diagram of squelch circuit.

being received and thus keep noise from being heard in the loudspeaker and headsets.

b. The squelch stage uses one triode section of Tube JAN–6SL7GT (V9(B)). As previously described, the voltages E_D developed across R81 and R83 by discriminator action are applied through R10 and C11 to the grid of the first a-f amplifier. These voltages E_D, however, are connected in parallel for squelch operation through resistors R82 and R84. The junction of R82 and R84 is connected to the cathode of the squelch tube through resistor R95. A fixed bias E_C is present across bleeder resistor R95. This fixed bias opposes the voltage E_D across R81 and R83. The resultant squelch grid bias is therefore the difference between fixed bias E_C and voltage E_D. This resultant bias is applied through a resistance-capacitance filter, R15, R16, C17, and C18, to the grid of the squelch tube. The R-C filter prevents audio voltages present on the discriminator load resistors R81 and R83 from appearing on the squelch grid.

c. Plate voltage is applied from the voltage divider through resistor R17 when SQUELCH switch D4 is in the ON position.

d. When no signal is being received, there is practically no voltage developed across the discriminator load resistors R81 and R83. Therefore, the resultant grid bias is equal to the positive voltage obtained from across resistor R95. Excessive grid current is limited by filter resistors R15 and R16. A large current flows in the squelch plate circuit and develops a large voltage drop across plate load R17. Since this resistor is also in the grid

circuit of the first a-f amplifier, the voltage drop is applied as negative bias through R11 to the grid of the first a-f amplifier. This bias is sufficient to drive V10(A) beyond cut-off. As a result, the receiver is disabled and noise is prevented from being heard in the headsets and loudspeaker.

e. When a signal is received, a d-c potential is developed across each of the discriminator load resistors R81 and R83. As previously mentioned, these two voltages, designated as E_D in figure 82, are connected in parallel and opposed to fixed positive bias E_C. If the carrier signal is strong enough, E_D will exceed E_C and cause the squelch tube to cut off or trip. Under this condition, no current flows in the plate circuit of V9(B) and no bias will be developed across R17. Thus the effect of the squelch is eliminated and the first a-f amplifier will function normally.

f. To sum up the squelch action, when there is no signal input to the receiver, the squelch tube biases the first a-f amplifier beyond cut-off, and when there is a signal input, the blocking bias is removed from the first a-f amplifier and the receiver operates normally.

g. The presence of a carrier signal sufficiently strong to cause the squelch tube to cut off is indicated by CALL SIGNAL lamp E1. When the squelch tube is cut off, the bias caused by squelch action is removed from the first a-f amplifier tube and plate current flows, developing a voltage across R19 sufficient to light the neon lamp. The intensity of the signal required to cut off the squelch tube (indicated by the lighting of the neon lamp) is determined by the setting of SENSITIVITY control P2. This control varies the gain of the r-f and i-f amplifier tubes, which indirectly control the amplitude of discriminator voltages E_D, and thus sets the operating point of the squelch circuit. Since noise voltages amplified by the receiver are strong enough at times to cut off the squelch tube, the SENSITIVITY control is set to adjust the gain of the receiver to a point just below the level where the strongest noise peaks cut off the squelch tube. An approximately proper setting of this control is obtained when it is adjusted in a counterclockwise direction to the point where the CALL SIGNAL lamp goes out with no signal being received.

130. I–F Oscillator (Fig. 83)

a. This oscillator, which uses one triode section of duo-triode Tube JAN–6SL7GT (V10 (B)), performs a function similar to that of the b-f oscillator in an amplitude-modulated type set in that it beats against an unmodulated wave from the output of the limiter to produce an audio signal at the input of the a-f amplifier. The beat-frequency oscillator (bfo) in an amplitude-modulated type receiver is used for reception of continuous waves. However, in this receiver, the i-f oscillator is intended primarily for use in presetting procedures and can also be used for testing purposes. Moreover, it may be used to simplify the over-all alinement of the receiver, should field conditions prohibit more precise methods. The i-f oscillator is inoperative during normal operation.

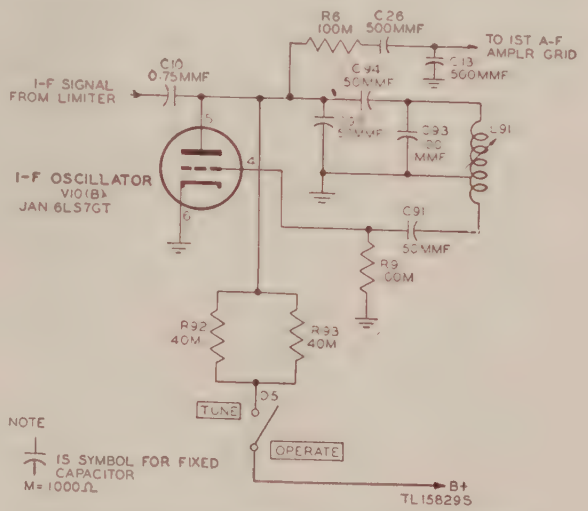


Figure 83. Radio Receiver BC–603–(*), functional diagram of i-f oscillator.

b. The i-f oscillator uses a Hartley circuit which is quite similar to the r-f oscillator stage. Inductor L91 is slug-tuned to permit alinement of the oscillator to the i-f frequency, 2.65 mc. Capacitor C93 provides the bulk of the resonating capacitance while C92 compensates for temperature variations. Plate voltage is obtained through the contacts of TUNE-OPERATE switch D5 (in the TUNE position) and is shunt-fed through parallel resistors R92 and R93. Plate-blocking capacitor C94 prevents the plate voltage from being shorted to ground through the coil. Capacitor C91 provides feed-

back and, in conjunction with grid leak resistor R91, provides grid bias.

c. The i-f oscillator operates as an autodyne detector. A portion of the i-f energy from the output of the limiter is coupled to the plate of the i-f oscillator through coupling capacitor C10. This signal mixes with the oscillator signal producing an a-f beat note which is fed to the grid of the first a-f amplifier through R6 and C26. Capacitor C26 blocks the oscillator plate voltage from the first a-f amplifier grid. Series resistor R6 prevents the i-f signal from shorting to ground through C13 which is included in the grid circuit of the first a-f amplifier. Coupling capacitor C10 is small enough to prevent the a-f beat voltage from appearing on the plate of the limiter.

131. Filament Circuit (Fig. 84)

All tubes in the receiver have 6.3-volt filaments with the exception of the two i-f amplifiers which operate on 12.6 volts. Battery voltage is applied through REC ON-OFF switch D1 and fuse F1. Closing this switch also energizes the motor element of the receiver dynamotor. The correct series parallel arrangement of the filament circuit for either 12- or 24-volt operation is accomplished by the appropriate strapping provided on each dynamotor terminal pin jack J701 and J801. This strapping is shown in figure 116.

132. Power Supplies (Fig. 126)

The receiver and interphone amplifier obtain their high voltage (approximately 230 volts) from either a 12-volt Dynamotor DM–34–(*) or a 24-volt Dynamotor DM–36–(*). These dynamotors are similar in mechanical construction to those used in the transmitter but are shunt-wound instead of compound-wound. Filter circuits are provided in both the low- and high-voltage supply leads. In the case of Dynamotor DM–34–(*), capacitors C703 and C704, together with choke L702, constitute a low-voltage filter to prevent commutator interference from the low-voltage motor element. Ca-

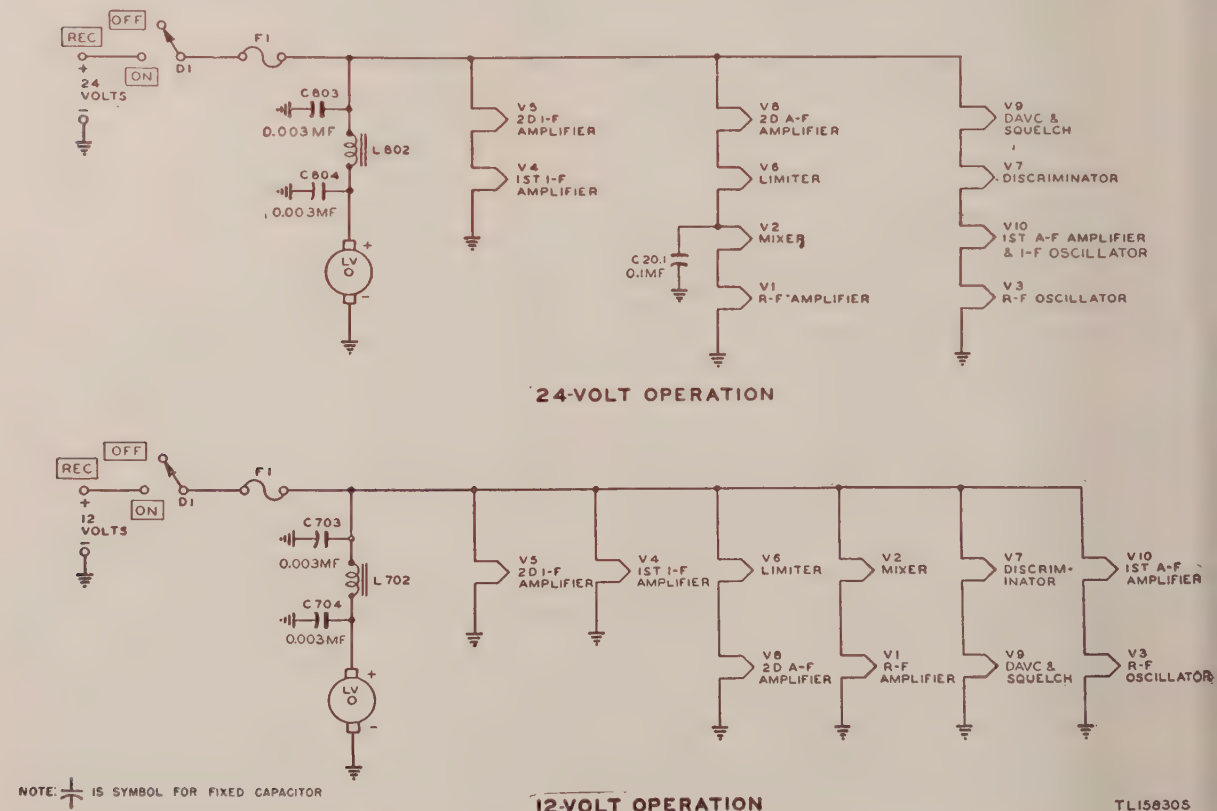


Figure 84. Radio Receiver BC–603–(*), functional diagram of filament circuits.

pacitors C705 and C702, together with choke L703, perform the same function in the negative lead of the high-voltage winding. Capacitors C706 and C701, together with choke L704, filter the positive high-voltage lead. Capacitor C16 (in the receiver) and choke L701 provide additional filtering for all stages except the plate circuit of the second a-f amplifier stage. The corresponding components numbered in the 800 series are used in 24-volt Dynamotor DM–36–(*).

Section XIII. RADIO SETS SCR–508–(*), SCR–528–(*), AND AN/VRC–5

133. Radio Set SCR–508–(*)

a. Radio Set SCR–508–(*) consists of one transmitter, two receivers, and associated equipment such as antenna mast sections and control boxes. A detailed theoretical discussion of the transmitter and receiver has been presented in sections XI and XII. The following description summarizes the over-all operation of Radio Set SCR–508–(*).

b. The equipment provides voice communiction on 10 preset transmitting channels and 20 preset receiving channels. Alternate operation of the transmitter and receivers on a single antenna is accomplished by means of an antenna switching relay in the transmitter. A receiver disabling circuit in the transmitter prevents interaction between the receiver and transmitter during transmission.

c. While the microphone press-to-talk switch is not pressed, the antenna switching relay is in the receive position. Signals are received on the antenna and passed through the antenna switching relay to the receiver. In the receiver, the f-m signals are tuned, amplified, limited, demodulated, and coupled to the loudspeaker and headsets. A storage battery supplies power for the receiver dynamotor which develops the high-voltage d-c supply in the receiver.

d. When the press-to-talk switch is pressed, the antenna switching relay connects the antenna to the transmitter and disables the receivers. Sound waves are converted to a-f voltage (or currents) in the microphone and fed to the transmitter. In the transmitter the a-f voltages are used in a phase-modulating system to produce an f-m signal which is radiated from the antenna. Schematic diagrams and control circuits for Radio Set SCR–508–(*) are shown in figures 110, 111, 112, 113, 115, and 116. The schematic diagram of Mounting FT–237–(*) is shown in figure 128.

134. Radio Set SCR–528–(*)

Radio Set SCR–528–(*) is exactly the same as Radio Set SCR–508–(*) except that it has one instead of two receivers.

135. Radio Set AN/VRC–5

Radio Set AN/VRC–5 is essentially the same as Radio Set SCR–528–(*) except that two mountings are used instead of one because of space limitations. (See fig. 2.) Radio Transmitter BC–604–(*) is mounted on Mounting FT–508 and Radio Receiver BC–603–(*) is mounted on Mounting FT–346. When these components are installed and connected, the equipment operates in the same manner as Radio Set SCR–528–(*). The receiver output circuit (headset circuit) is automatically disabled when the interphone circuit is used. Circuit diagrams of the mountings are shown in figures 85 and 86. Figure 50 shows the interconnections between the mountings.

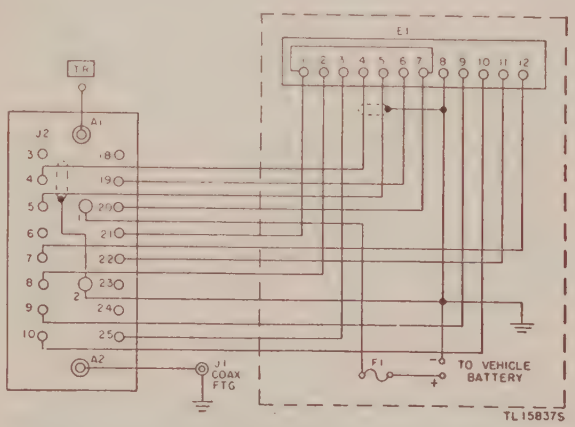


Figure 85. Radio Set AN/VRC–5, schematic diagram of Mounting FT–508.

Section XIV. TROUBLE SHOOTING

136. General

No matter how well equipment is designed and manufactured, faults occur in service. When such faults occur, the repairman must locate

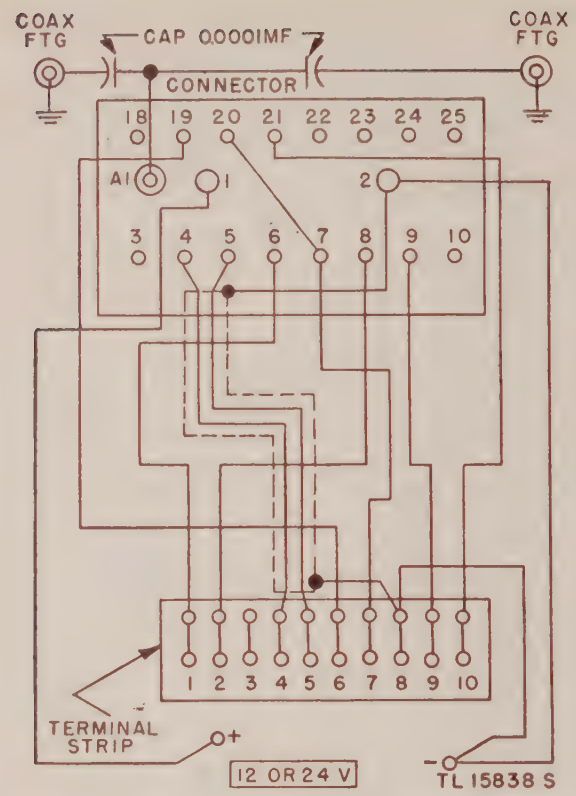


Figure 86. Radio Set AN/VRC–5, schematic diagram of Mounting FT–346.

and correct them as rapidly as possible. This section contains information to aid personnel engaged in this highly important duty of trouble shooting.

137. Trouble-Shooting Data

Take advantage of the material supplied in this manual. It will help in the rapid location of faults. Consult the following trouble-shooting data:

a. RADIO RECEIVER.

Figure No.	Description
115	Schematic diagram showing modifications during manufacture.
116	Schematic diagram showing changes per MWO SIG 11–600–4 or –9, and –6.
90	Apparatus location diagram, left side view.
92	Resistor and capacitor location diagram, left side view.
91	Apparatus location diagram, right side view.
93	Voltage diagram.
94	Resistance diagram.
117	Wiring diagram.
118	Front panel wiring diagram.

b. RADIO TRANSMITTER.

Figure No.	Description
112	Schematic diagram showing modifications during manufacture.
113	Schematic diagram showing changes per MWO SIG 11–600–4 or –9, –6, and –10.
95	Apparatus location diagram, end view.
96	Apparatus location diagram, top view.
97	Apparatus location diagram, front view.
98	Apparatus location diagram, bottom view.
99	Voltage diagram.
100	Resistance diagram.
114	Wiring diagram.

c. MOUNTINGS.

Figure No.	Description
128	Schematic diagram of Mounting FT–237–(*).
129	Wiring diagram of Mounting FT–237–(*).
85	Schematic diagram of Mounting FT–508.
86	Schematic diagram of Mounting FT–346.

d. DYNAMOTORS.

Figure No.	Description
125	Schematic diagram of transmitter dynamotors.
126	Schematic diagram of receiver dynamotors.
127	Wiring diagram of dynamotors.

e. INTERPHONE CONTROL BOXES.

Figure No.	Description
119	Schematic and wiring diagram of Interphone Control Boxes BC–606–A to –G.
120	Schematic and wiring diagram of Interphone Control Box BC–606–H.

f. CONTROL CIRCUIT DIAGRAMS.

Figure No.	Description
111	Radio Set SCR–508–(*), functional diagram of control circuits including changes through MWO SIG 11–600–10.
110	Radio Set SCR–508–(*), functional diagram of control circuits before any MWO changes.

138. Pin Connections

Pin connections on sockets, plugs, and receptacles are numbered or lettered on the various diagrams.

a. Seen from the bottom, pin connections are numbered in a *clockwise* direction around the sockets. On octal sockets, the first pin clockwise from the keyway is the No. 1 pin.

b. Plugs and receptacles are numbered on the side to which the associated connector is attached. To avoid confusion, some individual pins are identified by letters appearing directly on the connector.

139. Trouble-Shooting Steps

The first step in servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to the component 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 r-f arching can often be located by sight, smell, and hearing. The majority of faults, however, must be located by checking voltage and resistance.

a. 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 front panel often determines the stage or circuit at fault. Additional sectionalizing of the fault will be discussed in section XV.

b. LOCALIZATION. Sections XVI, XVII, and XVIII describe the method of localizing faults within the individual components. These sections are accompanied by trouble-shooting charts which list abnormal symptoms and their probable causes. These charts also give procedure for determining *which* of the probable locations of the fault is the exact one. In addition, there are a number of drawings which show the resistance and voltage at each socket pin connection.

140. Voltage Measurements

Voltage measurements are an almost indispensable aid, for most trouble 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. The circuit need not be interrupted.

a. Unless otherwise specified, voltages listed on the voltage charts are measured between the indicated points and ground.

b. 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.

c. When checking cathode voltage, remember that a reading can be obtained when the cathode resistor is actually open as the resistance of the meter may act as a cathode resistor. Thus, the cathode voltage may be approximately normal only as long as the voltmeter is connected between cathode and ground. Before cathode voltage is measured, first make a resistance check with the power off to determine whether the cathode resistor is normal.

141. Precautions Against High Voltage

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:

a. Connect the ground lead to the voltmeter.

b. Place one hand in your pocket. This will eliminate the possibility of making accidental contact with another part of the circuit thus causing the electricity to travel from one hand to the other through the body.

c. 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).

d. If the voltage is greater than 300 volts, shut off the power, connect the hot 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 which are above ground.

142. Voltmeter Loading

Voltmeter resistance must be at least 10 times as large as the resistance of the circuit across which the voltage is measured. If the voltmeter resistance is nearly equal to the circuit

resistance, the voltmeter will indicate a voltage *lower* than the actual voltage present when the voltmeter is removed from the circuit.

a. The resistance of a voltmeter on any range can be calculated by this simple rule: Resistance of the voltmeter equals its ohms per volt multiplied 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 (R = 1,000 ohms per volt times 300 volts = 300,000 ohms).

b. To minimize voltmeter loading in high-resistance circuits, use the highest voltmeter range. Although only a small deflection will be obtained (possibly only 5 divisions on a 100-division scale), the electrical accuracy of the voltage measurement will be increased. The decreased loading of the voltmeter will more than compensate for the visual inaccuracy which results from reading only a small deflection on the voltmeter scale.

c. Close observation of the meter when switching voltage ranges will show if the voltmeter is loading the circuit under test.

(1) *Extremely heavy loading* is indicated when the deflection of the pointer on the meter (not the voltage reading) is nearly the same for different ranges.

(2) *Appreciable loading* is indicated when the voltage readings (not the deflection) for different ranges do not agree.

(3) *Negligible loading* is indicated when the voltage readings (not the deflection) for different ranges do agree.

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 may be necessary to consider the effect of loading.

143. Capacitor Tests

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. Proper operation of the equipment after the auxiliary capacitor is added indicates that the suspected capacitor is open and should be replaced.

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. The flick of the needle will be small for small capacitors and the test is not reliable for capacitors which are smaller than about 0.05 mf. Electrolytic capacitors will normally show a resistance reading. The test above indicates a defective electrolytic capacitor only when the resistance reading is less than about 1,000 ohms.

144. 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 XV. SECTIONALIZATION OF TROUBLE TO COMPONENT

145. System Sectionalization

a. System sectionalization consists in determining whether the trouble is in the transmitter, receiver, mounting, antenna, or power source (battery).

b. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

c. Visually inspect the antenna system for obvious abnormalities.

d. Operate the radio set and observe its performance.

e. If the entire radio set is dead, it is obvious that the trouble is in battery or the mounting.

f. If only one component is dead, the trouble is in that component and is probably a fuse.

g. The over-all operation of the transmitter r-f stages can be checked by its antenna current reading. The audio stages of the transmitter can be checked by using it as an interphone amplifier. Sidetone should be heard in the headsets. If sidetone is not heard, but can be picked up on terminals 1 and 7 of terminal strip TS401 of the mounting, the trouble definitely is not in the transmitter.

h. If one receiver exhibits unsatisfactory performance such as excessive noise, howling, or weak signals, replace it with a good receiver. If the trouble disappears, the replaced receiver is defective. If the trouble persists, the trouble is not in the receivers but is in the vehicle or else it is caused by conditions external to the vehicle.

i. Remove the antenna from the mounting. If the symptoms persist, the trouble is in the installation or vehicle and may be ignition noise. If removal of the antenna causes the symptoms to become less pronounced or to disappear entirely, the trouble is in the antenna or is external to the vehicle.

j. By using procedures similar to the simple checks given above, the trouble can be isolated to a particular unit and then localized by using the methods given in sections XVI, XVII, and XVIII.

Section XVI. TROUBLE SHOOTING RECEIVER

146. General

a. The tests in this section aid in isolating the source of trouble. To be effective the procedure should be followed in the order given here. A faulty receiver will be referred to hereafter as the trouble receiver.

OUTLINE 1

EQUIPMENT REQUIRED FOR SERVICING OF RECEIVER BC-603-(*)

(1) Schematic Diagram of Circuit

(2) Voltage Measurements
Multi-range d-c voltmeter of at least 1,000 ohms per volt
Maximum range required—0-250 volts
Intermediate range—
. 0-30 volts approximately
Low range —0-3 volts approximately

(3) Resistance Measurements
Ohmmeter
Maximum range 5 megohms

(4) Tube Tests
(a) Suitable tube tester, or
(b) A second Receiver B-603-(*) in good condition, or
(c) Complete set of new tubes

(5) Signal Tracing
(a) Suitable signal generator, or
(b) A second Receiver BC-603-(*) in good condition, or
(c) A Transmitter BC-604-(*) in good condition

TL56225S

Figure 87. Receiver servicing procedure, outline 1.

OUTLINE 2

SERVICING PROCEDURE FOR RECEIVERS BC-603-(*)
NOT MOUNTED IN VEHICLE

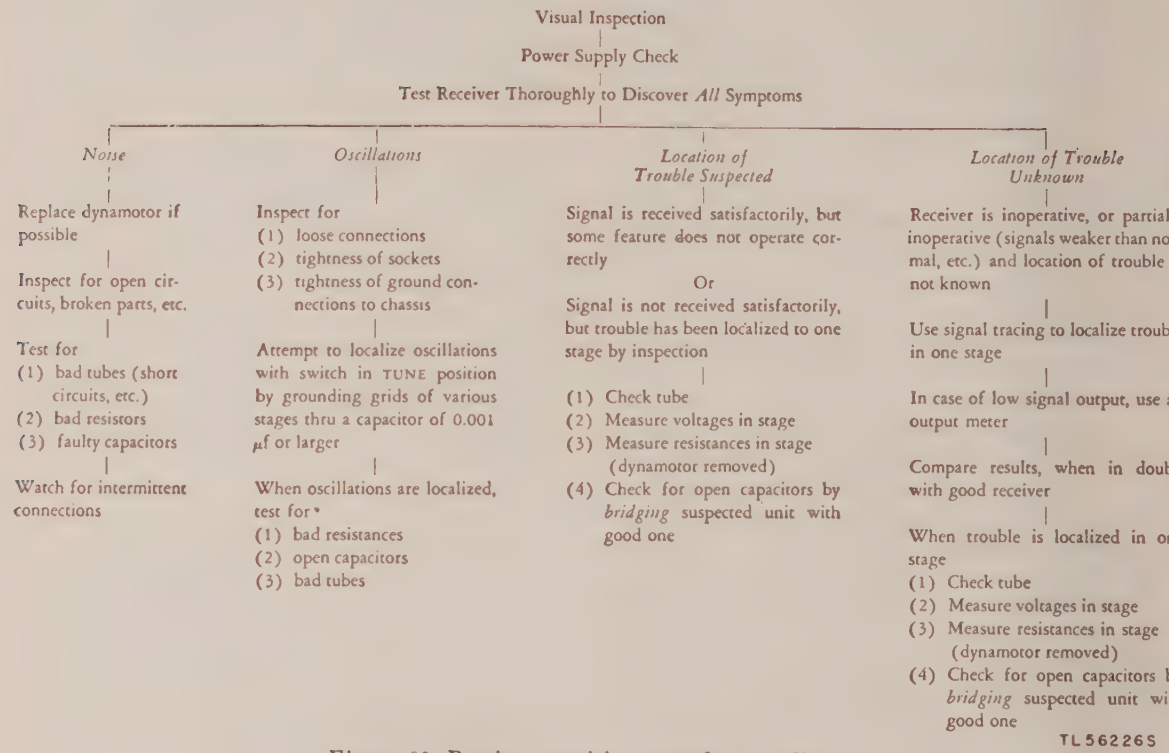


Figure 88. Receiver servicing procedure, outline 2.

b. The location of trouble in the receiver will be facilitated by reference to the figures in paragraph 137*a*.

c. Remember first, servicing procedure should cause no further injury to receiver. Second, trouble should be localized to a single stage or circuit. Third, the trouble may then be isolated within that stage or circuit by appropriate voltage, resistance and continuity measurements. The relationship of the various steps of this suggested procedure to these considerations, graphically illustrated in outlines 1, 2, and 3, shown in figures 87, 88, and 89, may be summarized in the following manner:

(1) The purpose of inspection is to locate any visible trouble. Through this inspection alone, the repair man may frequently discover the trouble, or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the receiver which might occur through improper servicing methods, and in forestalling future failures. The power supply test prevents further damage to the receiver or dynamotor from certain possible short circuits. Since this test gives an indication of the operation of the dynamotor and filter circuits, its function is not merely preventive.

(2) The operational test is important as it frequently indicates the general location of the trouble. In many instances the information gained will determine the exact nature of the fault. In order to utilize this information fully, all symptoms must be interpreted in relation to each other.

(3) The principal advantage of the signal tracing method is that it usually enables the repair man to localize a trouble accurately and quickly to a given stage when the general location of this trouble is not immediately evident from the above tests.

d. In all these tests the possibility of intermittents should not be overlooked. If present, this type of trouble may be made to appear in

OUTLINE 3

SERVICING PROCEDURE FOR RECEIVERS BC-603-(*) MOUNTED IN A VEHICLE

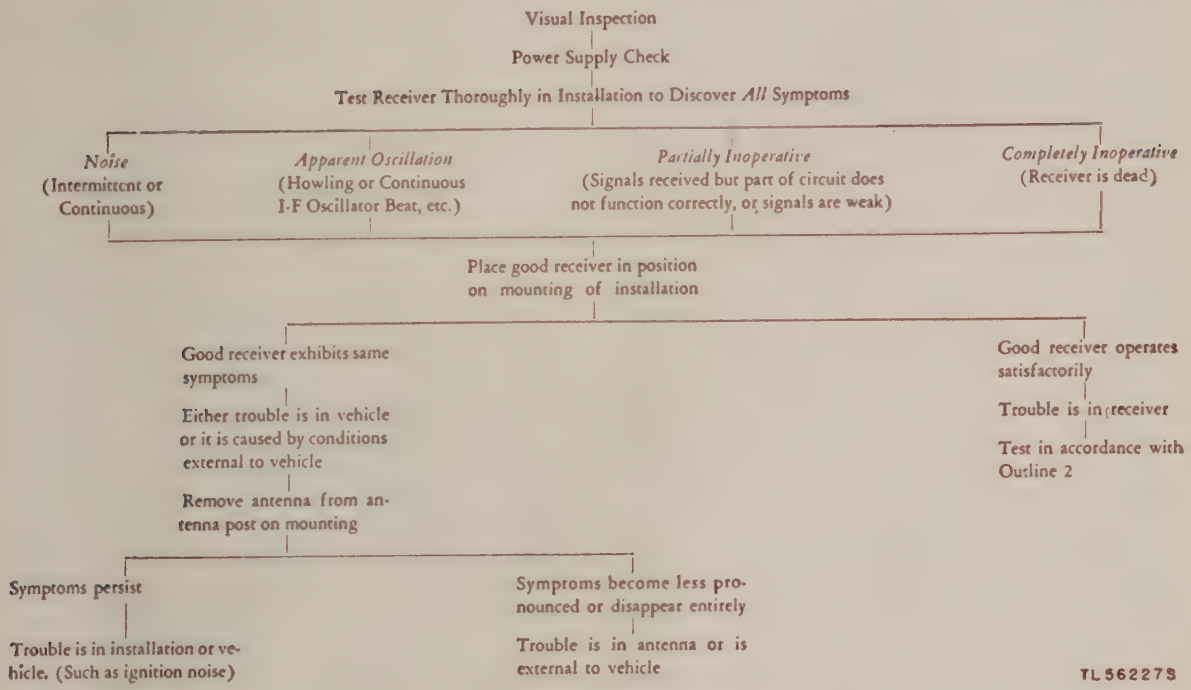


Figure 89. Receiver servicing procedure, outline 3.

most cases by tapping or jarring the set. It is possible that no trouble will be found in the receiver itself but that the trouble is in the installation (mounting, interphone system or vehicle), or possibly due to external conditions. In this event, test the installation, if possible.

e. The trouble shooting chart in paragraph 159 is provided to help localize trouble in a receiver.

147. General Precautions

Whenever a receiver is to be serviced, observe the following general precautions very carefully.

a. With the cover removed, dangerous voltages are exposed when the set is operating.

b. Whenever a receiver is suspected of being in trouble, the inspection and power supply test should be made. Moreover, the cause of any abnormal heating should be remedied before continuing procedure.

c. The dynamotor should not be allowed to run for any appreciable period of time at the start of the inspection until it is ascertained that there are no short circuits which will cause burning of receiver parts.

d. When resistance and continuity measurements are to be made, the power plug and *dynamotor* should first be removed.

e. The shield can of the tuned units (LCU or FL) should not be removed from any unit unless it is definitely known that trouble exists within that unit. Whenever one part of the tuned circuit is replaced, the unit should be realined.

f. Whenever intermittent trouble is suspected, a thorough check of wiring and parts should be made. In many cases intermittent troubles may be made to appear by jarring the receiver.

g. When inspecting wiring and soldered connections, take care not to damage the insulation. Do not leave the insulation in a broken or frayed condition. Wires should not be pulled or bent unnecessarily, nor should the cabling be pried open to trace wiring.

h. It is preferable that no more than one vacuum tube be removed from a receiver at one time. It is important that each tube, unless it is defective, be returned to the socket from which it was removed.

148. Visual Inspection

When a receiver is brought in from the field for check or repair, it is advisable that the cover be removed and the following inspection made.

a. Examine for burnt insulation and resistances. Examine for wax leakage and any discoloration of apparatus and wire.

Note. These symptoms may have been caused by a trouble previously repaired and serve only as a guide. In general, confine examination to parts readily visible with the cover removed. Usually more harm than good will be caused by the removal of the front panel, the FL or LCU can covers, and other inclosed parts. Trouble in these parts should be localized by signal tracing and voltage and resistance measurements.

b. Inspect for broken connections to tube sockets, plugs, and other apparatus as well as for defective soldered connections. Examine for bare wires touching the chassis or other wires.

c. Be sure that the labels on the tubes in the various sockets correspond to the correct tube numbers given in the instruction book for these positions. Replace any tubes which have the wrong numbers. Inspect for loose tube sockets.

d. Inspect the active and spare fuses. Check carefully for short circuits whenever a receiver with a blown fuse is encountered.

e. Inspect the selector mechanism for loose or bent parts. Be sure that the dial turns smoothly and that the push buttons operate satisfactorily. Check the selector tuning.

f. Inspect the power plug and replace or repair it if there are any bent or broken prongs.

g. Inspect for loose or missing screws especially those which fasten the tube sockets in place.

149. Power Supply Test

This test assumes that a voltmeter of at least 1,000 ohms per volt with a range of at least 250 volts, and an ohmmeter, are available. All switches should be at OFF or downward. The cover should be removed from the receiver for the following procedure.

a. The dynamotor marking must agree with the battery voltage available.

b. Remove the dynamotor and examine it for loose or badly worn brushes and worn or dirty commutators. Test the continuity of the dynamotor plug. Clean and replace the dynamotor in the set.

c. Connect the appropriate battery to the receiver plug PG1, using Mounting FT–237–(*) or Cord CD–786.

d. Throw the speaker switch to ON.

e. Place the voltmeter across C25 (the positive side should go to the terminal to which the wire with the red tracer is attached). Turn the power switch ON. Note that the meter rises immediately to approximately 200 volts when the switch is turned on. If it does not, turn the set OFF quickly and check C25 and C16 for a possible short circuit. Also, check the voltage divider, the dynamotor, and the associated equipment. A low reading of the voltmeter may be indicative of a faulty dynamotor or of a short circuit in the system.

f. If the dynamotor fails to start or if the fuse blows, turn the set OFF and inspect the dynamotor and the associated equipment as well as the fuse, plug PG2, the filament wiring, etc.

g. Assuming that the dynamotor starts correctly and that the voltage is satisfactory, inspect the inside of the receiver with the dynamotor running. See that no sparks occur and that nothing smokes. Stop the dynamotor immediately and repair the fault if a trouble condition is indicated.

h. After the dynamotor has been running for a few moments, feel the tubes cautiously to see if they are all warm. No other tube should be as hot as V8, which is a VT–107–A (JAN–6V6GT) tube. No tube should remain cold. If a tube remains cold after the others have warmed up, examine the wiring associated with the tube socket in question and examine the socket contacts. If there is no wiring trouble and the tube does not warm up, test it (or replace it if no vacuum tube test set is available).

150. Vacuum-Tube Testing Procedure

As the space around a vacuum tube is often small it is desirable either to use a tube extractor or to rock the tube with the fingers

at the top while pushing it up gently from the bottom. To test a vacuum tube, use a test set if available. If not, try the tube in Receiver BC–603–(*) which is operating satisfactorily. If another receiver is not available, try replacing the tube by another one.

151. Operational Test

For an operational test, a headset and a weak 20–28 mc signal are needed. A signal generator, or a transmitter with its TUNE-OPERATE switch at TUNE, is a good signal source. The transmitter requires no metallic connection with the receiver. A second receiver with a lead to bring the radio frequency to the antenna post of the receiver under test is satisfactory; in this case the radio frequency will be 2.65 mc higher than indicated. See paragraph 157*c*. Serious distortion and abnormally low output are trouble indications. Compare with a good receiver for output, if the condition of the trouble receiver permits. Irregularities of operation help to localize the trouble. Operating personnel may supply useful *supplementary* data.

a. PREPARATORY. Turn the trouble receiver ON and allow it sufficient time to warm up. All other switches should be OFF (down).

b. CALL SIGNAL LAMP. With the SQUELCH switch OFF, the CALL SIGNAL lamp should be lighted.

c. NOISE FROM LOUDSPEAKER. Turn the SPEAKER switch ON, and with the VOLUME control turned to the extreme right, listen for a rushing noise from the loudspeaker.

d. VOLUME CONTROL. The speaker output should vary smoothly from maximum until the noise has vanished at the extreme left position of the control.

e. HEADSET, SIDETONE. With the RADIO & INT-INT ONLY switch at INT ONLY, plug the headset into one of the PHONES jacks. There should be no sound in the headset.

f. NOISE IN HEADSET. With the VOLUME control adjusted for normal output from the speaker, switch to RADIO & INT. There should be a rushing noise in the headset.

g. NOISE IN HEADSET, SECOND JACK. Repeat step *f* for the second PHONES jack.

h. HEADSET VOLUME. Turn the SPEAKER switch ON and OFF. The headset volume should remain constant if R30 is intact.

i. R-F SIGNAL. Turn on a source of r-f signal and wait for it to warm up.

j. TUNING BEAT-NOTE INDICATION. Place the TUNE-OPERATE switch at TUNE. Roughly check the tuning of the receiver, both manual and push button, against the r-f test signal, using the beat note produced by the i-f oscillator as a tuning indication. The dial should turn freely.

k. TUNING SQUELCH INDICATION. With the SQUELCH switch ON and SENSITIVITY adjusted for maximum sensitivity (full right rotation) repeat the beat note test at one frequency.

l. SQUELCH OPERATION. With conditions as in step *k* above, the CALL SIGNAL lamp should light when the signal is tuned in. If it does not go out when the signal is turned off, turn the SENSITIVITY control to the left to reduce the sensitivity until it does. The noise from the loudspeaker should cease whenever the CALL SIGNAL lamp is extinguished. When the signal is turned on again the lamp should light.

m. SENSITIVITY CONTROL. Reduce the signal with conditions as in step *l* above, just short of the level where the CALL SIGNAL lamp would go out. Turn the SENSITIVITY control to the left and the lamp should go out.

n. INTERMITTENTS. Test the receiver for intermittents by jarring it while listening to a beat note.

o. TESTS INVOLVING TRANSMITTER AND RECEIVER. If the tests are being made in a mounting with a transmitter as a source of radio frequency, the following checks may be made quickly:

(1) *Disabling action.* Turn the transmitter RECEIVER TUNE-OPERATE switch to OPERATE. Pressing the microphone button should cut off the rushing noise in the receiver.

(2) *Sidetone.* Plug into either PHONE jack and set the SIDETONE control on the right end of the transmitter (fig. 51) to give sufficient headset volume. Sidetone should be heard when someone is speaking into the microphone.

152. Signal Tracing

a. Signal tracing tests require one of the following signal sources, listed in order of preference:

(1) A signal generator.

(2) A good receiver. (See par. 157.)

(3) A good transmitter (provides audio and radio frequencies only). (See par. 158.)

Caution: When connecting or disconnecting these wires turn the receiver OFF each time to avoid shock or equipment damage.

b. A voltmeter (not less than 1,000 ohms per volt), an ohmmeter, and a headset are also needed. If no vacuum tube test set is available, check the tubes in a good receiver, or substitute new tubes. This recommended procedure begins at the output and works back. For the location of parts see figures 90, 91, 92, and 117. An output meter plugged into one of the PHONES jacks, or an alinement meter bridged across L1 as described in paragraph 179, helps greatly in judging the performance of the receiver. If a signal generator having a 1-volt output at 2.65 mc is used, the discriminator circuits should be tested, as described in paragraph 154*i*, as soon as paragraph 154*b* is completed. In this event apply the signal generator output to the grid of the limiter (terminal 4 of V6). In all other cases, this test should be taken in the order given below.

c. The following general notes apply to all steps.

(1) At the beginning of the test, all switches should be OFF (or downward), and all push buttons released.

(2) *Do not remove the shield can of a tuned unit until the trouble has been traced to that particular unit. Do not remove the front panel of the receiver more often than necessary. Do not damage the wiring by pushing it back and forth during the inspection. Do as little damage to the receiver as possible.*

(3) Use a dynamotor known to be in good condition, and of correct voltage; and place it in the set before the test.

(4) Except as otherwise noted, ground one side of the signal generator and connect the other side to the receiver being tested.

(5) Note the volume, and listen for serious distortion from the loudspeaker at the various points in the signal tracing procedure. Experience helps. If possible, compare with a receiver known to be in good condition.

(6) Check the wiring and soldering in each stage as you proceed.

(7) Misalinement of one or more stages of the receiver will cause reduced output. Misalinement of the r-f oscillator may, however, prevent any output.

(8) In this outline, *no signal* or *no beat note* means either no signal from the loudspeaker, a signal that is weaker than it should be, or a seriously distorted signal.

(9) When trouble is localized in a given stage, first test the tube if such a test is indicated in the procedure, then the voltage, and finally the resistance at the tube socket of that stage.

(10) Trouble in a circuit or stage may not show in voltage and resistance measurements at the tube socket. Hints included in this section are merely a guide and should suggest other procedures, such as voltage and resistance measurements on individual parts.

(11) Remove only *one* tube at a time when testing. Check the number of the tube, test it, and return it to its proper socket before another tube is removed.

(12) If the receiver appears to be good, test the control circuits of the associated transmitter for short or open circuits. The wiring in Mounting FT–237–(*) as well as the remote circuit wiring, should be checked.

(13) It frequently helps to connect (with a clip lead) terminal 5 of V3 to the negative side of C25 (to which blue tracer leads are attached) when performing the audio and i-f tests outlined below. This stops the r-f oscillator and reduces interference. *Be careful, however, to remove this clip lead before proceeding with the radio frequency tests.*

(14) Each stop presupposes the satisfactory completion of all previous steps. Any trouble located should be isolated and cleared before proceeding with any succeeding steps.

153. Audio-Frequency Tests

For reference to a-f test signal sources, see paragraph 152*a*.

a. SECONDARY OF T1, SPEAKER CIRCUIT. Throw the SPEAKER switch ON and connect an audio signal through a series capacitor to the blue-brown tracer (fifth terminal counting from the front panel) on the output transformer T1. Listen for noise output in the speaker. The volume of noise will be *very low*. If no output is heard, check the circuit ele-

ments such as SPEAKER switch D3, the output transformer, the loudspeaker, etc.

Note. In replacing the front panel (if it has been removed) be sure that the wires are all pushed down beside potentiometers P1 and P2 and preferably tied in place.

b. SECONDARY OF T1, PHONES CIRCUIT. Throw the RADIO & INT-INT ONLY switch to RADIO & INT, and connect the signal to the blue-green tracer on the output transformer T1 (third terminal counting from the front panel). Try the headset in both PHONES jacks. Noise should be heard when the headset is plugged into either jack. If no signal is heard, remove the front panel and test (by resistance measurements if possible) such items as resistances R22, R23, and R33, switch D2, the jacks, and punchings 12 and 14 of PG3 and J3. Jacks and headsets may be at fault, or a permanent ground may exist on the receiver disabling lead.

c. PRIMARY CIRCUIT OF T1. Place the audio signal on the blue-yellow tracer (second terminal counting from the front panel) on output transformer T1 and listen for the signal from the speaker or headset. If no signal is present, C33 may be shorted or terminals 16 and 17 of plug PG3 may not be making good contact.

d. TERMINAL 5 OF V8 (GRID OF SECOND AUDIO AMPLIFIER). Turn the receiver ON. Put the signal on terminal 5 of V8. Listen for output in the speaker. If there is no output, test the tube, and the voltages at the socket terminals (figs. 93 and 94). C21, R19, or R18 may be faulty, or it may be necessary to check continuity to terminals 5, 6, and 10 of PG3 or J3.

e. TERMINAL 2 OF V10 (PLATE OF FIRST AUDIO AMPLIFIER). Introduce the signal at terminal 2 of V10, and listen for a signal from the loudspeaker. If there is no signal, R18, C19, or C21 may be at fault. Check terminals 5, 6, and 10 of PG3 or J3 for continuity.

f. TERMINAL 1 OF V10 (GRID OF FIRST AUDIO AMPLIFIER). Put the signal on terminal 1 of V10. Reduce the signal input. If there is no signal from the loudspeaker, test the tube. Circuit elements such as C11, C12, C13, C26, or R10 may be faulty. Note that when the SQUELCH switch is at OFF it should connect ground to R12, the side away from the tube.

g. TERMINAL 5 OF C10 (PLATE OF I-F OSCILLATOR). Place the signal on terminal 5 of V10. The TUNE-OPERATE switch should be at OPERATE. If there is no signal from the loudspeaker, R6, C26, C10, or D5 may be faulty.

h. JUNCTION OF C11 AND R10. Put the signal at the junction of C11 and R10. If the signal is not heard from the speaker, R10 or C11 may be faulty.

i. TERMINAL 4 OF V7 (OUTPUT OF DISCRIMINATOR). Place the signal across the output resistance (R81 in series with R83) of the discriminator (terminal 4 of V7). If there is no signal in the loudspeaker, check circuit elements such as V7, C81, C82, R81, R82, R83, or R84.

154. Intermediate-Frequency Tests

For reference to i-f test signal sources see paragraph 152*a*.

a. TERMINAL 8 OF V6 (PLATE OF LIMITER). With the i-f signal applied through a series capacitor to the plate of the limiter (terminal 8 of V6) place the SQUELCH switch at OFF, the TUNE-OPERATE switch in the TUNE position and listen for a beat note from the loudspeaker. If this beat note is not heard, note the setting and then vary the slug adjustment in LCU4 to obtain a beat note. If the beat note cannot be obtained such circuit elements as C10, LCU4, FL4, or D5 may be faulty. Retune the slug in LCU4 for a beat note with the i-f source after the trouble has been cleared.

b. TERMINAL 4 OF V6 (GRID OF LIMITER). Put the signal on terminal 4 of V6. If there is no beat note from the speaker, with the TUNE-OPERATE switch at TUNE, test V6 and other circuit elements. Voltage and resistance measurements at the tube socket terminals may be useful. (See figs 93 and 94.)

c. TERMINAL 8 OF V5 (PLATE OF SECOND I-F AMPLIFIER). With the signal on terminal 8 of V5 repeat the procedure given for the preceding stage. If there is no signal, FL3 may be misalined or faulty. If the alinement is not at fault, test such elements as V5, R13, C14, C15, or C6. If the alinement has been altered, realine FL3 after the trouble has been corrected.

d. TERMINAL 4 OF V5 (GRID OF SECOND I-F AMPLIFIER). Place the signal on terminal 4

of V5. Repeat the procedure which was followed on the limiter stage. If the test of the tube is satisfactory, there may be trouble in circuit elements such as FL2, C7, or R8.

e. TERMINAL 8 OF V4 (PLATE OF FIRST I-F AMPLIFIER). Feed the signal to terminal 8 of V4. If no beat note is obtained from the speaker, test the tube. FL2 may be misalined or may be faulty.

f. TERMINAL 4 OF V4 (GRID OF FIRST I-F AMPLIFIER). Introduce a signal on terminal 4 of V4. If no beat note is obtained and the tube is satisfactory, the trouble may be in FL1, C6, or associated circuit elements.

g. TERMINAL 8 OF V2 (PLATE OF MIXER). With the signal on terminal 8 of V2, listen for a beat note from the loudspeaker. If none is obtained, test the tube and make voltage and resistance measurements. (See figs. 93 and 94.) FL1 may be misalined or faulty. Check the associated circuit elements.

h. TERMINAL 4 OF V2 (GRID OF MIXER). Place the signal on terminal 4 of V2. If a beat note is not obtained, test the tube. The trouble may be in LCU2. Check for a short circuit of C1.5 or C1.6.

i. TERMINAL 4 OF V2 (DISCRIMINATOR TEST). With the i-f signal still on the grid of the mixer (terminal 4 of V2), measure the voltage across the series combination of R81 and R83 (between terminals 4 and 8 of V7, or between 3 and 7 of FL4). Turn off the i-f oscillator by setting the TUNE-OPERATE switch at OPERATE. Aline the secondary of FL4 to obtain a zero reading on the voltmeter. As the alinement is varied either way from this point the reading of the voltmeter should change polarity. In order to test the primary of FL4, connect the meter between terminals 3 and 8 of FL4. Adjust the primary slug of FL4 for maximum reading on the voltmeter. This is not an alinement but merely a check on the alinement capability of this circuit. Leave the circuit in approximate alinement after clearing any trouble that may have been present in FL4 or associated circuits.

155. Radio-Frequency Tests

For reference to r-f test signal sources see paragraph 152*a*.

a. TERMINAL 4 OF V2 (GRID OF MIXER). Apply an r-f signal through a capacitor to the grid of the mixer (terminal 4 of V2). Set the TUNE-OPERATE switch to TUNE. Manually set the dial of the trouble receiver to approximately the frequency of the r-f source and tune for a beat note. If it is impossible to obtain a beat note, either the source of radio frequency is not providing voltage on the grid of V2 or the r-f oscillator of the trouble receiver is not functioning. In the latter case check V3, LCU3, R4, R5, C5 and associated circuit elements. C1.7 and C1.8 may be shorted. Make resistance and voltage measurements at the tube socket terminals. (See figs. 93 and 94.) In order to isolate the trouble in the oscillator stage, put the r-f signal on the suppressor grid of the mixer (terminal 3 of V2). If the characteristic no-signal rushing noise is heard from the loudspeaker with the test signal but is not heard when the test signal is absent, then the oscillator stage is faulty. However, if the oscillator stage is operating but not properly alined, the rushing noise may be present, but a weak beat note may appear more than one channel away from the proper setting. A realinement of the oscillator is indicated.

Caution: Any attempt to vary the adjustment of the slug in LCU3 will result in a change in the tracking of the oscillator stage. This stage probably will then require careful alinement. This procedure is described in paragraphs 180*b* and 184*e*. No adjustment of LCU3 and C1.7 should be attempted until the method is fully understood.

b. TERMINAL 8 OF V1 (PLATE OF R-F AMPLIFIER). Place the signal on terminal 8 of V1. If no beat note is heard in the speaker, test V1. It may be that LCU2, C1.3, or C1.4 are shorted. Make voltage and resistance measurements.

c. TERMINAL 4 OF V1 (GRID OF R-F AMPLIFIER). Place the signal on terminal 4 of V1 and listen for the beat note. If no beat can be obtained and the tube is not at fault, check LCU1, C1.1, and C1.2 for short circuits. LCU2 may be misalined.

d. ANTENNA POST. Put the signal on the antenna post. If there is no beat note, LCU1 may be misalined or faulty. Test the antenna connections to LCU1.

e. SQUELCH CIRCUIT AND SENSITIVITY CONTROL. Check these functions as described in paragraph 151*l* and *m*. If operation of the squelch circuit and sensitivity control is not

normal, test V9. Circuit elements such as R15, R16, R17, C17, C18, C20.2, or C12 may be faulty.

Note. The voltage divider circuits bear an important relation to proper squelch action. (See figs. 93 and 94.)

f. TUNING. When all troubles have been removed, the tuning for all channels should be checked. If an LCU or an FL unit has been repaired or replaced or if its adjustment has been changed, that unit should be realined. If several units have been changed or there is any question of alinement, the whole receiver should be realined.

156. Signal Tracing Short Cuts

Signal tracing procedure may be simplified by determining, at the outset, whether the trouble is in the a-f, i-f, or r-f circuits. This may be determined in the following order:

a. AUDIO-FREQUENCY CIRCUITS. Put an a-f signal on the output of the discriminator (terminal 4 of V7). If output from the speaker is missing or weak, the trouble is probably located in the a-f circuit.

Caution: Unless you are familiar with these sets, you may fail to recognize a loss of amplification in the set in these tests. It is strongly recommended, therefore, that a comparison be made with a receiver known to be in good condition.

b. INTERMEDIATE-FREQUENCY CIRCUITS. Put an i-f signal on the grid of the mixer (terminal 4 of V2). When the TUNE-OPERATE switch is at TUNE a beat note should be heard. If step *a* gave a beat note but none is heard now, the trouble is probably in the i-f part of the circuit.

c. RADIO-FREQUENCY CIRCUITS. Place an r-f signal on the antenna post. Tune the receiver to the frequency of the test signal. Throw the SQUELCH switch to ON. The squelch circuit should operate satisfactorily with the SENSITIVITY control near its minimum or extreme left position. Throw the SQUELCH switch to OFF; a beat note should be heard from the speaker. The dial setting should agree approximately with the test signal frequency. Test the SQUELCH and SENSITIVITY control operation as described in paragraph 151*l* and *m*.

157. Use of Second Receiver as Signal Generator

In the event that no signal generator is available, it is recommended that a second receiver be kept in good operating condition at all times, to be used as a source of test signals. The a-f, i-f, and r-f signals may be obtained from the following points in the good receiver, in the following manner:

a. AUDIO-FREQUENCY. Audio-frequency signals may be obtained from one of the PHONES jacks of the good receiver. The VOLUME control of this receiver may be adjusted to give a satisfactory level of no-signal noise for use in testing the audio stages of the trouble receiver. If the signal strength is too great, the audio stages of the trouble receiver may be overloaded, thereby giving deceptive results. The *tip* of a plug inserted in one PHONES jack should be connected through a capacitor of 0.001 microfarad (mf) or larger as an audio source. The chassis of the two receivers should be connected together to complete the circuit. The RADIO and INT-INT ONLY switch should be at RADIO and INT.

b. INTERMEDIATE FREQUENCY. The intermediate frequencies may be obtained from the second receiver at terminal 7 of FL4. A somewhat higher output can be picked up on terminal 2 of FL4; for all cases except where the circuits are badly misalined, the former (lower level) point should be used. In all cases the connection should be made through a capacitor, preferably 0.001 mf or larger, which should be located close to the source of test tone. If no capacitor is available, two *insulated* wires may be twisted together for a few inches, making sure that there is *no metallic connection between the wires.* These two wires (at the far end) form the two ends of the lead which carries the test frequencies. In order to prevent unwanted pick-up and singing, this lead should be combined (in a twisted pair) with the ground wire which forms the circuit return. This twisted pair for pick-up and test frequency will then consist of:

(1) An insulated wire about 3 feet long used for connecting the chassis of the trouble receiver to the chassis of the source.

(2) Another insulated wire about 4 feet long cut in the middle and with the two cut ends wrapped together where they overlap.

(3) The two wires of the twisted pair should be different so that they can be identified. Both ends of both sides of the pair should be equipped with clips. The pair should go as directly as possible, preferably under the bottom of the good receiver (if it is at the left side) and the untwisted part should be as short as possible. The TUNE-OPERATE switch on the good receiver should be at TUNE.

c. RADIO FREQUENCY. The radio frequency may be obtained from the good receiver at the suppressor grid of the mixer (terminal 3 of V2). For most alinement purposes, the stray pick-up between two receivers about 2 feet apart is sufficient. For signal tracing, more pick-up may be necessary. In this event, connection may be made by using a capacitor, or two wires twisted together as described in *b* above. This frequency will be about 2.65 mc above the frequency indicated by the dial. Therefore, the receiver being tested should be tuned to a frequency which is approximately 2.65 mc above that to which the good receiver is tuned.

158. Use of Transmitter BC–604–(*) as Signal Generator

In the event that neither a signal generator nor a good receiver is available, a transmitter in good operating order may be used to provide a tone for tracing signals in the audio or r-f stages of a receiver which is in trouble.

a. AUDIO FREQUENCY. If the transmitter is in a mounting, an a-f tone can be obtained from terminal 1 of the terminal strip TS401, which can be seen in the base of the mounting when the door in the mounting at the left receiver position is opened. If no mounting is available, the tone can be picked up on terminal 6 of RADIO-INTERPHONE relay S104. This relay can be reached from the top with the cover plates removed. It is the rotary unit between C145 and T102. Terminal 6 on the top wafer has a blue-yellow lead attached to it. As this upper wafer is not made to be handled roughly, be very careful when making any connections to it. The return side of the circuit is through the ground connection.

Caution: Use a 0.001- to 1.0-mf capacitor in series with the lead, as one side of the audio source is grounded.

If the receiver is placed in Mounting FT–237–(*) with this transmitter, the RADIO INT-INT ONLY switch of the receiver should be thrown to INT ONLY. Turn the transmitter ON and throw the RADIO-INTERPHONE switch to INTERPHONE. Audio frequencies will be available if the operator presses the microphone button of the transmitter and whistles or hums into the microphone. The use of a throat microphone is suggested for this purpose.

b. INTERMEDIATE FREQUENCIES. Since no source of 2.6 mc is available in the transmitter, no direct method of signal tracing in the i-f section is available with the transmitter.

c. RADIO FREQUENCY. In general no direct connection between transmitter and receiver is necessary for picking up test radio frequencies for alinement work. In signal tracing where direct connection may be needed, a shielded wire may be used, with one end connected to the antenna terminal and the other hung near the transmitter. A capacitor should be connected in series with this wire to prevent accidental short circuits.

159. Receiver Trouble-Shooting Chart

Symptoms	Probable trouble	Corrections
1. Dynamotor cannot be turned on.	1. No d-c supply.	1. Check fuse F1 and REC ON-OFF switch. Replace defective components.
2. Dynamotor output voltage low.	2. Overload in receiver caused by shorted capacitor C25 or C16. The normal resistance between terminals 7 and 10 of PG2 is infinite.	2. Replace.
3. One or more tubes do not warm up.	3. Faulty filament circuit.	3. Check cold tube and filament leads to it.

Symptoms	Probable trouble	Corrections
4. With SQUELCH switch OFF, the CALL SIGNAL lamp does not light.	4. Faulty lamp.	4. Replace.
5. With SQUELCH switch ON, the CALL SIGNAL lamp cannot be turned off by rotating the SENSITIVITY control counterclockwise.	5. Run down battery. Faulty squelch stage.	5. Recharge or replace battery. Check V9 and associated circuit.
6. No output or weak output from speaker with an a-f signal applied to the discriminator output, terminal 4 of V7.	6. Faulty a-f stage.	6. Signal trace the a-f stages as described in paragraphs 152 and 153.
7. A-F circuits satisfactory but no beat note is obtained when an i-f signal is applied to the mixer grid, terminal 4 of V2. TUNE-OPERATE switch at TUNE.	7. Faulty i-f stage.	7. Signal trace the i-f stages as described in paragraphs 152 and 154.
8. A-F and i-f circuits satisfactory but no beat note is obtained when an r-f signal is applied to the antenna post.	8. Faulty r-f stage.	8. Signal trace the r-f stages as described in paragraphs 152 and 155.
9. R-F signal is received as indicated by lighting of CALL SIGNAL lamp with SQUELCH switch ON. No beat note is obtained with TUNE-OPERATE switch in TUNE position. Beat note is obtained when a 2.65 mc signal is applied through a 0.0005-mf capacitor to the grid of the first a-f amplifier, terminal 1 of V10.	9. Faulty i-f oscillator stage.	9. Check V10. Make resistance and continuity check of stage.

Symptoms	Probable trouble	Corrections
10. Rushing noise output of receiver is not cut off when the transmitter dynamotor is started.	10. Defective disabling relay S103. Faulty disabling circuit.	10. Replace. Make continuity checks.
11. Distortion.	11. Shorted audio coupling capacitor C11 or C21. Defective discriminator tube V7. Defective discriminator circuit.	11. Replace. Check tube and replace. Check discriminator alinement and circuit values.
12. Intermittent noise.	12. Defective tube, resistor, or capacitor. Defective volume control.	12. Gently tap and slightly move all tubes, resistors, capacitors, and soldered connections with an insulated prod to locate loose elements in tubes or loose connections of any component. Replace.
13. Excessive noise during reception of signal.	13. Faulty limiting.	13. Check V5, V6, and associated stages.
14. Oscillation (indicated by whistle or howl).	14. Defective tube, poor shielding, interstage coupling, or poor ground connection to chassis.	14. With the TUNE-OPERATE switch at TUNE, ground grids of various stages through a 0.001-mf capacitor, working from output to input. Grounding the grid of the faulty stage will not stop the oscillation. Check the suspected stage.
15. Weak signal output.	15. Poor tubes. Defective d-a-v-c circuit. Shorted plate circuit or screen bypass capacitor. Open coupling capacitor. Receiver not properly alined.	15. Check tubes and replace. Check V9 and d-a-v-c circuit. Check plate voltage to localize faulty capacitor and replace it. Bridge each coupling capacitor with one of same size. Replace defective capacitor. Realine.

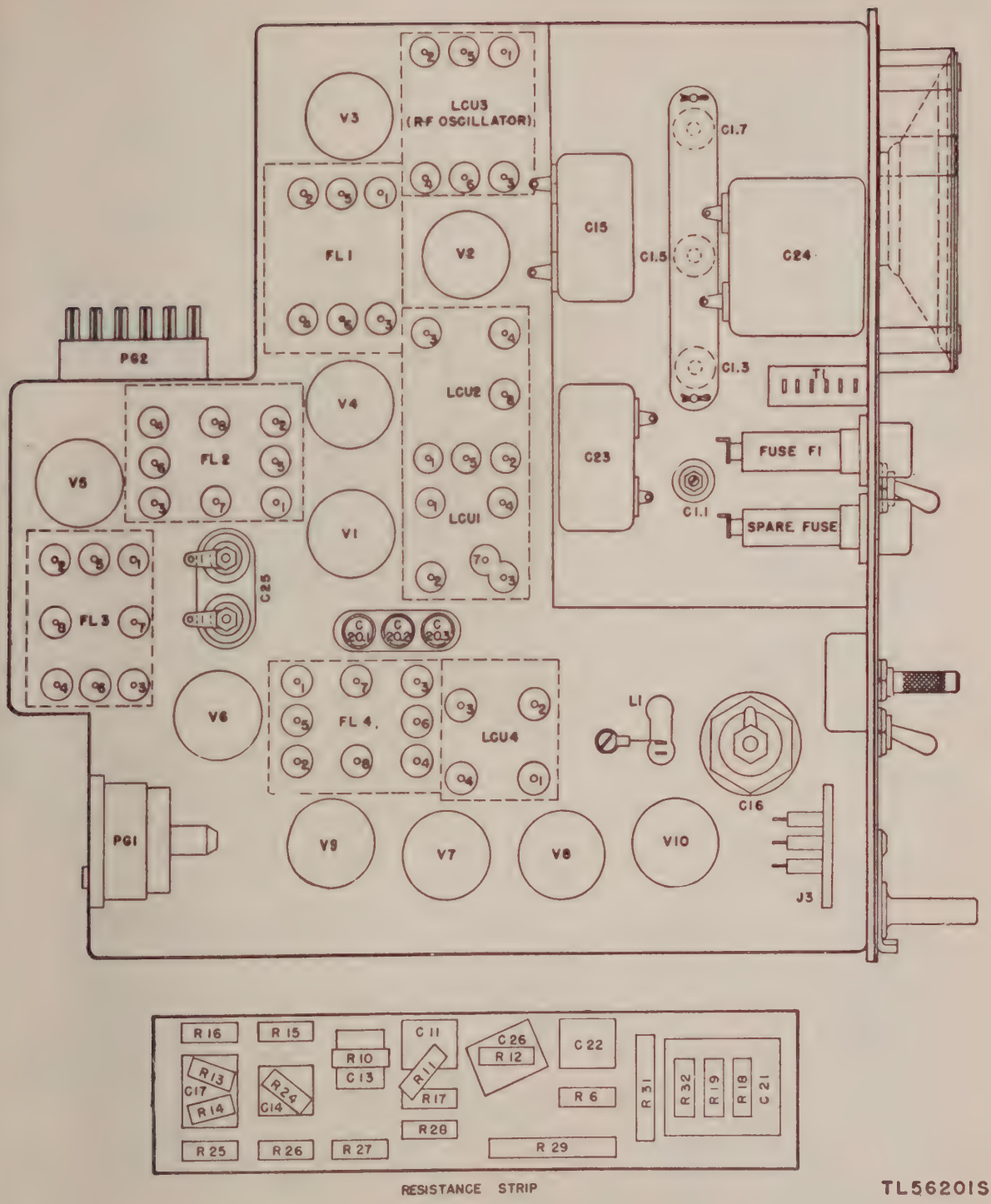


Figure 90. Radio Receiver BC–603–(*), apparatus location diagram, left side view.

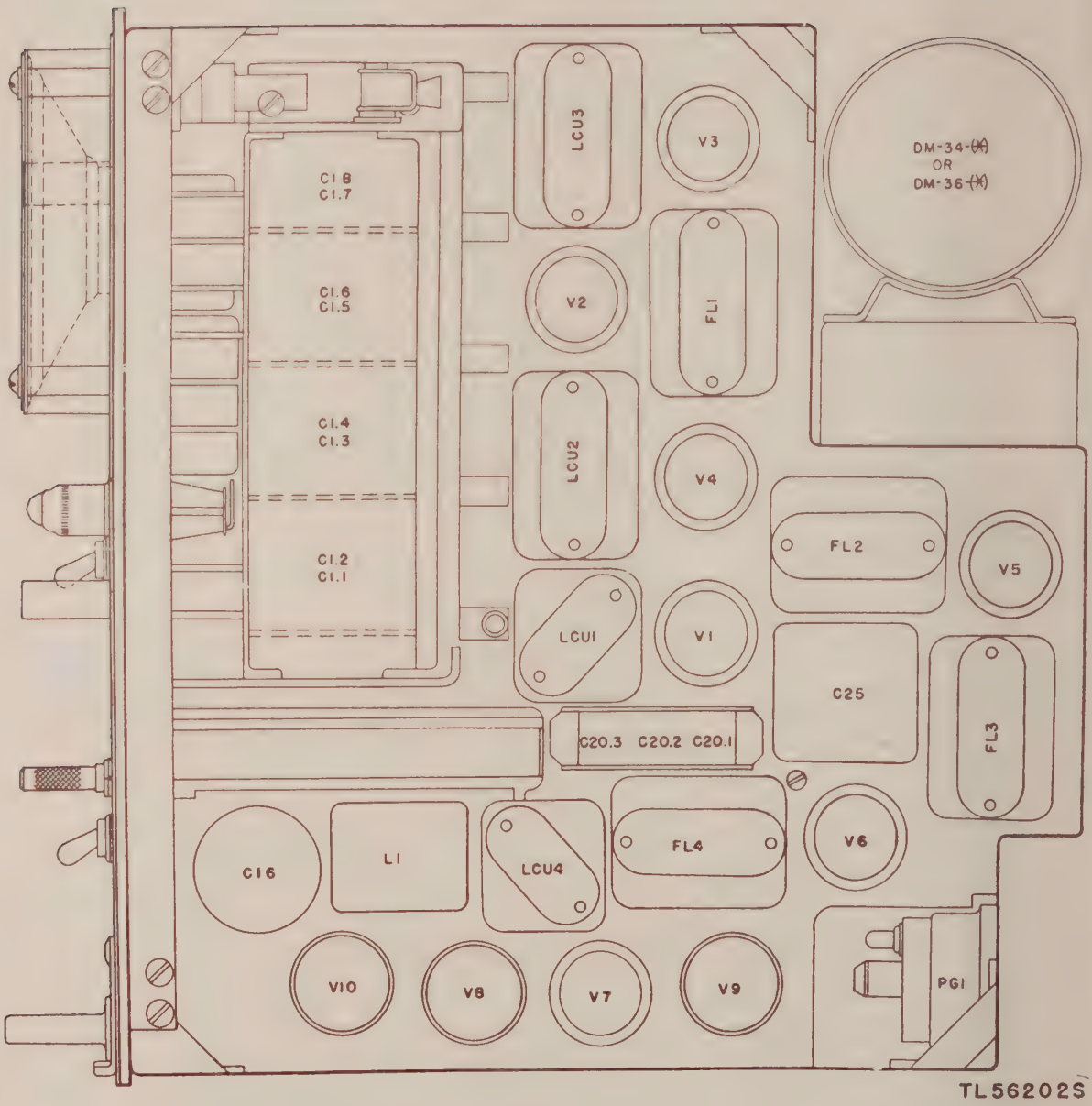
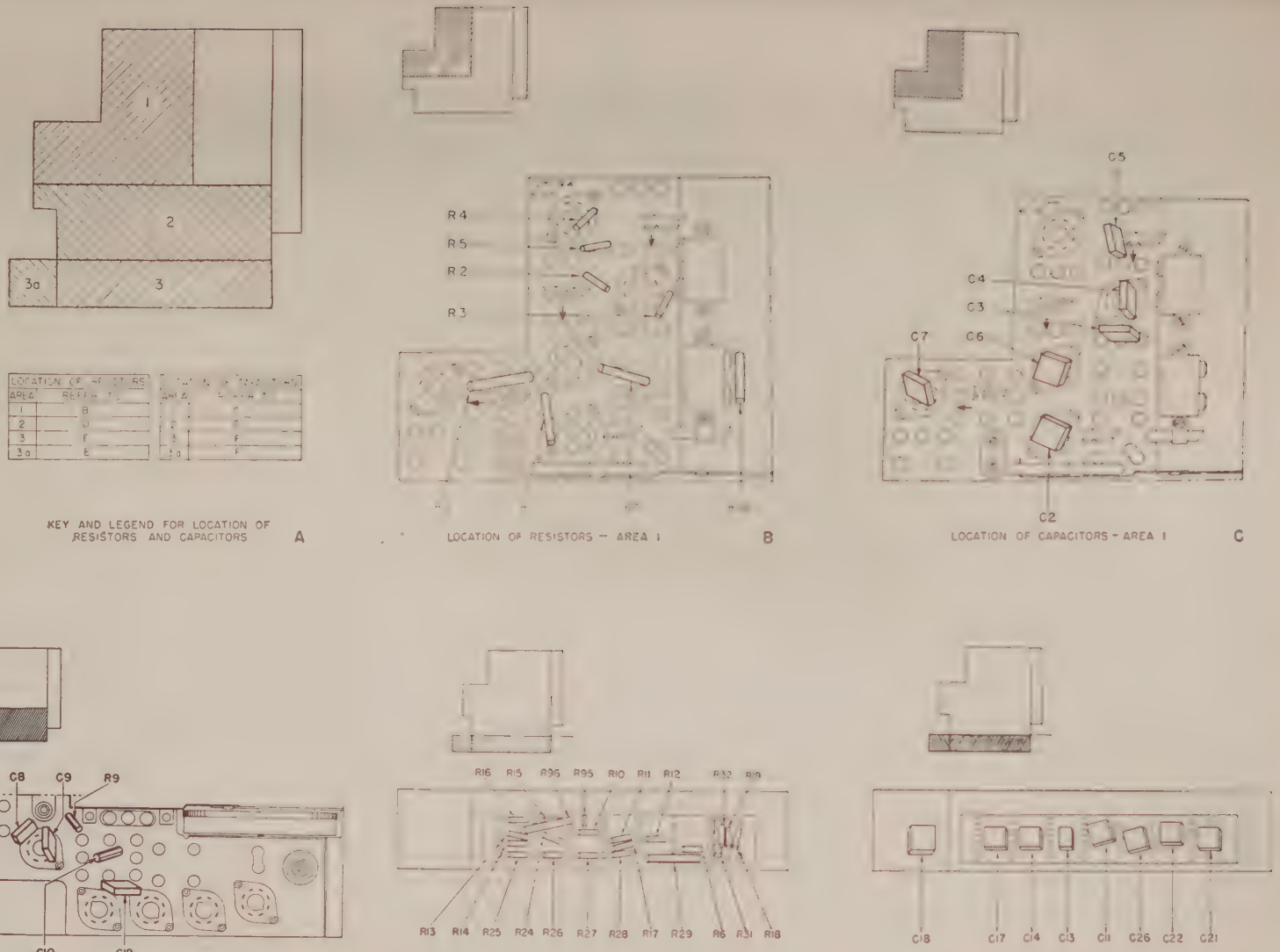


Figure 91. Radio Receiver BC–603–(*), apparatus location diagram, right side view.



KEY AND LEGEND FOR LOCATION OF RESISTORS AND CAPACITORS A

LOCATION OF RESISTORS – AREA 1 B

LOCATION OF CAPACITORS – AREA 1 C

LOCATION OF RESISTORS AND CAPACITORS – AREA 2 D

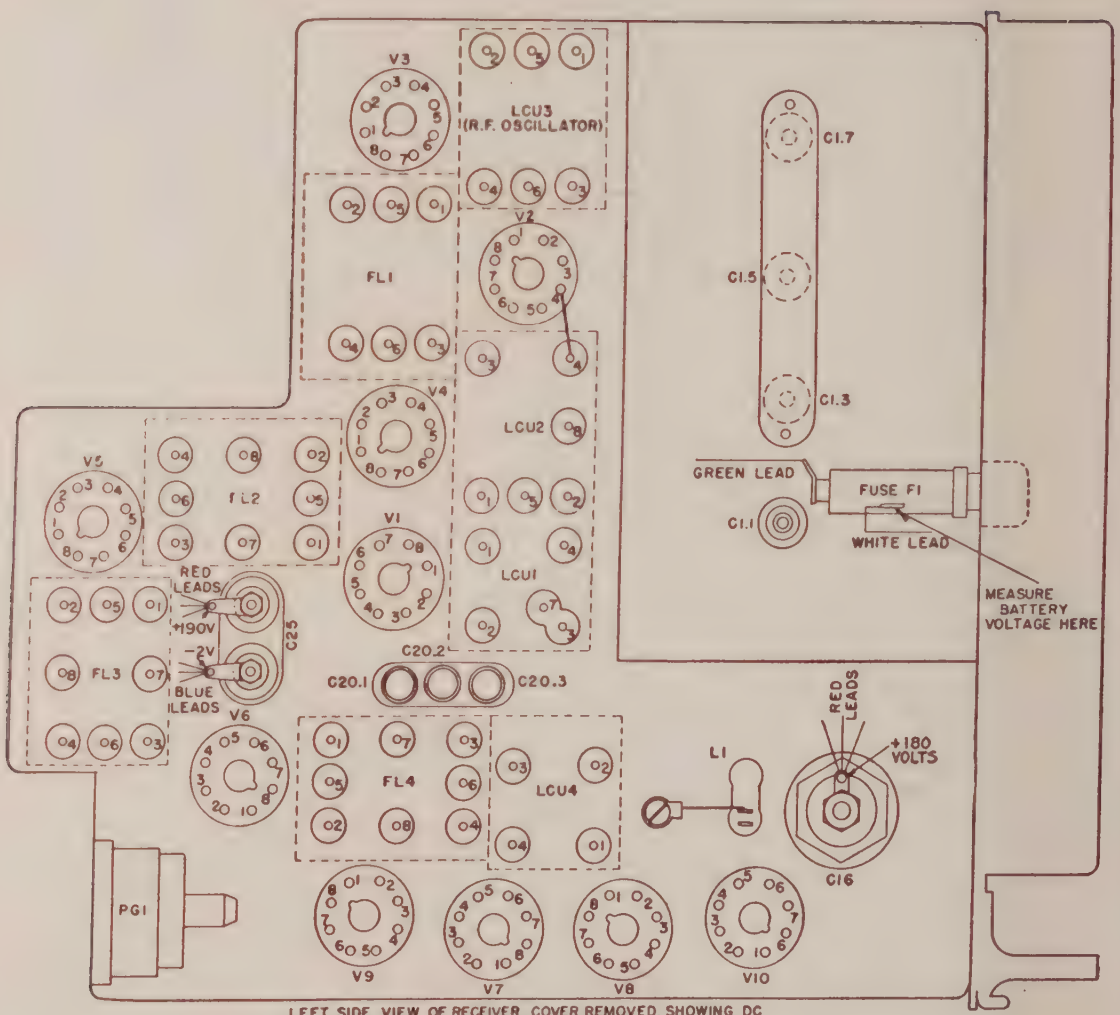
LOCATION OF RESISTORS – AREA 3 E

LOCATION OF CAPACITORS – AREA 3 F

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Figure 92. Radio Receiver BC-603-(*), resistor and capacitor location diagram, left side view.

CAUTION: DANGEROUS VOLTAGES ARE EXPOSED



LEFT SIDE VIEW OF RECEIVER, COVER REMOVED, SHOWING DC POTENTIALS BETWEEN THE DESIGNATED TERMINALS AND THE RECEIVER CHASSIS ON METER OF 1,000 OHMS PER VOLT.

NOTES:

1. ALL VOLTAGES SHOULD BE MEASURED BETWEEN THE DESIGNATED TERMINAL AND THE RECEIVER CHASSIS.
2. ALL SWITCHES EXCEPT THE TUNE-OPERATE AND THE ON-OFF SHOULD BE IN THE DOWNWARD POSITION.
3. VOLTAGES GIVEN ARE AVERAGE READINGS. A RECEIVER WHICH IS OPERATING SATISFACTORILY NEED NOT BE SERVICED JUST BECAUSE CERTAIN READINGS DIFFER FROM THOSE GIVEN AS DIFFERENCES IN MANUFACTURED EQUIPMENT CAUSE VARIATIONS IN VOLTAGES.
4. FIGURES GIVEN ARE BASED ON 12 OR 24 VOLTS FROM THE BATTERY. FOR OTHER BATTERY VOLTAGES THE READINGS GIVEN SHOULD BE ADJUSTED IN PROPORTION.
5. ACCURACY REQUIRES THAT ON MEASUREMENTS WITH A METER OF 1000 OHMS PER VOLT, FULL-SCALE READING MUST BE HIGHER THAN THE EXPECTED VOLTAGE.
6. VACUUM TUBE VOLTMETER MEASUREMENTS ARE BASED ON A VOLT-OHMMETER I-107 OR EQUIVALENT.
7. ◊ MEANS NOT TO EXCEED 0.5 VOLTS ON METER OF 1000 OHMS PER VOLT.

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Figure 93. Radio Receiver BC-603-(*), voltage diagram.

STAGE-BY-STAGE GAIN DATA FOR TROUBLE LOCATION

INPUT CONNECTION *	TEST FREQUENCY	INPUT REQUIRED TO OPERATE SQUELCH	INPUT REQUIRED FOR EQUIV CATHODE METER READING **	OUTPUT METER READING ***
TERM 4 OF V6 AND CHASSIS	2.65 MC		1 VOLT	16 VOLTS (APPROX) 400 CPS
" " " " "	"	2 VOLTS (MAX.)		
TERM 4 " V5 " "	"		0.05 VOLT (APPROX.)	16 VOLTS (APPROX) 400 CPS
" " " " "	"	0.1 VOLT (APPROX.)		
TERM 4 " V4 " "	"		1500 MICROVOLTS (APPROX.)	16 VOLTS (APPROX) 400 CPS.
" " " " "	"	3000 μV (APPROX.)		
TERM 4 " V2 " "	"		50 MICROVOLTS (MAX.)	16 VOLTS (APPROX) 400 CPS
" " " " "	"	100 μV (MAX.)		
" " " " "	28 MC		300 MICROVOLTS (APPROX.)	16 VOLTS (APPROX) 400 CPS
" " " " "	"	600 μV (APPROX.)		
TERM 8 " V1 " "	"		100 MICROVOLTS (APPROX.)	16 VOLTS (APPROX) 400 CPS
" " " " "	"	200 μV (APPROX.)		
TERM 4 " V1 " "	"		15 MICROVOLTS (APPROX.)	16 VOLTS (APPROX) 400 CPS
" " " " "	"	3 μV (APPROX.)		
ANT. AND GND TERMINALS	20 MC	1 μV (MAX.)		
" " " "	28 MC		1 MICROVOLT INPUT	11 VOLTS (APPROX.) 150 CPS
" " " "	"		" " "	20 " " 400 "
" " " "	"		" " "	20 " " 1000 "
" " " "	"		" " "	11 " " 2500 "
" " " "	"		" " "	4 " " 5000 "
" " " "	"		" " "	2 " " 1000 "
TERM 5 OF V8 AND CHASSIS	1000 CPS △		1 VOLT "	18 " " 1000 "
TERM 1 " V10 " "	"			

* THE SIGNAL GENERATOR CONNECTION SHALL ALWAYS BE MADE THROUGH A .006 MF SERIES CAPACITOR

** APPLY 1 VOLT OF 2.65 MEGACYCLES BETWEEN TERMINAL 4 OF V6 AND CHASSIS TO OBTAIN THE EQUIVALENT "CATHODE" METER READING. BETWEEN 4 AND 8 MICROAMPERES SHOULD BE OBTAINED.

*** SQUELCH SWITCH OFF AND VOLUME CONTROL IN MAXIMUM CLOCKWISE POSITION. A FREQUENCY MODULATED SIGNAL GENERATOR (±15 KC DEVIATION) IS REQUIRED FOR OUTPUT MEASUREMENTS INVOLVING R.F. AND I.F. INPUTS. SPEAKER SWITCH SHOULD BE IN OFF POSITION WHEN MEASUREMENTS ARE MADE.

△ THIS MEASUREMENT MAY BE MADE IF AN AUDIO FREQUENCY SOURCE IS AVAILABLE.

VOLTAGES AT TERMINALS OF FL AND LCU UNITS

FL UNITS			LCU UNITS		
TERMINAL	VOLTAGE		TERMINAL	VOLTAGE	
	1000 OHM PER VOLT METER (NOTE 5 & 7)	VACUUM TUBE VOLTMETER (NOTE 6)		1000 OHM PER VOLT METER (NOTE 5 & 7)	VACUUM TUBE VOLTMETER (NOTE 6)
FL1			LCU1		
1	.70	75	1	0	-2
2	70	75	2	0	-2
3	0	0	3	0	0
4	0	0	4	0	0
5	180	185	7	0	0
6	0	-2			
8	0	-2			
FL2			LCU2		
1	175	180	1	175	180
2	175	180	2	175	180
3	0	0	3	0	0
4	0	0	4	0	0
5	180	185	5	180	185
6	0	-2	8	0	0
7	-	-2			
8	-	-2			
FL3			LCU3		
1	55	60	1	0	0
2	55	60	2	75	110
3	0	0	3	0	0
4	0	0	4	180	185
5	55	60	5	0	-10
6	0	-2	6	0	-2
7	-	-2			
8	-2	-2			
FL4			LCU4		
1	25	25	1	180	185
2	55	60	2	0	0
3	5.5	25	3	135	160
4	5	20	4	0	-0.5
5	55	60			
6	5	20			
7	5.5	25			
0	5	20			

VOLTAGES AT VACUUM TUBE SOCKET TERMINALS

1000 OHM PER VOLT VOLTMETER MEASUREMENTS (SEE NOTES 5 & 7)

12 VOLT BATTERY

TERM. NOS.	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
1	0	0	0	0	0	0	0	0	0	0
2	0	12	0	12	12	6	12	6	0	70
3	0	0	75	0	0	0.5	5	185	15	0.5
4	0	0	0	0	0	0	5.5	170	0	0
5	0	12	0	0	0	0.5	5	0	0	135
6	145	40	0	115	90	55	0	0	5	0
7	6	6	6	0	0	12	6	0	6	6
8	175	70	0	175	55	55	5.5	6	0	12

24 VOLT BATTERY

1	0	0	0	0	0	0	0	0	0	0
2	0	12	0	12	12	18	12	18	0	70
3	0	0	75	0	0	0.5	5	185	15	0.5
4	0	0	0	0	0	0	5.5	170	0	0
5	0	1.2	0	0	0	0.5	5	0	0	135
6	145	40	0	115	90	55	0	0	5	0
7	6	6	6	0	24	12	18	24	18	6
8	175	70	0	175	55	55	5.5	6	24	12

VOLTAGES AT VACUUM TUBE SOCKET TERMINALS

VACUUM TUBE VOLTMETER MEASUREMENTS (SEE NOTE 6)

12 VOLT BATTERY

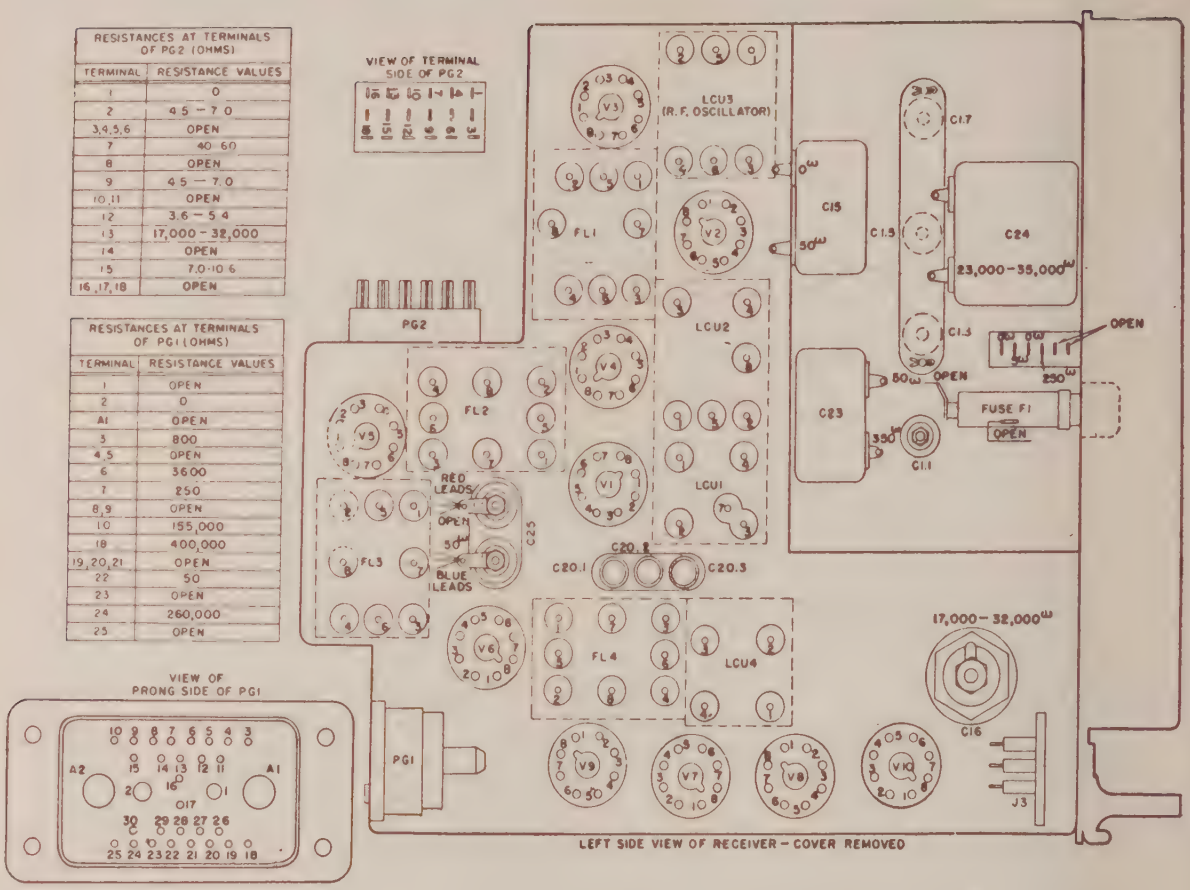
TERM. NOS.	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
1	0	0	0	0	0	0	0	0	15	0
2	0	12	0	12	12	6	12	6	0	75
3	0	-2	110	0	0	0.5	20	190	15	1
4	-2	0	0	-2	-2	-2	25	180	-2	0.5
5	0	1.3	-10	0	0	0.5	20	-2	-2	160
6	155	55	0	120	90	60	0	0	20	0
7	6	6	6	0	0	12	6	0	6	6
8	180	75	0	180	60	60	25	6	0	12

24 VOLT BATTERY

1	0	0	0	0	0	0	0	0	15	0
2	0	12	0	12	12	10	12	8	0	75
3	0	-2	110	0	0	0.5	20	190	15	1
4	-2	0	0	-2	-2	-2	25	180	-2	-0.5
5	0	1.3	-10	0	0	0.5	20	-2	-2	160
6	155	55	0	120	90	60	0	0	20	0
7	6	6	6	0	24	12	18	24	18	6
8	180	75	0	180	60	60	25	6	24	12

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Figure 93—Continued.



NOTES:

1. ALL RESISTANCE VALUES SHOWN ARE MEASURED BETWEEN THE RECEIVER CHASSIS AND DESIGNATED TERMINAL POINT.
2. A VARIATION OF ±20% FROM THE INDICATED VALUES SHOULD NOT BE REGARDED AS AN INDICATION OF A DEFECTIVE RECEIVER.
3. CERTAIN DISCREPANCIES MAY BE OBSERVED BETWEEN THE SCHEMATIC DRAWING CONTAINED IN THESE INSTRUCTIONS AND THE CIRCUIT LABEL APPEARING ON THE RECEIVER. THESE DISCREPANCIES ARE DUE TO CHANGES MADE IN MANUFACTURE. IN SUCH CASES THE CIRCUIT LABEL APPLIES. NATURALLY, SUCH DISCREPANCIES MAY AFFECT THE RESISTANCE VALUES INDICATED.
4. THE DYNAMOTOR MUST BE REMOVED BEFORE MAKING ANY RESISTANCE MEASUREMENTS.
5. WHERE MODIFICATIONS DURING MANUFACTURE HAVE CAUSED A CHANGE IN RESISTANCE, THE NEW FIGURE IS SHOWN IN THE COLUMN MARKED "MODIFIED"
6. PLACE ALL SWITCHES IN THE "OFF" OR DOWNWARD POSITION EXCEPT THE TUNE-OPERATE AND THE RADIO AND INT.-INT. ONLY SWITCHES, WHICH SHOULD POINT UP.
7. TURN THE VOLUME AND SENSITIVITY CONTROLS TO THEIR MAXIMUM CLOCKWISE ROTATION.
8. TO CHECK THE VOLUME CONTROL CONNECT THE OHMMETER TEST LEAD TO TERMINAL 5 OF J3. WITH THE VOLUME CONTROL AT MAXIMUM THE MEASURED RESISTANCE SHOULD BE APPROX. 100,000 OHMS AND SHOULD DECREASE TO 50 OHMS AS THE VOLUME CONTROL IS TURNED TO ITS EXTREME COUNTERCLOCKWISE POSITION.
9. TO CHECK THE SENSITIVITY CONTROL MEASURE THE RESISTANCE FROM THE TERMINAL OF C25 TO WHICH THE BLUE LEADS ARE ATTACHED. THE RESISTANCE AT THIS POINT SHOULD VARY BETWEEN 50 AND 250 OHMS AS THE SENSITIVITY CONTROL IS ROTATED.

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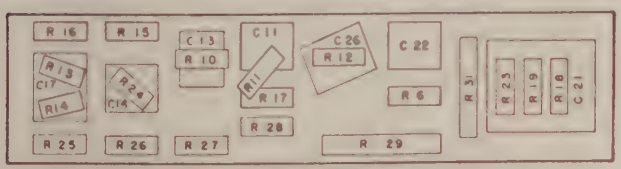
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Figure 94. Radio Receiver BC–603–(*), resistance diagram.

RESISTANCES AT VACUUM TUBE SOCKET TERMINALS (OHMS)										
RECEIVER WHICH DOES NOT INCLUDE R21, R95 ETC. (UNMODIFIED)										
TERMINAL	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
1	0	0	0	0	0	0	0	0	2 MEG	1½ MEG
2	0	4**	0	9**	9**	5**	5**	5**	¼ MEG	2 MEG
3	0	100,000	40,000	0	0	800	165,000	OPEN	2,500	2,000
4	500,000	0	OPEN	460,000	750,000	500,000	155,000	33,000	250,000	100,000
5	0	500	50,000	0	0	800	165,000	100,000	250,000	48,000
6	48,000	280,000	OPEN	60,000	48,000	10,000	OPEN	OPEN	165,000	0
7	25**	25**	4**	0	5**	4**	5**	5**	5**	4**
8	29,000	80,000	0	29,000	58,000	10,000	155,000	350	5**	5**
RECEIVER WHICH INCLUDES R21, R95 ETC. (MODIFIED)										
1	0	0	0	0	0	0	0	0	2 MEG	1½ MEG
2	0	4**	0	9**	9**	5**	5**	5**	¼ MEG	2 MEG
3	0	100,000	35,000	0	0	800	165,000	OPEN	5,700	2,000
4	500,000	0	OPEN	460,000	120,000	260,000	155,000	25,000	250,000	100,000
5	0	500	50,000	0	0	800	165,000	100,000	250,000	48,000
6	48,000	280,000	OPEN	50,000	90,000	10,000	OPEN	OPEN	165,000	0
7	25**	25**	4**	0	5**	4**	5**	5**	5**	4**
8	21,000	70,000	0	21,000	10,000	10,000	155,000	350	5**	5**

** TUBE FILAMENT RESISTANCE SUBJECT TO LARGE VARIATION WITH HEAT.

RESISTANCES AT FILTER TERMINALS			
FILTER	TERMINAL	RESISTANCE	
		UNMOD	MOD
LCU1	1	26 MEG	26 MEG
	2	.5 MEG	.5 MEG
	3,4	OPEN	OPEN
	7	0	0
LCU2	1,2,5	28,000	20,000
	3,4,8	0	0
LCU3	1	1	1
	2	40,000	35,000
	3	OPEN	OPEN
	4	28,000	20,000
	5	50,000	50,000
	6	1MEG	1MEG
LCU4	1	28,000	20,000
	2	25	25
	3	48,000	40,000
	4	1MEG	1MEG
FL1	1,2	80,000	70,000
	3,4	5MEG	5MEG
	5	28,000	20,000
	6	26MEG	26MEG
FL2	1,2	29,000	21,000
	3	0	0
	4	35	35
	5	28,000	20,000
	6	75MEG	11MEG
	7	5MEG	10,000
	8	25MEG	50
FL3	1,2	60,000	10,000
	3	0	0
	4	35	35
	5	50,000	9,000
	6	5MEG	25MEG
	7	25MEG	10,000
	8	50	50
FL4	1	3,500	3,500
	2	10,000	10,000
	3,7	155,000	155,000
	4,6,8	165,000	165,000
	5	9,000	9,000

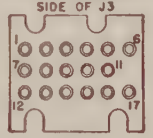


RESISTANCE STRIP

RESISTANCES AT RESISTANCE STRIP		
UNIT	LEFT SIDE (OR BOTTOM)	RIGHT SIDE (OR TOP)
R 16	2 MEG	1 MEG
R 13	.25 MEG	.25 MEG
C 17	0	1 MEG
R 14	50	.25 MEG
R 25	0	2,500
R 15	1 MEG	.2 MEG
R 24	50	0
C 14	.25 MEG	0
R 26	2,500	3,700
R 10	.2 MEG	.5 MEG
C 13	0	1.2 MEG
R 27	3,700	6,200
C 11	.5 MEG	1.2 MEG
R 11	.25 MEG	1.2 MEG
R 17	.25 MEG	0
R 28	6,200	8,700
C 26	1.2 MEG	150,000
R 12	0	2,000
R 29	8,700	21,000
C 22	OPEN	OPEN
R 6	150,000	45,000*
R 31	21,000*	25,000*
R 23	30,000*	25,000*
R 19	2 MEG	25,000*
R 18	2 MEG	2 MEG
C 21	.1 MEG	¼ MEG

* AVERAGE RESISTANCE OF MODIFIED AND UNMODIFIED RECEIVERS.

VIEW OF TERMINAL SIDE OF J3



RESISTANCES AT TERMINALS OF J3 (OHMS)	
TERMINAL	RESISTANCE VALUES
1,2	OPEN
3	17,000 – 32,000
4	2 MEG.
5	100,000
6	50
7,8	OPEN
9	6,000
10	100,000
11	50
12	280
13	0
14	10,000
15	17,000 – 32,000
16,17	OPEN

TL562045-A

(2)

Figure 94—Continued.

Section XVII. TROUBLE SHOOTING TRANSMITTER

160. General

a. The following procedure is designed to locate trouble in a transmitter quickly and with as little damage as possible to the transmitter. A report from the operating personnel on the trouble experienced will usually facilitate repair. A trouble-shooting chart is also provided in paragraph 169 to help localize the trouble.

b. The location of trouble in Radio Transmitter BC–604–(*) will also be facilitated by reference to the figures listed in paragraph 137*b*.

161. Visual Inspection

Remove all covers from the transmitter and inspect for obvious defects. These may include broken parts, burned resistors, bent capacitor plates, bent pins on the connection plugs, or loose pieces of wire or metal. There may be broken gears or the rack connecting the selector to the tuning capacitors may be out of alinement. Check for loose tubes or looseness in the grip of the socket receptacles on the contact pins of the tubes. A check for loose wires should also be made and any broken leads repaired. Clean the inside, both top and bottom, with compressed air, paying especial attention to the selector mechanism.

Note. If an air hose is used, be sure any water condensed in it is blown out before applying the air stream to the equipment. Use only air intended for cleaning purposes and do not blow hard enough to dislodge or damage any apparatus.

162. Preliminary Precautions

Caution: When the transmitter is operated with covers removed, dangerous voltages are exposed.

Never run the dynamotor for long periods in either the RECEIVER TUNE or OPERATE position. The design requirements of the dynamotor are based upon 5 minutes operation with 15 minutes off. In addition to this, prolonged operation of the set may cause objectionable heating effects within the transmitter. *Never start the dynamotor with the TRANSMITTER ON-OFF switch* (filament switch). The dynamotor should be started with the RECEIVER TUNE-OPERATE switch or the microphone switch after the filaments have been heated (by closing the TRANSMITTER ON-OFF switch) for about 5 seconds.

163. Power Supply Check

a. Lay the transmitter on its side with the panel up so that the meter may be read and the under chassis parts seen. There should be no microphone connected to the set and the RADIO - INTERPHONE switch should be thrown to RADIO.

b. Plug in auxiliary Cord CD–786 to connect the battery to power receptacle PG101 on the transmitter. If the dynamotor starts, look for a stuck dynamotor relay or shorted relay contacts.

c. Turn the TRANSMITTER ON - OFF switch to ON. The green signal lamp should light. If the lamp does not light check for a burned out pilot lamp or loose wiring at terminals 1 and 2 of PG101. Watch carefully for other obvious trouble as soon as the switch is turned on. If desired a voltmeter may be connected across the power supply during the above tests. Operating the filament supply switch as above should not cause an appreciable change in the voltage reading if no trouble is present. If the dynamotor is short-circuited the main fuse will open or there will be a continuous low voltage reading when the dynamotor starts. Assuming that the dynamotor does not start when the filament switch is operated and that no other trouble is noticed after operating the switch, a microphone may be connected to the set. Momentarily operate the microphone push button and note that the dynamotor starts. If the dynamotor does not start, inspect relay S102 for breakage, contact failure, or defective wiring. Inspect the dynamotor jacks and wiring. Check the dynamotor, also the microphone cord and jack. The dynamotor may start but may indicate by high speed whine that it is operating at no load. Inspect for an open high voltage fuse and other open-circuit trouble on the high voltage supply leads. If the dynamotor starts but operates at low speed, check for a high voltage overload. Remove the high voltage fuse. If the dynamotor still labors, remove the battery cord from the set and determine the origin of the short circuit. Also check the dynamotor.

164. Check on R–F Stages

Assuming that the dynamotor starts satisfactorily and that no other trouble is noticed upon operating the microphone push button, proceed to a rough check of the operation of the r-f stages.

a. Check to see that all crystals are in place.

Caution: High voltage is present on the crystal pin jacks when the transmitter is operating.

b. Operate the push button for the highest frequency channel. Place the RADIO-INTERPHONE switch on RADIO, the RECEIVER TUNE - OPERATE switch on RECEIVER TUNE and the TUNE-ANT CUR switch on TUNE. Turn the meter switch on the right end of the transmitter to position 2 and observe the oscillator output to the first r-f stage. This current will be considerably different for crystal of different activity. Any reading is probably satisfactory.

Note. This current may be high for sets with a 1,000-ohm R106. (See par. 183*d*(4).)

Operate the meter switch successively to positions 3, 4, 1, and 5, observing the grid current to the rectifier, doubler, tripler, and power amplifier. The current readings given in the following table now may be used as a guide but it is recommended (on account of tube and circuit variations which may be wide) that the normal current readings for each transmitter be recorded for use in locating trouble. If a considerably different reading from that shown in the table is obtained at one point, trouble may be indicated near the point of such reading. Voltage and resistance readings in accordance with figures 99 and 100 should be made at the stage in which trouble is suspected to be present and if necessary the tube in that stage may be replaced. Low voltage readings indicate short circuits or high series resistance; high voltage readings in general indicate defective tubes or open circuits or shorted series resistors.

Transmitter set to receiver tune

Meter switch positions	1	2	3	4	5	6
Circuit	Tripler grid	1st r-f grid	Rect grid	Doubler grid	P-a grid	Total plate and screen
Meter reading (20 mc) ...	20	40	20	25	30	35
Meter reading (27.9 mc)..	30	25	25	40	40	35

c. Start the transmitter and check the selector adjustment by depressing the No. 1 push button and observing the maximum meter deflection as the gang capacitor is varied slightly against the restoring force of the selector springs. *Do not attempt to rotate the capacitor control more than a few degrees.* The meter should indicate a maximum deflection at the capacitor setting determined by the selector. If the selector does not properly position the gang capacitor it should be reset in accordance with paragraph 188. Repeat this check for other push buttons. If the set has been correctly tuned, incorrect alinement of the set may be indicated by failure to obtain sufficient drive in the later stages as indicated by the panel meter readings. In checking the readings in positions 1 and 3, incorrect tuning may be indicated.

d. Do not operate with the switch on RECEIVER TUNE for more than a few minutes at a time. If no trouble is indicated by the meter readings with the push button for the highest numbered channel operated, take similar readings on the other channels in sequence.

165. Tuning Check

If the above meter readings indicate need for tuning the channels, perform the tuning adjustments in accordance with paragraph 188 and check as discussed in paragraph 164.

166. Power-Amplifier Check

To check the operation of the power amplifier throw the RECEIVER TUNE-OPERATE switch to OPERATE and the RADIO-INTERPHONE switch to RADIO. Throw the TUNE-ANT CUR switch in the ANT CUR position and see if the power output can be varied by variation of the antenna trimmer capacitor. An antenna (par. 185*b*) must be connected for this test. Also read the plate current (meter switch in position 6 and TUNE-ANT CUR switch on TUNE) with the RECEIVER TUNE-OPERATE switch first at RECEIVER TUNE and then at OPERATE (MIC. button pressed). The difference in readings should give the normal p-a plate current. Watch for sparking and overheating in the p-a tube it-

self. If there is output from the preceding stage and none from the power amplifier, check the voltage and resistance readings for the stage and the tube itself. Also check its alinement.

167. Check of Audio Stages

Replace the bottom cover plate and place the transmitter on the mounting for check with the associated receiver. Turn the SIDETONE (or INTERPHONE on some transmitters) control to maximum and operate the transmitter on INTERPHONE. Speak into a microphone. Sidetone should be heard in the associated receiver. As an over-all check of the audio stages and the transmitter itself, operate the transmitter on RADIO and listen on the receiver of another set. This should give a satisfactory check for both operation and noise in the transmitter. If there is trouble in the audio stages make a voltage and resistance check of both stages. Operating the transmitter on both RADIO and INTERPHONE with its own receiver also gives a satisfactory check of the operation of the control circuits.

168. Intermittent Trouble

Whenever a complete inspection of a transmitter is made every effort should be made to locate and clear intermittent trouble. This may be done by complete inspection of parts and wiring and many intermittent troubles may be made to recur by gently shaking or jarring the transmitter.

169. Transmitter Trouble-Shooting Chart

Symptoms	Probable trouble	Corrections
1. Pilot lamp does not light when the TRANSMITTER ON-OFF switch is turned to ON. Transmitter normal otherwise.	1. Burned out lamp. Open connection in pilot lamp circuit.	1. Replace. Replace.
2. Set dead. Pilot lamp and tubes do not light.	2. Dead battery. Open battery leads or connection.	2. Replace or recharge. Repair or replace leads.
3. Pilot lamp lights but dynamotor cannot be started.	3. Defective relay S102. Poor contact of dynamotor jacks. Defective dynamotor.	3. Replace. Clean jacks. See paragraph 171.
4. Dynamotor operates at no load as indicated by high speed whine.	4. Open fuse F101. Open circuit in high-voltage supply leads.	4. Replace. Repair.
5. Dynamotor operates at low speed.	5. High voltage overload.	5. Check for a resistance reading of 4,500 to 5,500 ohms between terminals 4 and 8 of power input plug PG103. If resistance reading is low, check for shorted plate or screen capacitors.
6. Dynamotor can be turned on by local microphone or RECEIVER TUNE position of RECEIVER TUNE-OPERATE switch but cannot be turned on by remote interphone microphone.	6. Faulty interphone wiring.	6. Check for open or grounded interphone wiring.
7. High meter readings (par. 164).	7. Excessive excitation. Bias failure. Plate voltage failure. Insufficient loading.	7. Make voltage and resistance check of suspected stage. Also check alinement.
8. Low meter readings (par. 164).	8. Grid circuit off resonance.	8. Same as step 7.
9. Grid current of one stage gradually decreasing daily.	9. Tube in preceding stage failing.	9. Replace defective tube.
10. No meter reading in one stage only.	10. Excitation failure. Grid circuit off resonance. Open grid circuit.	10. Same as step 7.

Symptoms	Probable trouble	Corrections
11. On any one channel, the meter indicates in position No. 6 only.	11. Defective crystal oscillator tube V107. Defective crystal.	11. Replace. Replace.
12. Erratic reading.	12. Intermittent circuit in bias supply. Defective tube. Intermittent in preceding stage.	12. Repair. Replace. Repair.
13. Meter attempts to read backward.	13. Coupling capacitor to preceding stage shorted.	13. Replace.
14. ANT CUR reading low.	14. Antenna trimmer capacitor misalined.	14. Readjust.
15. Power amplifier current reading. This reading, which should be about 30, is the *difference* between the readings taken when the meter switch is in position No. 6, the TUNE-ANT CUR switch is at TUNE, and the RECEIVER TUNE-OPERATE switch is first at RECEIVER TUNE and then at OPERATE (microphone button depressed).	15. See substeps below.	15. See substeps below.
a. High reading.	*a.* Plate circuit off resonance. Loss of excitation. Gassy tube V104.	*a.* Retune. Check C121. Replace.
b. Reading gradually increasing daily.	*b.* Gassy tube V104.	*b.* Replace.
c. Low reading.	*c.* Low plate voltage on V104. Insufficient loading. Low filament emission.	*c.* Check resistance to ground. Check tuning and alinement. Replace V104.
d. Reading gradually decreasing daily.	*d.* V104 filament emission decreasing.	*d.* Replace V104.
e. No reading.	*e.* Defective antenna relay S101. Open plate circuit.	*e.* Replace. Repair.
16. No sidetone	16. Faulty audio circuit.	16. Wind a length of wire around the sleeve of the PL–55 headset plug and ground the other end of the wire to the transmitter chassis. Connect a 0.05-mf capacitor to the tip of the headset plug. Depress the microphone button, speak into the microphone, and touch the capacitor lead of the headset to the upper terminal (white with black tracer) of microphone jack J102. Speech should be heard. If not, check the microphone circuit. In a similar manner touch the capacitor in turn to the following points: plate of V105, plate of V106, terminal 1 or 7 of TS401 on the mounting. Loss of sidetone between any two points indicates the trouble point. Make tube checks and resistance and voltage measurements of the faulty stage or circuit.

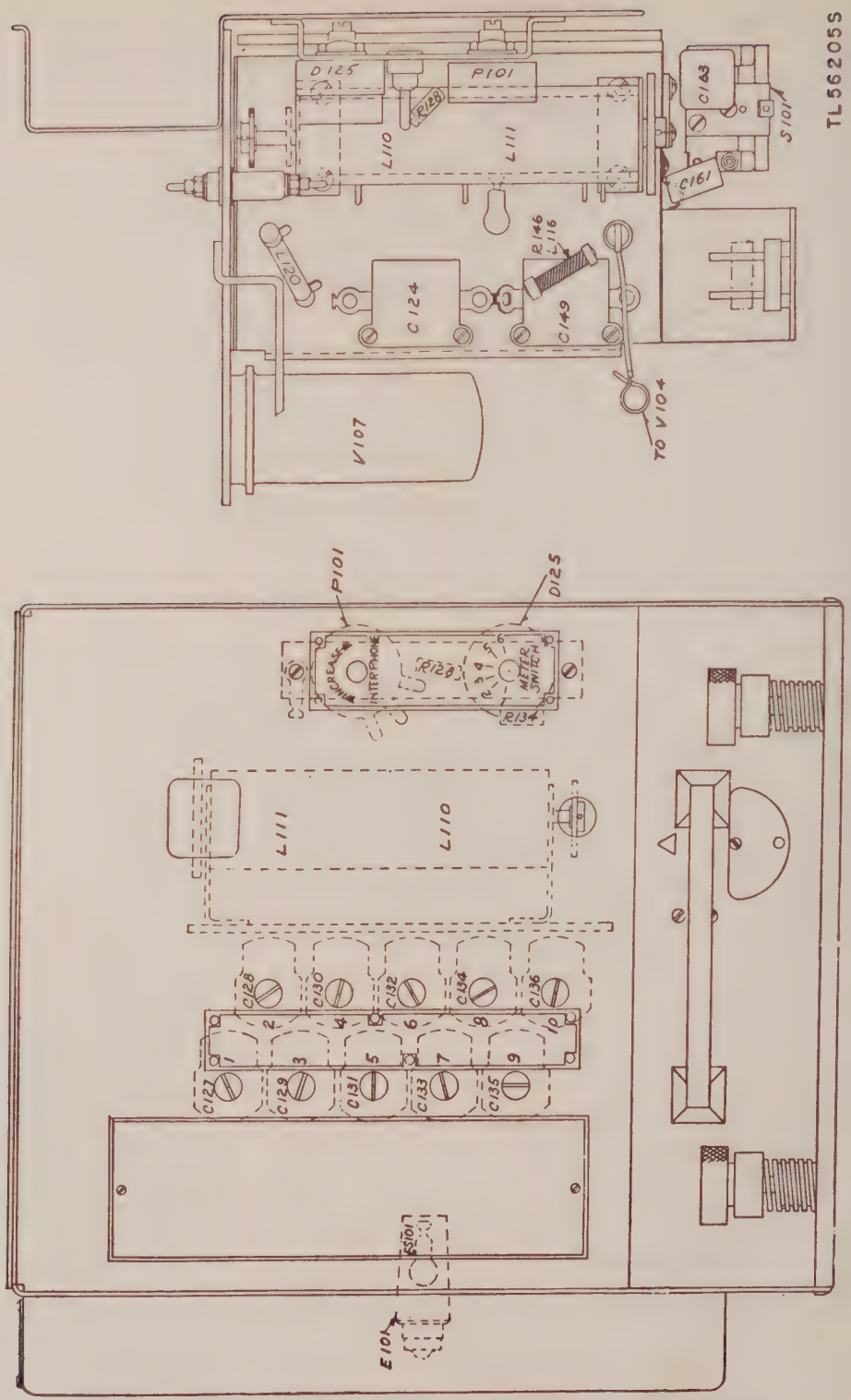


Figure 95. Radio Transmitter BC–604–(*), apparatus location diagram, end view and detail through section A–A.

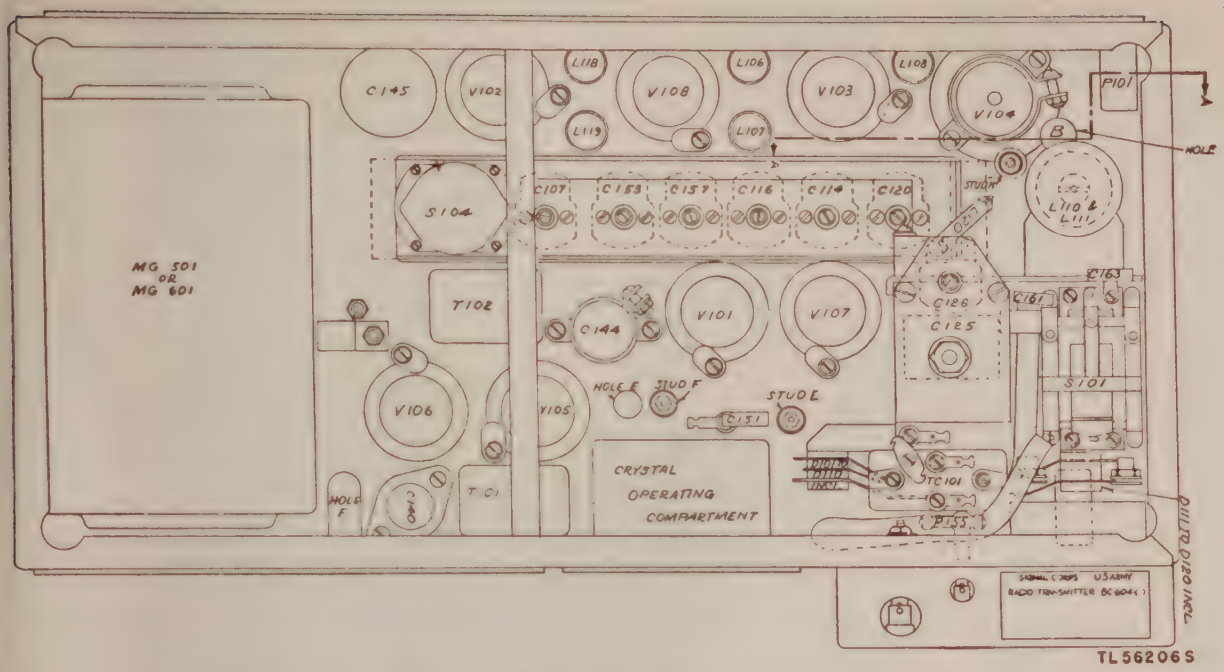


Figure 96. Radio Transmitter BC–604–(*), apparatus location diagram, top view.

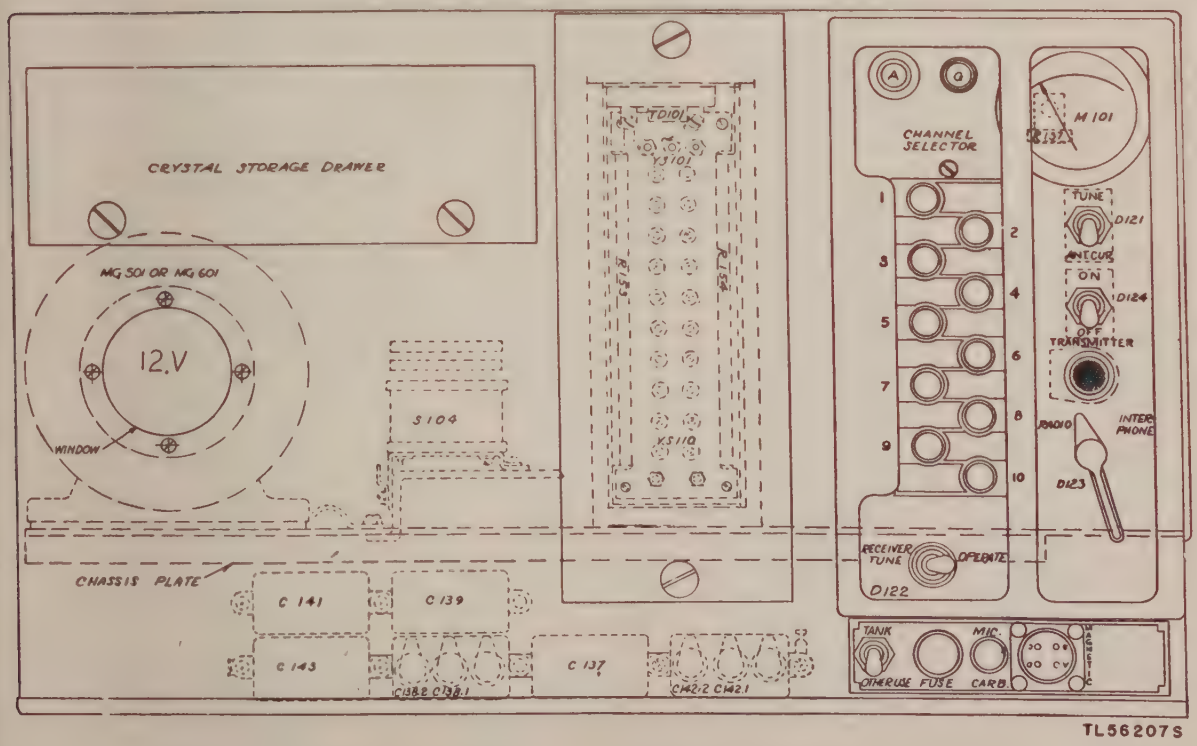
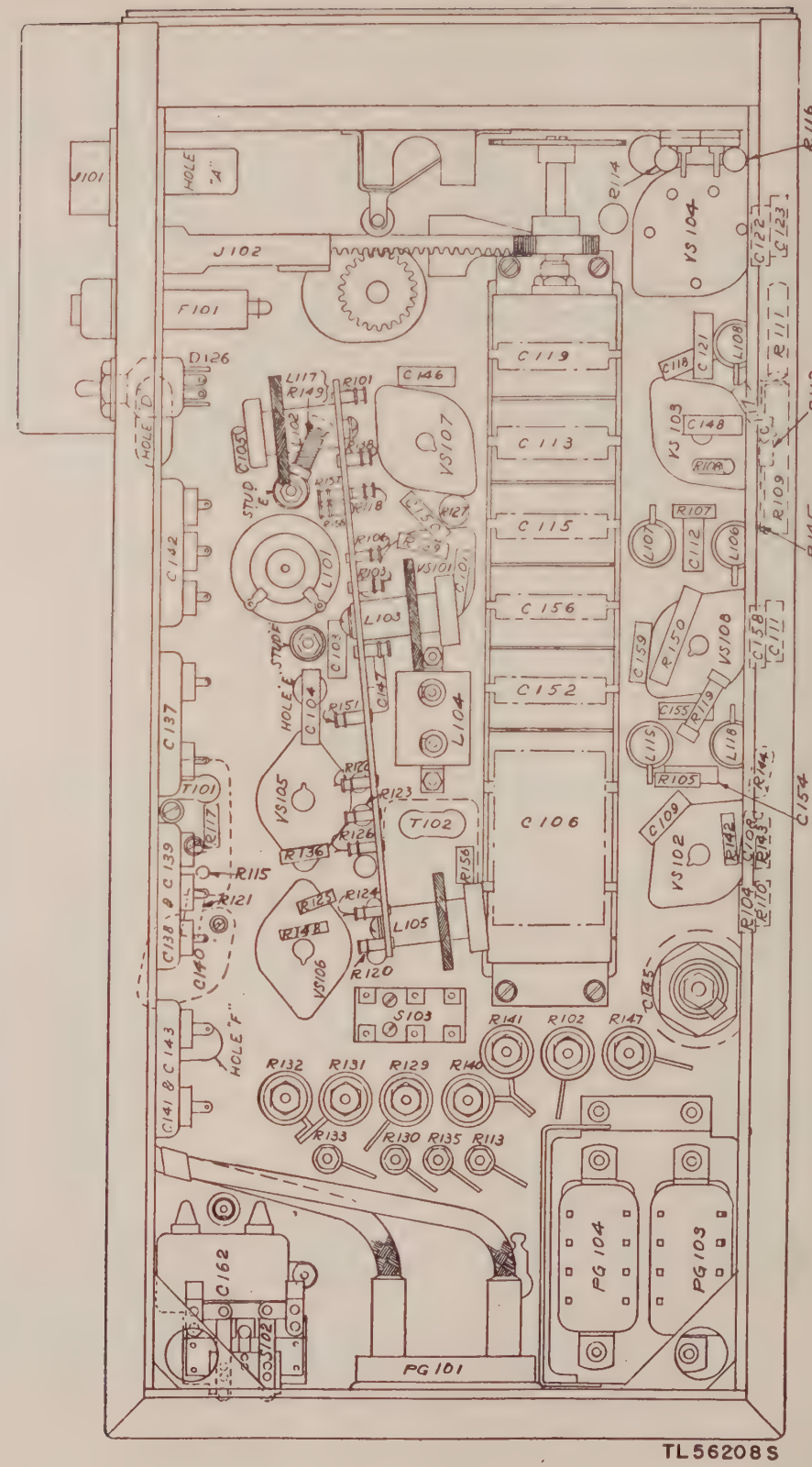


Figure 97. Radio Transmitter BC–604–(*), apparatus location diagram, front view.



TL56208S

Figure 98. Radio Transmitter BC-604-(*), apparatus location diagram bottom view.

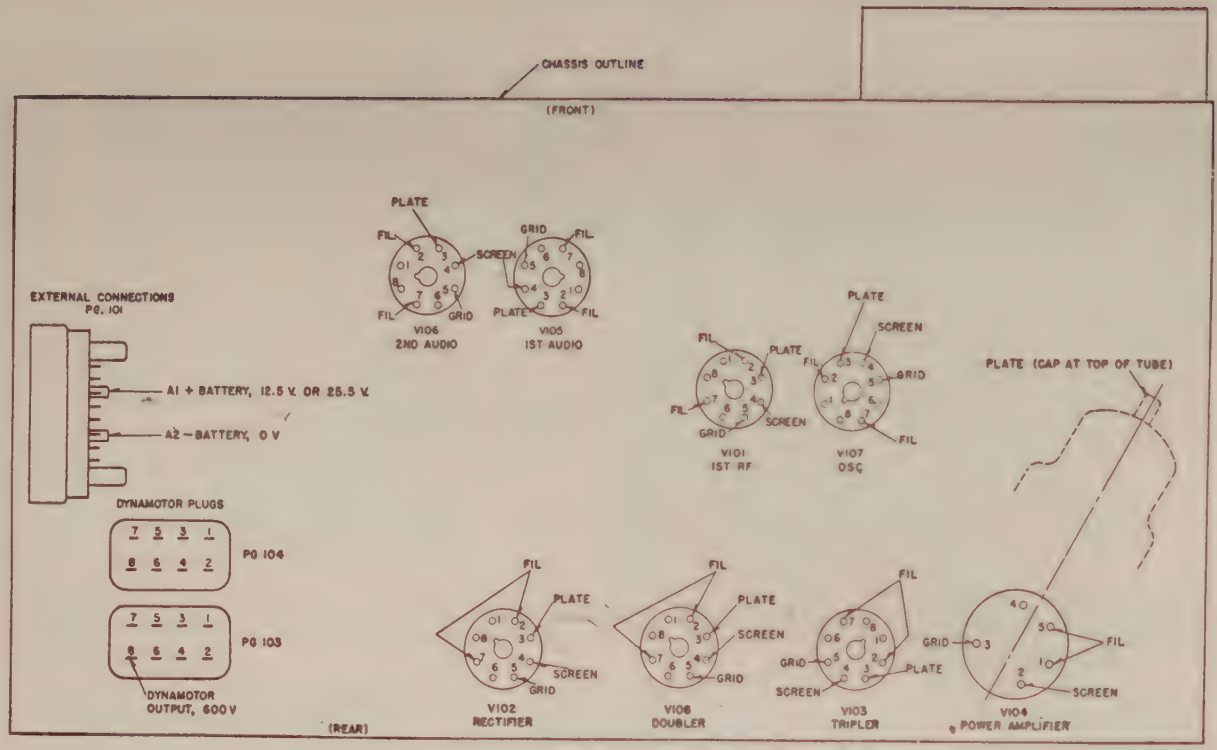


Figure 99. Radio Transmitter BC-604-(*), voltage diagram.

APPROXIMATE VOLTAGES AT PLUG TERMINALS		
12.5 VOLT BATTERY		
TERMINAL NOS.	PG 103	PG 104
1	0	12.5
2	0	12.5
3	0	12.5
4	-22	12.5
5	0	0
6	—	12.5
7	0	0
8	600	0
25.5 VOLT BATTERY		
TERMINAL NOS.	PG 103	PG 104
1	0	25.5
2	0	12.5
3	12.5	25.5
4	-22	25.5
5	0	0
6	—	12.5
7	12.5	0
8	600	0

CAUTION: DANGEROUS VOLTAGES ARE EXPOSED

NOTES:

1. LAYOUT CORRESPONDS WITH BOTTOM OF TRANSMITTER. DATA TAKEN WHILE TRANSMITTER IS OPERATING ON CHANNEL 79 INTO A PHANTOM ANTENNA. ALL VOLTAGES ARE MEASURED FROM DESIGNATED POINTS TO FRAME OF TRANSMITTER.
2. OBSERVED METER READINGS MAY EXCEED THE VALUES SHOWN BECAUSE OF RF VOLTAGE SUPERIMPOSED ON DC VOLTAGE AT SOME TERMINALS.
3. MEASUREMENTS TO BE MADE WITH CRYSTAL OVEN THERMOSTAT UNOPERATED.
4. FOR VOLTAGE MEASUREMENTS, USE VOLTMETER SCALES AS FOLLOWS: 0-3 V., 3 VOLT SCALE
   3-30 V., 30 VOLT SCALE
   30-300 V., 300 VOLT SCALE
   300-600 V., 600 VOLT SCALE

APPROXIMATE VOLTAGES AT VACUUM TUBE SOCKET TERMINALS

MEASUREMENTS WITH VOLTMETER OF 1000 OHMS PER VOLT								
TERM NOS	V101	V102	V103	V104	V105	V106	V107	V108
1	0	0	0	2.5	0	0	0	0
2	10	7.5	2.5	210	2.5	12.5	2.5	7.5
3	400	400	400	-20	200	370	100	400
4	130	50	220	—	40	220	40	100
5	-100	-30	-15	0	0	0	-6	-13
6	—	—	—	—	—	—	—	—
7	7.5	10	5	—	5	10	0	5
8	0	0	0	—	0	0	0	0
CAP	—	—	—	600	—	—	—	—

MEASUREMENTS WITH VACUUM TUBE VOLTMETER (RCA VOLTOHMYST OR EQUIVALENT)								
TERM NOS	V101	V102	V103	V104	V105	V106	V107	V108
1	0	0	0	2.5	0	0	0	0
2	10	7.5	2.5	210	2.5	12.5	2.5	7.5
3	400	400	400	— 50	220	370	100	400
4	180	50	220	—	40	220	40	100
5	-90	-35	-85	0	0	0	-9	-40
6	—	—	—	—	—	—	—	—
7	7.5	10.5	5.5	—	5	10	0	5.5
8	0	0	0	—	0	0	0	0
CAP	—	—	—	600	—	—	—	—

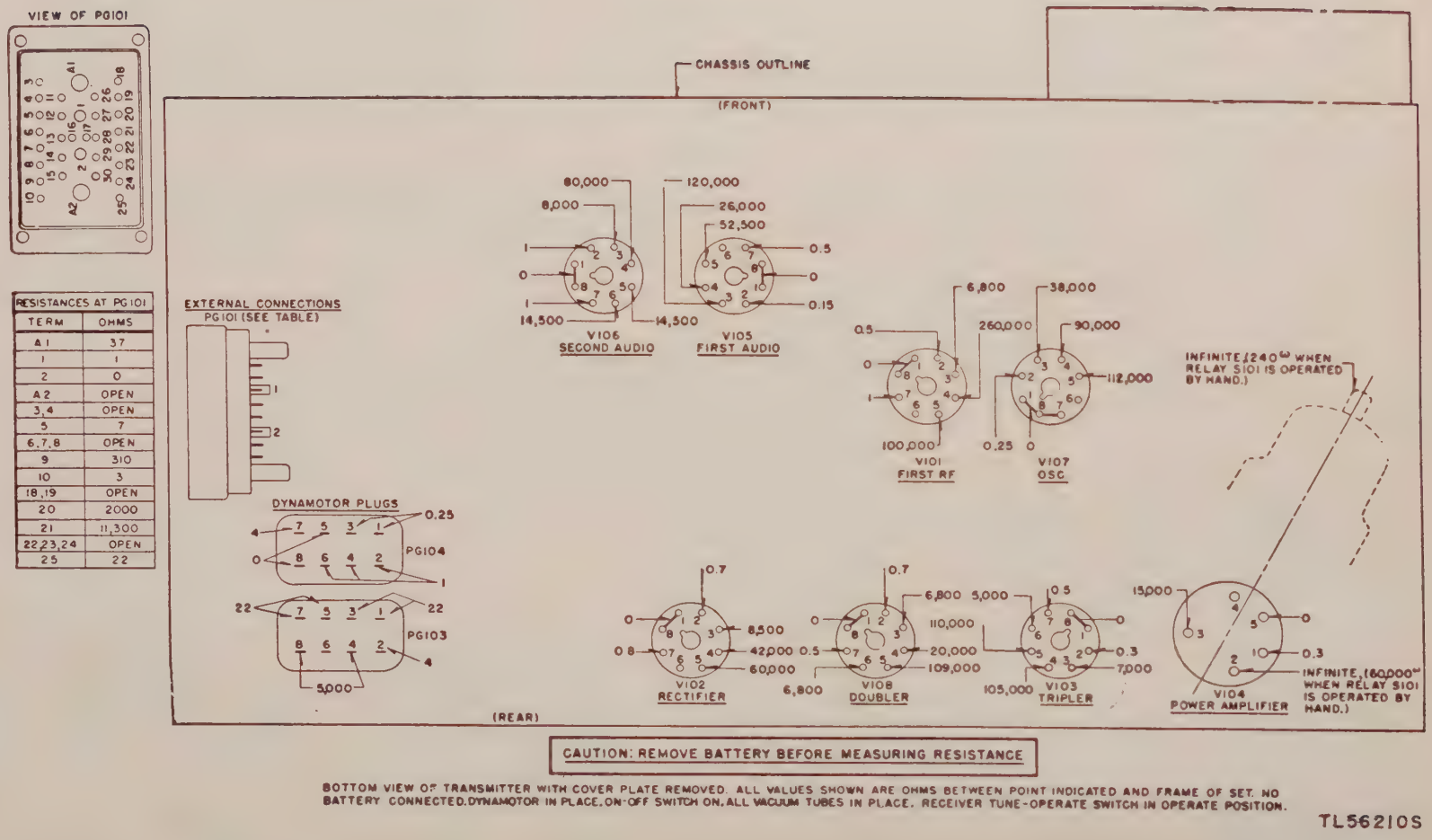


Figure 100. Radio Transmitter BC–603–(*), resistance diagram.

Section XVIII. TROUBLE SHOOTING DYNAMOTORS

170. General

a. A trouble-shooting chart for the dynamotors is given in paragraph 171. However, all of the indicated corrections are not authorized in the *field.* According to TB SIG 134, field reports and laboratory tests have shown that major repair operations on dynamotors, such as armature or field coil rewinding, commutator replacement, armature ball bearing replacement, or replacement of any part other than brushes, brush assemblies, brush holders, or parts of the filter assembly, has resulted in premature failures and consequent short operating life. The discontinuance of all major repair operations is, therefore, deemed necessary and, beyond preventive maintenance, only minor repair operations or the complete replacement of dynamotors is authorized in any repair organization.

b. The above limitations should be kept in mind when using the dynamotor trouble-shooting charts. For further information, refer to TB SIG 134.

c. Schematic and wiring diagrams are given in figures 125, 126, and 127.

171. Dynamotor Trouble-Shooting Chart

Symptoms	Probable trouble	Corrections
1. Failure to start, or dynamotor stops.	1. No d-c supply; open or loose connection.	1. Check d-c supply and tighten connections.
	Brushes not seated properly; dirty, sticking, or worn brushes.	Remove brushes. Clean thoroughly and reseat or replace as required.
	Poor commutation; dirty or rough commutator.	Clean commutator and brushes; if rough, sand with No. 0000 sandpaper, turn commutator and undercut mica.
	Worn bearings; armature strikes pole faces or connections.	Replace bearings.
	Defective armature; short-circuited or open-circuited.	Replace armature.
2. Excessive arcing at brushes.	2. Poor commutation; dirty or rough commutator.	2. Clean commutator and brushes; if rough, sand with No. 0000 sandpaper, turn commutator and undercut mica.
	Brushes not seated properly; dirty, sticking, or worn brushes.	Remove brushes. Clean thoroughly and reseat or replace as required.
	Defective brush spring.	Replace brush assembly.
	Short circuit between bars; dirty commutator.	Clean commutator, or replace armature.
	Open-circuited armature coil.	Replace armature.
3. Rapid brush wear.	3. Excessive arcing.	3. See step 2 above.
	High mica.	Replace armature.
	Dirty commutator.	Clean commutator and brushes; smooth with No. 0000 sandpaper.
4. Excessive noise picked up in Radio Receiver BC–603–(*).	4. Sparking at commutator.	4. See step 2 above.
	Loose connections.	Tighten connections.
	Capacitor open- or short-circuited.	Replace capacitor.
5. Excessive noise and vibration.	5. Armature striking internal wiring.	5. Rearrange wiring.
	Armature striking pole pieces.	Replace bearings.
	Worn bearings.	Replace bearings.

172. Replacement of Parts in Mounting FT–237–(*)

a. METHOD FOR REMOVING COAXIAL CABLES FROM L AND T CONNECTORS. (1) Remove the covers from the rear and end channels of the mounting.

(2) Unsolder at the ground clips the ground wires running from the ferrule of the coaxial cable to the ground clips in the channel; remove the varnished sleeving and bend the wires back from the channel.

(3) Remove the cover clips from the connectors and unsolder the connections inside the connectors.

(4) Loosen the Bristo setscrew on the under side of the connectors, cut the tie strings which hold the coaxial cable in position and pull out the coaxial cable and connectors from the rear channel.

(5) Cut the tie strings holding the coaxial cable in position in the end channel, unsolder the connection between the coaxial cable and the capacitor, remove the screw and nut from the coaxial cable ground clamp and pull out the coaxial cable from the end channel.

(6) With the connector held in a pair of gas pliers in the left hand, place the connector against the tip of a 200-watt soldering iron (held stationary) and remove the cable from the connector by pulling with the right hand when the solder in the connector has been heated sufficiently to become fluid. Remove the excess solder from the connector by tapping it while hot against a solid object. (This permits ready re-use of the connector.) The ground clip at the end of the coaxial cable may be removed and prepared for re-use in the same manner as for connectors.

b. METHOD FOR SOLDERING COAXIAL CABLES TO L AND T CONNECTORS. (1) Assemble the ground wire to the ferrule by wrapping bare, tinned 22-gage wire approximately three-quarters of a turn around the cable close to the ferrule and approximately 3 turns around the ferrule as close to the end of the ferrule as practicable. (The wire should be twisted around the open (flat) bead end of the cable.) Spot solder the wire to the ferrule (one spot) and cut off the wire end wrapped around the cable. The other end of the wire should be left approximately 3 inches long. Do not heat the coaxial any more than is absolutely necessary to solder it, otherwise the beads in the coaxial cable will soften.

(2) Insert the cable into the connector (L or T) far enough so that the bead is approximately 1/16 inch inside of the milled-out portion of the connector. With the connector and the cable held in a vertical position, solder the ferrule of the cable and the ground wire to the connector, using a 200-watt soldering iron and avoiding unnecessary heating of the cable.

(3) With the cable in a horizontal position, solder the ground clamp to the ferrule at the end of the cable. To avoid twisting the cable, solder the ground clamp at approximately 90° to the long axis of the portion of the connector having the Bristo setscrew.

(4) Place the cable in a position adjacent to and approximately parallel with the rear channel. Assemble the varnished tubing on the ferrule ground wires and connect and solder the ground wires to the ground clip at the J–401 and J–402 receptacles.

(5) Place the coaxial cable in the channel, push the connectors into position on the r-f terminals of the J–401 and J–402 receptacles and tighten the Bristo setscrews with a 3/32-inch Bristo hexagonal wrench. Assemble the ground clamp in the end channel with the screw and nut.

(6) Inside the connectors, twist together, solder and clip the coaxial cable wires and the wires from the r-f terminal on the J–401 and J–402 receptacles.

Note. Make sure that the beads are in position on the wire from the r-f terminals on the receptacles before twisting the wires together. If necessary, replace the beads.

Twist together, solder and clip the coaxial wire and the capacitor terminal in the end channel.

(7) Tie the coaxial cable to the hexagonal nut of the plunger pin assembly and to the local cable (approximately seven ties).

(8) Replace the channel covers.

173. Replacement of Parts in Radio Receiver BC–603–(*)

a. RELPACEMENT OF PUSH-BUTTON SELECTOR. To replace a push-button selector (tuner) unit in a receiver the following operations must be performed in removing the unit.

(1) *Connections to be unsoldered.* Unsolder seven (sometimes eight) electrical connections at the tuner unit (channel selector) to release it from other receiver apparatus.

(2) *Screws to be removed.* (*a*) Remove the four screws releasing the front guard of the receiver.

(*b*) Remove the eight screws releasing the front panel.

(*c*) Loosen the five screws in the rear of the tuner, releasing the tuner unit from the receiver chassis.

(3) *Method of replacing tuner (channel selector) unit.* To replace a tuner unit in Receiver BC–603–(*) the following operations are necessary:

(*a*) With the front panel guard and front panel removed from the receiver the tuner unit is inserted through the front panel opening into the chassis.

(*b*) The unit is loosely fastened to the chassis by five screws. See step (*e*) for tightening.

(*c*) With the tuner loosely in place the front panel is added, with its apparatus, and fastened securely to the chassis by eight screws.

(*d*) Add the front panel guard to the receiver, securing it firmly with four screws.

(*e*) Supplement step (*b*) above by securing the tuner firmly to the chassis with the five screws in the rear of the tuner. This procedure of fastening the five rear screws must be observed to avoid setting up strain while tightening the two front screws which hold the tuner in position. (The six other screws which hold the front panel do not affect the tuner.) Such possible strain might permanently impair the accuracy of the tuner. Check to see that all push buttons operate smoothly and do not bind on the receiver panel.

(*f*) Resolder the seven (sometimes eight) electrical connections at the tuner unit.

b. Replacement of Push Button (Plunger Assembly) in Channel Selector. (1) Release the push button setting as described in paragraph 189. Release all push buttons.

(2) *Removal of screws.* (*a*) Remove four screws to release the front panel guard.

(*b*) Remove eight screws to release the front panel.

(*c*) Remove four flathead screws to release the tuner front plate and latch plate assembly.

(3) *Removal of latch plate and push-button assembly.* Pull the lower end of the latch plate assembly outward slightly. Grasp the edges of the latch plate just behind the face plate and pull the latch plate downward. Pull the entire assembly outward gently to prevent jamming and nurse the top end of the latch plate past the edge of the mounting bracket. Pull the assembly further until it separates from the connecting rods.

(4) *Substitution of push button.* With the push buttons hanging downward, pull the latch plate back against its spring. Remove the faulty button and replace it with a new button making sure that the notch is in line with the notch on the other buttons. Allow the latch plate to return to normal.

(5) *Replacement of latch plate and push-button assembly.* Line up the latch plate assembly with the connecting rods. Release the latch plate and mesh each button separately, starting at the top. When all are properly meshed, pull all buttons forward so that the latch plate can release and hold them. Push the assembly into place carefully by nursing the latch plate past the mounting bracket while the latch plate is pulled down. When it is in position, release the latch plate and replace the flathead screws to hold it in place. Replace the front panel and the front panel guard. Set the push buttons for the desired channels as described in paragraph 189.

174. Replacement of Parts in Radio Transmitter BC–604–(*)

a. Replacement of Push-Button Selector Unit. The following operations must be performed in replacing a push-button selector unit of a transmitter:

(1) *Connections to be unsoldered.* (*a*) Unsolder the short and long coaxial cables at antenna post A on the rear of the front panel. Also unsolder R155 from this post.

(*b*) Unsolder the short coaxial cable at antenna relay S101.

(*c*) Unsolder at relay S101 capacitor C161 which connects a long coaxial cable to this relay.

(*d*) Unsolder, at the relay, the bare wire which connects the top of coil L111 to the antenna.

(*e*) Unsolder, at the bottom of output coil L110, the bare wire (covered with varnished tubing) which leads to power amplifier screen resistor R114 located in the bottom compartment of the chassis. Also unsolder the black-red wire leading from the coil to the local cable of the transmitter.

(*f*) Unsolder, at insulated stud E, the bare wire leading to the bottom of the left-hand tuner contact spring assembly.

(*g*) Unsolder, at the crystal oven, the 10 electrical connections to the tuner spring contact assembly.

(2) *Screws to be removed.* (*a*) Remove the screw on top of the selector to release the ground terminal lug and wire leading to ground post G on the rear of the front panel.

(*b*) Remove six screws from the thermocouple, releasing it from its electrical connections and mounting.

(*c*) Remove the screw which secures to the top of the tuner, the ground lug to which are connected the ground wires leading to the ferrules of the short and long coaxial cables.

(*d*) Remove the screw from the top of the tuner, releasing the clamp that holds the long coaxial cable in place across the top of the unit. Carefully bend this cable to the left so that it will not interfere with vertical movement of the tuner.

(*e*) Remove four screws, releasing antenna relay S101 from its location. Rotate the relay upward and to the right.

(*f*) Remove the gear from the bottom end of the tuner shaft by loosening the setscrew with the Bristo wrench, and remove the rack connecting the tuner to the six-gang capacitor.

(*g*) Remove the three screws at the base of the tuner, releasing it from the chassis.

(*h*) Remove the four screws in the panel guard and remove the guard; unscrew the seven front panel screws and rotate the panel about its right-hand edge (where cables are located) to remove the panel apparatus from the panel opening. Lift the channel selector unit out through the top opening of the transmitter.

(3) *Method of remounting channel selector.* (*a*) With the front panel guard removed and the front panel swung out of the way, insert the selector unit into the chassis through the top opening of the transmitter.

(*b*) Loosely fasten the unit to the chassis by the three screws applied into the base of the selector through the bottom opening of the transmitter.

(*c*) Repeat in reverse order the remaining steps of (1) and (2) above with the exception of step (2) (*f*).

Caution: When fastening the tuner firmly in position (after the front panel and its apparatus have been secured to the transmitter), observe that the tuner shaft rotates freely; if it does not, loosen the three mounting screws and shift the tuner until the tuner shaft is free to rotate without binding action. When locating the front panel and tuner in position, make sure the push buttons do not rub in the panel openings.

(*d*) With the six-gang capacitor fully engaged and the pin (on the disk by which this capacitor is manually rotated) resting against the front stop in the semicircular opening in the right end of the chassis, and with the single-section tuning capacitor at the top of the tuner also fully closed (maximum capacitance), insert the gear on the tuner shaft, assemble the rack in place, and securely tighten the setscrew on the gear. Note that the rack is centrally located and that it may be moved freely back and forth over its total travel.

b. Replacement of Capacitor Assembly (Including Six-Gang Capacitor and Trimmer Capacitors). To remove and replace a capacitor assembly in a transmitter the following operations are necessary:

(1) *Connections to be unsoldered.* Unsolder, through the bottom opening of the transmitter, all wires connecting to the six-gang capacitor.

(2) *Screws to be removed.* (*a*) Remove at the left-hand end of the gang capacitor, the screw which holds a bracket and insulated terminal in place.

(*b*) Through the top opening of the transmitter remove the four screws which secure RADIO-INTERPHONE relay S104 to the top of the capacitor assembly.

(*c*) Through the bottom of the transmitter remove four screws from the trimmer capacitor assembly bracket, releasing the entire capacitor assembly from the chassis.

(3) *Replacement of capacitor assembly.* Remove the capacitor assembly; replace with a new unit and reassemble in the reverse order from steps (1) and (2) above.

c. Replacement of Gang Capacitor in Gang Capacitor Assembly.

(1) Repeat the operations of *b*(1) and (2) above to release the entire capacitor assembly from the transmitter chassis.

(2) Unsolder all electrical connections between the six-gang capacitor assembly and the trimmer capacitors.

(3) Remove four elastic stop nuts on the six-gang capacitor assembly to release the bracket on which the associated trimmer capacitors are mounted.

(4) Separate the six-gang capacitor from the trimmer capacitor assembly bracket released by the stop nuts.

(5) Replace the six-gang capacitor with a new unit and reassemble, with the trimmer capacitor assembly, into the transmitter chassis.

d. Replacement of Trimmer Capacitor Assembly. (1) Repeat the operations of *c*(1) to (4) above.

(2) Replace the trimmer capacitor section with a new unit and reassemble, with the six-gang capacitor assembly, into the transmitter chassis.

e. Replacement of Push Button (Plunger Assembly) in Transmitter Channel Selector. To remove and replace a selector push button in the transmitter the following operations are performed:

(1) Unsolder the long and short coaxial cables at antenna post A on the rear of the front panel.

(2) Remove the screw from the frame at the top of the selector unit to release the ground terminal wire leading to ground post G on the rear of the front panel.

(3) Remove the tie-string which supports the short coaxial cable in position near the left-hand post of the panel meter.

(4) Remove the four screws holding the front panel guard.

(5) Remove the seven screws holding the front panel and rotate the panel outward about its right-hand edge.

(6) Remove the four screws on the tuner front plate and latch plate assembly in order to release the push buttons.

(7) Pull the defective plunger (push button) forward to separate it from its associated rod.

(8) Replace the plunger and reassemble.

f. Removal of Tuning Coils in Low-Power Stages. (1) Unsolder the leads to the upper and lower terminals of the defective coil winding (L106, L107, L108, L118, or L119).

(2) Break the glyptal seal at the bottom of the cylindrical metal tube in the top compartment.

(3) Unscrew the metal tube from the coil form.

(4) Remove the coil winding assembly from the chassis by withdrawing it from its location hole into the bottom compartment of the transmitter.

g. Removal of Coaxial Cable Terminals From Plug PG101. (1) Unsolder the ground straps between the coaxial cable ferrules and the chassis.

(2) Remove two screws and hexagonal nuts from each end of the plug to release the two metal plates (clamps) that hold the cable terminals in place.

(3) Remove the metal clamps and pull the cables and terminals from their locations in the plug.

175. Disassembly of Dynamotors for Lubrication of Armature Bearings (Fig. 60)

a. Remove the end bells (A) by cutting the keying wires on the end of the dynamotor.

b. Remove screws (B), washers (C), and lockwashers (D). Wipe out loose dust and dirt.

c. Take out screws (E) holding the bearing retainer plate (F).

d. Remove the retainer plate, being careful not to lose any shims from the end of the shaft.

e. To lubricate the armature bearings see paragraphs 87 and 88.

176. Disassembly and Reassembly of Dynamotor Armature (Fig. 60)

a. Armature Removal. (1) Remove both end covers (A).

(2) Remove the brush-holder caps (G) and brushes (H and I) at both ends of the dynamotor. Note that each brush is marked for correct replacement.

(3) Wipe loose dust or dirt from the unit.

(4) Disconnect the leads from the stator windings (K) to the brush holders at the high-voltage end of the unit.

(5) Remove the nuts (L) on the through

bolts (M) at the high-voltage end of the machine. Remove the high-voltage end bearing bracket (N).

(6) The armature may be slid out of the low-voltage end bearing and removed.

(7) Bearing bracket (0) on the low-voltage end may now be removed, if desired, after removing the stator connections at the end. The bearing brackets are so designed that they cannot be interchanged.

b. REASSEMBLY. Reverse the procedure for disassembly. Precaution should be taken not to scratch the commutator, damage the coil winding, or get dirt into the bearing. When remounting the bearing retainer plates, care should be taken in adjusting the shims as required so that the armature shaft has a perceptible end play (0.005 inch), not exceeding 0.005 inch. Shims should be of the proper diameter so as to bear between the outer race and the retainer plate. Use shims on both ends of the shaft; do not take up play by putting all shims on one end.

177. Rustproofing and Repainting

a. If the finish on the case is badly scarred or damaged, touch up the exposed surface in order to prevent rust and corrosion. Using No. 00 or No. 000 sandpaper, clean the surface down to the bare metal until the finish is bright and smooth. Apply paint with a small brush.

Caution: The use of steel wool is not recommended. Although it removes rust rapidly, small particles of metal fall into the case and may cause internal electrical shorting and grounding of circuits.

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

(1) Remove the chassis from the case.

(2) Clean corroded metal with dry-cleaning solvent (SD).

(3) If the dry-cleaning solvent (SD) does not remove the rust, use sandpaper to complete the rust removal.

(4) Mask the metal nameplates.

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

(6) By hand, touch up those areas adjacent to the nameplate which the spray failed to cover.

178. Unsatisfactory Equipment Report

a. WD AGO Form 468 (War Department Unsatisfactory Equipment Report) for equipment used by Army Ground Forces and technical services will be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C., when trouble occurs more often than is normal, as determined by qualified repair personnel.

b. AAF Form 54 (Unsatisfactory Report) for equipment used by Army Air Forces will be filled out and forwarded to Commanding General, Air Matériel Command, Wright Field, Dayton, Ohio, in accordance with AAF Regulation No. 15–54, when trouble occurs more often than is normal, as determined by qualified repair personnel.

Section XX. ALINEMENT AND ADJUSTMENT

179. Emergency Check of Receiver Output Volume and Circuit Alinement

a. GENERAL. When the testing equipment for precision servicing of a receiver is not available, a rough check of alinement of the receiver circuits may be made as described below. The tests described may be made with the receiver mounted in the vehicle. Misalined circuits so found may be realined with a minimum of testing apparatus by following the directions in paragraphs 180 and 181. The location of the alinement controls for the receiver is shown in figure 101.

b. TESTING APPARATUS REQUIRED.

1 transmitter known to be in good condition.
1 Microphone T–17 or Microphone T–33.
1 output meter of Test Set I–56–(*) equipped with a 3½-foot assembly of Cordage CO–144 and Plug PL–55.
1 voltohmmeter of Test Set I–56–(*), or a 1,000-ohm-per-volt voltmeter, 3-volt scale.

c. CHECK OF OUTPUT VOLUME. (1) Install the transmitter on the mounting.

(2) Plug in a microphone and adjust the transmitter and receiver to the same channel (the transmitter not operating).

(3) Connect the plug and cord assembly of Test Set I–56–(*) to the ± and voltmeter (VM) terminals of the output meter, adjust

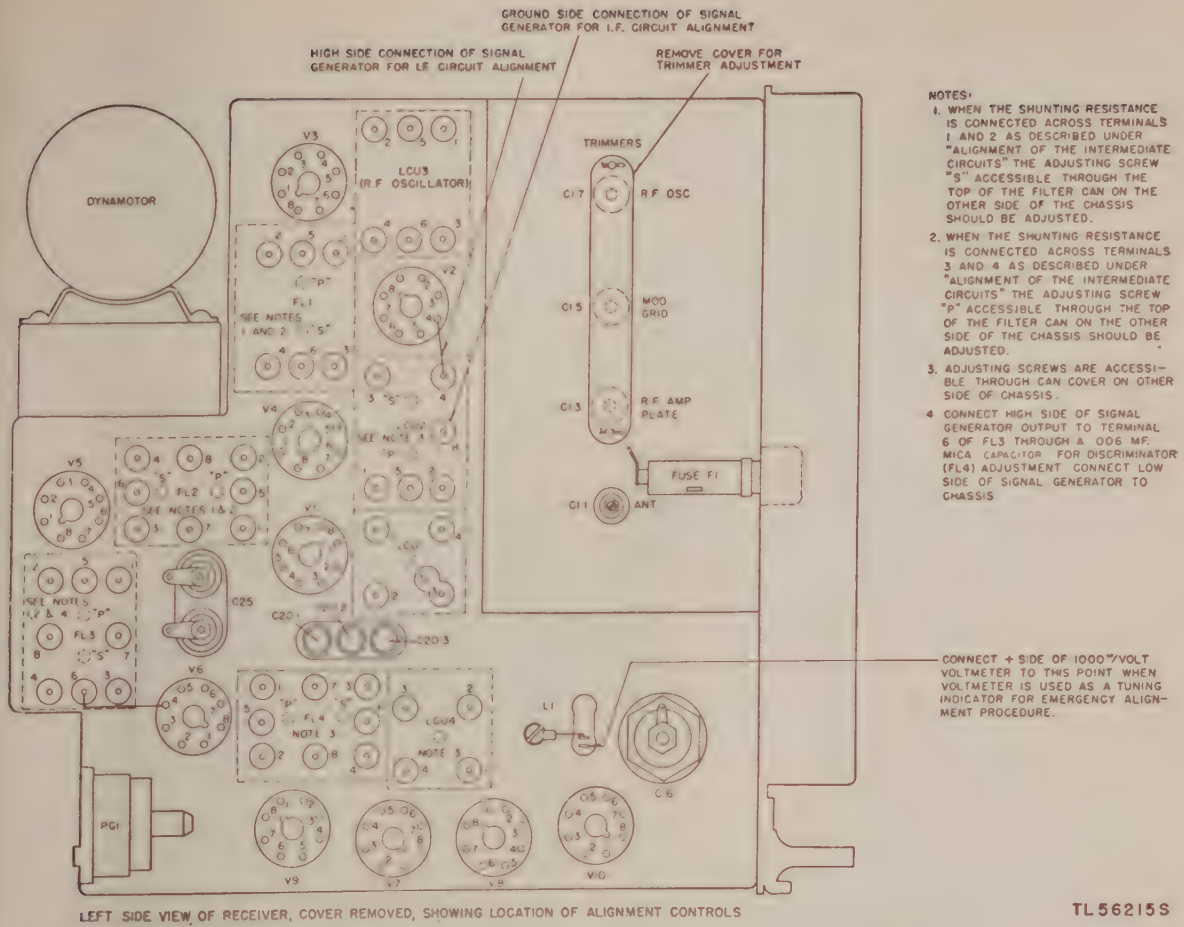


Figure 101. Radio Receiver BC–603–(*), location of alinement controls.

the meter for the 15-volt scale, and insert the plug into one of the PHONES jacks on the receiver.

(4) Turn the SPEAKER switch on, throw the TUNE-OPERATE switch to OPERATE, the RADIO & INT—ONLY switch to RADIO & INT, and the SQUELCH switch to OFF. Adjust the SENSITIVITY and VOLUME controls to the extreme right (maximum volume).

(5) Turn ON the transmitter and the receiver and, after the vacuum tubes are hot, throw the RECEIVER TUNE-OPERATE switch on the transmitter to RECEIVER TUNE.

(6) Operate the microphone switch and whistle for about 3 seconds or shout into the microphone. The output meter should indicate 12 volts or more; if it does not, check the receiver in accordance with section XVI. (Tune the receiver to the transmitter frequency.)

(7) Check the receiver VOLUME control by turning the control to the extreme left while whistling or shouting. The output meter reading should decrease uniformly to 1 volt or less; if it does not, it indicates that the volume control may be defective or the amplifiers may be noisy.

d. Check of Circuit Alinement. (1) Remove the receiver dust cover and place the receiver in the right-hand position of the mounting. Leave the left-hand position vacant.

(2) Turn the SPEAKER switch ON, throw the TUNE-OPERATE switch to TUNE, and the SQUELCH switch to ON. Adjust the SENSITIVITY and VOLUME controls to the extreme right.

(3) Press any convenient channel push button on the transmitter and start the transmitter filaments and the receiver. After the transmitter tubes have heated, throw the RE-

CEIVER TUNE-OPERATE switch to RECEIVER TUNE.

(4) Manually tune the receiver to zero beat with the transmitter frequency. Make sure that the CALL SIGNAL lamp lights. Read the setting of the receiver dial.

(5) Carefully adjust the tuning dial to each side of the zero-beat setting until the CALL SIGNAL lamp goes out. Note the two dial readings at which the lamp goes out. The lamp should remain lighted over approximately three channel divisions, and the zero-beat setting should be close to the center of this tuning range.

(6) Set the SENSITIVITY control to the extreme left (minimum sensitivity) and carefully adjust the tuning dial to each side of the zero-beat setting. The lamp should remain lighted over approximately two channel divisions; and the zero-beat setting should be at the center of this tuning range, within ± one-half channel.

(7) If the zero-beat setting is found to be not centered, in steps (5) and (6) above, obtain the *reduced-voltage* points as described in the following paragraph and realine the circuits as outlined in *e* below.

e. REDUCED-VOLTAGE POINTS. (1) Connect the voltmeter across the limiter cathode choke (L1), by connecting between terminal 5 of V6 and ground, with the — terminal of the meter connected to ground.

(2) Turn the SPEAKER switch OFF, set the TUNE-OPERATE switch on OPERATE, and throw the SQUELCH switch OFF.

(3) With the transmitter operating on RECEIVER TUNE, manually tune the receiver dial for a maximum deflection of the voltmeter. Note the voltmeter reading and the dial setting.

(4) Carefully adjust the tuning dial to each side of the maximum deflection until the voltmeter indicates three-fourths of the maximum voltmeter deflection. Note the two dial readings so obtained. These are the *reduced-voltage* points. The dial should be found adjustable to between ± ½ and ± 1 channel division without reducing the voltmeter indication to less than three-fourths of its maximum deflection.

(5) Throw on the SPEAKER switch and the SQUELCH switch, and turn the TUNE-OPERATE switch to TUNE.

(6) Tune for zero beat with the transmitter frequency. The zero-beat setting of the dial should be centered between the *reduced-voltage* points. If the zero-beat setting is not centered, the i-f oscillator should be adjusted as described in paragraph 181*b*(2). If the zero-beat setting is centered with respect to the *reduced-voltage* points but not centered with respect to the dial settings at which the CALL SIGNAL lamp goes out, realine the discriminator circuit, FL4, as described in paragraph 181*b*(5).

180. Emergency Alinement of Radio Receiver BC–603–(*), Using Good Receiver

a. GENERAL. When a receiver is found to be out of alinement it can be put into serviceable condition if another receiver in good condition or a transmitter in good condition is available. Check such emergency alinement in accordance with paragraph 184. The method using a good receiver is described first as it permits complete alinement of the receiver.

b. METHOD. (1) *Testing apparatus required.* The following testing equipment is required:

1 receiver known to be in good condition.
1 insulated ¼-inch hexagon socket wrench.
1 resistor, 1,000 ohms (not critical), equipped with clips. (The clips should be insulated, if possible, to avoid accidental short-circuits.)
1 voltmeter of Test Set I–56–(*) or other voltmeter of 1,000 ohms or more per volt, equipped with approximately 3-foot leads (preferably twisted) and clips.
1 twisted pair (1 wire with tracer) about 3 feet long, with clips at both ends, one wire to have a capacitor of 0.001 microfarad (mf) or larger between the wire and the clip.
1 wire about 8 inches long, with clips at both ends.
3 wires each about 1 inch long, with clips at each end.
1 cord CD–786.

Caution: When connecting or disconnecting these wires turn the receiver OFF each time to avoid shocks or equipment damage.

(2) *Preliminary steps.* The following steps in receiver alinement are divided functionally for convenience in description and understanding; but remember *that in most cases a change*

in the alinement of any of the parts involves checking the adjustment of the other parts. The receiver under test will be referred to as the *trouble* receiver in the following discussion.

(*a*) Remove the covers from both receivers.

(*b*) Place all switches at OFF (or downward) in both sets.

(*c*) Apply appropriate power to both sets. The two receivers must not be on the same mounting. Cord CD–786 is provided for such uses as this.

(*d*) Turn both sets ON and set the TUNE-OPERATE switches to TUNE.

(*e*) Allow both sets 10 to 15 minutes to warm up.

(*f*) Connect both chassis together using one wire of the above twisted pair. Use the wire which does *not* have the capacitor in series.

(3) *Tuning of I-F Oscillator and I-F Amplifier Tuned Circuits FL1, FL2, and FL3.* A signal from the i-f oscillator in the good receiver is picked up by connecting the 0.001-mf capacitor (which is attached to the twisted pair as discussed above) to terminal 7 of FL4 of the good receiver. The other end of the wire in series with the capacitor goes to the control grid (terminal 4) of the mixer (V2) in the trouble receiver (step (*c*) below). This signal passes through the i-f amplifier and is used to beat with the i-f oscillator in the trouble receiver. Thus this i-f oscillator can be tuned to agree with that in the good receiver. As a quantitative indicator for tuning the i-f circuits a 3-volt (1,000 or more ohms per volt) voltmeter is bridged across L1 (step (*e*) below). A rough adjustment of FL1, FL2, and FL3 (step (*f*) below) may be necessary in order to pass enough i-f tone for beating with the i-f oscillator. Unless the i-f amplifier in the good receiver is shorted (step (*b*) below), noise will be superimposed on the test signal. In order to avoid undesirable interference in the alinement, the r-f oscillator in the trouble receiver is disabled by increasing the bias on the grid (step (*a*) below). In order to avoid flattened response and consequent errors in alinement, the d-a-v-c load resistor, R14, is shorted (step (*a*) below). In alining the secondary of an FL unit a 1,000-ohm resistor is connected across the primary to improve the accuracy of the adjustment. Similarly, in alining the primary the resistor is connected across the secondary.

(*a*) Short-circuit terminals 7 and 8 of FL3, and short R14 of the trouble receiver. Also connect terminal 5 of V3 to C25, the side to which blue tracer wires are attached.

(*b*) Short terminals 1 and 2 of FL3 of the good receiver with short clip lead.

(*c*) Connect terminal 7 of FL4 in the good receiver through the series capacitor to terminal 4 of V2 in the trouble receiver. Use for this the remaining wire of the twisted pair (the wire which has the capacitor in series). The untwisted part at the ends should be as short as possible. The capacitor should be nearest to the good receiver.

(*d*) Place the SPEAKER switch of the trouble receiver at ON.

(*e*) Clip the 3-volt meter across L1 of the trouble receiver with the negative side on the ground lug.

(*f*) If the receiver is seriously misalined, adjust the slugs in FL3, FL2, and FL1, in that order, approximately for maximum meter reading.

Note. If no change in meter reading is observed when the slugs of FL3 are adjusted, turn the good receiver ON and OFF and note the deflection of the meter. If this does not cause any change in deflection the trouble receiver may be faulty and require service. If the deflection is too small for satisfactory reading, the connection at terminal 7 of FL4 may be moved to terminal 2 of FL4 to obtain a larger reading for the preliminary adjustment. After that preliminary adjustment it should be returned to terminal 7 of FL4 which gives a signal strength more appropriate for the subsequent tests.

Caution: The lockwashers on the tuning slugs of the tuned circuits may be damaged by turning the slug in too far. When any adjustment of these units is made, make sure that the tuning slug binds sufficiently to insure permanency of setting. If it feels loose during adjustment, tighten the lockwasher by turning it to the right with a small screwdriver.

(*g*) Aline LCU4 of the trouble receiver for zero beat and then turn the TUNE-OPERATE switch to OPERATE.

(*h*) Clip a 1,000-ohm resistor across terminals 3 and 4 of FL3. Adjust the primary slug, (P), for maximum meter reading.

(*i*) Remove the 1,000-ohm resistor and clip it across terminals 1 and 2 of FL3 and adjust

the secondary slug, (S), for maximum meter reading.

(*j*) Repeat step (*h*) for FL2.

(*k*) Repeat step (*i*) for FL2.

(*l*) Repeat step (*h*) for FL1.

(*m*) Repeat step (*i*) for FL1 and remove the 1,000-ohm resistor when the alinement is completed.

(*n*) It is advisable to check all adjustments, especially that of LCU4.

(4) *Tuning of FL4, Discriminator Circuit.* The voltmeter is connected across the discriminator load resistors (step (*a*) below). The secondary is adjusted for zero d-c output in this meter (step (*b*) below). As the secondary slug is adjusted through the proper point, the d-c reading will change polarity. The a-v-c is restored to operation and the delay bias removed (step (*c*) below); and the meter is connected across the resistor (R38) in the plate circuit of V1 (step (*e*), below) thus giving an indication of a-v-c action amplified through V1. The primary of FL4 can then be adjusted for a minimum reading in the meter. The 1,000-ohm shunt is used across the output of FL1 (step (*d*) below) to control the gain.

(*a*) Remove the meter and bridge it across terminals 3 and 7 of FL4. Polarity of the meter cannot be specified as it will depend on the adjustment.

(*b*) Aline the secondary of FL4 for zero reading on the meter. Note that as the slug is varied in either direction from the zero reading, the alinement meter should move *up* scale for one direction and *down* scale for the other.

(*c*) Remove the short from R14, and ground terminal 1 of FL4.

(*d*) Place the 1,000-ohm shunt between terminals 3 and 4 of FL1.

(*e*) Remove the meter and bridge it between terminals 5 and 1 of LCU2, the positive lead going to terminal 5. It may be necessary to use the 30-volt scale.

(*f*) Aline the primary of FL4 for *minimum* meter reading.

(*g*) Remove both the 1,000-ohm shunt and the meter.

(*h*) Remove the short between C25 and terminal 5 of V3.

(*i*) Remove the lead from terminal 4 of V2 of the trouble receiver, and from terminal 7 of FL4 of the good receiver.

(*j*) Remove the short between terminal 1 of FL4 and ground.

(5) *Tuning of R-F Oscillator, assuming intermediate frequency to be exactly 2.65 mc.* This involves beating the r-f oscillator of the trouble receiver with that of the good receiver to give zero beat in the loud speaker. The stray pick-up in the trouble receiver from the good receiver is sufficient so that no direct connection of the radio frequency between the two receivers is required. The i-f oscillator of the trouble receiver has been adjusted and is thus suitable for beating purposes. The meter is bridged across L1 (step (*a*) below) as an indicator to show when the current through the i-f amplifier is increasing even though the frequencies are not close enough together to give an audible beat. It is left in this position to show when LCU1 and LCU2 are properly adjusted. The short is placed across R14 (step (*b*) below) to avoid a flattened response curve. The i-f oscillator is turned on (step (*c*) below) to provide a beat note. At the upper end of the scale, the oscillator is set by adjusting trimmer C1.7 to give zero beat in the loudspeaker. Since the intermediate frequency is nominally 2.65 mc, there must be a corresponding difference between the two oscillators involved in order to produce a beat tone which will pass through the i-f amplifier. For the h-f end of the scale, set the trouble receiver dial at 28 mc and set the good receiver dial at (28.0 — 2.65 =) 25.35 mc. Then the trimmer, C1.7, is set for zero beat in the loudspeaker. For the low frequency end of the scale set the good receiver dial at 20 mc and the trouble receiver at 22.65 mc. With this setting the slug in LCU3 is set for zero beat. These two adjustments are then made alternately until the oscillator *tracks* satisfactorily at both ends of the band.

(*a*) Bridge the meter across L1 (negative terminal toward ground).

(*b*) Place a short across resistor R14.

(*c*) Place the TUNE-OPERATE switch of the trouble receiver at TUNE and throw the TUNE-OPERATE switch in the good receiver to OPERATE.

(*d*) Assuming the intermediate frequency to be 2.65 mc, set the good receiver at (28.0 — 2.65 =) 25.35 mc and the trouble receiver at 28 mc.

(*e*) Adjust the r-f oscillator trimmer capacitor C1.7 of the trouble receiver to give zero beat in the loudspeaker.

(*f*) Still assuming the intermediate frequency to be 2.65 mc, set the good receiver at 20 mc and the trouble receiver at (20.0 + 2.65 =) 22.65 mc and, in the same way, adjust the slug in LCU3 for zero beat.

(*g*) Repeat the two preceding steps until the r-f oscillator tracks at both ends of the band.

(6) *Check of intermediate frequency and readjustment of R-F Oscillator.* In the foregoing procedure it was assumed that the intermediate frequency was 2.65 mc. Actually a variation in this frequency over a moderate range will not interfere with satisfactory operation so long as the radio frequency is consistent with the intermediate frequency. For example, if the dial of the trouble receiver is set at 28 when the i-f amplifier (and oscillator) circuits of the good receiver and the trouble receiver are tuned for 2.5 mc, then set the dial of the good receiver at (28.0 — 2.5 =) 25.5 mc for alining the r-f oscillator in the trouble receiver. Otherwise the dial calibration will not be correct. For this reason, it is desirable to make the following tests which supplement paragraph 180*b*(5) rather than supersede it. The trouble receiver is set (in the middle of the range) at 24 mc and the good receiver is adjusted to a frequency which will give zero beat with the i-f oscillator in the trouble receiver. The reading on the dial of the good receiver should be very close to (24.0 — 2.65 =) 21.35. (This reading serves as a guide. The second beat, to be obtained near 26.65, is a better indication of the accuracy of adjustment.) A similar beat, though not so strong, can be obtained by tuning the good receiver the same distance above the trouble receiver. (If the beat note cannot be found readily, because of insufficient pick-up, connect the bared end of a piece of insulated wire to the ANT post of the trouble receiver and extend it across the top of the good receiver to act as an antenna. Remove this wire when the observation is complete.) This dial setting should be between 26.6 and 26.7 mc. This allows for the 0.05-mc tolerance at (24 + 2.65 =) 26.65 mc. If it falls within that range, the r-f oscillator is properly tuned and no further work on it is necessary. If not, steps (*d*) through (*g*) below should be followed. Assume, as an example, that the two dial settings giving zero beat were 21.35 and 26.35 mc. Half the difference between these frequencies represents the true intermediate frequency which, in this example, comes out as 2.5 mc. This figure is then used instead of 2.65 in steps (*d*) to (*g*) below. Ordinarily, the necessary correction will be obtained by a slight change in trimmer C1.7 at the high end of the scale. The procedure to be followed if a correction is necessary is described in steps (*a*) to (*g*) below.

(*a*) Set the dial of the trouble receiver to 24 mc.

(*b*) Adjust the dial of the good receiver to give zero beat at approximately 21.35 mc and note the dial reading at which it occurs.

(*c*) Leaving the trouble receiver tuned to 24 mc, retune the good receiver to obtain the (somewhat weaker) beat note between 26 and 27 mc. Note the dial reading.

(*d*) By subtraction, obtain the difference between the two dial readings obtained in steps (*b*) and (*c*).

(*e*) Divide this difference by 2.

(*f*) The value obtained in this way is the actual intermediate frequency.

(*g*) Repeat the alinement procedure ((5) (*d*) to (*g*), inclusive) for the r-f oscillator, using this value in place of 2.65 mc.

(*h*) Make certain that the r-f oscillator tracks at both ends of the band.

(*i*) Remove the short from terminals 1 and 2 of FL3 in the good receiver.

(*j*) Replace the cover on the good receiver.

(7) *Adjusting LCU1 and LCU2.* In tuning the r-f circuits, a shunt is placed across FL1 (step (*a*) above) to avoid limiting action. Also, R14 is shorted for reasons discussed above. If the trouble receiver is not in a mounting, the ground on the primary at LCU1 is floating. Therefore, terminal 4 of LCU1 must be shorted directly to ground (step (*b*) below). Also, short the antenna post (terminal 3 of LCU1) to terminal 4 and ground (step (*b*) below) as its effect on the adjustment of the secondary would be noticeable if it were allowed to float. Without the ground, this floating condition would exist as there is no termination across the primary of LCU1 when relying on stray pick-up for the test signal. For preliminary

alinement, at the top of the frequency band, the trimmers C1.1, C1.3, and C1.5 are adjusted to give maximum reading in the meter; at the bottom of the band, the slugs of LCU1 and LCU2 are adjusted for maximum meter reading. For final alinement, the 1,000-ohm shunt may be removed, the good receiver turned off and the final alinement of LCU1 and LCU2 may be made on noise alone at both ends of the scale. This procedure is given as step (*k*) below.

(*a*) Place a 1,000-ohm shunt between terminals 1 and 2 of FL1.

(*b*) Short terminals 3 and 4 of LCU1 to ground, using the shortest wires.

(*c*) Set the dial of the trouble receiver to 28 mc.

(*d*) Tune the good receiver at approximately 25.35 mc on the dial to give a beat note on the loudspeaker.

(*e*) Aline C1.1, C1.3, and C1.5 for maximum reading on the meter.

(*f*) Set the dial of the good receiver at 20 mc.

(*g*) Tune the trouble receiver at approximately 22.65 mc to give a beat note.

(*h*) Adjust the slugs in both the primary and secondary of LCU2 and the slug in LCU1 for maximum reading of the meter.

(*i*) Repeat steps (*c*) through (*h*) above until these units track at both ends of the band. (This completes the rough adjustment.)

(*j*) Turn the good receiver OFF.

(*k*) Repeat the alinement steps for LCU1 and LCU2 using noise background alone for maximum meter reading at both ends of the dial (20 and 28 mc).

(*l*) Remove the short from R14 and remove the 1,000-ohm shunt. Remove also the meter, and the short circuits from terminals 3 and 4 of LCU1 to ground.

(*m*) Replace all cover plates securely.

(*n*) Replace the dust cover.

(*o*) Reset the push buttons using a transmitter as described in paragraph 188.

(*p*) Place the set in its installation and trim C1.1.

181. Emergency Alinement of Radio Receiver BC–603–(*), Using a Transmitter

a. GENERAL. One, or possibly two, misalined circuits in a receiver may be approximately alined with the remaining circuits of a receiver in an emergency by using an associated transmitter, or the transmitter in a near-by vehicle, as a source of testing frequency. An emergency alinement should be checked in accordance with paragraph 184 as soon as practicable. Alinement of the r-f oscillator portion of the receiver (LCU3) by this method should not be attempted under emergency conditions. In the instructions which follow, it is assumed that the r-f oscillator is functioning properly.

Note. During the following tests operate the dynamotor only when reading the meter or making an adjustment which requires power from the dynamotor. For all these receiver tests, the RECEIVER TUNE-OPERATE switch of the transmitter should be at RECEIVER TUNE.

b. METHOD. (1) *Testing apparatus required.* The following testing equipment is required in addition to that listed in paragraph 179*b* for emergency checking of the receiver output and alinement:

1 insulated ¼-inch hexagon socket wrench.
1 IRC BT-½ 5,000-ohm resistor, or equivalent.
1 50-mmf mica capacitor equipped with clips and very short leads.
1 75-mmf mica capacitor equipped with clips and very short leads.
1 100-mmf mica capacitor equipped with clips and very short leads.

(2) *Emergency Alinement of I-F Oscillator.* Alinement of a replacement LCU4 tuning unit may be accomplished as follows:

(*a*) Install the transmitter on the mounting.

(*b*) Find the *reduced-voltage* points as directed by paragraph 179*e*, and make the setting halfway between.

(*c*) Remove the cover plate which permits access to the adjusting screw in LCU4.

(*d*) Vary the setting of this screw until a beat note is heard. Carefully adjust for zero beat. This step brings the replacement tuning unit, LCU4, into alinement with the i-f amplifier.

(3) *Emergency Alinement of I-F Amplifier.* Emergency alinement of a replacement i-f filter unit (FL1, FL2, or FL3) may be accomplished as follows:

(*a*) Install the transmitter on the mounting.

(*b*) Connect the voltmeter (3-volt scale) across the limiter cathode choke, L1, by con-

necting between terminal 5 of V6 and the chassis (— terminal of meter to chassis).

(*c*) Connect the 50-mmf capacitor between terminals 1 and 2 of tuning unit LCU2. (The capacitor reduces the signal input to the i-f amplifier sufficiently to prevent action of the a-v-c circuits from masking the desired tuning point in the test.)

(*d*) Turn the SPEAKER switch ON, throw the TUNE-OPERATE switch to TUNE, and turn the SQUELCH switch ON. Adjust the SENSITIVITY and VOLUME controls to the extreme right.

(*e*) Adjust the transmitter for operation near the 20-mc end of its frequency range and start the transmitter and receiver.

(*f*) Carefully adjust the receiver dial (use the same setting as on the transmitter) for zero beat with the transmitter signal and note the maximum deflection of the voltmeter as the dial is tuned through the zero-beat point. The meter deflection should decrease as the dial is varied to either side of zero beat. Restore the zero-beat adjustment when the observation has been completed.

(*g*) Remove the capacitor from LCU2 and note the reading of the voltmeter. The voltmeter reading with the capacitor in place should not be more than three-fourths of the reading with the capacitor removed. If it is more, the capacitor leads are too long, the clips are not making good contact, or the capacitor is too small. In the latter event, try a 75-mmf capacitor. Adjustment of the SENSITIVITY control may help to control the reading.

(*h*) Replace the capacitor.

(*i*) Detune the receiver by several channels (to a point where no signals are being received) and note the minimum voltmeter reading. (The voltmeter is effective as a tuning indicator only if its deflection is kept between the minimum value and the *three-fourths* reading above. Therefore, keep the deflection within this range at all times during emergency alinement procedure.)

(*j*) Remove the cover plates from the replacement tuning unit (FL1, FL2, or FL3) to be alined.

(*k*) Adjust the P (primary) and S (secondary) adjusting screws of the tuning unit for a rough approximation of the maximum voltmeter deflection.

(*l*) Connect the 5,000-ohm resistor between terminals 3 and 4 of the tuning unit being adjusted.

(*m*) Adjust the P screw for maximum voltmeter reading. (See note following step (*o*) below.)

(*n*) Remove the resistor from terminals 3 and 4 and connect it between terminals 1 and 2.

(*o*) Adjust the S screw for maximum voltmeter reading.

Note. Keep the voltmeter reading at about 0.5 volt by adjusting the SENSITIVITY control with the SQUELCH switch ON. Check the zero-beat setting occasionally as the work progresses.

(4) *Emergency Alinement of R-F Amplifier.* Emergency alinement of a replacement r-f tuning unit (LCU1 or LCU2) may be accomplished as follows:

(*a*) Install the transmitter on the mounting.

(*b*) Connect the voltmeter (3-volt scale) across the limiter cathode choke (L1) by connecting between terminal 5 of V6 and the chassis (— terminal of meter to chassis).

(*c*) Connect the 100-mmf capacitor between terminals 1 and 2 of filter unit FL1. (The capacitor reduces the signal input to the i-f amplifier sufficiently to prevent action of the a-v-c circuits from masking the desired tuning point in the test.)

(*d*) Remove the cover plates from the LCU1 and LCU2 tuning units and from the trimmer capacitors, C1.3, C1.5, and C1.7. (The latter cover plate is beside C24.)

Caution: Do not disturb the setting of the oscillator trimmer capacitor, C1.7, during this test.

(*e*) Turn the SPEAKER switch on, set the TUNE-OPERATE switch to TUNE, and turn the SQUELCH switch ON. Adjust the SENSITIVITY and VOLUME controls to the extreme right.

(*f*) Adjust the transmitter for operation near the 28-mc end of its frequency range and start the transmitter and receiver.

(*g*) Carefully adjust the receiver dial for zero beat with the transmitter (receiver and transmitter dials should read the same.) Adjust each of trimmer capacitors C1.1, C1.3, and C1.5, for maximum voltmeter deflection. If the 100-mmf capacitor bridged across terminals 1 and 2 of FL1 has not reduced the signal strength (from the transmitter) sufficiently to obtain a good range of meter deflection, a fur-

ther reduction may be obtained by connecting that capacitor across terminal 1 and 2 of either FL2 or FL3 instead of FL1. When the trimmers are properly set, the voltmeter deflection decreases as the set is detuned from the zero-beat point.

(*h*) Remove the 100-mmf capacitor shunt from terminals 1 and 2 of the filter unit shunted as called for in step (*g*) above. The voltmeter reading with the capacitor in place should be not more than three-fourths of the reading with the capacitor removed. If it is more, the capacitor leads are too long, or the clips are not making good contact.

(*i*) Replace the capacitor and trim the settings of C1.1, C1.3, and C1.5 if necessary.

(*j*) Operate the transmitter near the 20-mc end of its frequency range and carefully adjust the receiver to zero beat with the transmitter. Receiver and transmitter dials should read the same.

(*k*) Adjust the P (primary) and S (secondary) adjusting screws in tuning unit LCU2, and the single adjusting screw in LCU1 for maximum deflection of the voltmeter.

(*l*) Readjust the transmitter and receiver to the highest test frequency and trim C1.1, C1.3, and C1.5 for maximum voltmeter deflection.

(*m*) Check back and forth between the two test frequencies, repeating steps (*k*) and (*l*) above until no further improvement can be made.

(*n*) Restore the receiver to normal and check the antenna trimmer capacitor as described in paragraph 189.

(5) *Emergency Alinement of Discriminator.* A replacement discriminator filter unit (FL4) may be alined in an emergency as follows:

(*a*) Install the transmitter on the mounting, if necessary.

(*b*) Connect the voltmeter (3-volt scale) across the limiter cathode choke, L1, by connecting between terminal 5 of V6 and the chassis (— terminal of meter to chassis).

(*c*) Connect the 100-mmf capacitor between terminals 1 and 2 of filter unit FL2. (The capacitor reduces the signal input to the i-f amplifier sufficiently to prevent action of the a-v-c circuits from masking the desired tuning point in the test.)

(*d*) Remove the cover plate from filter FL4.

(*e*) Turn the SPEAKER switch ON, turn the TUNE-OPERATE switch to TUNE and turn the SQUELCH switch OFF. Adjust the SENSITIVITY and VOLUME controls to the extreme right.

(*f*) Adjust the transmitter for operation near the 20-mc end of its frequency range and start the transmitter and receiver.

(*g*) Carefully adjust the receiver tuning dial for zero beat with the transmitter frequency. Observe that zero beat occurs at maximum deflection of the voltmeter and note the maximum reading.

(*h*) Remove the capacitor from FL2 and note the new voltmeter reading. The voltmeter reading with the capacitor connected to FL2 should not exceed three-fourths of the reading with the capacitor removed. If it does, the capacitor leads are too long, or the clips are not making good contact.

(*i*) Reconnect the capacitor to terminals 1 and 2 of FL1.

(*j*) Ground terminal 1 of FL4 to the chassis with a short lead. Remove the voltmeter from across L1 and connect it between terminals 3 and 7 of filter FL4 (3-volt scale, + terminal to terminal 3 of filter).

(*k*) Check the zero-beat setting of the dial while observing the voltmeter. The meter should read zero at zero beat and reverse polarity as the receiver is tuned through the zero-beat point. If this is not the case, filter FL4 should be adjusted as directed below.

(*l*) Restore the zero-beat setting of the tuning dial and adjust the S (secondary) adjusting screw in FL4 for zero voltmeter reading.

(*m*) Remove the voltmeter from FL4 and connect it between terminals 1 and 5 of tuning unit LCU2 (+ terminal of voltmeter to terminal 5 of LCU2).

(*n*) Adjust the P (primary) screw in filter FL4 for a minimum deflection of the voltmeter.

(*o*) Reconnect the voltmeter to terminals 3 and 7 of FL4 and recheck the adjustment of screw S in FL4 as in step (*l*) above.

(*p*) Restore the receiver to normal.

182. Emergency Alinement of Radio Transmitter BC–604–(*)

a. GENERAL. The test procedures described hereafter are intended to apply when it is

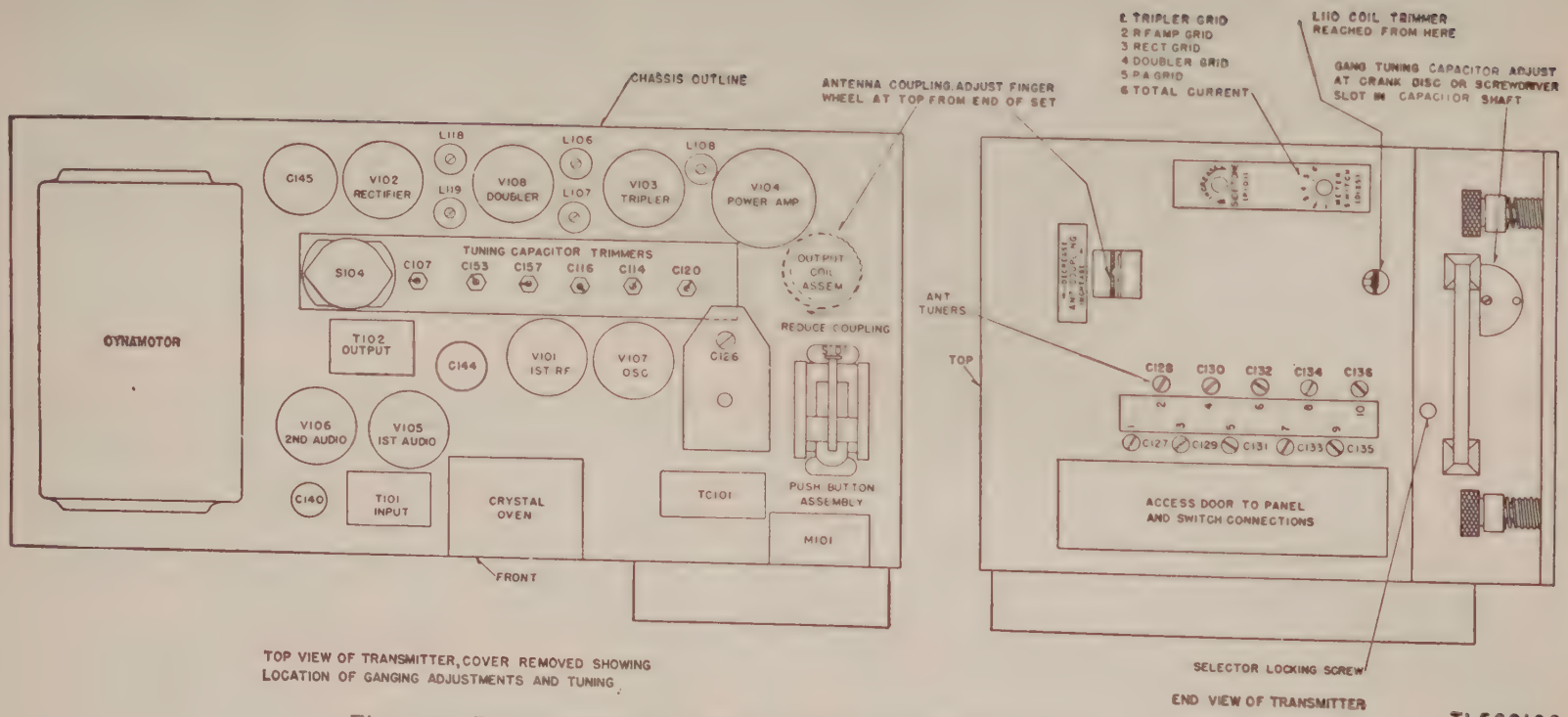


Figure 102. Radio Transmitter BC–604–(*), location of alinement and tuning controls.

necessary to replace one or more transmitter components which are likely to affect alinement of the transmitter tuned circuits and a precision wavemeter is not available for use. The critical components are: coils L101, L103, L104, L105, L106, L107, L108, and L110; the ganged adjustable capacitor assembly C106, C113, C115, C119, C125, C152, and C156; and trimmer capacitors C107 (if used in the transmitter under test), C114, C116, C120, C126, C153, and C157. Replacement of capacitor C147 or the channel selector assembly also necessitates checking alinement of the circuits. The location of the alinement controls for the transmitter is shown in figure 102.

Note. During the following tests operate the dynamotor only when reading the meter or making an adjustment which requires power from the dynamotor. Paragraph 40 should be read and understood before the following or other servicing tests are made.

b. Testing Apparatus Required.

1 narrow-blade (1/8-inch) screwdriver or preferably a long handled hexagon adjusting tool.

1 rule (6 inches by 3/16 inches wide).

c. Preliminary to Alinement. It is desirable to check the operation of the oscillator and metering circuits prior to emergency alinement of the transmitter circuits. This may be done as follows:

(1) Insert a low-numbered and a high-numbered crystal (preferably channel 0 and channel 79) in sockets numbered 1 and 10, respectively, in the crystal operating compartment.

(2) Set the METER SWITCH to position 2 (first r-f amplifier grid current), turn the TUNE-ANT CUR switch to TUNE, and unlock the channel selector. This is described in paragraph 188*b*(7) and (8).

(3) Press selector push button No. 1, start the transmitter, and operate the RECEIVER TUNE-OPERATE switch to RECEIVER TUNE.

(4) Observe the reading on the panel meter.

(5) Repeat steps (3) and (4) above for push button No. 10. If meter readings are noted for both these frequencies the oscillator is operating properly.

d. Emergency Alinement of R-F Amplifier. (1) In later transmitters C107 has been omitted, but if there is a C107 in the transmitter under test see that it is set to the minimum capacitance position (open end of slot to left as viewed from the front of the transmitter).

(2) Press push button No. 10 and start the transmitter. Set the METER SWITCH to position 3 (rectifier grid current) and the RECEIVER TUNE-OPERATE switch to RECEIVER TUNE.

(3) Adjust the gang capacitor assembly for maximum deflection of the meter.

(4) Press push button No. 1 and repeat step (3) above.

(5) Carefully release push button No. 1, carefully turn the gang capacitor control to its extreme front position, and lock the selector unit as described in paragraph 188*b*(19).

(6) Check the selector adjustments by pressing the No. 1 and No. 10 push buttons and observing the maximum meter deflection at each frequency as the gang capacitor assembly is rotated slightly against the restoring force of the selector. *Do not attempt to rotate the capacitor assembly more than a few degrees.* The test meter should indicate a maximum at the settings determined by the selector. If this is not the case, repeat steps (2) to (6), inclusive, until the proper adjustment of the selector is obtained.

a. Emergency Alinement of Rectifier. Since the filters following the rectifier are primarily responsible for selection of the correct crystal harmonic frequency it is important that these circuits be disturbed as little as possible when replacing components which affect the alinement.

(1) If L118 or L119 has been replaced, adjust the tuning slugs to about 1 inch from the open end of the coil as measured with the scale mentioned in paragraph 182*b*.

(2) Set the METER SWITCH to position 4 (grid current of doubler).

(3) Start the transmitter at the h-f end of its range (by pressing the appropriate selector button and throwing the RECEIVER TUNE-OPERATE switch to RECEIVER TUNE).

(4) Adjust C153 and C157, respectively, for maximum deflection of the meter.

(5) Adjust the transmitter to the low-frequency (l-f) end of its range (by pressing the appropriate selector button and throwing the RECEIVER TUNE-OPERATE switch to RECEIVER TUNE). Adjust L119 and L118, in turn, for maximum meter deflection.

(6) Repeat steps (3), (4), and (5) above

until no further increase in meter deflection can be obtained.

(7) Start a near-by receiver, throw the SPEAKER switch to ON, the TUNE-OPERATE switch to TUNE, and the SQUELCH switch to ON. Adjust the SENSITIVITY control so that the receiver is operated by only *one* frequency from the transmitter. This frequency, as determined from the receiver dial calibration, should be that for which the transmitter is tuned. If it is not, readjust the filter circuits but with a somewhat different initial setting of the tuning slugs in L118 and L119 until the receiver (used as a wavemeter) indicates that this stage has been alined properly, and the correct harmonic has been chosen by the L118, L119, and C153, C157 circuits.

f. Emergency Alinement of Doubler. (1) If L106 or L107 has been replaced, adjust the tuning slugs to about 1 inch from the open end of the coil.

(2) Set the METER SWITCH to position 1 (grid current of tripler).

(3) Start the transmitter at the h-f end of its range.

(4) Adjust C114 and C116, in turn, for maximum deflection of the meter.

(5) Adjust the transmitter to the l-f end of its range and adjust L106 and L107 for maximum meter deflection.

(6) Repeat steps (3), (4), and (5) above until no further increase in meter deflection is obtainable.

g. Emergency Alinement of Tripler. (1) If L108 has been replaced, adjust the tuning slug to about 1 inch from the open end of the coil.

(2) Set the METER SWITCH to position 5 (grid current of power amplifier).

(3) Start the transmitter at the h-f end of its range and adjust C120 for maximum meter deflection.

(4) Adjust the transmitter to the l-f end of its range and adjust L108 for maximum deflection of the meter.

(5) Repeat steps (3) and (4) until no further increase in meter deflection is possible.

h. Emergency Alinement of Power Amplifier. (1) If the L110–L111 coil assembly has been replaced, adjust the tuning slug at the bottom of L110 to the center of its range in variation.

(2) Set the METER SWITCH to position 6 (total plate and screen current) and make sure the RECEIVER TUNE-OPERATE switch is at OPERATE and left there for the following power amplifier tests.

(3) Set for minimum coupling of L111 to L110 (rotation of the coupling control to the right). Detune C136 by setting it to the maximum capacitance position and detune C127 by adjusting it to the minimum capacitance position.

(4) Start the transmitter at the h-f end of its range (for this test the dynamotor must be started by operating a microphone switch), and adjust C126 for a *minimum* deflection of the meter. If a tuning point cannot be found, try a different setting of the L110 adjusting slug.

(5) Adjust the transmitter to the l-f end of its range and adjust the slug in L110 for a *minimum* deflection of the meter. Adjust this slug by inserting a screwdriver through the hole in the end of the transmitter and turning the slug adjusting gear.

(6) Adjust C126 at the higher frequency and L110 at the lower frequency until no further reduction in the meter deflection can be made at either end.

183. Emergency Sources of Test Tones

In the absence of a test oscillator, test tones can be obtained from a receiver or a transmitter known to be in good condition. The methods of doing this are discussed in detail in paragraph 153 for the receiver and paragraph 158 for the transmitter. Signal sources other than a signal generator are summarized as follows:

a. Audio-Frequency Signal. (1) A good receiver will provide a-f noise when there is no input signal.

(2) If two good receivers are available they can be used together to provide a beat note.

(3) A good transmitter can be used with a microphone into which the operator hums or whistles. The resulting audio output can be picked up for test purposes.

b. Intermediate-Frequency Signal. This can be obtained from a good receiver.

c. Radio-Frequency Signal. This may be obtained from either a receiver or a transmitter.

d. ATMOSPHERIC NOISE. Atmospheric noise may be used as a signal source in the absence of another signal source. Since noise is an indefinite sort of signal (no precise frequency) and the i-f bandwidth is considerably wider than the range of frequency which may be heard, the number of circuits alined by this means should be a minimum.

e. SIGNALS FROM DISTANT VEHICLE. Signals from a vehicle about 10 miles distant may be used as a rough check of receiver sensitivity, particularly when such signals are compared to the noise background when the distant transmitter is off the air.

f. SIGNALS FROM NEAR-BY VEHICLE. Signals from a near-by tank which is operating into Antenna A–62 (Phantom), instead of the regular antenna structure, may be strong enough for testing purposes and the range over which such signals may be intercepted by the enemy is very restricted.

184. Precision Alinement of Radio Receiver BC–603–(*)

a. GENERAL. Whenever a complete inspection of a receiver is made, check alinement of the tuned circuits as follows:

b. TESTING APPARATUS REQUIRED.

1 adapter FT–384–(*).
1 insulated ¼-inch hexagon socket wrench.
1 output meter from Test Set I–56–(*) or equivalent.
1 voltohmmeter I–107 or equivalent.
1 signal generator (frequency modulated).
1 Cornell-Dubilier capacitor, type 1 watt, 0.006 mf, or equivalent, with suitable clips.
1 IRC resistor, type BT–½, 1,000 ohms, or equivalent, equipped with insulated clip connectors.

Caution: When connecting or disconnecting these wires, turn the receiver OFF each time to avoid shocks.

Adapter FT–384–(*) is a switching box for connecting test meters in various parts of the circuit to facilitate alinement procedure. Photographs and a circuit diagram are shown in figures 103, 104, and 105.

c. ALINEMENT OF DISCRIMINATOR CIRCUIT (FL4) AND I-F OSCILLATOR CIRCUIT (LCU4). When alining the i-f amplifier or discriminator, if no shielded room is available and disturbing interference from near-by electrical equipment is observed, this interference can be minimized by connecting a short strap lead from terminal 5 of V3 to C25 (the terminal to which blue-

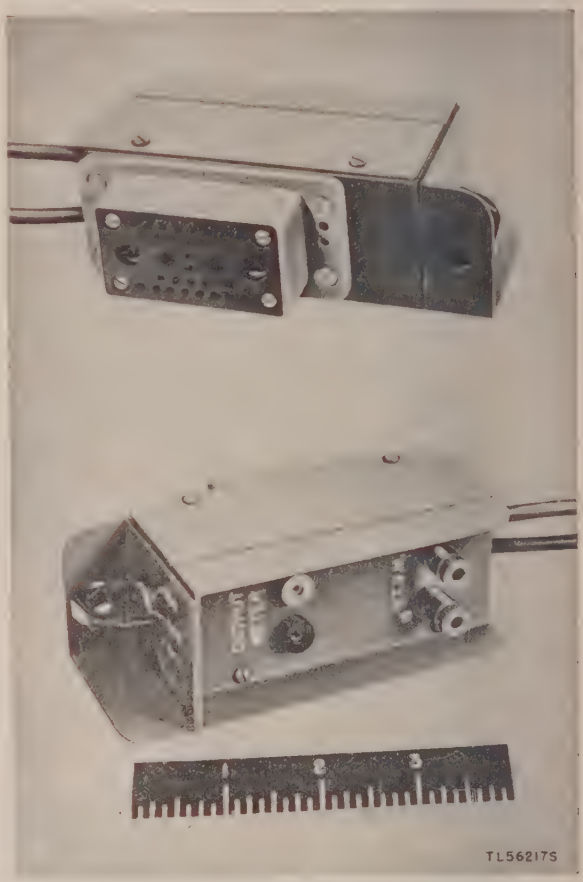


Figure 103. Adapter FT–384–(*) front and back views.

tracer wires are connected), whenever using the intermediate frequency.

(1) Remove the dust cover from the receiver.

(2) Make sure that a dynamotor of the correct primary voltage rating is in place.

(3) Loosen the cover plates from LCU1, LCU2, FL1, FL2, FL3, FL4, and LCU4. (The plates may be loosened by removing the cotter pin at one end.)

Caution: Do not remove the cover plate from LCU3.

(4) Set the receiver controls as follows: the SPEAKER switch ON, the SENSITIVITY and VOLUME controls to the extreme right, the TUNE-OPERATE switch at OPERATE, the

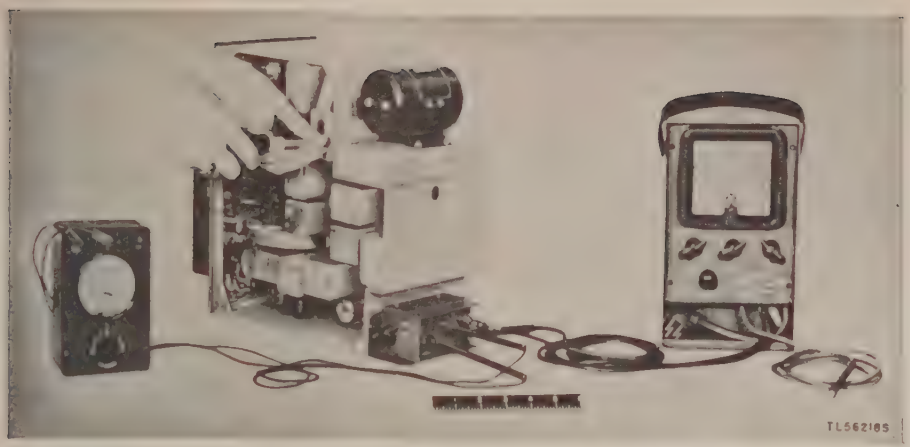


Figure 104. Adapter FT–384–(*), application to Radio Receiver BC–603–(*).

REC switch OFF until ready, the RADIO & INT–INT ONLY switch at RADIO & INT, and the SQUELCH switch OFF.

(5) Set up Voltohmmeter I–107–(*) as follows: Connect the battery plug attached to the short cable at the bottom of the voltohmmeter to a Battery BA–40. Set the SELECTOR switch for — VOLTS and the RANGE switch for 3 volts direct current. Short the COMMON and D.C. VOLTS leads together and turn the ZERO ADJ knob for zero indication on the meter. It is advisable to leave Voltohmmeter I–107–(*) on for approximately 5 minutes before using it, to allow the zero adjustment of the meter to become stable. Connect the voltohmmeter leads to the V.T.V.M. posts of Adapter FT–384–(*).

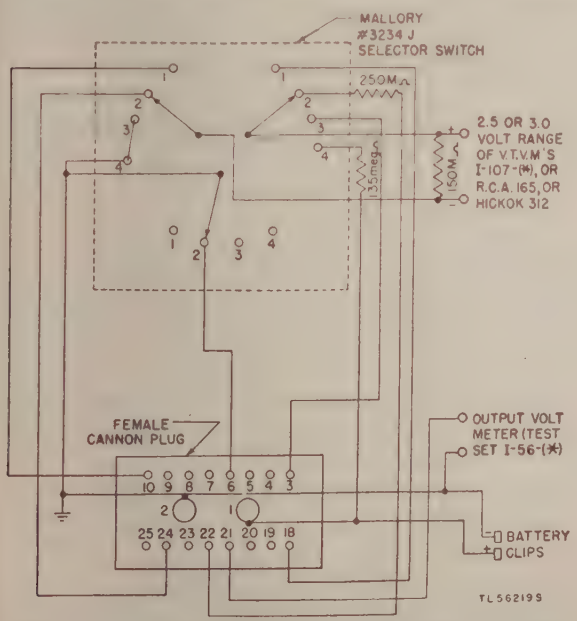


Figure 105. Adapter FT–384–(*), schematic wiring diagram.

(6) Connect the high side of the signal generator output through the 0.006-mf capacitor to the limiter control grid (terminal 6 of FL3) and connect the low side of the generator to the chassis.

(7) Adjust the generator for an output of between one and two volts at 2.65 mc.

(8) Plug Adapter FT–384–(*) into receptacle PG1 of the receiver and connect to the battery. Turn the switch of the adapter to DISC (discriminator output voltage).

(9) Turn the receiver ON and, after allowing sufficient time for the vacuum tubes to heat, adjust screw S (secondary) in filter FL4 for zero current in the voltmeter. The meter should reverse polarity as S is varied to either side of the zero-current point. The selector switch of Voltohmmeter I–107–(*) can be turned from — VOLTS to + VOLTS to note this effect. This is an accurate indication of frequency and can be used as a check during the test. A check may be made from to time to make sure that this meter still reads zero. If it does not, the signal generator should be readjusted to restore the reading to zero.

(10) Throw the TUNE-OPERATE switch to TUNE. Adjust the slug in tuning unit LCU4 for zero beat. Set the TUNE-OPERATE switch to OPERATE.

(11) Turn the switch of the adapter to ALINE and adjust the P (primary) adjusting

screw in FL4 for maximum indication on the voltohmmeter.

(12) Restore the adapter switch to DISC and trim the S screw setting for zero meter current. Adjust the signal generator 50 kc above and 50 kc below 2.65 mc and make sure that the readings of the voltohmmeter are approximately the same (but of opposite polarity).

(13) Vary the signal generator frequency *above* 2.65 mc until the test meter deflection is greatest. Note the meter reading and the generator frequency. The frequency should be between 2.725 and 2.745 mc.

(14) Repeat step (12) *below* 2.65 mc. The meter reading should be within 0.3 volt of the previous reading and the frequency should be between 2.560 and 2.580 mc.

(15) Place the switch of the adapter at CATH, with the signal generator set for 1-volt output at 2.65 mc and note the reading of the voltohmmeter for later use in testing the i-f amplifier.

d. ALINEMENT OF I-F AMPLIFIER. (1) Reduce the signal generator output to zero and connect its shielded output cord to the control grid of the mixer (terminal 4 of V2). Exposed unshielded wires are dangerous and should be kept as short as possible, preferably less than 2 inches, *including the clip.*

(2) Adjust the generator to 2.65 mc and make sure that it agrees with the i-f oscillator when the TUNE-OPERATE switch is set at TUNE. Then restore the switch to OPERATE.

(3) With the switch of the adapter at CATH, increase the generator output sufficiently to cause a reading of 0.9 on the voltohmmeter. Adjust the generator output from time to time during the following alinement to maintain a meter reading of between 0.6 and 0.9 volt.

(4) Connect the 1,000-ohm resistor between terminals 3 and 4 of filter unit FL3 and adjust the primary of FL3, designated P, for maximum voltmeter reading.

(5) Connect the resistor between terminals 1 and 2 of FL3 and tune the secondary of FL3, designated S, for maximum voltmeter indication.

(6) Repeat steps (4) and (5) above for filter units FL2 and FL1, respectively. Upon completion of these adjustments, note the signal generator output required to obtain the same meter deflection as in *c*(15) above. It should not be necessary to increase the signal generator output beyond 50 microvolts to obtain this reading.

(7) Vary the signal generator frequency through the 2.65-mc setting and note that the selectivity is approximately symmetrical about the midfrequency.

(8) Adjust the generator frequency to 2.65 mc and the generator output as required for a meter reading of 0.9 volt.

(9) Double the signal generator output voltage (6-db increase) and determine the frequencies above and below 2.65 mc at which 0.9 volt is obtained. The bandwidth between the two *6 db down* frequencies should not be less than 75 kc and the midband frequency should be within 5 kc of 2.65 mc.

(10) Repeat steps (8) and (9) for a 1,000-fold voltage increase (60 db) of generator output. The bandwidth between the two *60 db down* frequencies shall not exceed 350 kc.

(11) Remove the strap between C25 and terminal 5 of V3.

e. ALINEMENT OF R-F OSCILLATOR (LCU3) AND R-F AMPLIFIER CIRCUITS (LCU1 AND LCU2). (1) Reduce the signal generator output to zero and connect its shielded output cord directly to the A and G binding posts on the receiver, with short leads. (This will be a test through the whole receiver except the connections from the front A and G binding posts to the regular A and G terminals in the plug PG1. It may be wise, therefore, to test for continuity between these two sets of terminals.)

(2) Rotate the tuning dial to the stop at the 20-mc end of the scale. The reference line on the dial should be in approximate alinement with the tuning index. If the error is ⅛ inch or more repair the unit. This involves removing the front panel and adjusting the glass with the hairline on it. It should be done only if unavoidable.

(3) Adjust the dial and the signal generator to 28.0 mc.

(4) Loosen the cover plate (near C24) from C1.3, C1.5, C1.7 and the cover plate of LCU3.

(5) Turn the switch of Adapter FT–384–(*) to DISC.

(6) Place the TUNE-OPERATE switch of the receiver at TUNE.

(7) Adjust the trimmer C1.7 for zero beat in the loudspeaker. The (discriminator) voltmeter should read zero when the frequency is correct. This is an additional check on the frequency of the i-f oscillator.

(8) Set the signal generator and the receiver dial at 20 mc and adjust the slug in LCU3 for zero beat.

(9) Repeat steps (7) and (8) until the oscillator tracks satisfactorily at both ends of the band.

(10) When the oscillator is satisfactory at both ends of the band, check the 26-, 24-, and 22-mc points also. Zero beat should be obtained within one-half dial division at each of these frequencies. If tracking at these frequencies is not satisfactory repeat step (7) above using 27 mc and step (8) above using 21 mc. After the dial tracking is regarded as satisfactory, take care to avoid touching C1.7 and the slug of LCU3 when making further adjustments.

(11) Turn the switch of Adapter FT–384–(*) to ALIGN and restore the TUNE-OPERATE switch to OPERATE.

(12) Increase the signal generator output sufficiently to cause a meter reading of 0.9 volt. Adjust the generator during the course of the following procedure to maintain a reading of between 0.6 and 0.9 volt on the meter.

Note. During the final alinement adjustments it is usually impossible to keep the meter deflection below 0.9 volt by reducing generator output. Under these conditions modulate the generator with 400 cycles and a frequency swing of ± 15 kc. Connect the output meter of Test Set I–56–(*) to Adapter FT–384–(*), and supplement the test meter deflection by observing the output meter deflection.

(13) With the signal generator at 28 mc, tune the receiver dial for zero beat at 28 mc. Adjust, in turn, trimmer capacitors C1.5, C1.3, and C1.1 for maximum test meter deflection.

(14) Adjust the generator and the receiver to 20.0 mc as in step (13) above.

(15) Adjust, in turn, the slugs in the LCU1 and LCU2 shield cans for maximum deflection of the meter.

(16) Readjust the trimmer capacitors at 28.0 mc and the inductance trimmers at 20.0 mc alternately until no further improvement can be obtained.

185. Precision Alinement of Radio Transmitter BC–604–(*)

a. General. Whenever a complete inspection of a transmitter is made, check alinement of the tuned circuits as follows:

b. Testing Equipment Required.

1 antenna A–62 (Phantom) or an artificial antenna (fig. 130), or a vehicle antenna of correct dimensions (including lead-in and ground) if radiation is permissible.
1 sensitive precision wavemeter, 3.0- to 10.0-mc range.
1 narrow-blade (⅛-inch) screwdriver or long-handled hexagon socket wrench for adjusting the trimmer capacitors and coil slugs.
1 3/16-inch screwdriver for locking the selector, etc.
1 6-inch rule (narrow blade).
1 Cord CD–786 for connection of transmitter under test to the power supply through a convenient mounting or equivalent.

c. Preliminary to Alinement. (1) Throw the TRANSMITTER switch to OFF, the RECEIVER TUNE-OPERATE switch to OPERATE, the RADIO-INTERPHONE switch to RADIO, and the TUNE-ANT CUR switch to TUNE.

(2) Insert Crystal Holder FT–241–(A), Channel 0, into socket No. 1 and Crystal Holder FT–241–(A), Channel 79, into socket No. 10 in the crystal operating compartment. If these particular crystals are unavailable, others within five channels of these may be used.

(3) Remove the top and bottom cover plates from the transmitter and lay the transmitter on its back so the bottom and top sections are accessible. Plug one end of Cord CD–786 into the left end of the transmitter and the other end into the left connector of the mounting which is connected to a large 12- or 24-volt battery supply. Make sure a dynamotor of the correct input voltage rating has been inserted in the transmitter.

(4) Unlock the channel selector (par. 188*b* (7) and (8)) and then set the gang capacitor for minimum capacitance (plates all out).

d. Alinement of First R-F Amplifier.

(1) Set the METER SWITCH to position 2

(grid current in the first r-f amplifier) and turn the TRANSMITTER switch ON.

(2) Set C107 to the minimum capacitance position (open end of slot at left as viewed from front of the transmitter).

Note. This capacitor has been omitted from later transmitters.

(3) Press push button No. 10 and start the dynamotor by placing the RECEIVER TUNE-OPERATE switch on RECEIVER TUNE. If the oscillator and metering circuit are working, the meter will deflect, indicating current in the first r-f amplifier grid circuit. Stop the dynamotor by throwing the RECEIVER TUNE-OPERATE switch to OPERATE. Do not let the dynamotor run for long periods of time during the following tests.

(4) Set the METER SWITCH to position 3 (grid current in rectifier).

(5) Start the dynamotor (RECEIVER TUNE-OPERATE switch to RECEIVER TUNE). Adjust the gang capacitor for maximum meter deflection and observe the relative position of the capacitor plates. Rotate the gang capacitor by inserting a screwdriver in the slot on the end of the gang capacitor shaft (located near the handle on the right end of the transmitter) or by the associated small indicating knob.

(6) Press push button No. 1 and repeat step (5) above. The observed rotation of the gang capacitor in passing from No. 10 to No. 1 should be at least 75 percent of the total possible rotation.

(7) Carefully release push button No. 1, turn the gang capacitor to the extreme front, and lock the selector unit.

(8) Start the transmitter (dynamotor); and check the selector adjustment by pressing the No. 1 and then the No. 10 push button. Observe the maximum meter deflection at each frequency as the gang capacitor is varied slightly against the restoring force of the selector springs. *Do not attempt to rotate the capacitor control more than a few degrees.* The meter should indicate a maximum deflection at the capacitor setting determined by the selector. If the gang capacitor has not been properly positioned at each frequency, repeat the above procedure (steps (5) to (8)) until the proper adjustment is obtained or the trouble is located.

e. ALINEMENT OF RECTIFIER. (1) Set the METER SWITCH to position 4 (grid current in doubler).

(2) Adjust the tuning slugs in L119 and L118 to about 1 inch from the open end of the coils. This may be measured with the 6-inch narrow blade rule inserted in the open end of the coil form.

(3) Set C153 and C157 to the midcapacitance position (open end of slot toward rear of set).

Note. Steps *e*(2) and *e*(3) are probably unnecessary if there is reason to believe that there has been no major change in the coils or capacitors in this stage.

(4) Adjust the wavemeter to *one-sixth* of the output frequency ($\frac{27.9}{6}$ = 4.65 mc) and place the pick-up coil near L118 and L119.

Caution: The wavemeter may affect the tuning of L118 and L119 if it is coupled too closely to these coils.

(5) Press push button No. 10, start the dynamotor, and adjust C153 and C157 for a maximum deflection of the transmitter panel meter at the wavemeter frequency. *Take care that the circuits are being tuned to the correct frequency.* If the circuits cannot be tuned, try a different setting of the L119 and L118 tuning slugs. Repeat this procedure until a panel meter deflection is obtained, and with the wavemeter determine the frequency to which the circuits are tuned. If the tuned frequency is higher than the correct frequency, increase the tuning inductance or capacity, or both; if the tuned frequency is lower than the correct frequency, decrease the tuning inductance or capacity, or both, until the correct frequency is obtained. The transmitter uses copper tuning slugs in the coils and therefore the coil inductance is decreased as the slug is inserted further into the coil winding.

(6) Press push button No. 1 and adjust the slugs in L119 and L118, respectively, for maximum deflection of the panel meter. Do not adjust C153 and C157. Check the frequency being tuned ($\frac{20.0}{6}$ = 3.33 mc) with the wavemeter and proceed as in (5) above if the frequency is incorrect.

(7) Repeat step (5) above (adjusting only the capacitance trimmers on button 10) and step (6) above (adjusting only the coil slugs

on button 1) until no further adjustment is required. In some cases where the circuits do not appear to aline properly at both ends of the band it may be desirable (with the meter switch in position 3) to adjust and lock selector button 5 at some frequency near the middle of the band (about 24.0 mc) and aline between buttons 10 and 5 to get the coil slugs and capacitors near their correct positions. Then finally aline between buttons 10 and 1 as described above.

f. ALINEMENT OF DOUBLER. (1) Set the METER SWITCH to position 1 (grid current in tripler).

(2) Adjust the tuning slugs in L106 and L107 to about 1 inch from the open end of the coils.

(3) Set C114 and C116 to the midcapacitance position (open end of slot toward rear of set).

Note. Steps *f*(2) and *f*(3) are probably unnecessary if there has been no major change in the coils or capacitors in this stage.

(4) Adjust the wavemeter to *one-third* of the output frequency $\left(\frac{27.9}{3} = 9.30 \text{ mc}\right)$ and place the pick-up coil near L106 and L107.

(5) Press push button No. 10, start the dynamotor, and adjust C114 and C116 for a maximum deflection of the panel meter at the wavemeter frequency. Take care that the circuits are being tuned to 9.3 mc. If the circuits cannot be tuned to the proper frequency, try a different setting of the L106 and L107 tuning slugs.

(6) Depress push button No. 1 and adjust the slugs in L106 and L107 for maximum deflection of the meter. Check the frequency being tuned $\left(\frac{20.0}{3} = 6.67 \text{ mc}\right)$ with the wavemeter. If the frequency is incorrect it will be necessary to recheck the frequencies to which the rectifier stage has been alined in accordance with paragraph *e*(4) and *e*(6) above.

(7) Repeat steps (5) above (adjusting only the capacitance trimmers on button 10) and (6) above (adjusting only the coil slugs on button 1) until no further adjustment is required.

g. ALINEMENT OF TRIPLER. (1) Set the METER SWITCH to position 5 (grid current in power amplifier).

(2) Adjust the tuning slug in L108 to about 1 inch from the open end of the coil.

Note. This step is unnecessary if there has been no major change in the coil or capacitor in this stage.

(3) Press push button No. 10, start the dynamotor, and adjust C120 for a maximum deflection of the meter. If a tuning point cannot be found, try a different setting of the L108 tuning slug. Frequency measurements are not required in this stage if the alinement of the preceding circuits has been done correctly.

(4) Press push button No. 1 and adjust the slug in L108 for a maximum meter deflection.

(5) Repeat step (3) above (adjusting only C120 on button 10), and step (4) above (adjusting only L108 on button 1), until no further adjustment is required.

(6) Replace the bottom cover plate of the transmitter and trim all alinement adjustments previously made, by repeating the procedure described in *d*, *e*, *f*, and *g*. The bottom cover makes only small changes in the circuit capacitances or inductances and so only small changes in the trimmer capacitors or coil slugs will be required. They are necessary, however, if most satisfactory performance and tube life are to be obtained.

h. ALINEMENT OF POWER AMPLIFIER. (1) Set the METER SWITCH to position 6 (total plate current).

(2) Throw the RECEIVER TUNE-OPERATE switch to OPERATE.

(3) Adjust the coupling of L111 to L110 until the center of coil L111 is opposite the top of coil L110 as seen through the vertical slot in L110. This is done by rotating the knurled finger wheel which is accessible through a rectangular hole in the right end panel (fig. 102).

(4) Connect an antenna (artificial or real, par. 185*b*) to the transmitter. (During manufacture this stage is adjusted with the artificial antenna (fig. 130) plugged into the A and G posts on the front panel of the transmitter.)

(5) Press push button No. 10, plug in a microphone, and start the dynamotor by operating the microphone switch. Immediately adjust C126 on top of the selector unit for minimum deflection of the panel meter (minimum plate current).

(6) Adjust antenna trimmer capacitor C136 (marked as No. 10 on the right end panel of the transmitter) for maximum antenna current in the artificial antenna meter.

Note. If an Antenna A–62 (Phantom) or a real antenna is used for these coupling adjustments it will be necessary, in order to have an indication of antenna current, to throw the TUNE-ANT CUR switch to ANT CUR and observe the deflection of the panel meter. Restore the TUNE-ANT CUR switch to the TUNE position whenever adjustments are to be made to capacitor C126 or to the inductance trimmer of L110.

(7) Adjust the coupling between L110 and L111 for maximum antenna current, then reduce the coupling to lower the antenna current to approximately 60 percent of maximum and readjust the antenna capacitor, C136, for maximum antenna current.

(8) Press selector button No. 1 and adjust the tuning slug (inductance trimmer) of L110 for *minimum* plate current (with the TUNE-ANT CUR switch at TUNE). The tuning slug is operated by a toothed wheel which is turned by inserting a screwdriver through the hole opposite the bottom of L110 in the right end panel of the transmitter.

(9) Adjust the antenna trimmer, C127 (No. 1), for maximum antenna current.

(10) Shift alternately between selector buttons No. 1 and No. 10, making the proper adjustment of L110 and C126 for minimum plate current until no further adjustment of L110 and C126 is required. When on button No. 1, adjust the tuning slug L110 for *minimum* plate current and adjust the antenna trimmer, C127, for *maximum* antenna current. When on button No. 10, adjust the trimmer capacitor, C126, for *minimum* plate current and adjust the antenna trimmer, C136, for *maximum* antenna current. As the minimum meter reading may not be sharply defined when the inductance trimmer is turned, it is sometimes easier to adjust the capacity trimmer C126 for *minimum* plate current when on selector button No. 10, then operate selector button No. 1 and again adjust C126 for minimum plate current. Then adjust the inductance trimmer by a few turns and repeat the procedure already outlined, noting the position of C126 for each selector button. Turn the inductance trimmer of L110 one way or the other until the position of C126 for *minimum* plate current is the same at both ends of the band (selector buttons 1 and 10). The r-f stages have now been ganged and should track satisfactorily at all frequencies.

i. COUPLING TO THE ANTENNA CIRCUIT. When the procedure in *h* above has been properly accomplished the transmitter is ready for coupling to a suitable antenna. The method of making coupling adjustments is described in paragraph 188*c*.

186. Receiver Over-All Test Requirements

a. CHECK OF CIRCUIT ALINEMENT. (1) Remove the receiver dust cover and connect the receiver to an appropriate power source.

(2) Turn the SPEAKER switch to ON, the TUNE-OPERATE switch to TUNE, and the SQUELCH switch to ON. Turn the SENSITIVITY and VOLUME controls to the extreme right. Turn the receiver ON.

(3) Set the signal generator at 24 mc. Connect the signal generator to posts A and G of the receiver. Manually tune the receiver to zero beat. Make sure that the CALL SIGNAL lamp lights. Read the setting of the receiver dial.

(4) Carefully adjust the tuning dial to each side of the zero-beat setting until the CALL SIGNAL lamp goes out. Note the two dial readings at the points where the lamp goes out. The lamp should remain lighted over approximately three channel divisions, and the zero-beat setting should be close to the center of this range.

(5) Set the SENSITIVITY control at the extreme left (minimum sensitivity), and carefully adjust the tuning dial to each side of the zero-beat setting. The lamp should remain lighted over approximately two channel divisions, and the zero-beat setting should be at the center of the tuning range.

(6) Repeat steps (3) through (5) above, setting the signal generator at 28 mc.

(7) Repeat steps (3) through (5) above, setting the signal generator to 20 mc.

(8) If the zero-beat setting in step (5) above is not centered, the receiver requires realinement.

b. CHECK OF SENSITIVITY AND STABILITY. (1) Set the signal generator to 28.0 mc and adjust the receiver to zero beat at 28 mc. Then reduce the signal generator to zero output.

(2) Switch the SQUELCH control to ON and adjust the SENSITIVITY control so that

the CALL SIGNAL lamp is *barely* extinguished.

(3) Increase the generator output sufficiently to illuminate the CALL SIGNAL lamp. A signal of 1.0 microvolt or less should suffice.

(4) Repeat steps (2) and (3) above at 20.0 mc.

(5) Set the signal generator to give 3 microvolts output at 28 mc. It should be possible to extinguish the CALL SIGNAL lamp by turning the SENSITIVITY control to the left. Repeat this test at 20 mc.

(6) Throw the TUNE-OPERATE switch to TUNE and adjust the tuning dial for a low-pitched beat note.

(7) Vary the signal generator output from about 1 to 1,000 microvolts. The pitch of the beat note should remain within audibility over the entire range of signal voltage.

c. OUTPUT POWER MEASUREMENT. (1) Adjust the signal generator frequency to 20.0 mc and 1 microvolt output.

(2) With the SPEAKER switch ON, and the TUNE-OPERATE switch at TUNE, set the RADIO & INT–INT ONLY switch to RADIO & INT, and the SQUELCH switch to ON. Turn the SENSITIVITY and VOLUME controls to the extreme right.

(3) Tune to zero beat with the signal generator and operate the TUNE-OPERATE switch to OPERATE. Turn the SPEAKER switch OFF.

(4) The output meter should show approximately zero output since the signal generator is not modulated. The output meter is connected between pin 21 and PG1 and ground. (If Adapter FT–384–(*) is connected to PG1, the output meter is connected to the OUTPUT METER pin jacks of the adapter.)

(5) Modulate the signal generator with 400 cycles with a frequency swing of ± 15 kc and read the output meter. The meter should read over 18 volts.

d. NOISE TEST. With the signal generator output at 1 microvolt completely remove the modulation from the signal. The reading on the voltmeter should drop to not more than one-fifth of the reading obtained in paragraph 186*c*(5).

e. CHECK OF LIMITER ACTION. (1) With conditions as in paragraph 186*c*, increase the signal generator output to 10 microvolts and observe the reading on the output meter.

(2) Increase the signal generator output to 100, 1,000, and 10,000 microvolts successively. The voltmeter reading should stay within ± 5 volts of the reading obtained in step (1) above.

f. VOLUME CONTROL. Remodulate the signal with 400 cycles with a frequency swing of ± 15 kc and 1 microvolt input, and gradually rotate the VOLUME control to the left. The output meter should decrease progressively to less than 1 volt. After restoring the volume to maximum, turn the SPEAKER switch ON. The output meter reading should remain approximately constant. Observe the tone from the loudspeaker as a check on the operation of the speaker. A very weak response or a bad rattle may indicate that the speaker diaphragm has been damaged.

187. Transmitter Over-All Test Requirements

a. GENERAL. (1) After the transmitter has been properly alined, and the antenna satisfactorily coupled to the power amplifier, test the performance characteristics as directed below.

(2) The test equipment required is as follows:

Item	Description
A-F oscillator	50 to 5,000 cps, 0- to 5-volt output, such as General Radio type 608A, for modulation tests and measurement of audio stage gains, set for 500 ohms output.
Oscilloscope	Oscilloscope such as Oscilloscope BC–1060–( ), for modulation capability test, or for measurement of audio stage gains.
Output meter	0 to 15 volts with scales marked in decibels and volts, such as General Radio type 583A, for measuring the audio stage gains.
A-C voltmeter	0 to 5 volts rectifier type such as General Radio type 483F or Test Unit I–176.
Input circuit attenuator	0 to 30 db, (500 ohms) such as Western Electric type 1A.
Dummy antenna	Dummy load (fig. 130) or equivalent.
Distortion noise meter.	General Radio type 732B, or equivalent.
D-C ammeter	0 to 30 amperes.
D-C voltmeter	0 to 30 volts.
Battery	12 volts, 26 amperes maximum.
Battery	24 volts, 18 amperes maximum.

(3) Before the tests can be made, the battery must be connected with the transmitter, and the 40-ohm dummy load (fig. 130) must be connected with binding posts A and G on the front panel. The 20-, 24-, and 27.9-mc crystal holders must be placed in the number 1, 5, and 10 sockets, respectively. The push buttons must also be preset.

(4) At the beginning of the testing procedure the switches must be set as follows:

(*a*) TRANSMITTER ON-OFF switch at OFF.

(*b*) TUNE-ANT CUR switch at TUNE.

(*c*) RECEIVER TUNE-OPERATE switch at OPERATE.

(*d*) METER SWITCH in position 6.

(*e*) RADIO-INTERPHONE switch to RADIO.

(*f*) TANK-OTHER USE switch to OTHER USE.

(5) The text for the following tests is written as a step by step procedure; that is, the test equipment connected with the transmitter, and the switch adjustments at the beginning of a test are assumed to be the same as those at the end of the preceding test.

b. R-F POWER OUTPUT, D-C POWER INPUT TEST. (1) The data required for making this test is given in figure 106.

(2) Connect a d-c ammeter (0 to 30 amp) in series with the battery (fig. 111) observing polarity in making the connection.

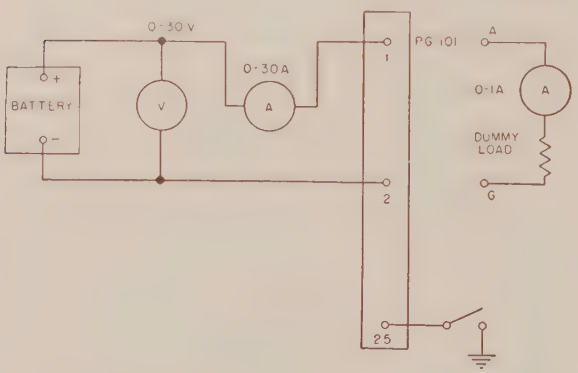
(3) Latch push button No. 1, turn the TRANSMITTER ON-OFF switch to ON. After the tubes have warmed up for at least 5 seconds, start the dynamotor by depressing the microphone push-to-talk switch.

(4) Compare the readings obtained on the dummy load meter with the ANT CUR readings in the table of figure 106 for the three crystals as selected by push buttons No. 1, 5, and 10.

(5) Note the input current value as read by the 0 to 30 ampere d-c ammeter with the dynamotor running, and compare this reading with that given for RADIO in the table in figure 106.

(6) Turn the RADIO-INTERPHONE switch to INTERPHONE and note the ammeter reading with the dynamotor running. Compare it with the value given in figure 111 for battery drain on INTERPHONE.

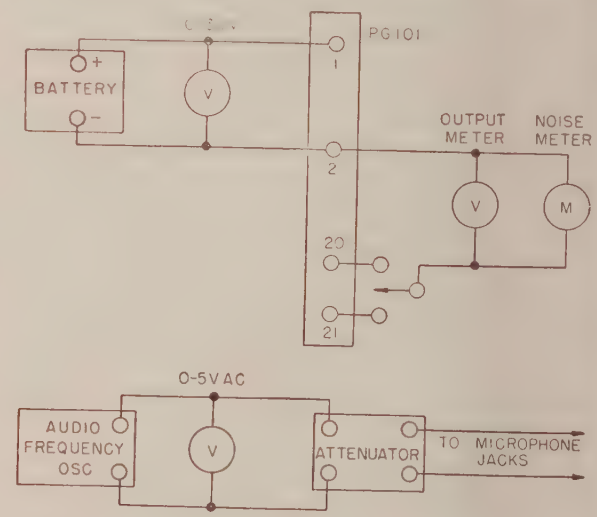
(7) Stop the dynamotor and again compare



TEST DATA					
SELECTOR BUTTON	FREQ MC	ANT CUR	BATTERY CURRENT		
			RADIO	INTERPHONE	FIL
1	20	65			
5	24	65	22 A	12 A	5A
10	27 9	65			

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Figure 106. Radio Transmitter BC-604-(*), r-f power output, d-c power input test diagram.



TEST DATA						
AUDIO OUTPUT VOLTS	ATTEN-UATION DB	INTERPHONE			SIDETONE OUTPUT DB	TEST
		OUTPUT D B	DIST %	NOISE DB		
1 73	−20	21	12	25	15	PART 1
40	0	22	12	25		PART 2

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Figure 107. Radio Transmitter BC-604-(*), audio output test diagram.

the reading with that given in the table on figure 106 for battery drain on FILAMENTS.

c. AUDIO OUTPUT TEST. (1) The data required for making this test is given in figure 107.

(2) Procure the test equipment specified in paragraph 187. Turn the TRANSMITTER ON-OFF switch to OFF, and connect the equipment with the transmitter as follows:

(*a*) Connect the output of the audio oscillator with the input of the calibrated attenuator. Do not ground either lead of the audio oscillator.

(*b*) Connect the output of the attenuator with terminals C and D of the magnetic microphone jack (J–101) through a suitable plug (PL–118).

(*c*) Connect the a-c voltmeter (0 to 5 volts) across the output of the audio oscillator.

(*d*) Adjust the load on the output meter to 8,000 ohms. Connect the meter with terminals 2 and 20 (or 21) on PG–101.

(3) Test the audio output of the transmitter using the magnetic microphone jack (part I) as follows:

(*a*) Turn the a-f oscillator on and set the frequency to 400 cycles per second (cps). Set the output control to give 1.73 volts as read by the 0- to 5-volt a-c meter.

(*b*) Set the calibrated attenuator to 20 db.

(*c*) Set the SIDETONE CONTROL to maximum.

(*d*) Turn the transmitter on, latch push button 1, 5, or 10, and after the tubes have warmed up for at least 5 seconds, start the dynamotor.

(*e*) The output, and noise and distortion meters should now indicate approximately the readings given in figure 107. Record the readings obtained.

(*f*) Stop the dynamotor.

(4) Test the audio output of the transmitter using the carbon microphone jack (part II) as follows:

(*a*) Change the attenuator connection from the magnetic microphone jack to carbon microphone jack J–102 using plug PL–68 instead of plug PL–118.

(*b*) Change the audio oscillator output to 4 volts, and change the attenuator to 0 db.

(*c*) Start the dynamotor. The output and noise and distortion meter readings should be approximately the same as those in the table in figure 107.

d. MODULATION CAPABILITY TEST. (1) The data required for making this test is given in figure 108. This method is a practical modulation capability check for this transmitter but is not in general applicable to all f-m modulators.

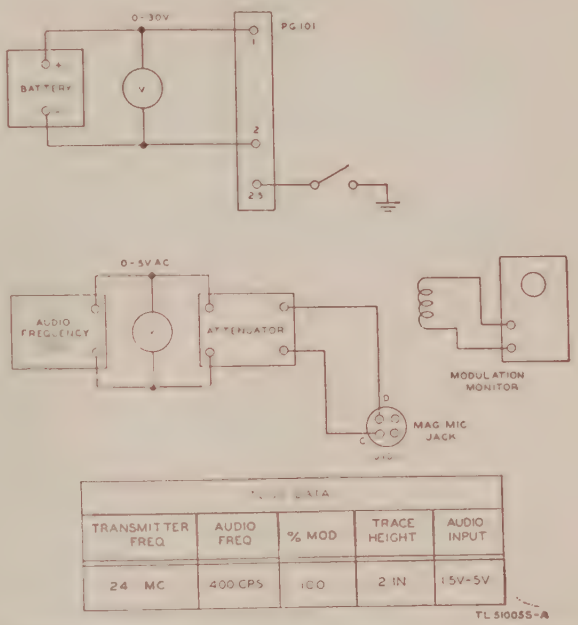


Figure 108. Radio Transmitter BC–604–(*), modulation capability test diagram.

(2) Stop the dynamotor and disconnect the output meter and the noise and distortion meter.

(3) Change the audio oscillator output to the minimum setting. Leave the frequency at 400 cps.

(4) Turn on the modulation monitor oscilloscope and place its pick-up coil near the transmitter antenna coupling coil (L–110). Latch push button No. 5 and start the dynamotor. Then adjust the coupling distance between L–110 and the pick-up coil to obtain about 2 inches deflection on the modulation monitor oscillograph.

(5) Gradually increase the output of the audio oscillator until a series of dots just begins to appear along the zero carrier (base) line on the oscilloscope. The dots indicate full modulation capability of the transmitter.

(6) Adjust the sweep frequency of the oscilloscope until the dots are clearly defined.

(7) The correct audio oscillator voltage (as read by the 0 to 5 volt a-c meter) is that which just causes the dots to appear at the base line of the oscilloscope.

(8) Compare this voltage with that given in the table on figure 108.

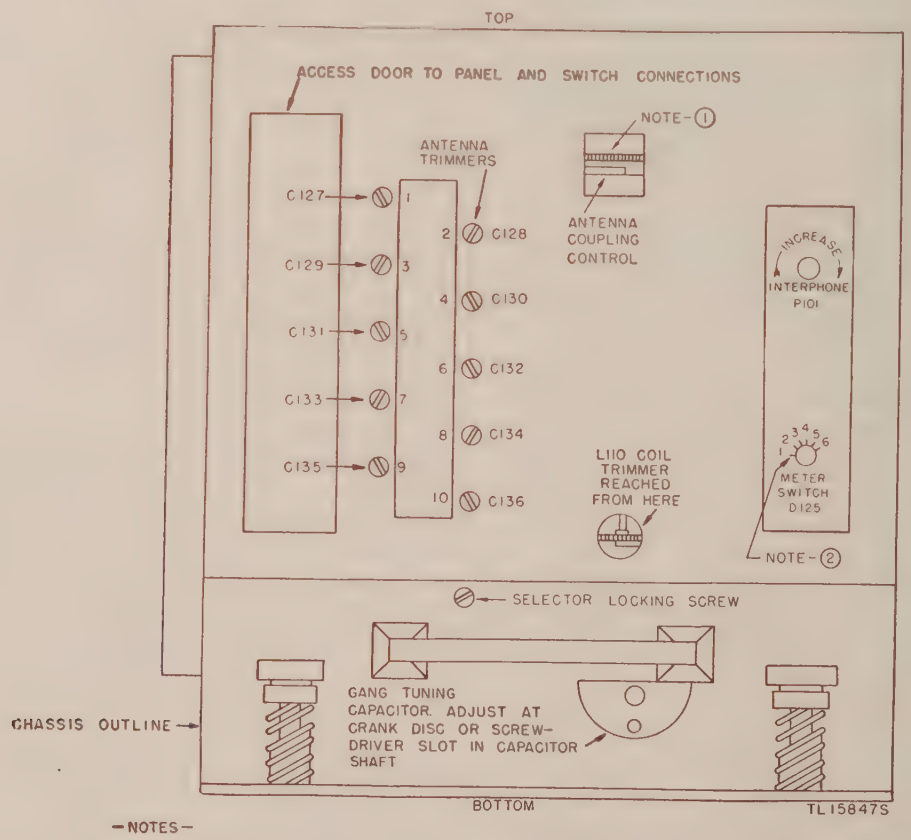
Section XXI. PRESETTING

188. Presetting Transmitter (Fig. 109)

a. GENERAL. Presetting the transmitter consists of adjusting the ganged tuning capacitors and individual antenna tuning capacitors for each channel to be used. Thus, after the channel selector mechanism is adjusted and locked, depressing a push button will automatically rotate the tuning capacitors, and choose the proper crystal and antenna trimmer capacitor for the desired operating channel. Once these adjustments are made it is not necessary to alter them until the channel frequency assignments are changed. The presetting procedure may be divided into two parts: setting the push buttons and tuning the antenna circuit.

b. SETTING PUSH BUTTONS. (1) Set the push buttons with the transmitter in the vehicle, or removed. If the transmitter is removed a suitable source of d-c power and a Mounting FT–237–(*) or other means of connecting the source of power to the transmitter are required.

(2) Remove the receivers from Mounting FT–237–(*) by loosening the thumbscrews and pulling the receiver forward. (If the receivers



—NOTES—

NOTE-①-ADJUST FINGER WHEEL AT TOP FROM END OF SET. THIS CONTROL REGULATES ANTENNA COUPLING.

NOTE-②-METER SWITCH POSITION LEGEND:
POSITION NO.–
1-TRIPLER GRID
2-R-F AMP GRID
3-RECTIFIER GRID
4-DOUBLER GRID
5-POWER AMP GRID
6-TOTAL CURRENT

Figure 109. Radio Transmitter BC–604–(*), right end view.

are to be preset also, save time by leaving the right-hand receiver in position and setting its REC ON-OFF switch to ON.)

(3) Remove the crystal holders from the crystal compartment and put them in the crystal storage drawer.

(4) Select the required crystal holders for the new frequencies and insert them into the sockets in the crystal oven compartment. The crystals should be arranged according to frequency; the lowest frequency crystal in position No. 1, the next higher frequency crystal in position No. 2 and so on. Replace the crystal oven compartment cover.

(5) Throw the RECEIVER TUNE-OPERATE switch to OPERATE. Leave the TRANSMITTER ON-OFF switch OFF.

(6) Release any depressed push button by partially depressing any button.

(7) Turn the ganged-tuning capacitor control, under the handle on the right side of the transmitter (fig. 109), as far as it will go toward the front of the transmitter.

(8) The operation in step (7) above positions the selector locking screw (accessible through a hole immediately above the handle), so that it can be reached with a screwdriver. Loosen this locking screw counterclockwise until it binds slightly, and then turn it clockwise one-half turn. The ganged-tuning capacitor assembly can now be rotated independently of the push buttons. Turn the ganged-tuning capacitor control to its maximum rear (minimum capacitance) position.

(9) Throw the TUNE-ANT CUR switch to TUNE and turn the METER SWITCH, D125, on the right side of the transmitter, to position No. 3.

(10) Depress the push button which selects the highest frequency crystal in use.

(11) Turn the TRANSMITTER ON-OFF switch to ON and allow the transmitter to warm up for 5 minutes.

(12) Start the dynamotor by throwing the RECEIVER TUNE-OPERATE switch to RECEIVER TUNE. This operation grounds the dynamotor relay coil and causes all stages in the transmitter, except the power amplifier, to become operative. The transmitter emits a very weak signal in the RECEIVER-TUNE position.

Caution: Never start the dynamotor with the ON-OFF switch. Always use either the RECEIVER TUNE-OPERATE switch or the microphone button. Do not operate the dynamotor any longer than necessary. Always stop the dynamotor when any pause is made in the presetting procedure.

(13) Slowly rotate the ganged-tuning capacitor control to the front until the panel meter indicates a maximum value. At some frequencies, two peaks will be obtained, one of which is considerably greater than the other; set the ganged tuning capacitor to the higher of the two peaks.

(14) Turn the METER SWITCH to position No. 1.

(15) Move the ganged-tuning capacitor control slightly about its setting (obtained in step (13) above) until a maximum meter reading is obtained. This operation provides a fine adjustment of step (13) above, and the ganged capacitors now are set accurately for this channel.

(16) Throw the RECEIVER TUNE-OPERATE switch to OPERATE; this turns the dynamotor off.

(17) Release the depressed push button by holding it with a finger and partially depressing an adjacent push button with the other hand. *Do not allow push buttons to snap out or the presetting adjustment will be jarred from its correct setting.*

(18) Depress the push button for the next lower frequency, place the RECEIVER TUNE-OPERATE switch in the RECEIVER TUNE position and repeat steps (13) to (17) above. Tune each one of the remaining channels in the same manner, each time going from a higher to a lower channel, being careful not to depress a push button for any channel which already has been preset. After the last channel has been preset, partially depress any one of the other buttons just far enough to release the last push button.

(19) Rotate the ganged-tuning capacitor control to the maximum front position and tighten the selector locking screw. *Do not tighten far enough to strip the threads.* All circuits are now preset except the antenna circuits.

(20) Depress push button No. 1, place the RECEIVER TUNE-OPERATE switch to RECEIVER TUNE, and check the locked adjustment of the selector by turning the ganged-

tuning capacitor control slightly to each side of its setting against the restoring spring. A screwdriver may be used for this test. If the mechanism is adjusted correctly, the panel meter needle will dip as the control is moved to either side of its setting. Repeat this procedure for each channel and readjust all channels not giving the proper indication.

c. TUNING ANTENNA CIRCUIT. When tuning the antenna circuit, Antenna A–62 (Phantom) should be used to prevent radiation. If Antenna A–62 (Phantom) is not available, the transmitter must be in place in the vehicle, the mast antenna must not touch anything and the vehicle should preferably be located well away from trees, trucks, and other large objects, but *only* to the extent permitted by camouflage requirements.

(1) Throw the TUNE-ANT CUR switch to ANT CUR, turn the METER SWITCH to position No. 6 (to prevent stray r-f pick-up from affecting meter readings), and place the RECEIVER TUNE-OPERATE switch at OPERATE.

(2) Set the antenna coupling control at minimum coupling (clockwise rotation of the wheel). This adjustment is made through the square hole on the right side of the transmitter.

WARNING: Do not remove the cover and reach down from the top, as dangerously high voltage is exposed when the set is turned on.

(3) Depress a push button of a channel whose circuits have been preset. Insert the microphone plug into the CARB MIC jack and press the push-to-talk switch. Adjust the antenna tuning capacitor numbered to correspond to the depressed push button, for maximum indication on the panel meter; (this reading is relative antenna current). It may be necessary to increase the antenna coupling to obtain a reading; however, the coupling should be as loose as possible. Tune each antenna circuit of the remaining preset channels in a similar manner.

(4) Depress the push button corresponding to a frequency halfway between the highest and the lowest frequency used. Adjust the antenna coupling control for maximum indication on the panel meter. Then reduce the coupling sufficiently to reduce the antenna current to about one-half the observed maximum value.

(5) Throw the TUNE-ANT CUR switch to TUNE, depress the microphone switch, and determine on which channel the greatest meter deflection is obtained.

(6) Throw the TUNE-ANT CUR switch to ANT CUR.

(7) Adjust the coupling for maximum antenna current on the frequency at which the greatest deflection was noted in step (5) above.

(8) Starting with channel No. 1, depress each push button and readjust its associated antenna tuning capacitor for maximum antenna current.

(9) Place the TUNE-ANT CUR switch at TUNE; the RECEIVER TUNE-OPERATE switch at OPERATE; depress a channel selector push button; depress the microphone switch; and check the meter readings for each position of the METER SWITCH. The readings should be an approximation of those shown below.

Radio transmitter BC–604–(*) meter readings

Switch position	1	2	3	4	5	6
Circuit	Tripler grid	1st r-f grid	Rect grid	Doubler grid	P-a grid	Total plate and screen
Meter reading (20 mc) ...	20	40	20	25	15	60
Meter reading (27.9 mc)..	30	25	25	40	20	60

Note. Transmitter RECEIVER TUNE-OPERATE switch thrown to OPERATE.

(10) The transmitter is now tuned and ready for operation on any one of the preset channels. Make sure the RECEIVER TUNE-OPERATE switch is in the OPERATE position. With the microphone button released, place the ON-OFF TRANSMITTER switch in the OFF position. Remove Antenna A–62, if used, and connect the mast antenna.

189. Presetting Receiver

a. GENERAL. Presetting consists of adjusting the ganged variable capacitors of the r-f amplifier, mixer, and r-f oscillator stages for each channel to be used. Thus, after the channel selector mechanism is adjusted and locked, depressing a push button will automatically rotate the tuning capacitors to the preset, resonant position for that channel. Once these adjustments are made it is not necessary to alter

them until the channel frequency assignments are changed. The presetting procedure may be divided into two parts: setting the push buttons and tuning the antenna circuit.

b. SETTING PUSH BUTTONS. (1) The push buttons may be set with the receiver in the vehicle or removed. However, if the receiver is removed a suitable source of d-c power and a Mounting FT–237–(*) or other means of connecting the source of power are required. An unmodulated signal at the frequency or frequencies to which the receiver is to be tuned must be available. This signal may be from either a remote transmitter or an associated transmitter. The following procedure uses an associated transmitter:

(2) Turn the REC OFF-ON switch to ON. Permit the receiver to warm up for 15 minutes. If the right-hand receiver was left in place and was warming while the transmitter was being preset it should not be necessary to wait long. However, steps (3) to (5) below may be performed while waiting.

(3) Release all push buttons by partially depressing any one of them. Hold down the PUSH TO TUNE button to engage the manual TUNING control. Turn the TUNING control to the left until the LOCK line coincides with the hair line on the window. This positions the selector locking screw (accessible through a hole above the push buttons), so that it can be loosened with a screwdriver, thereby permitting the TUNING control to operate the capacitor assembly independently of the push buttons. Turn the selector locking screw in a counterclockwise direction as far as possible; then turn it clockwise about one-half turn.

(4) Set the calibrated dial to some midfrequency and, while holding down the PUSH TO TUNE button, depress one push button after the other until all have been depressed. This procedure changes all previous settings and assures a free-running mechanism.

(5) Place the controls on the receiver panel in the following positions: TUNE-OPERATE to TUNE, SPEAKER OFF-ON to ON, RADIO & INT-INT ONLY to RADIO & INT, SQUELCH OFF-ON to OFF, and VOLUME control almost completely clockwise.

(6) If 15 minutes have elapsed since the REC ON-OFF switch on the receiver to be preset was set to ON, place the RECEIVER TUNE-OPERATE switch on the transmitter panel in the OPERATE position, and the TRANSMITTER ON-OFF switch in the ON position. *Do not start the transmitter dynamotor with the ON-OFF switch.*

(7) Depress the transmitter push button for channel No. 1, and place the transmitter RECEIVER TUNE-OPERATE switch in the RECEIVER TUNE position.

(8) With all receiver push buttons released, manually tune the receiver dial to the frequency corresponding to channel No. 1 of the transmitter.

(9) Depress the receiver PUSH TO TUNE button and depress receiver push button No. 1.

(10) While depressing the receiver PUSH TO TUNE button just enough to engage the tuning wheel, manually rotate the ganged capacitor slightly about the desired setting until an audio beat note is obtained. The frequency of the beat note should be brought to a low audio frequency, preferably zero beat. At zero beat the r-f oscillator is exactly 2.65 mc above the incoming signal. Therefore, the intermediate frequency is 2.65 mc and produces a zero beat when heterodyned with the fixed 2.65 mc i-f oscillator signal.

(11) Release the push button by partially depressing an adjacent push button. Use two fingers, one to press the adjacent push button to effect release, and the other to make sure that the push button to be freed is released slowly and without mechanical shock which may disturb the adjustments already made. The frequency of the beat note may change slightly when the push button is released. However, if the frequency of the beat note is no higher than a very low audio note, the setting should be regarded as satisfactory. If the frequency change is too great, repeat steps (7) to (11) above before attempting to set the next push button.

(12) Adjust the push buttons of each of the remaining channels whose frequency it is desired to preset, being careful not to depress a push button for any channel which already has been preset.

(13) When the last channel has been tuned to the correct frequency and all push buttons have been released, again rotate the tuning dial to its LOCK position and tighten the selector locking screw. This completes the receiver pre-

setting. However, all push buttons should be checked for accuracy of setting at least twice after locking the mechanism to be sure that they are tightly locked and that no slippage is likely to occur under operating conditions. The setting of a push button may be regarded as satisfactory if a whistle can be heard when the corresponding push buttons of the transmitter and receiver are depressed. Under noisy working conditions, it is sometimes hard to hear a high pitched whistle and if the setting happens to be exactly on zero beat, a beat note will not be heard. Therefore, if a beat note is not heard, press the PUSH TO TUNE button and rotate the ganged capacitor slightly with the TUNING control. If the beat note is heard with a motion of the TUNING control of approximately plus or minus one-tenth of a channel division, the setting is satisfactory. If the setting for any channel is unsatisfactory, it should be preset again. Do not rotate the manual TUNING control too much with a push button depressed. This places a stress on the mechanism.

(14) Place both the receiver and the transmitter ON-OFF switches in the OFF position, remembering that the transmitter RECEIVER TUNE-OPERATE switch should be in the OPERATE position before the TRANSMITTER ON-OFF switch is turned OFF.

c. TUNING ANTENNA CIRCUIT. The receiver antenna circuit must be tuned when the set is first installed in the vehicle. Ordinarily it will not require tuning thereafter unless some change is made in the antenna. It can be tuned before setting the push buttons if desired. In making the following adjustments the receiver should be in place in the vehicle and the antenna should be connected. The antenna must not touch anything and the vehicle should preferably be located in the open, but *only* to the extent permitted by camouflage requirements.

(1) Make sure that the receiver is installed in the right-hand position on the mounting so that the left side of the receiver is accessible.

(2) Place the receiver controls at the following positions: REC ON-OFF switch at ON, SQUELCH switch at OFF, TUNE-OPERATE switch at OPERATE, and SPEAKER switch at ON.

(3) Release the push buttons by partially depressing one.

(4) Hold down the PUSH TO TUNE button and rotate the TUNING control to a frequency near the high frequency end where there is noise (not a signal).

(5) Adjust the VOLUME control so that noise is just audible.

(6) Adjust the antenna trimmer (accessible through the port hole on the left side of the receiver) for maximum *noise* output.

(7) Place the REC ON-OFF switch to OFF position.

APPENDIX I

REFERENCE PARTS LIST

1. War Department Signal Supply Pamphlet Reference

The following information was compiled on 3 April 1946. The appropriate pamphlets of the War Department Signal Supply Catalog for Radio Sets SCR–508 and SCR–528 are:

Organizational spare parts
SIG 7–AN/URA–1
Higher echelon spare parts
SIG 8–AN/URA–1
Organizational and higher echelon spare parts
SIG 7 & 8–SCR–508
SIG 7 & 8–SCR–528
SIG 7 & 8–H–16/U
SIG 7 & 8–HS–30
SIG 7 & 8–T–17
SIG 7 & 8–TD–4

For an index of available catalog pamphlets, see the latest issue of War Department Signal Supply Catalog, SIG 1 and 2, Introduction and Index.

2. Identification Table of Replaceable Parts for Radio Sets SCR–508–A, B, C, D, AM, CM, DM

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Parts for basic unit

Ref symbol	Name	Signal Corps stock No.
Fig. 25	ANTENNA A–62 (Phantom)	2A262
	CLAMP MC–424 (for MS–52)	2Z2651–424
Fig. 8	CRYSTAL UNIT, chan 0	2X74–20.0
	CRYSTAL UNIT, chan 1	2X74–20.1
	CRYSTAL UNIT, chan 2	2X74–20.2
	CRYSTAL UNIT, chan 3	2X74–20.3
	CRYSTAL UNIT, chan 4	2X74–20.4
	CRYSTAL UNIT, chan 5	2X74–20.5
	CRYSTAL UNIT, chan 6	2X74–20.6
	CRYSTAL UNIT, chan 7	2X74–20.7
	CRYSTAL UNIT, chan 8	2X74–20.8
	CRYSTAL UNIT, chan 9	2X74–20.9
	CRYSTAL UNIT, chan 10	2X74–21.0
	CRYSTAL UNIT, chan 11	2X74–21.1
	CRYSTAL UNIT, chan 12	2X74–21.2
	CRYSTAL UNIT, chan 13	2X74–21.3
	CRYSTAL UNIT, chan 14	2X74–21.4
	CRYSTAL UNIT, chan 15	2X74–21.5
	CRYSTAL UNIT, chan 16	2X74–21.6
	CRYSTAL UNIT, chan 17	2X74–21.7
	CRYSTAL UNIT, chan 18	2X74–21.8
	CRYSTAL UNIT, chan 19	2X74–21.9
	CRYSTAL UNIT, chan 20	2X74–22.0
	CRYSTAL UNIT, chan 21	2X74–22.1
	CRYSTAL UNIT, chan 22	2X74–22.2
	CRYSTAL UNIT, chan 23	2X74–22.3
	CRYSTAL UNIT, chan 24	2X74–22.4
	CRYSTAL UNIT, chan 25	2X74–22.5
	CRYSTAL UNIT, chan 26	2X74–22.6
	CRYSTAL UNIT, chan 27	2X74–22.7
	CRYSTAL UNIT, chan 28	2X74–22.8
	CRYSTAL UNIT, chan 29	2X74–22.9
	CRYSTAL UNIT, chan 30	2X74–23.0
	CRYSTAL UNIT, chan 31	2X74–23.1
	CRYSTAL UNIT, chan 32	2X74–23.2
	CRYSTAL UNIT, chan 33	2X74–23.3
	CRYSTAL UNIT, chan 34	2X74–23.4
	CRYSTAL UNIT, chan 35	2X74–23.5
	CRYSTAL UNIT, chan 36	2X74–23.6
	CRYSTAL UNIT, chan 37	2X74–23.7
	CRYSTAL UNIT, chan 38	2X74–23.8
	CRYSTAL UNIT, chan 39	2X74–23.9
	CRYSTAL UNIT, chan 40	2X74–24.0
	CRYSTAL UNIT, chan 41	2X74–24.1
	CRYSTAL UNIT, chan 42	2X74–24.2
	CRYSTAL UNIT, chan 43	2X74–24.3
	CRYSTAL UNIT, chan 44	2X74–24.4
	CRYSTAL UNIT, chan 45	2X74–24.5
	CRYSTAL UNIT, chan 46	2X74–24.6
	CRYSTAL UNIT, chan 47	2X74–24.7
	CRYSTAL UNIT, chan 48	2X74–24.8
	CRYSTAL UNIT, chan 49	2X74–24.9
	CRYSTAL UNIT, chan 50	2X74–25.0
	CRYSTAL UNIT, chan 51	2X74–25.1
	CRYSTAL UNIT, chan 52	2X74–25.2
	CRYSTAL UNIT, chan 53	2X74–25.3
	CRYSTAL UNIT, chan 54	2X74–25.4
	CRYSTAL UNIT, chan 55	2X74–25.5

Parts for basic unit (contd.)

Ref symbol	Name	Signal Corps stock No.
	CRYSTAL UNIT, chan 56	2X74–25.6
	CRYSTAL UNIT, chan 57	2X74–25.7
	CRYSTAL UNIT, chan 58	2X74–25.8
	CRYSTAL UNIT, chan 59	2X74–25.9
	CRYSTAL UNIT, chan 60	2X74–26.0
	CRYSTAL UNIT, chan 61	2X74–26.1
	CRYSTAL UNIT, chan 62	2X74–26.2
	CRYSTAL UNIT, chan 63	2X74–26.3
	CRYSTAL UNIT, chan 64	2X74–26.4
	CRYSTAL UNIT, chan 65	2X74–26.5
	CRYSTAL UNIT, chan 66	2X74–26.6
	CRYSTAL UNIT, chan 67	2X74–26.7
	CRYSTAL UNIT, chan 68	2X74–26.8
	CRYSTAL UNIT, chan 69	2X74–26.9
	CRYSTAL UNIT, chan 70	2X74–27.0
	CRYSTAL UNIT, chan 71	2X74–27.1
	CRYSTAL UNIT, chan 72	2X74–27.2
	CRYSTAL UNIT, chan 73	2X74–27.3
	CRYSTAL UNIT, chan 74	2X74–27.4
	CRYSTAL UNIT, chan 75	2X74–27.5
	CRYSTAL UNIT, chan 76	2X74–27.6
	CRYSTAL UNIT, chan 77	2X74–27.7
	CRYSTAL UNIT, chan 78	2X74–27.8
	CRYSTAL UNIT, chan 79	2X74–27.9
	MAST SECTION MS–52	2A2352
	MAST SECTION MS–53	2A2353
Fig. 5	RADIO RECEIVER BC–603	2C4403
Fig. 5	RADIO TRANSMITTER BC–604	2C6494
Fig. 5	WIRE W–128	1B128
Fig. 14	DYNAMOTOR DM–34 (12-volt)	3H1634
Fig. 16	DYNAMOTOR DM–35 (12-volt)	3H1635
Fig. 14	DYNAMOTOR DM–36 (24-volt)	3H1636
Fig. 16	DYNAMOTOR DM–37 (24-volt)	3H1637

Additional parts for vehicular installations

Fig. 5	CABLE, power: Sig C Cordage CO–212	3E2212
	CABLE, AF: Sig C Cordage CO–213	3E2213
Fig. 6	CABLE, AF: Sig C Cordage CO–218	3E2218
	CABLE, RF: Army-Navy Radio Frequency Cable RG–11/U	1F425–11
	CHEST SET TD–4	4B417–4
	CLAMP MC–423	2Z2651–423

Additional parts for vehicular installations (contd.)

Ref symbol	Name	Signal Corps stock No.
Fig. 6	CORD CD–307–A	3E1307A–5.5
Fig. 36	CORD CD–318	3E1318
Fig. 6	CORD CD–604	3E1604
Fig. 33	HEADSET H–16/U	2B800–16
Fig. 31	HEADSET HS–30	2B830
	INSULATOR IN–101	3G601
Fig. 6	INSULATOR IN–121	3G621
Fig. 39	INTERPHONE CONTROL BOX BC–606	2C1738
	MAST SECTION MS–51	2A2351
Fig. 35	MICROPHONE T–17	2B1617
Fig. 36	MICROPHONE T–45	2B1645
Fig. 6	MICROPHONE COVER M–367	2B1567
Fig. 36	SHIELD, breath	2B1589/1

Additional parts used only for navy installations

	ADAPTER ASSEMBLY	2Z307–26
	HEADSET-MICROPHONE ASSEMBLY AN/URA–1	2B1055–1

3. Identification Table For Replaceable Parts for Radio Sets SCR–528–A, B, C, D, AM, CM, DM

The first, second, and third echelon maintenance parts for these radio sets include all the items listed in paragraph 2 above and the following list:

Additional parts for vehicular installations

Ref symbol	Name	Signal Corps stock No.
	INSULATOR IN–86	3G586
	INSULATOR IN–104	3G604
	INSULATOR IN–111	3G611

4. Identification Table of Replaceable Parts for Radio Set AN/VRC–5

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Identification table of replaceable parts for radio set AN/VRC–5 (contd.)

Ref symbol	Name	Signal Corps stock No.
Fig. 8	CRYSTAL UNITS, chan 0 to 79. See paragraph 2 above for further description.	2X74–20.0 to 2X74–27.9
Fig. 27	MAST SECTION MS–116–A	2A2416A
Fig. 27	MAST SECTION MS–117–A	2A2417A
Fig. 27	MAST SECTION MS–118–A	2A2418A
Fig. 14	DYNAMOTOR DM–34 (12-volt)	3H1634
Fig. 16	DYNAMOTOR DM–35 (12-volt)	3H1635
Fig. 14	DYNAMOTOR DM–36 (24-volt)	3H1636
Fig. 16	DYNAMOTOR DM–37 (24-volt)	3H1637

5. Identification Table of Replaceable Parts for Radio Receiver BC–603–A, C, D, DM

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
PG3, J1, J2	BOARD ASSEMBLY BUSHING	2C4403A/P3 2C4403DM/B1
C23	CAPACITOR	3DB40–54
C10	CAPACITOR	3DA750–12
C8, C13, C26	CAPACITOR	3K2051122
C19	CAPACITOR	3K3020222
C22	CAPACITOR	3K3551222
C2, C3, C4, C5, C6, C7, C9, C11, C14	CAPACITOR	3K3562222
C20.1, C20.2, C20.3	CAPACITOR	3DA100–557
C12, C17, C18, C21	CAPACITOR	3K4010321
C15	CAPACITOR	3DA500–423
C24	CAPACITOR	3DB1–42
C16	CAPACITOR	3DB2–83
C25	CAPACITOR	3DB2–82

Identification table of replaceable parts for Radio Receiver BC–603–A, C, D, DM (contd.)

Ref symbol	Name	Signal Corps stock No.
C1.1, C1.3, C1.5	CAPACITOR	2C4403A/C1
L1	COIL	2C4403A/C7
LCU1	COIL	2C4403A/C18
LCU4	COIL	2C4403A/C21
LCU2	COIL	2C4403A/C19
LCU3	COIL	2C4403A/C20
J3	CONNECTOR	2C4403A/J2
PG1	CONNECTOR	2C4403A/P1
PG2	CONNECTOR	2Z7228
F1	FUSE FU–24 GUARD, front panel	3Z1924 2C4403A/G1
FM1, FM2	HOLDER, fuse	3Z3282
Fig. 11	INSULATOR, feed through, mounts A and G binding posts	2C4403A/J3
Fig. 11	KNOB, marked VOLUME	2C4403A/K2
E1	LAMP, glow	2Z5893–1
ES1	INDICATOR, light	2Z5990–4
Fig. 58	LOCK ASSEMBLY, push-button tuner	2C6494A/S6/2
Fig. 11	MOUNTING, bracket, secures receiver	2C4403A/B3
Fig. 11	PANEL ASSEMBLY	2Z6960–59
Fig. 11	POST, binding, push type, marked A	2C4403A/B1
Fig. 11	POST, binding, push type, marked G	2C4403A/B2
R11, R15, R16	RESISTOR	3RC21BF105K
R19, R94	RESISTOR	3RC21BF205J
R9, R38, R64, R74, R85	RESISTOR	3RC21BF102K
R5	RESISTOR	3RC21BF301J
R3	RESISTOR	3RC21BF511J
R4	RESISTOR	3RC21BF513J
R26	RESISTOR	3RC21BF122J
R12	RESISTOR	3RC21BF202J
R23	RESISTOR	3RC21BF512J
R13, R63, R73	RESISTOR	3RC21BF103K
R95	RESISTOR	3RC21BF153K
R1, R7	RESISTOR	3RC31BF303J
R52, R72, R96	RESISTOR	3RC21BF303J

Identification table of replaceable parts for Radio Receiver BC–603–A, C, D, DM (contd.)

Ref symbol	Name	Signal Corps stock No.
R92, R93	RESISTOR	3RC21BF393J
R62	RESISTOR	3RC21BF433J
R8, R31, R83	RESISTOR	3RC21BF683J
R6, R18, R53, R54, R61, R91	RESISTOR	3RC21BF104K
R2, R10, R14, R17, R37, R51, R71, R82, R84	RESISTOR	3RC20BF244J
R20	RESISTOR	3RU30001
R31	RESISTOR	3RC31BF682J
R1, R7	RESISTOR	3RC31BF303J
R29	RESISTOR	3RC41BF133J
R3, R31, R83	RESISTOR	3RC21BF683J
R21	RESISTOR	3RC41BF303J
R30	RESISTOR	3RW10501
R24	RESISTOR	3RU22801
R25, R27, R28	RESISTOR	3RC21BF242J
P2	RESISTOR	3RA4205
P1	RESISTOR	2Z7298–1
Fig. 12	SCREW, for mounting PG1	2C1617A/S2.1
VS1 to VS10	SOCKET, tube	2C4403A/S1
LS1	SPEAKER	6C35
D5	SWITCH	3Z9849.71
D4	SWITCH	2C4403A/S3
D1, D2	SWITCH	3Z9858–8.3
D3	SWITCH	2C4403A/S4
T1	TRANSFORMER	2C4403A/T3
FL4	TRANSFORMER ASSEMBLY	2C4403A/F4
FL1	TRANSFORMER ASSEMBLY	2C4403A/F1
FL2	TRANSFORMER ASSEMBLY	2C4403A/F2
FL3	TRANSFORMER ASSEMBLY	2C4403A/F3
V1, V2, V6	TUBE JAN 6AC7 (VT112)	2J6AC7
V3	TUBE JAN 6J5 (VT94)	2J6J5
V4, V5	TUBE JAN 12SG7 (VT209)	2J12SG7
V7	TUBE JAN 6H6 (VT90)	2J6H6
V8	TUBE JAN 6V6GT/G (VT107A)	2J6V6GT/G
V9, V10	TUBE JAN 6SL7GT (VT229)	2J6SL7GT
Fig. 58	TUNING ASSEMBLY, RF: push button	2C4403A/S5

6. Identification Table of Replaceable Parts for Radio Transmitter BC–604

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
Fig. 8	BINDING POST, marked A	2C4403A/B1
Fig. 8	BINDING POST, marked G	2C6494A/B2
E, Fig. 59	BUTTON, brass plug	2C6494A/B3
	CABLE, RF, coaxial, Radio Frequency Cable RG–62/U	1F425–62
C105	CAPACITOR	3D9015–59
C147	CAPACITOR	3D9175–6
C162	CAPACITOR	3DB4–240
C140	CAPACITOR	2C6494A/C6
C144	CAPACITOR	3DB100–34
C151	CAPACITOR	3K2051022
C103	CAPACITOR	3K2510122
C161	CAPACITOR	3D9100–70
C104, C108, C165	CAPACITOR	3K3051122
C124, C149	CAPACITOR	3K4510221
C150	CAPACITOR	3DA1–72
C101, C109, C111, C112, C117, C118, C121, C122, C146, C148, C154, C155, C158	CAPACITOR	3K3030222
C123, C159	CAPACITOR	3K4010324
C138.1, C138.2, C142.1, C142.2	CAPACITOR	3DA100–549
C163	CAPACITOR	3DA250–322
C125	CAPACITOR	3D9060V–7

Identification table of replaceable parts for Radio Transmitter BC–604 (contd.)

Ref symbol	Name	Signal Corps stock No.
C106, C113, C115, C119, C152, C156	CAPACITOR	2C6494A/C1
C114, C116, C120, C126, C153, C157	CAPACITOR	3D9020V–1
C137, C139, C141, C143	CAPACITOR	3DA500–452
C145	CAPACITOR	3DB2–100
C127 to C136	CAPACITOR	3D254
H	CLAMP capacitor	6Z1885
H	CLAMP, tube	2C6494A/C28
	CLAMP ASSEMBLY, tube	2C6494A/S11
E	CLIP, tube contact	2Z2724
L110, L111	COIL ASSEMBLY	2C6494A/C15
L102	COIL	2C6494A/C9
L104	COIL	2C6494A/C11
L101	COIL	2C6494A/C8
L103	COIL	2C6494A/C10
L120	COIL	3C357–3
L105	COIL	2C6494A/C12
L106, L107	COIL	2C6494A/C13
L118, L119	COIL	2C6494A/C17
L108	COIL	2C6494A/C14
J101	CONNECTOR	2ZB799–231
PG101	CONNECTOR	2C6494A/P1
PG103, PG104	CONNECTOR	2Z7228–20
	COVER, crystal oven	2C6494A C24
F101	FUSE	3Z2595.3
Fig. 59	GEAR, spur	2Z4875–146
Fig. 59	GEAR RACK, steel	2Z4875–147
Fig. 9	GUARD, transmitter	2C6494A/G1
FM101, FM102	HOLDER, fuse	3Z3282
E	INSULATOR	2C6494A/J3
E	INSULATOR	3G1250–5.2
E	INSULATOR	2C4403A/J3
E	INSULATOR	2C6494A/J2
E	INSULATOR	3G1250–14.6
J102	JACK	2Z5575

Identification table of replaceable parts for Radio Transmitter BC–604 (contd.)

Ref symbol	Name	Signal Corps stock No.
ES101	LAMPHOLDER	2Z5990–2
E101	LAMP LM–38	2Z5938
Fig. 11	LENS, green	2Z5891–14
Fig. 59	LOCK ASSEMBLY, push-button tuner	2C6494A/S6/2
M101	METER	3F910–47
Fig. 11	MOUNTING, indicator light	2Z6820.102
	OVEN	6Z7422
P101	POTENTIOMETER	2Z7288–3
S101	RELAY	2C6494A/R2
S102	RELAY	2C6494A/R3
S103	RELAY	2C6494A/R5
S104	RELAY AND SWITCH ASSEMBLY	2C6494A/R4
R110, R143	RESISTOR	3RC21BF102K
R123	RESISTOR	3RC30BF122K
R124, R128	RESISTOR	3RC21AF103K
R111, R123	RESISTOR	3RC31BF103K
R106, R121, R137	RESISTOR	3RC21BF101K
R120	RESISTOR	3RC30BF201J
R119	RESISTOR	3RC21BF122K
R133	RESISTOR	3Z4840–3
R150	RESISTOR	3RC31BF243J
R134, R136	RESISTOR	3RC21BF303J
R114, R116	RESISTOR	3RC41BF303J
R125	RESISTOR	3RC21BF393J
R104, R117, R138, R142	RESISTOR	3RC31BF513J
R126	RESISTOR	3RC41BF753J
R135	RESISTOR	3Z4845.1
R101, R107, R115, R139, R144, R155	RESISTOR	3RC21BF104K
R151	RESISTOR	3RC31BF104K
R109, R118, R145, R157, R158	RESISTOR	3RC41BF104J
R105	RESISTOR	3RC21BF244J
R103, R122	RESISTOR	3RC31BF244J
R113, R127	RESISTOR	3Z4801–1
R131, R132, R140, R141	RESISTOR	3Z4812

Identification table of replaceable parts for Radio Transmitter BC–604 (contd.)

Ref symbol	Name	Signal Corps stock No.
R130	RESISTOR	3Z4900–1
R102, R147	RESISTOR	3Z5410.2
R152	RESISTOR	3RW26108
R129	RESISTOR	3Z5450.6
R153, R154	RESISTOR	3Z5998–2
R112	RESISTOR	3RC21BF100K
R156	RESISTOR	3RC31BF390J
R108	RESISTOR	3RC21BF510J
	RESISTOR, fixed, 1 ohm, 10 w	3RW2703
Fig. 59	ROLLER ASSEMBLY, guide	2Z4885–7
Fig. 59	ROLLER ASSEMBLY, guide	2Z4885–8
	SCREW, machine	6L6632–40.49S
Fig. 10	SCREW ASSEMBLY	2C6530–684A/S9
Fig. 9	SOCKET ASSEMBLY, crystal	2C6494A/S10
VS104	SOCKET, tube	2Z8711
VS101, VS102, VS103, VS105, VS106, VS107, VS108	SOCKET, tube	2C4403A/S1
(L116, R146) (L117, R149)	SUPPRESSOR, parasitic	3Z1892–1.5
D111 to D120	SWITCH	2C6494A/S6/3
D101 to D110	SWITCH	2C6494A/S6/4
D125	SWITCH	2C6494A/S5
D121, D122, D123, D126	SWITCH	2C6494A/S3
D123, D124	SWITCH	3Z9858–8.20
TD101	SWITCH, thermostatic	2Z9183
TC101	THERMOCOUPLE	3F910–27/T1
T102	TRANSFORMER, AF	2C6494A/T3
T101	TRANSFORMER, AF	2C6494A/T2
Fig. 59	TUNING ASSEMBLY, r-f, push-button	2C6494A/S6
V101, V102, V103, V105, V106, V107, V108	TUBE JAN 1619 (VT–164)	2J1619
V104	TUBE JAN 1624 (VT–165)	2J1624

7. Identification Table of Replaceable Parts for Interphone Control Box BC–606–D, E, H

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
Fig. 120	BOARD, terminal	4E9900–700A
Fig. 39	CLAMP, spring, Model H only	2C1738A/CL1
Fig. 39	COLLAR, jack spacing, Model H only	2Z2935–35
	COVER, jack, rubber, Model H only	2Z3351–107
Fig. 39	COVER, jack, steel, Model H only	2Z3403.10
Fig. 39	COVER, switch, Model H only	3Z9849.39–1/B2
Fig. 39	GASKET, rubber, 13/32" ID, 61/64" OD x 5/16" d, Model H only	6L54012
	GASKET, rubber, 3" sq opening, Model H only	2Z4868.391
J1	JACK JK–33–A, telephone	2Z5533A
Fig. 39	KNOB, marked VOLUME	2C4403A/K2
Fig. 120	RESISTOR, 2,000 ohms	3RC20BE202J
Fig. 120	RESISTOR, potentiometer	2Z7288–3
Fig. 120	SWITCH, Model H only	3Z9849.151
Fig. 119	SWITCH, Models D, E only	3Z9858–8.3

8. Identification Table of Replaceable Parts for Dynamotor DM–34–A, C, D

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
Fig. 60	BRUSH, high voltage	3H1634A/B5
Fig. 60	BRUSH, low voltage	3H1634A/B4
C701 to C706	CAPACITOR	3DKA5–89
L702	COIL	3H1634A/C1
L701	COIL	2C4403A/C8
L703, L704	COIL	3H1634A/C2
Fig. 15	CONNECTOR, female	2Z8688.5

9. Identification Table of Replaceable Parts for Dynamotor DM–35–A, C, D

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Identification table of replaceable parts for Dynamotor DM–35–A, C, D (contd.)

Ref symbol	Name	Signal Corps stock No.
Fig. 60	BRUSH, high voltage	3H1635A/B5
Fig. 60	BRUSH, low voltage	3H1635A/B4
C501, C502	CAPACITOR	3DA2–63.2
Fig. 17	CONNECTOR	3H1635A/R1
Fig. 16	SCREW, captive	3H1635A/S1

10. Identification Table of Replaceable Parts for Dynamotor DM–36–A, B, C, D

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
Fig. 60	BRUSH, high voltage	3H1634A/B5
Fig. 60	BRUSH, low voltage	3H1636A/B4
C801 to C806	CAPACITOR	3DKA5–89
L802	COIL	3H1634A/C1
L801	COIL	2C4403A/C8
L803, L804	COIL	3H1634A/C2
Fig. 15	CONNECTOR	2Z8688.5

11. Identification Table of Replaceable Parts for Dynamotor DM–37–B, C, D

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
Fig. 60	BRUSH, high voltage	3H1635A/B5
Fig. 60	BRUSH, low voltage	3H1637A/B4
C601, C602	CAPACITOR, 2,000 mmf	3DA2–63.2
Fig. 17	CONNECTOR, female	3H1635A/R1
Fig. 16	SCREW, captive	3H1635A/S1

12. Identification Table of Replaceable Parts for Mounting FT–237–A, C, D, E, DM

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
Fig. 20	BOARD, terminal	2Z9410.131
Fig. 20	BOARD ASSEMBLY, terminal	2Z6721–237A/P1
	BUSHING, spacer, for mounting terminal board assembly	2Z8807–60

Identification table of replaceable parts for Mounting FT–237–A, C, D, E, DM (contd.)

Ref symbol	Name	Signal Corps stock No.
	CABLE, RF, Radio Frequency Cable RG–62/U	1F425–62
Fig. 5	CABLE ASSEMBLY, power, battery cable	3E2278
C401	CAPACITOR	3K2010121
	CONNECTOR, female, 90° angle type	2Z6721–237A/C12
	CONNECTOR, female, T-shaped	2Z6721–237A/C11
J401, J402	CONNECTOR	2Z8689–1
J403	CONNECTOR	2Z8690–6
Fig. 18	COVER, dust	2Z6721–237A/C1
Fig. 20	DOOR ASSEMBLY	2Z3352.110
Fig. 20	FASTENER, Dzus	6L31412N
Fig. 20	FASTENER ASSEMBLY, screw, mounting	2Z6721–346/1
F401	FUSE FU–67	3Z1967
	INSULATOR, bushing	2C6494A/J4
	MOUNT, virbation, rectangular	2Z8500
Fig. 20	PIN ASSEMBLY, alinement	2Z6721–237A/R3
Fig. 18	PLATE, warning, marked BATTERY VOLTAGE 12 (24) V	2Z6833–1
	POST, binding, marked GND	2Z7259–36
Fig. 18	POST, binding, marked TR	2Z6721–237A/T2
Fig. 18	POST, binding, marked REC	2Z6721–237A/T1
Fig. 20	SPRING, coil	2Z6721–346/3

13. Identification Table of Replaceable Parts for Antenna (Phantom) A–62

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
Fig. 26	CAPACITOR	3D9055VE5–1
Fig. 26	CLAMP, ground	2Z2635.167
Fig. 26	COIL	3C1083A–22
Fig. 26	CONNECTOR, male, for coaxial cable	2Z3021–112
Fig. 26	LAMP LM–27	2Z5927
Fig. 26	LAMPHOLDER	2Z8723.1
Fig. 26	POST, marked ANT	3Z737–38
Fig. 26	POST, marked GND	3Z737–39
Fig. 25	RESISTOR	3E6024–14

14. Identification Table of Replaceable Parts for Mast Base AB–15/GR

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
Fig. 28	CONNECTOR, female	2Z3062–109
	CONNECTOR, male, Sig C Plug PL–259	2Z7226–259
Fig. 28	GASKET, insulator and post spacer	2A1173.2–16
Fig. 28	GASKET, insulator and connector spacer	2A1173.2–18
Fig. 28	GASKET, insulator spacer	2A1173.2–17
Fig. 28	INSULATOR, bowl, 1⅞" lg x 2¾" diam	3G1050–30.2
Fig. 28	INSULATOR, bowl, 2" lg x 3" diam	3G1000–16.7
Fig. 28	INSULATOR, washer	3G1838–24.23
Fig. 28	NUT, hexagon	6L3005–24JN
Fig. 28	POST, binding, screw type	3Z741–19.1
Fig. 28	POST, supporting, flexible	3Z741–19
	STRAP, bonding, grounding	2Z9049.41
Fig. 28	WASHER, flat, brass	6L50030–2
Fig. 28	WASHER, lock, steel	2A3171.6

15. Identification Table of Replaceable Parts for Mast Base MP–48 and MP–48–A

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
	ADAPTER ASSEMBLY, includes binding post TM–146, pin, coupling, insert retainer, insert, washer, for unshielded wire, Model MP–48 only	2A2088–48/A1
	BINDING POST TM–146, Model MP–48 only	3Z246
	CABLE ASSEMBLY, RF, Wire W–128, Model MP–48 only	2A2088–48/W5
	CAP, for plug case, Model MP–48 only	2A2088–48/C1
	CASE, plug, Model MP–48 only	2A2088–48/C9
	COLLAR, spacing, Model MP–48–A only	2A2088–48/C7

Identification table of replaceable parts for Mast Base MP–48 and MP–48–A (contd.)

Ref symbol	Name	Signal Corps stock No.
	CONNECTOR, female, for coaxial cable, Model MP–48–A only	2A2088–48/C4
	INSULATOR IN–118, bushing	3G618
	INSULATOR, white ceramic, Model MP–48–A only	3G1250–60
	PLUG, across flats, Model MP–48 only	2A2088–48/P1
	SOCKET ASSEMBLY, mast, Model MP–48 only	2A2088–48/M1
	SOCKET ASSEMBLY, mast, Model MP–48–A only	2A2088–48A/M1
	RETAINER ASSEMBLY, Model MP–48 only	2A2088–48/R7
	RETAINER ASSEMBLY, Model MP–48–A only	2A2088–48A/R1
	TERMINAL, lug, Model MP–48–A only	3Z12076–7
	WIRE W–128, Model MP–48–A only	1B128
	NUT, brass, Model MP–48 only	2A2088–48/N1
	NUT, steel, Model MP–48–A only	6L3522–20–28S
	SCREW, machine, No. 6–32 RHB (part of IN–118)	6L6632–6–1.1
	SCREW, machine, brass, ⅛" ball point, ¼" –28 NF–2 thread, 9/32" lg, Model MP–48–A only	2A2088–48/S1
	SCREW, set, cup point, steel, 8–32 x 9/32" lg, Model MP–48–A only	5B14308–4–1.31
	SCREW, set cone point, 10–32 x 7/16" lg	6L7968–7.35S
	SCREW, set, cone point, steel, 5/16" –24 x 9/32" lg, Model MP–48 only	6L7945–5–5.35P
	SCREW, set, cone point, steel, 10–32 x ⅝" lg, Model MP–48 only	6L7949–10.35P
	SCREW, set, cone point, steel, No. 10–32, 5/16", Model MP–48–A only	6L7968–10–1.31S
	WASHER, spacing, 15/16" OD, 7/16" ID, 3/16" thk, Model MP–48–A only	3G1250–3.1
	WASHER, lock SAE geq for No. 6 screw	6L70006P
	WASHER lock, internal tooth, Shakeproof No. 1244	6L72244

Identification table of replaceable parts for Mast Base MP–48 and MP–48–A (contd.)

Ref symbol	Name	Signal Corps stock No.
	WASHER, lock, steel, 1⅝" OD, 1-13/32" ID, 1/16" thk, Model MP–48 only	2A2088–48/W2
	WASHER, rubber, Model MP–48 only	6L54012–2
	WASHER, brass, 3¼" OD, 1-13/32" ID, ¼" thk, two ⅛" holes, Model MP–48 only	2A2088–48/W1
	WASHER, steel, 3¼" OD, 1-7/16" ID, 3/16" thk	6L58053

16. Identification Table of Replaceable Parts for Headset-Microphone Assembly AN/URA–1

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
	ADAPTER, microphone	2Z307–26
	CORD, extension, microphone	3E4035–60.1
	CORD, extension, receiver	3E4035–83
	CORD ASSEMBLY, headset	3E4035–82
	CUSHION, headset	2B1055–1/1
	HARNESS, face	2B670
	HEADBAND	2B1055–1/2
	HEADSET	2B955
	MICROPHONE	2B1750–1
	RECEIVER	2B1055–1/3
	SCREW, machine, secures cord tip connections	6L6264–3–1.12S
	SCREW, machine, limits adjustment of headband	6L6440–2–3.81BF
	SCREW, machine, fastens receiver to headband	6L6540–3.67
	WASHER, lock	6L72906BF

17. Identification Table of Replaceable Parts for Headset H–16/U

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Identification table of replaceable parts for Headset H–16/U (contd.)

Ref symbol	Name	Signal Corps stock No.
Fig. 33	CEMENT, liquid, seal between cover plate and earcup assembly	6G212.2
Fig. 33	CLAMP, cable, fastens cord to earcup	6Z1932–31
Fig. 33	CUSHION, headset, for LH earcup	2B275–1
Fig. 33	CUSHION, headset, for RH earcup	2B275
Fig. 33	EARCUP MX–239/U, headset receiver marked RIGHT	2B450–239
Fig. 33	EARCUP MX–240/U, headset receiver marked LEFT	2B450–240
Fig. 33	GASKET, molded buna, seals cover plate and casting of right-hand Earcup MX–240/U	2Z4868.257
Fig. 33	GASKET, molded buna, seals cover plate and casting of left-hand Earcup MX–240/U	2Z4868.249
	GASKET, neoprene, terminal board mounting	2B800–16/1
Fig. 33	HEADBAND MX–175/U	2B735–175
Fig. 33	INSERT, headset receiver	2B800–16/6
Fig. 33	PLUG PL–54	2Z7154
	RECEIVER UNIT, headset, for left-hand earcup	2B800–16/5
	RECEIVER UNIT, headset, for right-hand earcup	2B800–16/4
	SCREW, machine, mounts earcup cover	6L6256–2.7B
	SCREW, machine, mounts earcup cover and cover plate	6L6256–3.7BS
	SCREW, machine, mounts cord clamp	6L6256–3.12S
	SCREW, machine, mounts chassis assembly	6L6256–8.47S
	SCREW, machine, fastens cords to plug	6L6264–1–1.3
Fig. 33	SCREW, set, fastens headband to earcup casting	6L18506–3.32BD
Fig. 33	SHELL, plug, for Plug PL–54	2Z7154/1
	SPRING, earcup	2B800–16/11

18. Identification Table of Replaceable Parts for Headset HS–30–A, B, C, D, E, F, G, H, J, K, L, R, U

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
	BUSHING, cord, seals cord in receiver case. Does not apply to models A and D	6Z1667
Fig. 31	CAP, telephone receiver	2B2030A/C1
Fig. 32	CLAMP, cord. Does not apply to models A and D	2B830U/C1
Fig. 32	CORD CD-620-U, headset	3E1620U
	DIAPHRAGM, receiver	2B830U/D1
Fig. 31	HEADBAND HB-30	2B730
Fig. 31	HOUSING, headset receiver	2B830U/S1
	HOUSING, headset receiver, Model F only	2B2030F/H1
Fig. 31	INSERT M-300	2B1300
Fig. 32	RECEIVER R-30-U, headset	2B2030U
	RECEIVER UNIT, headset. Does not apply to models A, D, E, F, K	2B2030A/R1
	SCREW, machine, contacts on receiver unit. Does not apply to Models F and G	2B830A/S1
	SCREW, machine, mounts back-plate of receiver, Model E only	6L6342–2–1.7S
	WASHER, lock, secures connections to receivers	6L72202–1Z

19. Identification Table of Replaceable Parts for Chest Set TD–4

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
J2	CONNECTOR, female	2Z3062–111
P1	CONNECTOR, male	2Z3021–121
E2	CONTACT ASSEMBLY, switch	4B443.1–6
W1	CORD CD-802, chest set	3E1802
O4	COVER, housing, phenolic	2Z3352.113
E1	HOUSING, switch, phenolic	4B1465
H4	INSERT, threaded, fastens headset jack assembly and switch contact assembly to housing	4B1475–1

Identification table of replaceable parts for Chest Set TD–4 (contd.)

Ref symbol	Name	Signal Corps stock No.
H3	INSERT, threaded, fastens cover and chest plate to housing	4B1475
J1	JACK, telephone, for 2-conductor plug	4C4312–27
J101	JACK JK–53, for 4-conductor plug	2Z5549–53
N1	LABEL, circuit	6D16781
O1	LEVER, switch	4B141–1
H5	PIN, straight, brass, actuates switch contact	4B2175
H6	PIN, straight, brass, actuates switch contact	4B2175–1
O3	PLATE, retainer, female connector cover	4B2250–1
O2	PLATE, retainer, male connector cover	4B2250–2
H11	SCREW, machine, clamp plate	6L6256–5.8
H7	SCREW, machine, contact assembly	6L6448–13.8
H8	SCREW, machine, strap bracket assembly	6L6448–9.7B
H9	SCREW, machine, cover screw	6L6448–6.4B
H10	SCREW, machine, headset jack	6L6448–5.1
E3	SLEEVE, telephone jack	4C3839
H2	SPRING, flat, S-shape, stops rocker arm in HOLD ON position	4B3843.5
H1	SPRING, flat, S-shape, maintains rocker arm in neutral position	4B3843.4
H14	STRAP ST–24, carrying	4Z6924
H13	STRAP ST–25, carrying	4Z6925
H12	WASHER, lock, headset jack	6L72204–3Z

20. Identification Table of Replaceable Parts for Microphone T–17 and T–17–B, C, D, E

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
Fig. 35	BUTTON, push, p/o Switch SW–109	3Z8109/1
	BUTTON, push, p/o Switch SW–217, Models T–17 and T–17–D mfd by Universal only	3Z8217/1
Fig. 35	CORD CO–76–A, microphone	3E2076A

Identification table of replaceable parts for Microphone T–17 and T–17–B, C, D, E (contd.)

Ref symbol	Name	Signal Corps stock No.
Fig. 35	MICROPHONE ELEMENT ASSEMBLY, carbon	2B490
	PLUG PL–68	2Z7168
	SCREW, machine, mounts cord ferrule in phenolic handle model, Models T–17 and T–17–D mfd by Universal only	6L6440–3.12S
	SCREW, machine, microphone unit mounting	6L6440–5.4
	SCREW, machine, mounts removable section of bakelite handle model, Models T–17 and T–17–B and E mfd by Shure only	6L6632–14.55S
	SCREW, machine, mounts Switch SW–217, Models T–17 and T–17–D mfd by Universal only	6L6440–9.49S
	SCREW, machine, terminates cord at plug	2Z7168/3
	SCREW, machine, mounts switch cap	3Z8109/5
	SCREW, self-tapping, mounts Switch SW–109	6L6440–13.4
	SCREW, self-tapping, mounts stop bracket on Switch SW–217, Models T–17 and T–17–D mfd by Universal only	6L18202–4.49S
	SCREW, self-tapping, mounts switch housing and back section, Model T–17 mfd by WECo only	6L18204–6.49S
Fig. 35	SPRING, spiral, cord strain relief	2B1617/19
	SPRING, spiral, push-button return. Does not apply to Models T–17 and T–17–D mfd by Universal	3Z8109/13
	STOP, switch, Models T–17 and T–17–D mfd by Universal only	2B1617/152
	SWITCH SW–109, push type, for all models except Universal phenolic handle model	3Z8109
	SWITCH SW–217, push type, for T–17 and T–17–D phenolic handle models only	3Z8217
	TERMINAL TM–161, lug, cord termination to replace TM–89	3Z10161
	WASHER, lock, terminates wire at transmitter unit and mounts stop bracket. Does not apply to Models T–17, T–17–B, E	6L72202C
	WASHER, lock, mounts switch cap	6L72904
	WASHER, lock, mounts switch housing and back	6L73004

21. Identification Table of Replaceable Parts for Mounting FT–346

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
	CABLE ASSEMBLY, power, battery cable, Sig C Cord CD–948	3E1948
Fig. 86	CAPACITOR	3K2510114
Fig. 23	CONNECTOR, female, coaxial, antenna interconnector	2Z8799–239
Fig. 23	CONNECTOR, female, plug	2Z8689–1
Fig. 23	FASTENER ASSEMBLY, screw	2Z6721–346/1
Fig. 24	MOUNT, vibration	2Z6721–346/5
	SPRING, coil, alinement pin tension	2Z6721–346/3

22. Identification Table of Replaceable Parts for Mounting FT–508

Note. The following list covers first, second, and third echelon maintenance parts. See paragraph 1 above for appropriate sections of the War Department Signal Supply Catalog.

Ref symbol	Name	Signal Corps stock No.
Fig. 21	BOARD ASSEMBLY, terminal strip	2Z9412.131
	CABLE ASSEMBLY, power, battery cable, Sig C Cord CO–278	3E2278
Fig. 21	CONNECTOR, female, coaxial, antenna interconnector	2Z8799–239
Fig. 21	CONNECTOR, plug, connects to transmitter	2Z8690–6
Fig. 21	FUSE FU–67	3Z1967
Fig. 21	INSULATOR	3G1000–6.10
Fig. 22	MOUNT, vibration	2Z8406–13
Fig. 21	POST, binding, antenna connector, engraved TR	3Z286
	SPRING, coil, tension spring for alinement pin	2Z6721–346/3

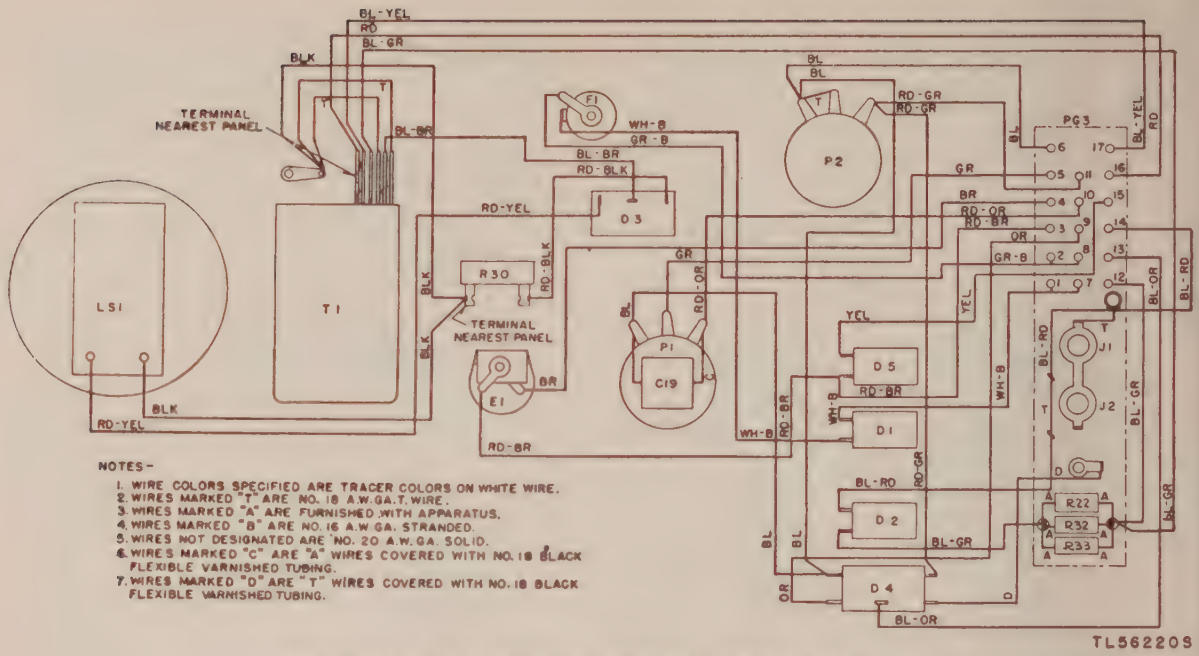


Figure 118. Radio Receiver BC–603–(*), front panel wiring.

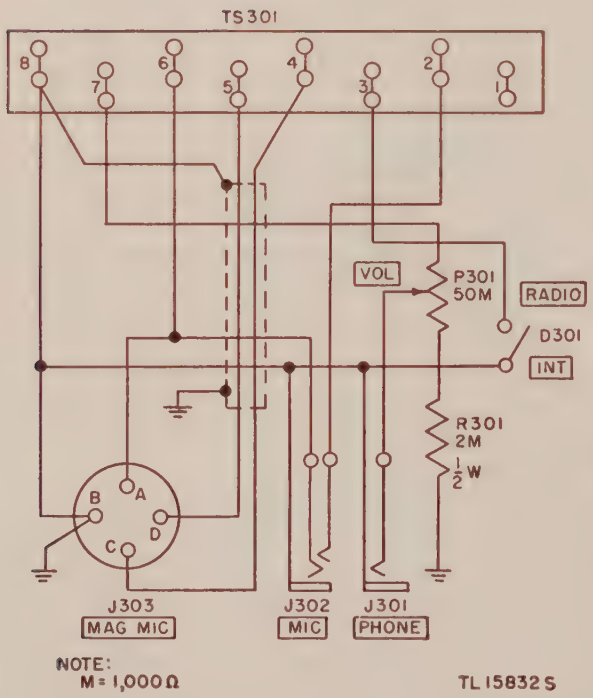


Figure 119. Interphone Control Box BC–606–A, to G, schematic diagram.

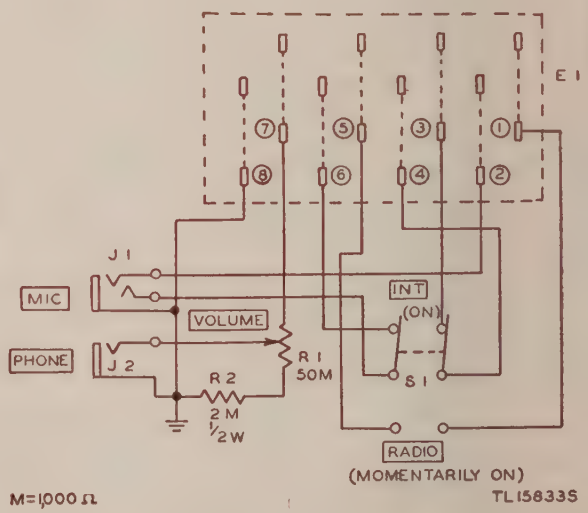


Figure 120. Interphone Control Box BC–606–H, schematic diagram.

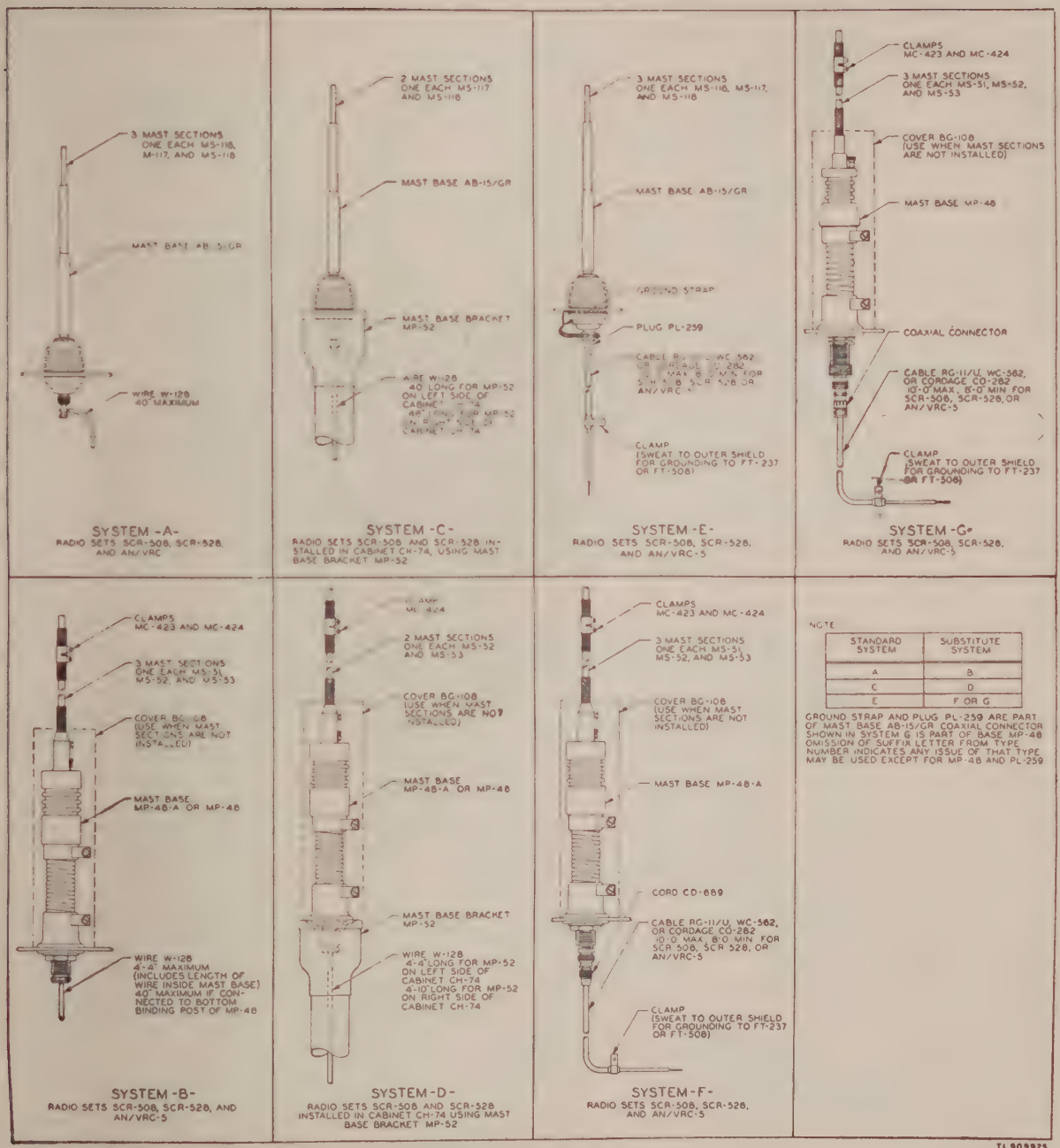


Figure 124. Antenna systems for vehicular radio installations.

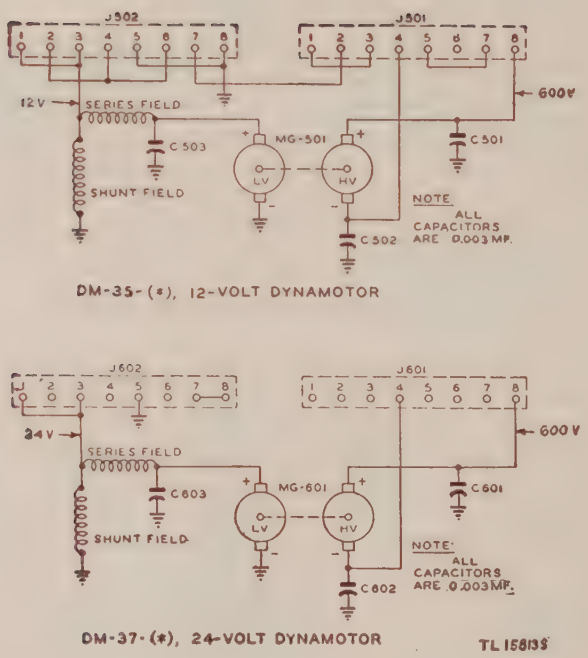


Figure 125. Dynamotors DM–35–(*) and DM–37–(*), schematic diagram.

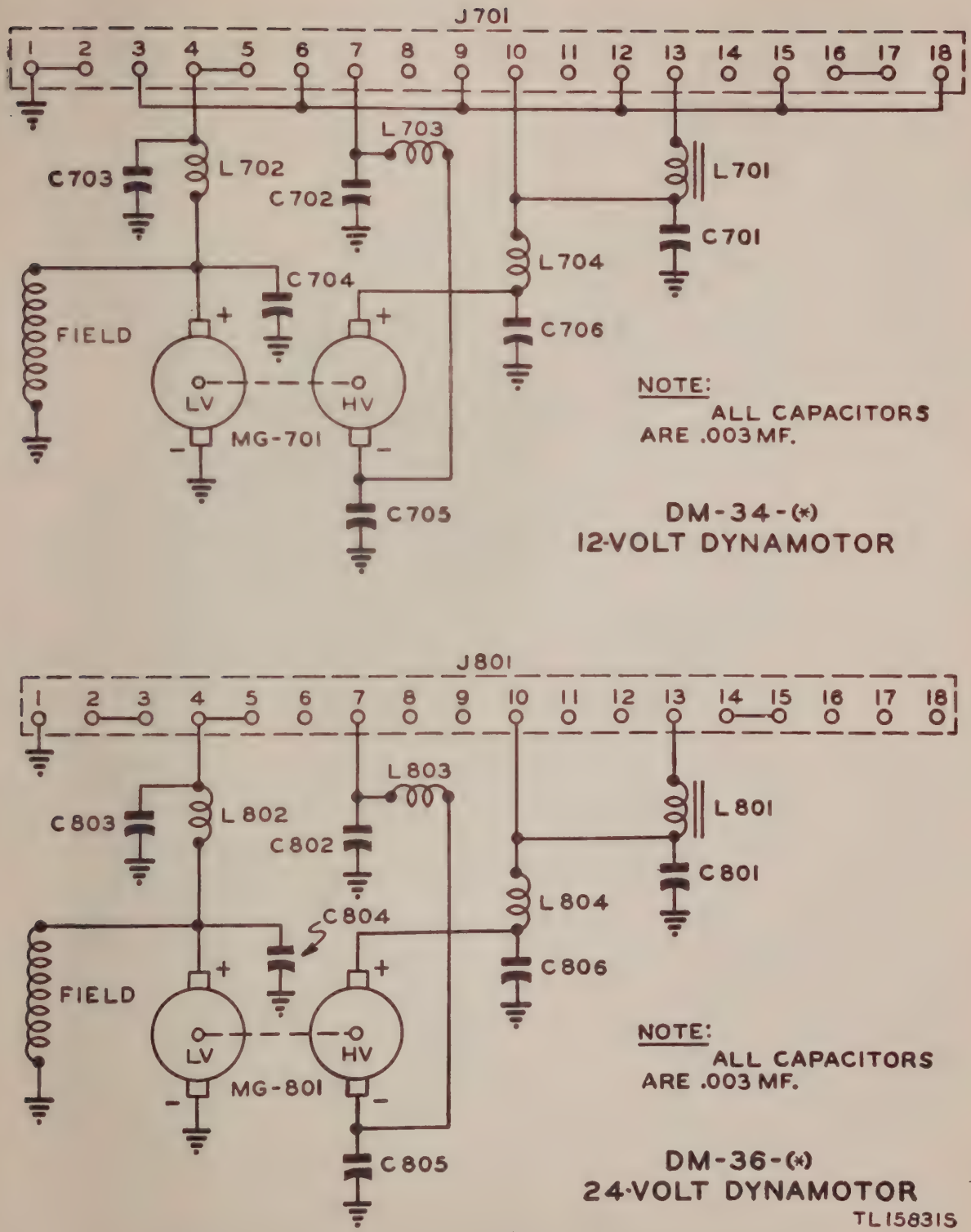
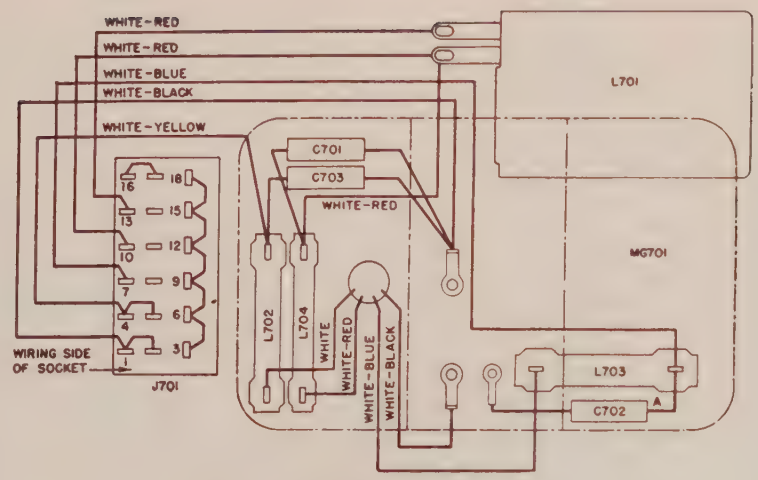
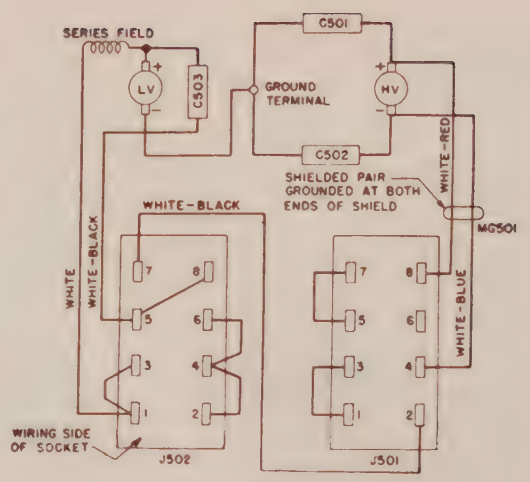


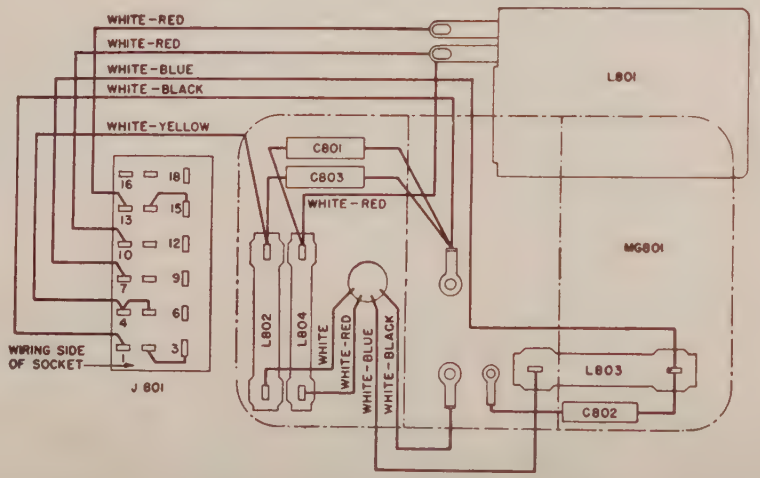
Figure 126. Dynamotors DM-34-(*) and DM-36-(*), schematic diagram.



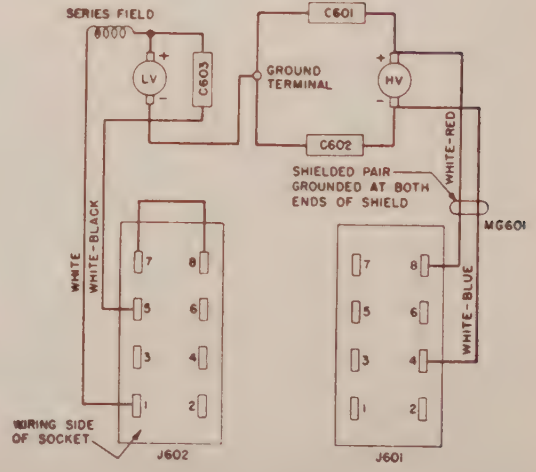
DYNAMOTOR DM-34-(*)



DYNAMOTOR DM-35-(*)



DYNAMOTOR DM-36-(*)



DYNAMOTOR DM-37-(*)

Figure 127. Dynamotors DM-34-(*), DM-35-(*), DM-36-(*), DM-37-(*), wiring diagram.

TL15846S

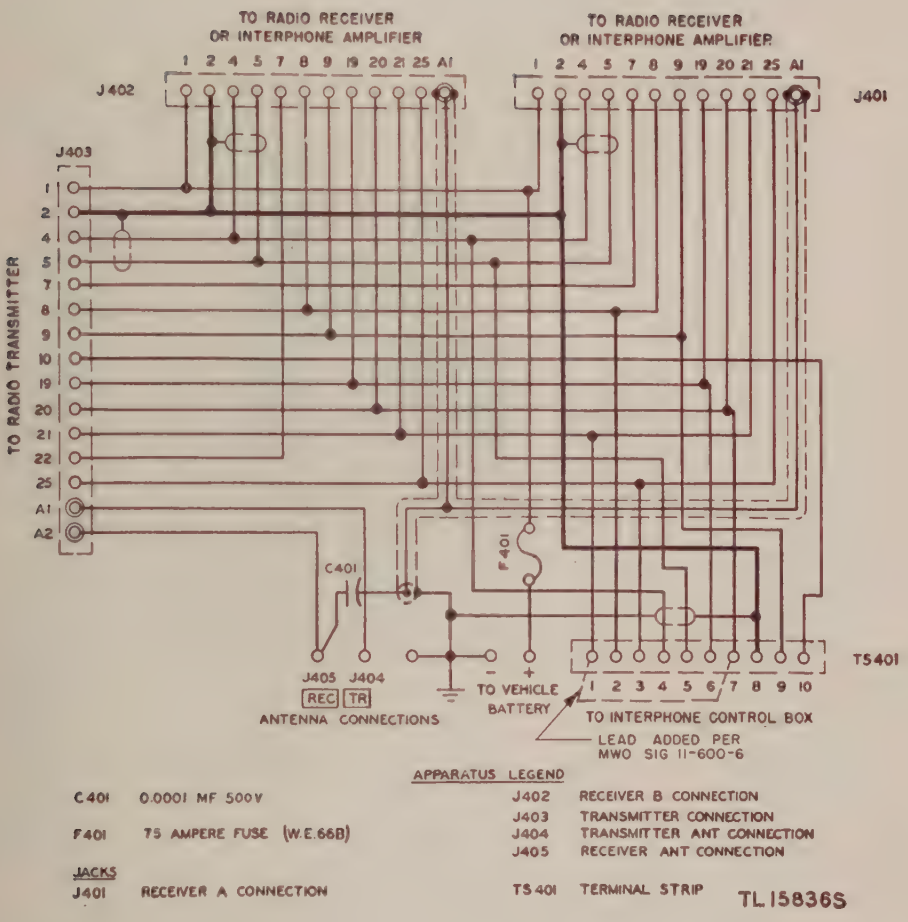


Figure 128. Mounting FT-237-(*), schematic diagram.

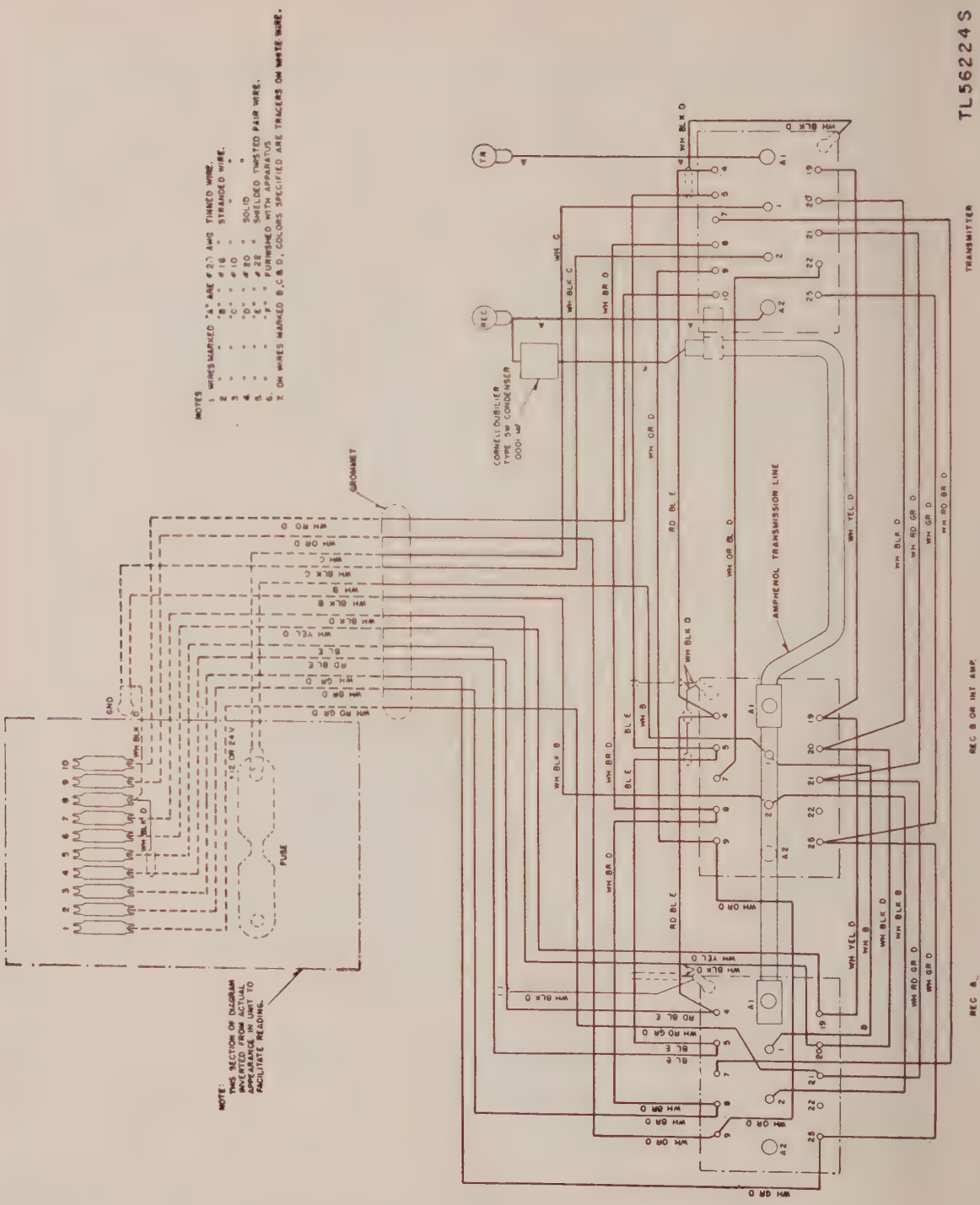


Figure 129. Mounting FT–237–(*), wiring diagram.

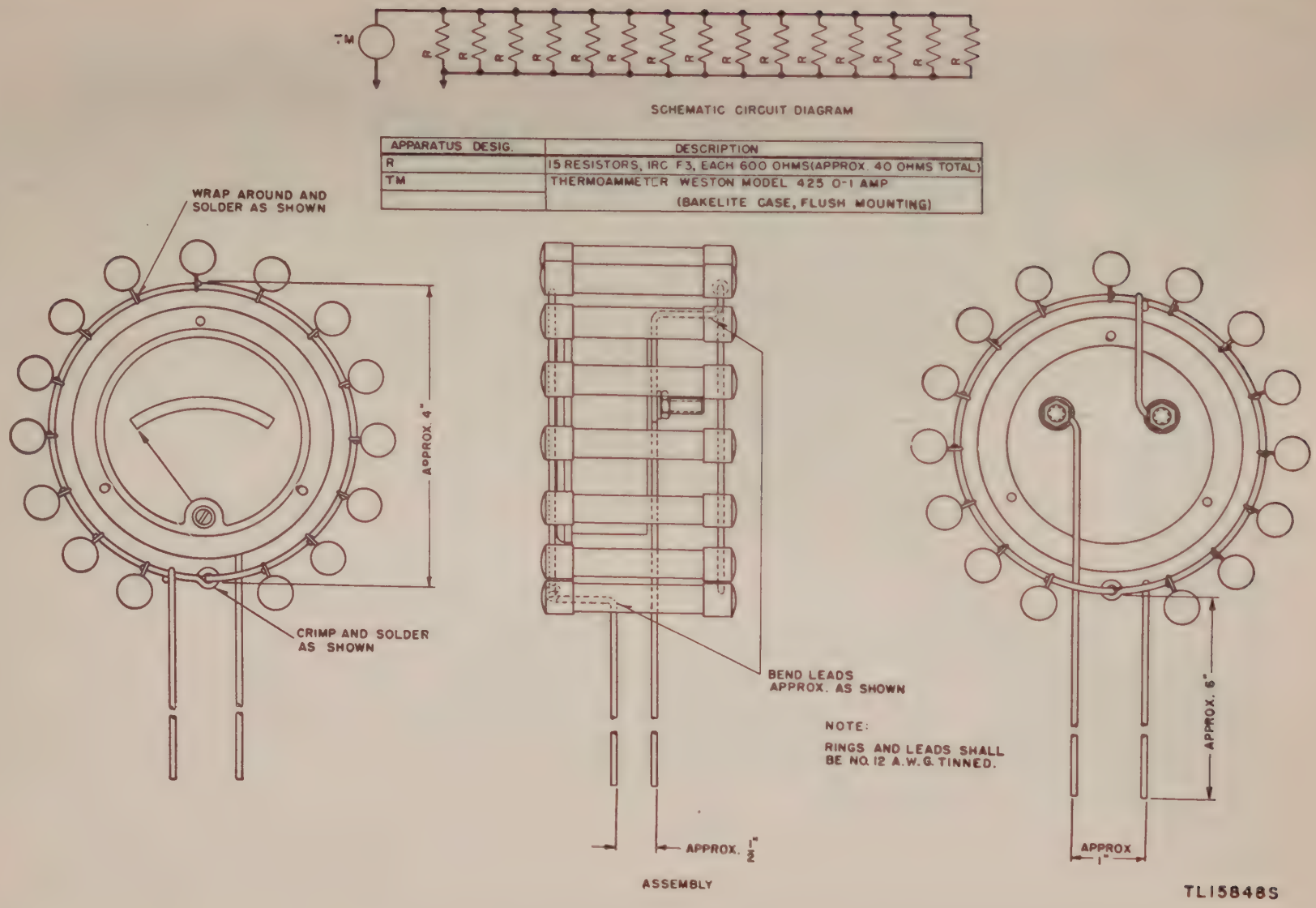
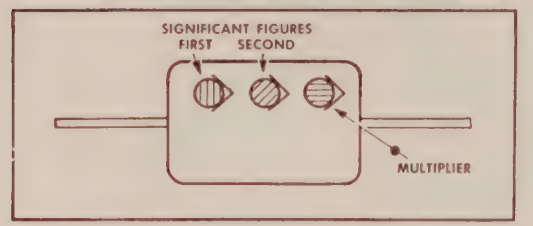


Figure 130. Artificial antenna for testing Radio Transmitter BC-604-(*).

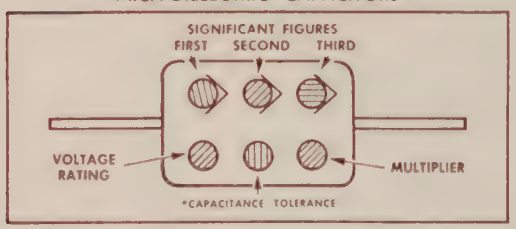
CAPACITOR COLOR CODES

RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

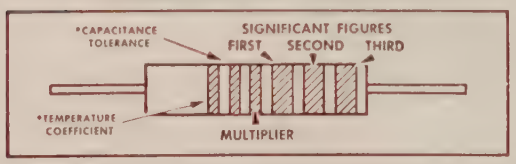


Capacitors marked with this code have a voltage rating of 500 volts.

RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



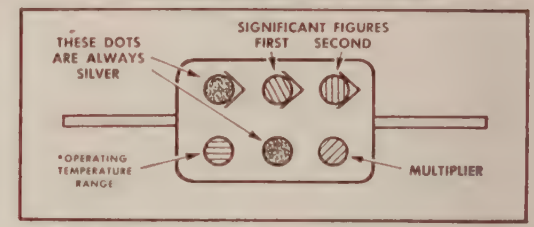
Capacitors marked with this code have a voltage rating of 500 volts.

RMA Radio Manufacturers Association JAN Joint Army Navy

Note: These color codes give all capacitances in micromicrofarads.

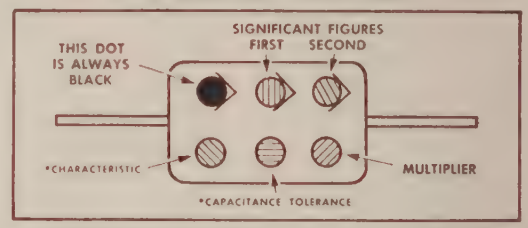
*Items marked with an asterisk are of interest primarily to depot and higher echelon repair personnel.

JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



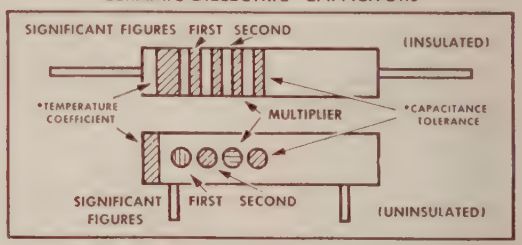
The silver dots serve to identify this marking. For working voltages see JAN type designation code.

JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



The black dot serves to identify this code. For working voltages see JAN type designation code.

JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS



Capacitors marked with this code have a voltage rating of 500 volts. Either the band or dot code may be used.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000			400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD		0.1	0.1		1,000
SILVER		0.01	0.01		2,000
NO COLOR					500

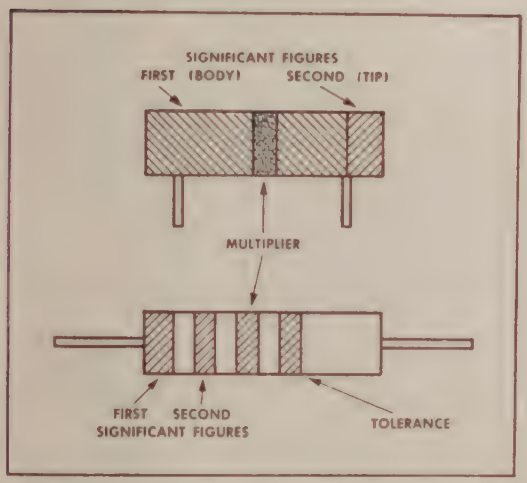
TL 13417 A

858-Ft. Mon.-6-6-45-600

Figure 131. Capacitor color codes.

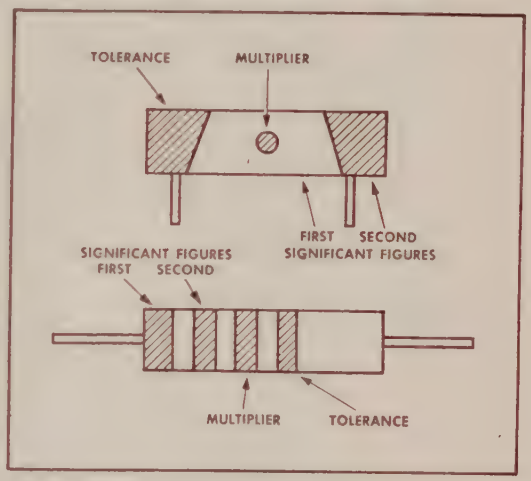
RESISTOR COLOR CODES

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.

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS



Resistors with axial leads are insulated. Resistors with radial leads are uninsulated.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	
RED	2	100	
ORANGE	3	1,000	
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

*JAN ONLY

Example: A 50,000-ohm resistor with a standard tolerance of 20 percent (no color) would be indicated by a green ring (5), a black ring (0), and an orange ring (000)

RMA: Radio Manufacturers Association
JAN: Joint Army-Navy

FL 13418 A

Figure 132. Resistor color codes.

APPENDIX II

REFERENCES

Note. For availability of items listed, check FM 21–6 and War Department Supply Catalog SIG 1 and 2. Also see FM 21–6 for applicable Technical Bulletins, Supply Bulletins, Modification Work Orders, and changes.

1. Army Regulations

AR 380–5	Safeguarding Military Information.

2. Supply Publications

SIG 1 and 2	Introduction and index (to War Department Signal Supply Catalog).
SB 11–8	Chests for Running Spares.
SB 11–76	Signal Corps Kit and Materials for Moisture and Fungi - Resistant Treatment.
SB 11–17	Electron Tube Supply and Reference Data.

3. Technical Bulletin and Technical Manuals on Auxiliary Equipment and Test Equipment

TB SIG 192	Interphone Extension Kit RC–298.
TM 11–300	Frequency Meter Sets SCR–211–( ).
TM 11–303	Test Sets I–56–C, –D, –H, and –J.
TM 11–321	Technical Manual for Test Set I–56–E.
TM 11–472	Repair and Calibration of Electrical Measuring Instruments.
TM 11–2613	Voltohmmeter I–166.
TM 11–2626	Test Unit I–176.
TM 11–2627	Tube Tester I–177.
TM 11–2632	Remote Control Equipment RC–261.

4. Painting, Preserving, and Lubrication

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69	Lubrication of Ground Signal Equipment.

5. Camouflage

FM 5–20	Camouflage, Basic Principles.

6. Shipping Instructions

U. S. Army Spec. No. 100–14A	Army-Navy General Specification for Packaging and Packing for Overseas Shipment.

7. Decontamination

TM 3–220	Decontamination.

8. Demolition

FM 5–25	Explosives and Demolitions.

9. Other Publications

FM 24–18	Radio Communication.
FM 72–20	Jungle Warfare.
TB SIG 4	Methods for Improving the Effectiveness of Jungle Radio Communication.
TB SIG 5	Defense Against Radio Jamming.
TB SIG 54	Working Through Jamming with Frequency Modulated Radio Sets.
TB SIG 66	Winter Maintenance of 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.

TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TM 1–455	Electrical Fundamentals.
TM 11–310	Schematic Diagrams for Maintenance of Ground Radio Communications Sets.
TM 11–314	Antennas and Antenna Systems.
TM 11–453	Shop Work.
TM 11–455	Radio Fundamentals.
TM 11–483	Suppression of Radio Noises.
TM 11–486	Electrical Communication Systems Engineering.
TB 11–499–( )	Basic Radio Propagation Predictions.
TM 11–2700 Series	Installation Instructions.
TM 11–4000	Trouble Shooting and Repair of Radio Equipment.
TM 37–250	Basic Maintenance Manual.
TM 11–4033	Radio Receivers BC–603–A, –C, –D, –AM, –CM, and –DM, Repair Instructions.
TM 11–4034	Radio Transmitters BC–604–A, –C, –D, –AM, –CM, and –DM, Repair Instructions.

10. Forms

WD AGO Form 468 (Unsatisfactory Equipment Report).
AAF Form 54 (Unsatisfactory Report).

11. Abbreviations

a-f..... audio-frequency
amp.... ampere
a-v-c.... automatic-volume-control
bfo..... beat-frequency oscillator
cps..... cycles per second
d-a-v-c.. direct-automatic-volume-control
emf..... electromotive force
f-m..... frequency-modulation
h-f..... high-frequency
i-f..... intermediate-frequency
JAN.... Joint-Army-Navy. (Also prefix designation for electrical components procured under joint Army-Navy specifications.)
kc..... kilocycles
l-f..... low-frequency
mc..... megacycles
mf..... microfarad
mmf.... micromicrofarad
p-a..... power-amplifier
r-f..... radio-frequency
μv..... microvolt
v..... volt
w..... watt

12. Glossary

Refer to the glossary in TM 11–455.

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I-F oscillator	130	105
Limiter	123	96
Mixer	120	93
Operation	48	40
Power supplies	132	106
Precision alinement	184	156
Replacement of parts	173	140
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R-F oscillator	119	92
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Installation	37	30
Operation	47	40
Precision alinement	185	159
Replacement of parts	174	141
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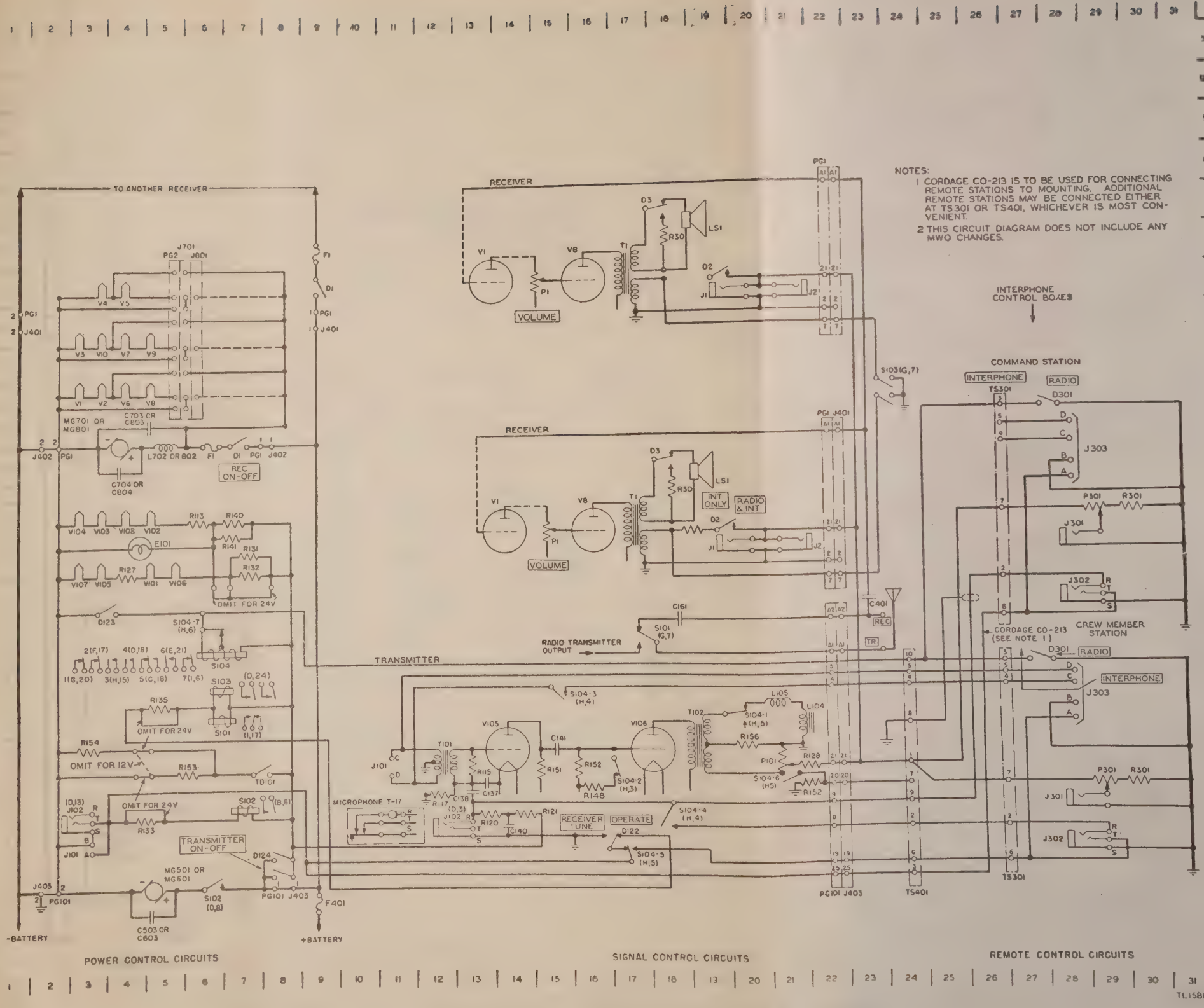


Figure 110. Radio Set SCR-508-(*), control circuits before MWO changes, functional diagram.



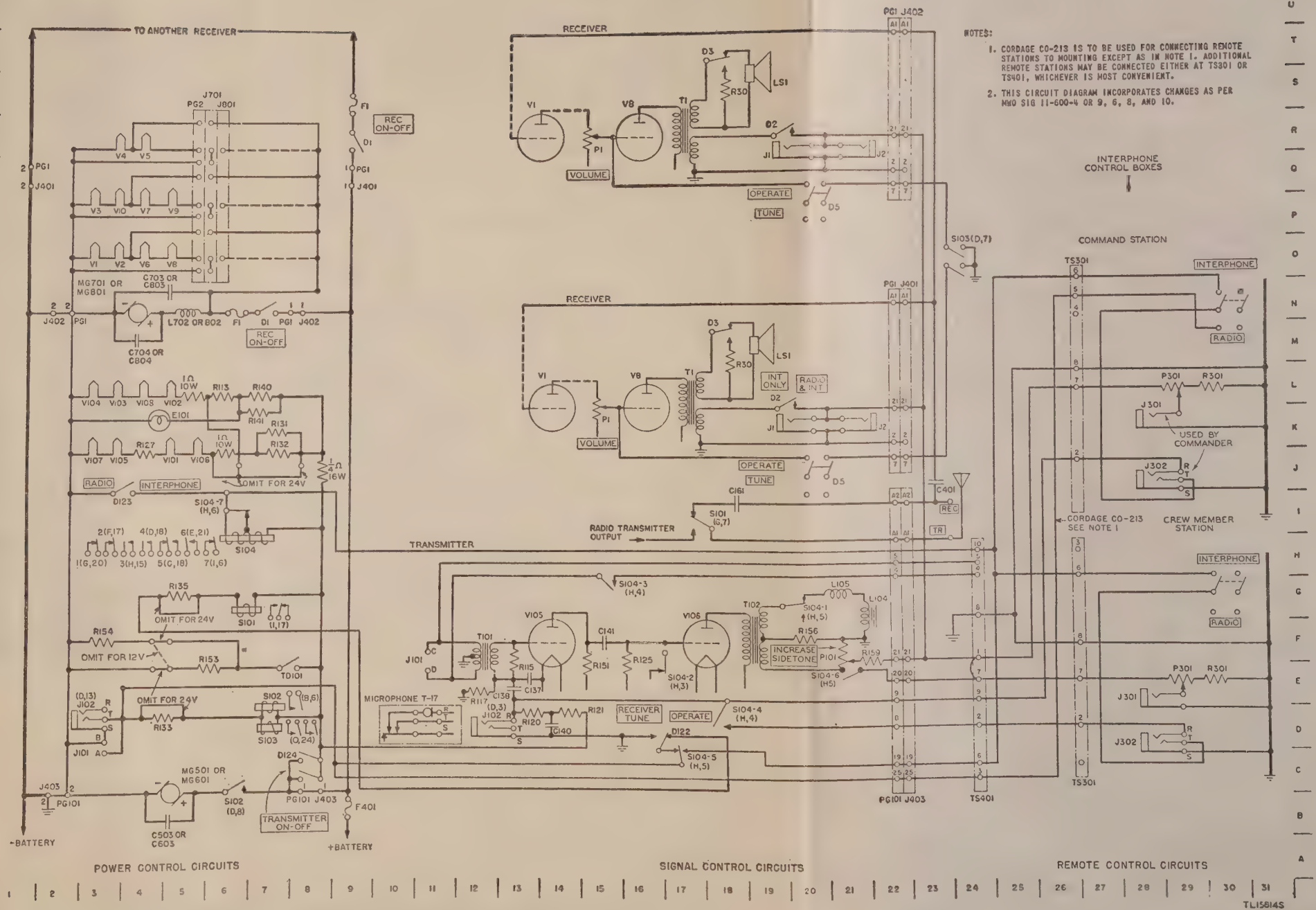
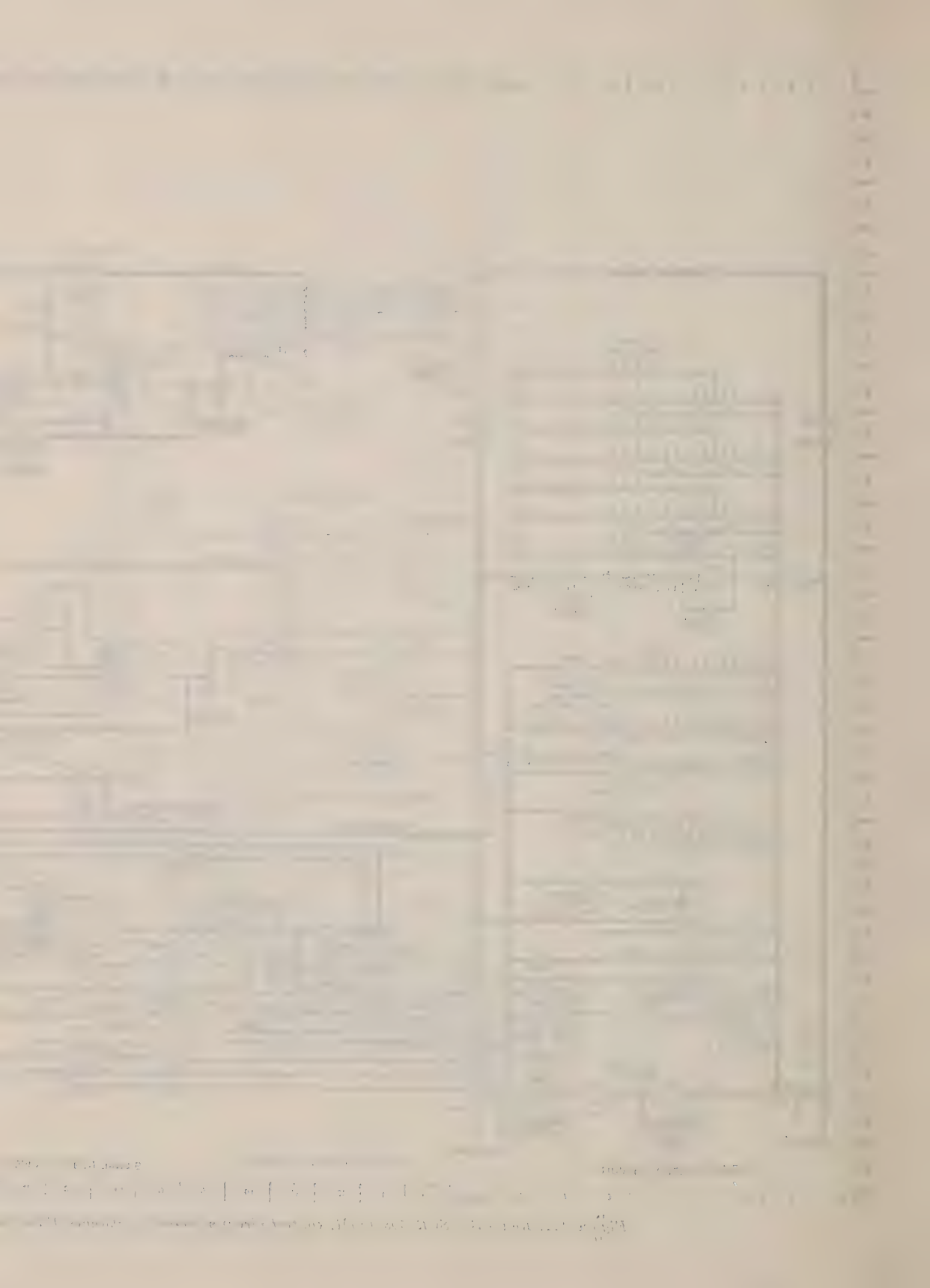


Figure 111. Radio Set SCR-508-(*)M, control circuits including changes through MWO SIG 11-600-10, functional diagram.



APPARATUS LEGEND

CAPACITORS

C101	0.003 MF 800
~~C102~~	ELIMINATED IN LATER UNITS
C103	0.0001 MF 800V
C104	0.0005 MF 800V
C105	15 MMF 500V
C106	350 MMF MAX AIR GAP 0.025"
C113	60 MMF MAX AIR GAP 0.025"
C115	60 MMF MAX AIR GAP 0.025"
C119	80 MMF MAX AIR GAP 0.025"
C152	60 MMF MAX AIR GAP 0.025"
C156	60 MMF MAX AIR GAP 0.025"
~~C107~~	ELIMINATED IN LATER UNITS
~~C110~~	ELIMINATED IN LATER UNITS
C111	0.003 MF 800V
C112	0.003 MF 800V
C114	20 MMF MAX AIR GAP 0.025"
C116	20 MMF MAX AIR GAP 0.025"
C117	0.003 MF 800V
C118	0.003 MF 800V
C120	20 MMF MAX AIR GAP 0.025"
C121	0.003 MF 800V
C122	0.003 MF 800V
C123	0.01 MF 300V
C124	0.001 MF 1200V
C125	60 MMF MAX AIR GAP 0.030"
C126	20 MMF MAX AIR GAP 0.025"
C127	100 MMF MAX AIR GAP 0.0195"
C128	100 MMF MAX AIR GAP 0.0195"
C129	100 MMF MAX AIR GAP 0.0195"
C130	100 MMF MAX AIR GAP 0.0195"
C131	100 MMF MAX AIR GAP 0.0195"
C132	100 MMF MAX AIR GAP 0.0195"
C133	100 MMF MAX AIR GAP 0.0195"
C134	100 MMF MAX AIR GAP 0.0195"
C135	100 MMF MAX AIR GAP 0.0195"
C136	100 MMF MAX AIR GAP 0.0195"
C137	0.5 MF 600V
C138.1	0.1 MF 600V
C138.2	0.1 MF 600V
C139	0.5 MF 600V
C140	30 MF 50V
C141	0.5 MF 600V
C142.1	0.1 MF 600V
C142.2	0.1 MF 600V
C143	0.5 MF 600V
C144	100 MF 50V
C145	2 MF 1000V
C146	0.003 MF 800V
C147	175 MMF 800V
C148	0.003 MF 800V
C149	0.001 MF 1200V
C150	0.001 MF 800V
C151	50 MMF 800V
C153	20 MMF MAX AIR GAP 0.025"
C154	0.003 MF 800V
C155	0.003 MF 800V
C157	20 MMF MAX AIR GAP 0.025"
C158	0.003 MF 800V
C159	0.01 MF 300V
~~C160~~	ELIMINATED IN LATER UNITS
C161	0.0001 MF 800V
C162	4 MF 50V
C163	0.003 MF 1000V
~~C500~~	ELIMINATED IN LATER UNITS
~~C503~~	ELIMINATED IN LATER UNITS

SWITCHES

D101 TO D110	PUSH BUTTON ASSEMBLY CRYSTAL SELECTORS
D111 TO D120	PUSH BUTTON ASSEMBLY ANT CAP SELECTORS
D121	ANT CUR-TUNE
D122	RECEIVER TUNE-OPERATE
D123	RADIO-INTERPHONE
D124	ON-OFF POWER SUPPLY
D125	METER SWITCH
E101	PILOT LAMP
F101	1/2 AMPERE FUSE

JACKS

J101	MAGNETIC MICROPHONE
J102	CARBON MICROPHONE

COILS

L101	1ST R-F PLATE CHOKE
L102	OSC PLATE
L103	1ST R-F PLATE TUNING
L104	MODULATION
L105	R-F CHOKE
L106	DOUBLER PLATE TUNING
L107	TRIPLER GRID TUNING
L108	TRIPLER PLATE TUNING
L110	POWER AMPLR TUNING
L111	ANTENNA COUPLING
L116	POWER AMPLR ANTI-SING
L117	OSC GRID ANTI-SING
L118	DOUBLER GRID TUNING
L119	RECTIFIER PLATE TUNING
M101	ANT CUR-TUNE METER
P101	50,000Ω SIDETONE CONTROL

PLUGS

PG101	TRANSMITTER DYNAMOTOR
PG103 PG104	DYNAMOTOR

RESISTORS

R101	100,000Ω 1/2W
R102	1,000Ω 20W
R103	250,000Ω 1W
R104	50,000Ω 1/2W
R105	250,000Ω 1/2W
R106	~~1000~~ 100Ω 2W
R107	100,000Ω 1/2W
R108	50Ω 1/2W
R109	100,000Ω 2W
R110	1,000Ω 1/2W
R111	10,000Ω 1W
R112	10Ω 1/2W
R113	1.0Ω 10W
R114	30,000Ω 2W
R115	100,000Ω 1/2W
R116	30,000Ω 2W
R117	50,000Ω 1/2W
R118	~~30,000~~ 100,000Ω 2W
R119	1,200Ω 1/2W
R120	200Ω 1W
R121	100Ω 1/2W
R122	250,000Ω 1W
R123	10,000Ω 1W
R124	10,000Ω 1/2W
R125	40,000Ω 1/2W
R126	75,000Ω 2W
R127	1.0Ω 10W
R128	10,000Ω 1/2W
R129	5,000Ω 25W
R130	100Ω 10W
R131	12Ω 25W
R132	12Ω 25W
R133	80Ω 10W
R134	30,000Ω 1/2W
R135	30Ω 10W
R136	30,000Ω 1/2W
R137	100Ω 1/2W
R138	50,000Ω 1/2W
R139	100,000Ω 1/2W
R140	12Ω 25W
R141	12Ω 25W
R142	50,000Ω 1/2W
R143	1,000Ω 1/2W
R144	100,000Ω 1/2W
R145	100,000Ω 2W
R146	50Ω 1/2W
R147	1,000Ω 20W
R148	5,000Ω 1/2W
R149	50Ω 1/2W
R150	25,000Ω 1W
R151	100,000Ω 1W
R152	2,000Ω 2W
R153	8.3Ω 17.9W
R154	8.3Ω 17.9W
R155	100,000Ω 1/2W
R156	40Ω 1W
R157	100,000Ω 2W (ADDED)
R158	100,000Ω 2W (ADDED)

RELAYS

S101	ANTENNA SWITCHING
S102	DYNAMOTOR STARTING
S103	RECEIVER DISABLING
S104	RADIO-INTERPHONE

TRANSFORMERS

T101	A-F INPUT
T102	A-F OUTPUT
TC101	ANT. CUR THERMOCOUPLE
TD101	OVER THERMOSTAT

VACUUM TUBES

V101	JAN-1619 (VT-164)
V102	JAN-1619 (VT-164)
V103	JAN-1619 (VT-164)
V104	JAN-1624 (VT-165)
V105	JAN-1619 (VT-164)
V106	JAN-1619 (VT-164)
V107	JAN-1619 (VT-164)
V108	JAN-1619 (VT-164)

Y101 TO Y110	CRYSTAL HOLDERS FT-241-A

DYNAMOTOR DM-35-(*) 12V

CAPACITORS

C501	0.003 MF 800V
C502	0.003 MF 800V
~~C503~~	0.003 MF 800V

JACKS

J501	DYNAMOTOR
J502	DYNAMOTOR

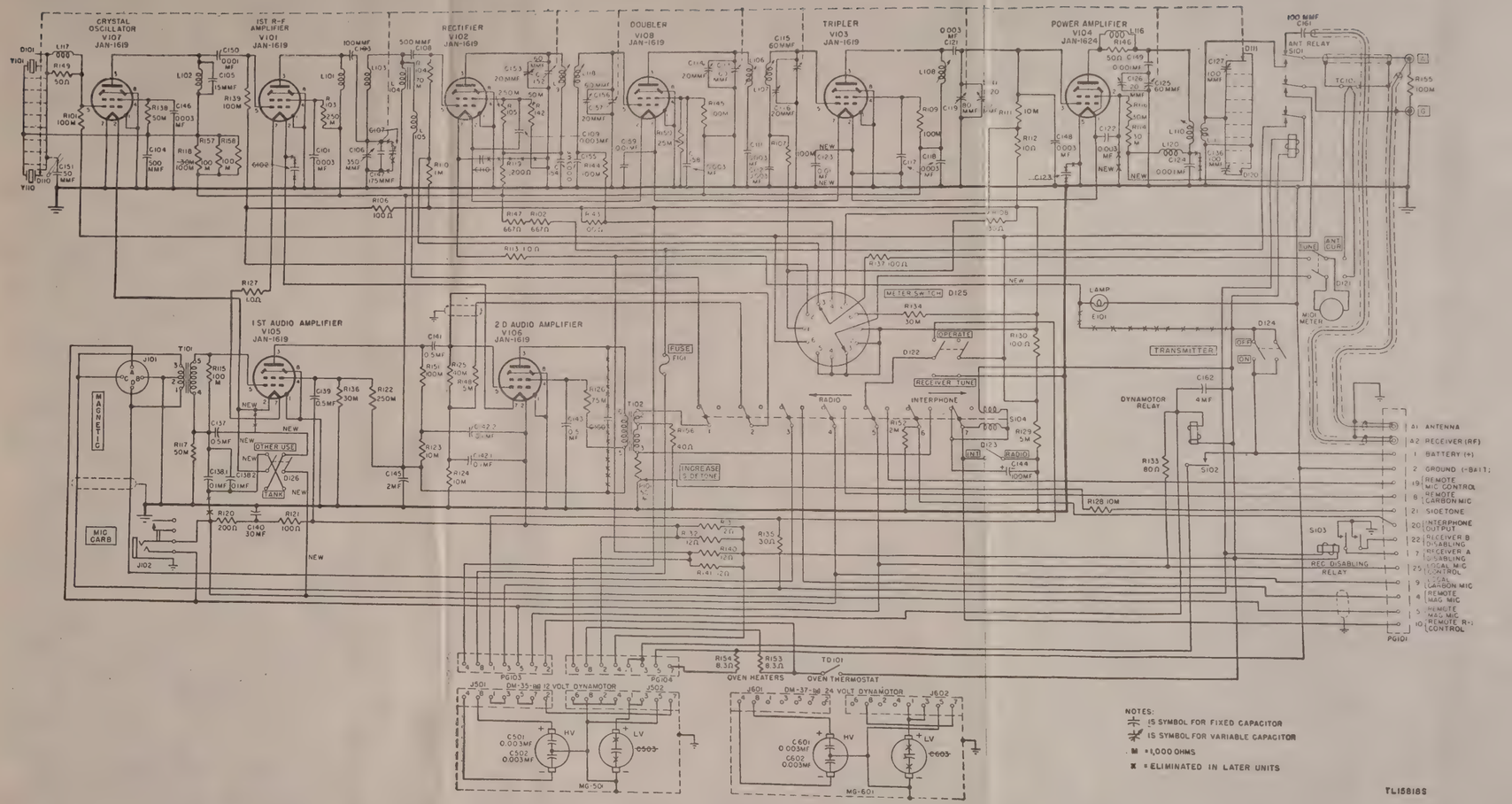
DYNAMOTOR DM-37-(*) 24V

CAPACITORS

C601	0.003 MF 800V
C602	0.003 MF 800V
~~C603~~	0.003 MF 800V

JACKS

J601	DYNAMOTOR
J602	DYNAMOTOR



NOTES:
- ⊣⊢ IS SYMBOL FOR FIXED CAPACITOR
- ⊣/⊢ IS SYMBOL FOR VARIABLE CAPACITOR
- M = 1,000 OHMS
- ~~X~~ = ELIMINATED IN LATER UNITS

TL158185

THIS SCHEMATIC DOES NOT SHOW ANY MWO CHANGES

Figure 112. Radio Transmitter BC-604-(*), showing modifications during manufacture, schematic diagram.

APPARATUS LEGEND

CAPACITORS

C101	0.003 MF 800V
C103	0.0001 MF 800V
C104	0.0005 MF 800V
C105	15 MMF 500V
C106	350 MMF MAX AIR GAP 0.025"
C113	60 MMF MAX AIR GAP 0.025"
C115	60 MMF MAX AIR GAP 0.025"
C119	60 MMF MAX AIR GAP 0.025"
C152	60 MMF MAX AIR GAP 0.025"
C156	60 MMF MAX AIR GAP 0.025"
C108	0.0005 MF 800V
C109	0.003 MF 800V
C111	0.003 MF 800V
C112	0.003 MF 800V
C114	20 MMF MAX AIR GAP 0.025"
C116	20 MMF MAX AIR GAP 0.025"
C117	0.003 MF 800V
C118	0.003 MF 800V
C120	20 MMF MAX AIR GAP 0.025"
C121	0.003 MF 800V
C122	0.003 MF 800V
C123	0.01 MF 300V
C124	0.001 MF 1200V
C125	60 MMF MAX AIR GAP 0.030"
C126	20 MMF MAX AIR GAP 0.025"
C127	100 MMF MAX AIR GAP 0.0195"
C128	100 MMF MAX AIR GAP 0.0195"
C129	100 MMF MAX AIR GAP 0.0195"
C130	100 MMF MAX AIR GAP 0.0195"
C131	100 MMF MAX AIR GAP 0.0195"
C132	100 MMF MAX AIR GAP 0.0195"
C133	100 MMF MAX AIR GAP 0.0195"
C134	100 MMF MAX AIR GAP 0.0195"
C135	100 MMF MAX AIR GAP 0.0195"
C136	100 MMF MAX AIR GAP 0.0195"
C137	0.5 MF 600V
C138.1	0.1 MF 500V
C138.2	0.1 MF 500V
C139	0.5 MF 600V
C140	30 MF 50V
C141	0.5 MF 600V
C142.1	0.1 MF 600V
C142.2	0.1 MF 600V
C143	0.5 MF 600V
C144	100 MF 50V
C145	2 MF 1000V
C146	0.003 MF 800V
C147	175 MMF 800V
C148	0.003 MF 800V
C149	0.001 MF 1200V
C150	0.001 MF 800V
C151	50 MMF 800V
C153	20 MMF MAX AIR GAP 0.025"
C154	0.003 MF 800V
C155	0.003 MF 800V
C157	20 MMF MAX AIR GAP 0.025"
C158	0.003 MF 800V
C159	0.01 MF 300V
C161	0.0001 MF 800V
C162	4 MF 50V

SWITCHES

D101 TO D110	PUSH BUTTON ASSEMBLY CRYSTAL SELECTORS
D111 TO D120	PUSH BUTTON ASSEMBLY ANT. CAP. SELECTORS
D121	ANT. CUR-TUNE
D122	RECEIVER TUNE-OPERATE
D123	RADIO-INTERPHONE
D124	ON-OFF POWER SUPPLY
D125	METER SWITCH
D126	TANK-OTHER USE SWITCH
E101	PILOT LAMP
F101	1/2 AMPERE FUSE

JACKS

J101	MAGNETIC MICROPHONE
J102	CARBON MICROPHONE

COILS

L101	1ST R-F PLATE CHOKE
L102	OSC PLATE
L103	1ST R-F PLATE TUNING
L104	MODULATION
L105	R-F CHOKE
L106	DOUBLER PLATE TUNING
L107	TRIPLER GRID TUNING
L108	TRIPLER PLATE TUNING
L110	POWER AMPLR TUNING
L111	ANTENNA COUPLING
L116	POWER AMP. ANTI-SING
L117	OSC GRID ANTI-SING
L118	DOUBLER GRID TUNING
L119	RECTIFIER PLATE TUNING
L120	POWER AMPLR R-F CHOKE
M101	ANT CUR-TUNE METER
P101	50,000Ω SIDETONE CONTROL

PLUGS

PG101	TRANSMITTER
PG103	DYNAMOTOR
PG104	DYNAMOTOR

RESISTORS

R101	100,000Ω 1/2W
R102	1,000Ω 20W
R103	250,000Ω 1W
R104	50,000Ω 1/2W
R105	250,000Ω 1/2W
R106	100Ω 1/2W
R107	100,000Ω 1/2W
R108	50Ω 1/2W
R109	100,000Ω 2W
R110	1,000Ω 1/2W
R111	10,000Ω 1W
R112	10Ω 1/2W
R113	1.0Ω 10W
R114	30,000Ω 2W
R115	100,000Ω 1/2W
R116	30,000Ω 2W
R117	50,000Ω 1/2W
R118	100,000Ω 2W
R119	1,200Ω 1/2W
R120	200Ω 1W
R121	100Ω 1/2W
R122	250,000Ω 1W
R123	10,000Ω 1W
R124	10,000Ω 1/2W
R125	10,000Ω 1/2W
R126	75,000Ω 2W
R127	1.0Ω 10W
R129	5,000Ω 25W
R130	100Ω 10W
R131	12Ω 25W
R132	12Ω 25W
R133	80Ω 10W
R134	30,000Ω 1/2W
R135	95Ω 10W
R136	30,000Ω 1/2W
R137	100Ω 1/2W
R138	50,000Ω 1/2W
R139	100,000Ω 1/2W
R140	12Ω 25W
R141	12Ω 25W
R142	50,000Ω 1/2W
R143	1,000Ω 1/2W
R144	100,000Ω 1/2W
R145	100,000Ω 2W
R146	50Ω 1/2W
R147	1,000Ω 20W
R148	50Ω 1/2W
R150	25,000Ω 1W
R151	100,000Ω 1W
R153	8.3Ω 179W
R154	8.3Ω 17.9W
R155	100,000Ω 1/2W
R156	40Ω 1W
R157	100,000Ω 2W
R158	100,000Ω 2W
R159	1,200Ω 1W

RELAYS

S101	ANTENNA SWITCHING
S102	DYNAMOTOR STARTING
S103	RECEIVER DISABLING
S104	RADIO-INTERPHONE

TRANSFORMERS

T101	AF INPUT
T102	AF OUTPUT
TC101	ANT. CUR. THERMOCOUPLE
TD101	OVEN THERMOSTAT

VACUUM TUBES

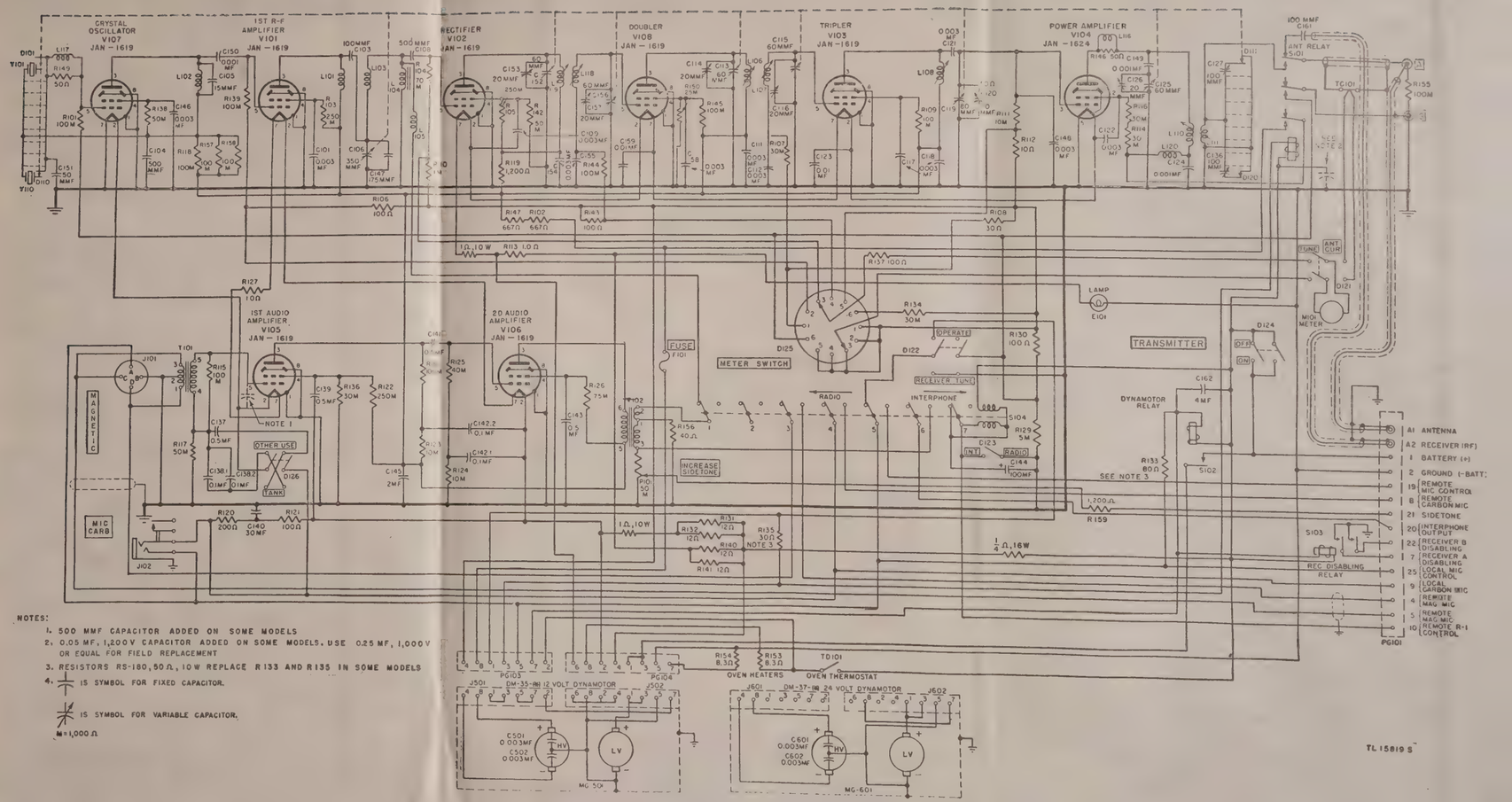
V101	JAN-1619 (VT-164)
V102	JAN-1619 (VT-164)
V103	JAN-1619 (VT-164)
V104	JAN-1624 (VT-165)
V105	JAN-1619 (VT-164)
V106	JAN-1619 (VT-164)
V107	JAN-1619 (VT-164)
V108	JAN-1619 (VT-164)
Y101	CRYSTAL HOLDERS
TO Y110	FT-241-A

DYNAMOTOR DM-35-D 12V

CAPACITORS	
C501	0.003 MF 800V
C502	0.003 MF 800V
JACKS	
J501	DYNAMOTOR
J502	DYNAMOTOR

DYNAMOTOR DM-37-D 24V

CAPACITORS	
C601	0.003 MF 800V
C602	0.003 MF 800V
JACKS	
J601	DYNAMOTOR
J602	DYNAMOTOR



NOTES:

1. 500 MMF CAPACITOR ADDED ON SOME MODELS
2. 0.05 MF, 1,200V CAPACITOR ADDED ON SOME MODELS. USE 0.25 MF, 1,000V OR EQUAL FOR FIELD REPLACEMENT
3. RESISTORS RS-180, 50Ω, 10W REPLACE R133 AND R135 IN SOME MODELS
4. ⊣⊢ IS SYMBOL FOR FIXED CAPACITOR.

⫽ IS SYMBOL FOR VARIABLE CAPACITOR.

M = 1,000 Ω

THIS SCHEMATIC INCORPORATES CHANGES AS PER MWO SIG 11-600-4 OR 9, 6, AND 10

Figure 113. Radio Transmitter BC-604-(*)M, showing changes per MWO SIG 11-600-4 or 9, 6, and 10, schematic diagram.



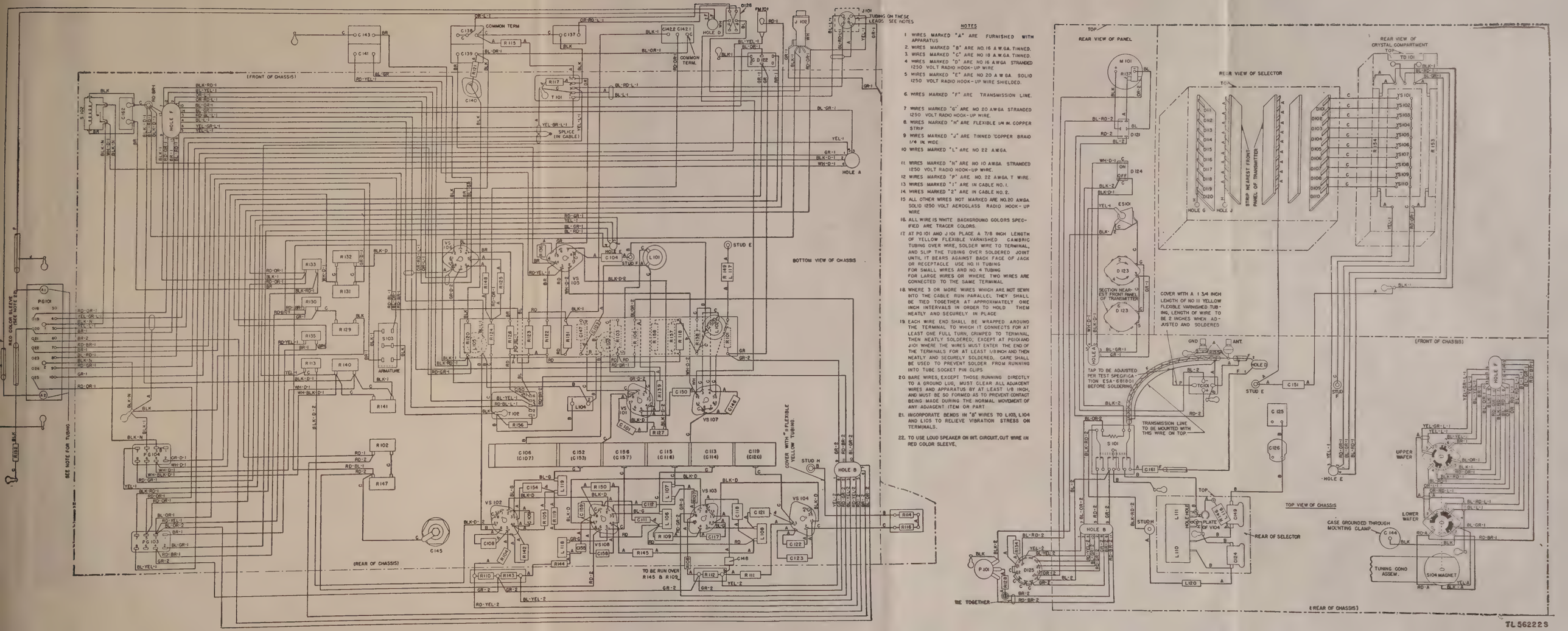


Figure 114. Radio Transmitter BC-604-(*), wiring diagram.



APPARATUS LEGEND

SWITCHES
S1 REC ON-OFF
S2 RADIO-INT
S3 ON-OFF SPEAKER
S4 ON-OFF SQUELCH
S5 TUNE-OPERATE

E1 CALL SIGNAL

F1 FUSE 15 AMP

JACKS
J1 PHONES
J2 PHONES
J3 FRONT PANEL JACK

COILS
L1 LIMITER CATHODE CHOKE
L32 ANTENNA COUPLING
L33 R-F PLATE
L34 MIXER GRID
L41 R-F OSCILLATOR
L51 1ST I-F GRID
L52 MIXER PLATE
L61 2 D I-F GRID
L62 1ST I-F PLATE
L71 LIMITER GRID
L72 2D I-F PLATE
L81 DETECTOR INPUT
L82 LIMITER PLATE
L91 I-F OSCILLATOR

LS1 LOUD SPEAKER

POTENTIOMETERS
P1 100,000Ω
P2 20Ω

PLUGS
PS1 RECEIVER PLUG
PS2 DYNAMOTOR PLUG
PS3 FRONT PANEL PLUG

RESISTORS
R1 ~~30,000~~-30,000Ω 1/2W
R2 250,000Ω 1/2W
R3 500Ω 1/2W
R4 50,000Ω 1/2W
R5 300Ω 1/2W
R6 100,000Ω 1/2W
R7 30,000Ω 1W
R8 ~~20,000~~-70,000Ω 1/2W
R9 1,000Ω 1/2W
R10 250,000Ω 1/2W
R11 1,000,000Ω 1/2W
R12 2,000Ω 1/2W
R13 10,000Ω 1/2W
R14 250,000Ω 1/2W
R15 1,000,000Ω 1/2W
R16 1,000,000Ω 1/2W
R17 ~~1,000,000~~ 250,000Ω 1/2W
R18 100,000Ω 1/2W
R19 ~~1,000,000~~ 2,000,000Ω 1/2W
R20 300Ω 1W
R21 30,000Ω 2W ADDED
R22 30,000Ω 1/2W
R23 5,000Ω 1/2W
R24 50Ω 1/2W
R25 2,500Ω 1/2W
R26 1200Ω 1/2W
R27 2,500Ω 1/2W
R28 2,500Ω 1/2W
R29 13,000Ω 2W
R30 5Ω 1W
R31 6,800Ω 1W
R32 30,000Ω 1/2W
R33 30,000Ω 1/2W
R37 250,000Ω 1/2W
R38 1,000Ω 1/2W
R41 100,000Ω 1/2W
R42 30,000Ω 1W
R43 30,000Ω 1/2W
R51 100,000Ω 1/2W
R52 30,000Ω 1/2W
R53 100,000Ω 1/2W
R54 100,000Ω 1/2W
R61 ~~200,000~~ 100,000Ω 1/2W
R62 ~~50,000~~-40,000Ω 1/2W
R63 ~~250,000~~ 10,000Ω 1/2W
R64 1,000Ω 1/2W
R71 250,000Ω 1/2W
R72 30,000Ω 1/2W
R73 ~~250,000~~ 10,000Ω 1/2W
R74 ~~40,000~~ 1000Ω 1/2W
R81 70,000Ω 1/2W
R82 250,000Ω 1/2W
R83 70,000Ω 1/2W
R84 250,000Ω 1/2W
R85 1,000Ω 1/2W
R91 100,000Ω 1/2W
R92 40,000Ω 1/2W
R93 40,000Ω 1/2W
R94 2,000,000Ω 1/2 NEW
R95 5,000Ω 1/2W NEW
R96 30,000Ω 1/2W NEW

T1 OUTPUT TRANSFORMER

VACUUM TUBES
V1 JAN-6AC7 (VT-112)
V2 JAN-6AC7 (VT-112)
V3 JAN-6J5 (VT-94)

V4 VT-209 (12SG7)
V5 VT-209 (12SG7)
V6 VT-112 (6AC7)
V7 VT-150 (6H6)
V8 VT-107-A (6V6GT)
V9 VT-229 (6SL7GT)
V10 VT-229 (6SL7GT)

DYNAMOTORS
DM-36-D 12 VOLT
CAPACITORS
C701 ~~.005~~ .003 MF 500V
C702 ~~.005~~ .003 MF 500V
C703 ~~.005~~ .003 MF 500V
C704 ~~.005~~ .003 MF 500V
C705 ~~.005~~ .003 MF 500V
C706 ~~.005~~ .003 MF 500V

COILS
L701 H-V FILTER
L702 L-V FILTER
L703 H-V FILTER
L704 H-V FILTER

J701 DYNAMOTOR JACK

M701 12-V DYNAMOTOR

DM-36-D 24 VOLT
CAPACITORS
C801 ~~.005~~ .003 MF 500V
C802 ~~.005~~ .003 MF 500V
C803 ~~.005~~ .003 MF 500V
C804 ~~.005~~ .003 MF 500V
C805 ~~.005~~ .003 MF 500V
C806 ~~.005~~ .003 MF 500V

COILS
L801 H-V FILTER
L802 L-V FILTER
L803 H-V FILTER
L804 H-V FILTER

J801 DYNAMOTOR JACK

M801 24-V DYNAMOTOR

NOTES:
1- WHEN CAPACITORS C85 AND C86 ARE 60 MMF, CAPACITOR C84 IS OMITTED. (OPTIONAL METHOD NOT SHOWN IN DIAGRAM.)

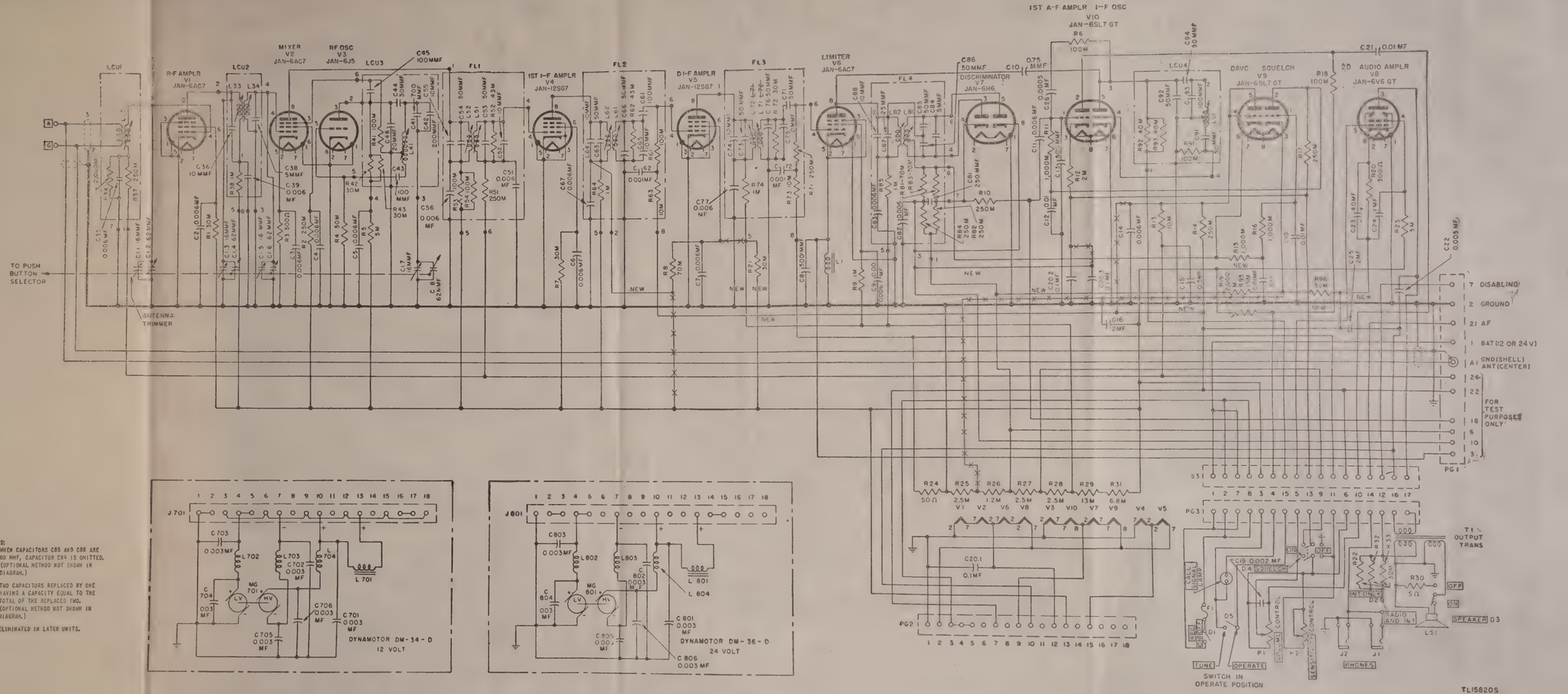
2- TWO CAPACITORS REPLACED BY ONE HAVING A CAPACITY EQUAL TO THE TOTAL OF THE REPLACED TWO. (OPTIONAL METHOD NOT SHOWN IN DIAGRAM.)

X= ELIMINATED IN LATER UNITS.

CAPACITORS
C1 15 MMF MAX
C1.3 16 MMF MAX
C1.5 16 MMF MAX
C1.7 16 MMF MAX
C1.2 62 MMF MAX
C1.4 62 MMF MAX
C1.6 62 MMF MAX
C1.8 62 MMF MAX
C2 0.006 MF 300V
C3 0.006 MF 300V
C4 0.006 MF 300V
C5 0.006 MF 300V
C6 0.006 MF 300V
C7 0.006 MF 300V
C8 500 MMF 500V
C9 0.006 MF 300V
C10 0.75 MMF 500V
C11 ~~.01~~ .006 MF 300V
C12 0.01 MF 300V
C13 500 MMF 500V
C14 0.005 MF 300V
C15 0.5 MF 600V
C16 2 MF 600V
C17 0.01 MF 300V
C18 0.01 MF 300V
C19 0.002 MF 500V
C20.1 0.1 MF 600V
C20.2 0.1 MF 600V
C20.3 0.1 MF 600V
C21 0.01 MF 330V
C22 0.005 MF 300V
C23 40 MF 25V
C24 1 MF 600V
C25 2 MF 500V
C26 ~~.01~~ .0005 MF 500V
C35 ~~.01~~ .002 MF 300V
C36 10 MMF 500V
C38 10 MMF 500V
C39 .0005 MF 300V
C41 700 MMF 500V
C42 200 MMF 500V
C43 ~~400~~ 250 MMF 500V
C44 30 MMF 500V
C45 100 MMF 500V
C46 20 MF 500V
C51 0.006 MF 300V

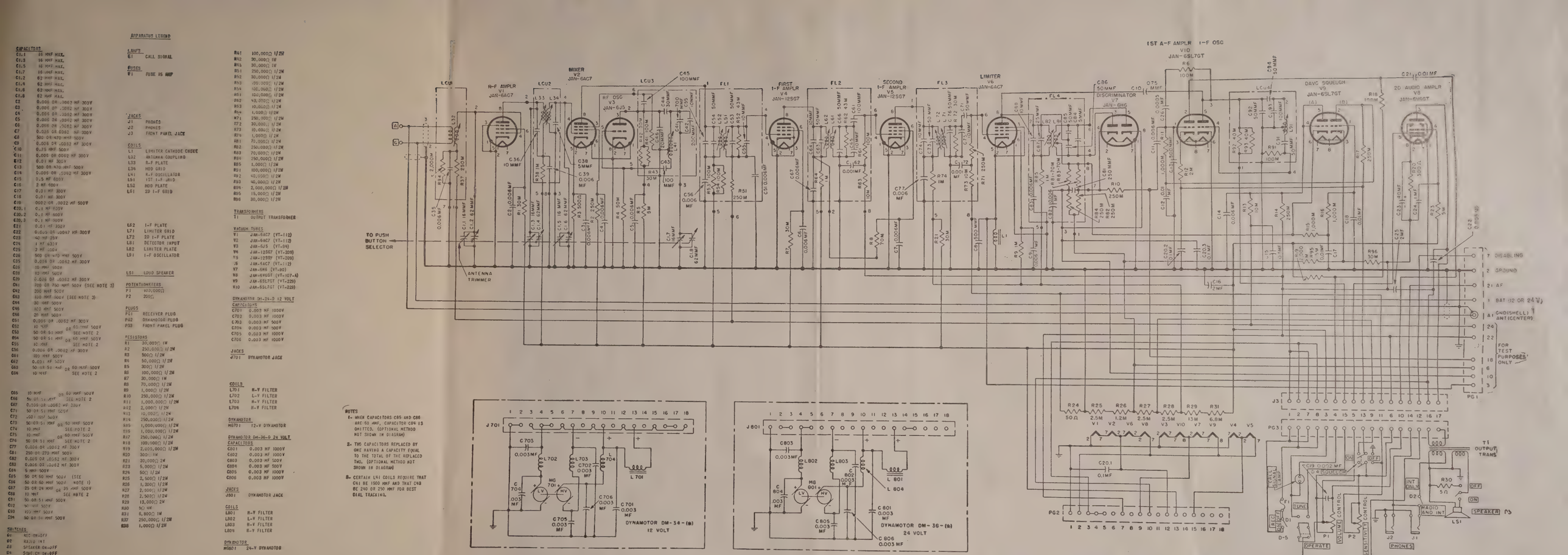
C52 10 MMF 60 MMF 500V
C53 50 MMF OR SEE NOTE 2
C54 50 MMF 60 MMF 500V
C55 10 MMF OR SEE NOTE 2
C56 0.006 MF 300V
C61 ~~.01~~ 100 MMF 500V
C62 ~~.005~~ .001 MF 500V
C63 50 MMF 60 MMF 500V
C64 10 MMF OR SEE NOTE 2
C65 10 MMF 60 MMF 500V
C66 50 MMF OR SEE NOTE 2
C67 0.006 MF 300V
C71 ~~.01~~ 50 MMF 500V
C72 ~~.005~~ .001 MF 500V
C73 50 MMF 60 MMF 500V
C74 10 MMF OR SEE NOTE 2
C75 10 MMF 60 MMF 500V
C76 50 MMF OR SEE NOTE 2
C77 0.006 MF 300V
C78 250 MMF 500V
C82 ~~.01~~ .006 MF 300V
C83 0.006 MF 300V
C84 5 MMF 500V
C85 50 MMF OR 60 MMF 500V
C86 50 MMF OR 60 MMF 500V
C87 25 MMF OR 35 MMF 500V
C88 10 MMF SEE NOTE 2
C91 50 MMF 500V
C92 50 MMF 500V
C93 100 MMF 500V
C94 60 MMF 500V

SEE NOTE 1



THIS SCHEMATIC DOES NOT INCORPORATE ANY MWO CHANGES

Figure 115. Radio Receiver BC-603-(*), showing modifications during manufacture, schematic diagram.



NOTE: THIS SCHEMATIC INCORPORATES CHANGES AS PER MWO SIG 11-600-4 OR 9, AND 6, MWO SIG 11-600-10 DOES NOT AFFECT RECEIVER

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Figure 116. Radio Receiver BC-603-(*)M, showing changes per MWO SIG 11-600-4 or 9, and 6, schematic diagram.



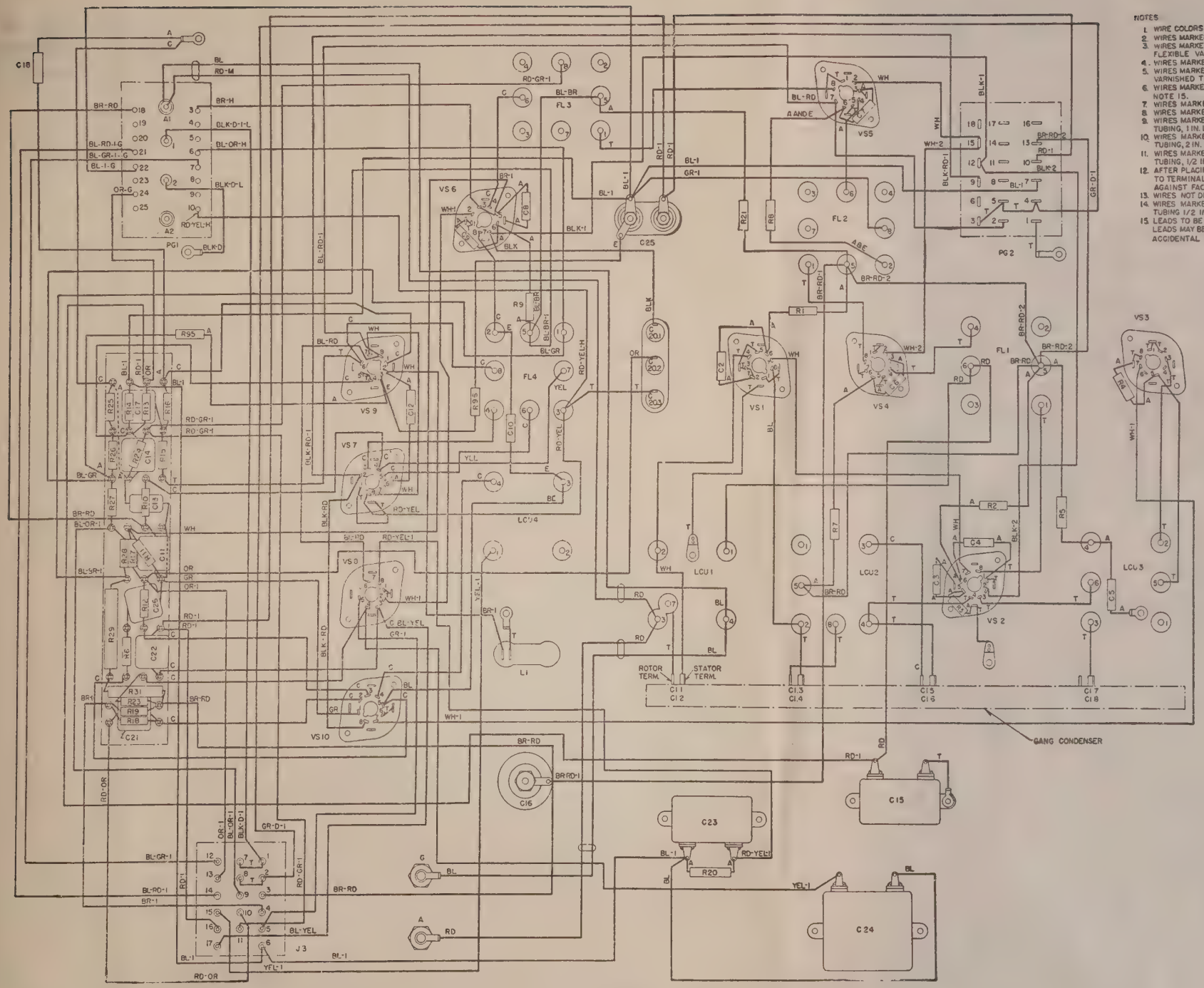
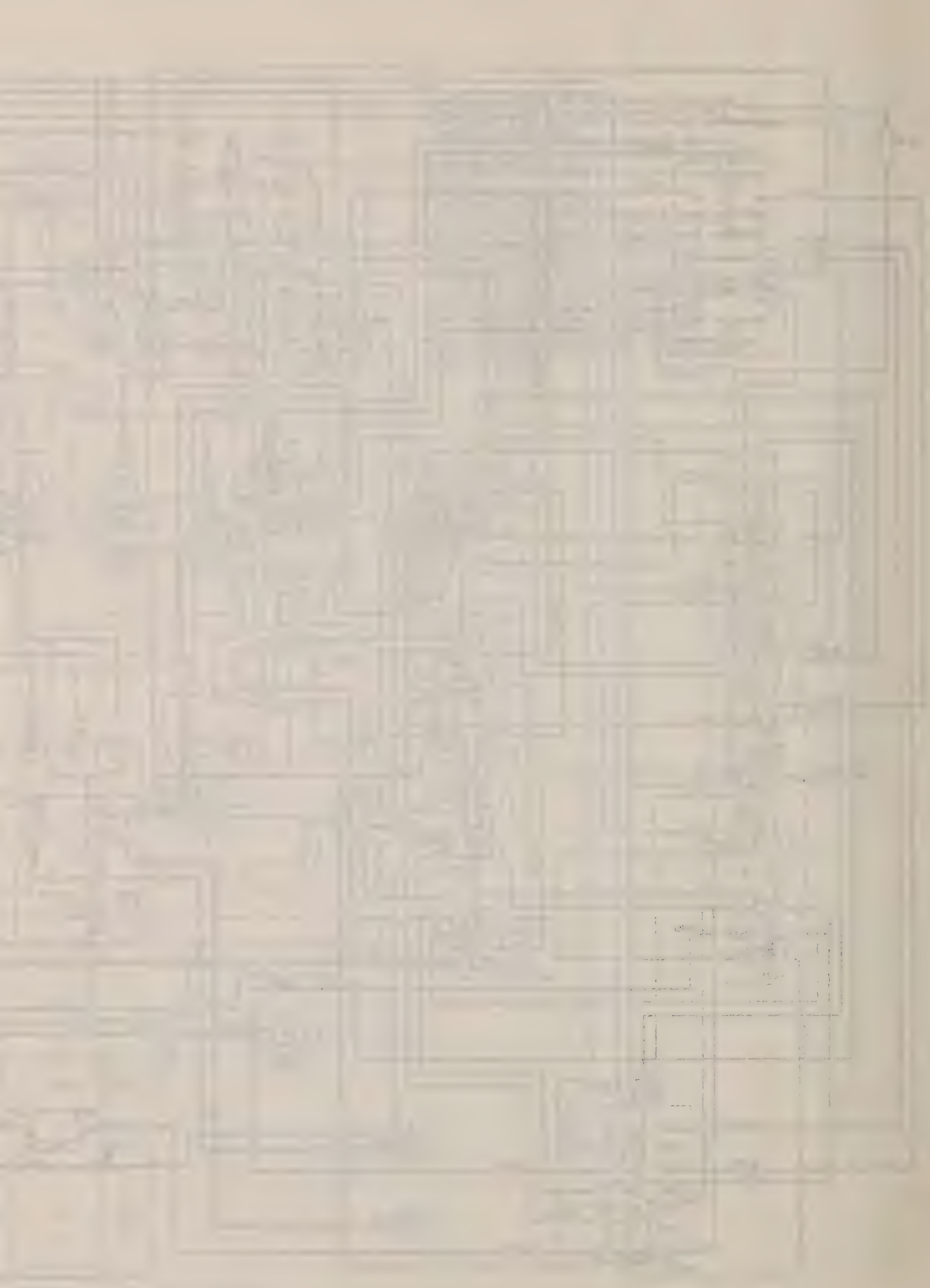
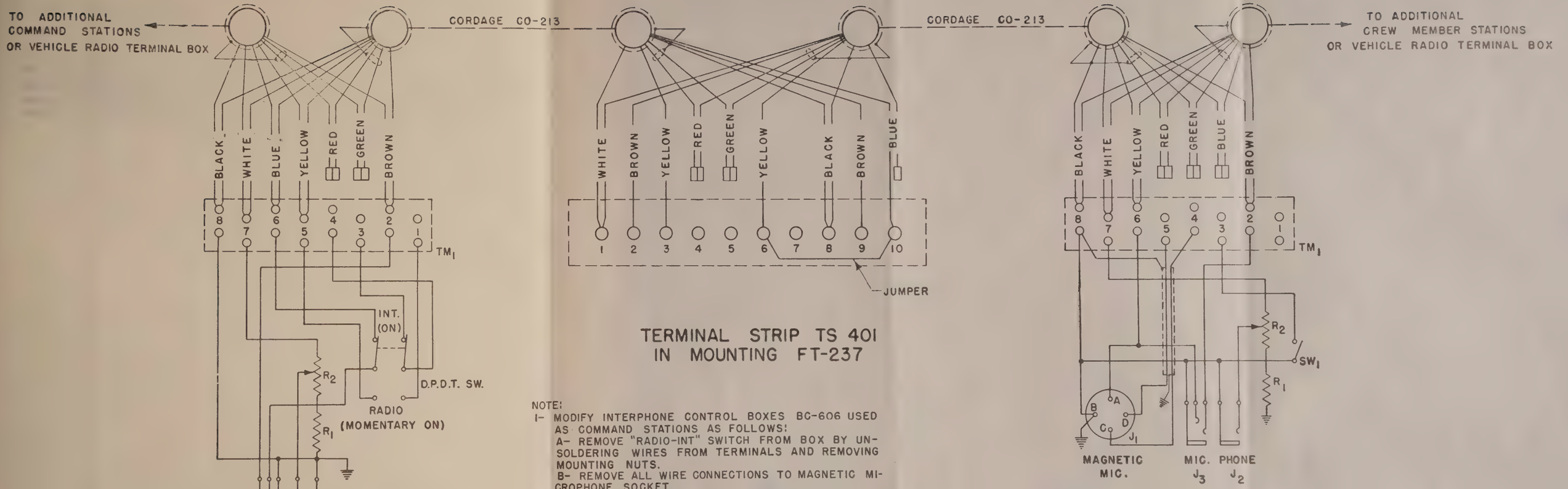


Figure 117. Radio Receiver BC–603–(*), wiring diagram.

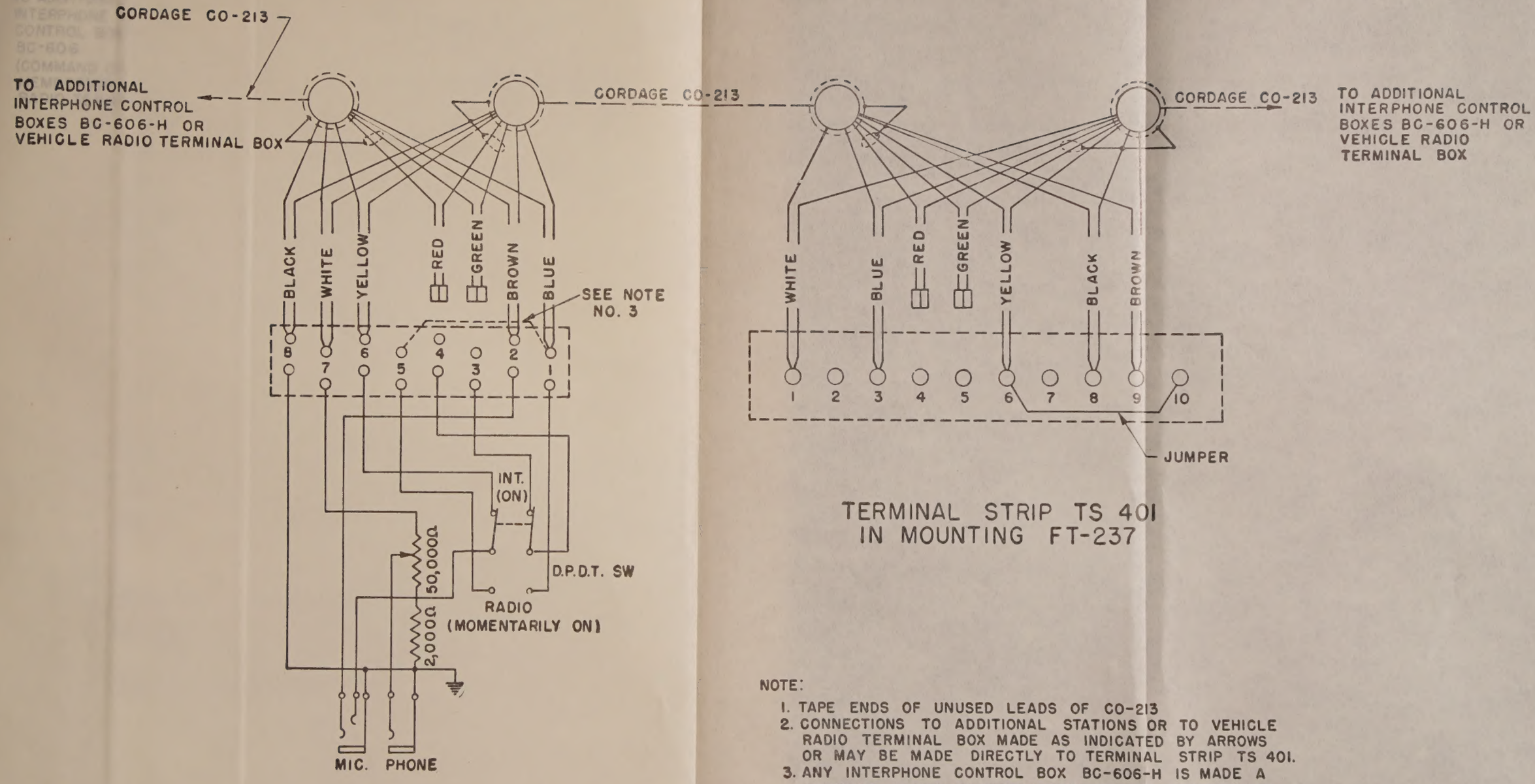




NOTE:
1- MODIFY INTERPHONE CONTROL BOXES BC-606 USED AS COMMAND STATIONS AS FOLLOWS:
A- REMOVE "RADIO-INT" SWITCH FROM BOX BY UNSOLDERING WIRES FROM TERMINALS AND REMOVING MOUNTING NUTS.
B- REMOVE ALL WIRE CONNECTIONS TO MAGNETIC MICROPHONE SOCKET.
C- MOUNT NEW SWITCH (D.P.D.T. MOMENTARY ON, AWS TYPE NO. ST22R, SIGNAL CORPS STOCK NO. 3Z 9863-22R) SO THAT SWITCH LEVER NORMALLY POINTS TO "INT" POSITION. FASTEN SWITCH MOUNTING NUTS SO THAT MOUNTING BUSHING IS FLUSH WITH EXTERNAL MOUNTING NUT. BEND TERMINALS ON POTENTIOMETER AWAY FROM SWITCH IF NECESSARY.
D- CHANGE INTERNAL WIRING OF BOX AS SHOWN.
2- TAPE ENDS OF UNUSED LEADS OF CO-213.
3- CONNECTIONS TO ADDITIONAL STATIONS OR TO VEHICLE RADIO TERMINAL BOX MAY BE MADE AS INDICATED BY ARROWS OR MAY BE MADE DIRECTLY TO TERMINAL STRIP TS 401.

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Figure 121. Wiring diagram of interphone system using Interphone Control Box BC-606-A to G modified for improved system operation.



NOTE:

1. TAPE ENDS OF UNUSED LEADS OF CO-213
2. CONNECTIONS TO ADDITIONAL STATIONS OR TO VEHICLE RADIO TERMINAL BOX MADE AS INDICATED BY ARROWS OR MAY BE MADE DIRECTLY TO TERMINAL STRIP TS 401.
3. ANY INTERPHONE CONTROL BOX BC-606-H IS MADE A COMMAND (RADIO CONTROL) STATION BY ADDITION OF JUMPER BETWEEN TERMINALS 1 AND 5.

Figure 122. Wiring diagram of interphone system using Interphone Control Box BC-606-H and 5-wire connection.

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INTERPHONE CONTROL BOX
BC-606-A,-B,-C,-D,-E,-F OR -G
(MODIFIED) (SEE NOTE 1)

COMMAND (RADIO CONTROL) STATION