

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	15	OFF-ON switch	Turn to ON position.	Meter lamp and dial lamps go on. Rushing noise is heard in loudspeaker.	Check fuse F1 on back of power supply unit. Check line cord. Check terminal screws on rear of receiver and power supply unit. Check tubes in receiver and power supply unit. Check speaker cord.
	EQUIPMENT PERFORMANCE	16	MAIN TUNING control.	Set band switch control at any desired position. Tune across entire band by rotating MAIN TUNING control.	Signals heard in loudspeaker. S meter shows relative strength of signals.
17		BAND switch	Check each of the tuning ranges. Use procedure given in step 16 above.		
18		BAND SPREAD control.	Rotate band switch to a high-frequency band and rotate the BAND SPREAD control from 100 to 0.	Same as normal indications in step 16 above.	
19		PHONES jack	Insert phone plug into PHONES jack.	Signals heard on loudspeaker are audible in phones.	Check phones cord and plug.
20		SENSITIVITY control ..	Tune in any station by rotating the MAIN TUNING control. Then rotate the SENSITIVITY control in either direction.	Strength of signal increases or decreases.	Refer to part five.
21		AUDIO GAIN control...	Rotate control in either direction.	Strength of signal increases or decreases.	Refer to part five.
22		SEND-REC switch	Turn to SEND position. (When check is completed, return to REC position.)	No sound is heard in loudspeaker or in phones.	Refer to part five.

	No. Item	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	23	AVC-MANUAL switch ..	Turn to MANUAL position.	Strength of signal may or may not increase. S meter becomes inoperative.	Refer to part five.
	24	BAND WIDTH control..	Tune the receiver to a modulated signal and then rotate the BAND WIDTH control to each of the higher numbers.	The tuning is broader and the high-frequency response (audio) increases at the higher numbered positions.	Refer to part five.
	25	CRYSTAL SELECTIVITY control.	Set BAND WIDTH control at 3. Then set the CRYSTAL SELECTIVITY control at 1, 2, 3, 4, and 5.	The tuning of the receiver is sharper at the higher numbered positions.	Refer to part five.
	26	LIMITER	Turn switch to ON. Man-made static may be present.	Noise peaks are reduced in amplitude.	Refer to part five.
	27	MOD-CW switch	Turn switch to CW and tune in a c-w carrier on one of the high-frequency bands. (Be sure that the BEAT OSCILLATOR control is set at 0.)	Beat-frequency audio signal is heard in loudspeaker.	Check bfo tube V10.
STOP	28	BEAT OSCILLATOR control.	Obtain beat note of c-w carrier as explained in step 27 above. Rotate the BEAT OSCILLATOR control on either side of 0.	A change in the pitch of the audio tone is noted.	Refer to part five.
	29	OFF-ON switch	Turn to OFF position.	Dial lamps and meter lamp go out. No noise or signals are heard in loudspeaker.	

PART THREE

MAINTENANCE INSTRUCTIONS

Section VI. PREVENTIVE MAINTENANCE TECHNIQUES

T—Tighten
C—Clean
A—Adjust
L—Lubricate

22. Meaning

Preventive maintenance (PM) 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. To understand what is meant by PM, it is necessary to distinguish between preventive maintenance, trouble shooting, and repair. The prime function of PM is to prevent break-downs and, therefore, the need for repair. On the other hand, the prime function of trouble shooting and repair is to locate and correct the existing defects. The importance of PM cannot be overemphasized. The entire system of radio communication depends upon each set's being on the air when it is needed and upon its operating efficiency. Therefore, it is important that radio operators and repairmen maintain their radio sets properly. See TB SIG 178, Preventive Maintenance Guide for Radio Communication Equipment.

Note. The operations in sections VI and VII are organizational maintenance.

23. Description of Techniques

a. GENERAL. Most of the electrical parts used in the equipment require routine preventive maintenance. This PM varies. Some parts require a different kind of maintenance than others. Some require more; some less. Follow definite and specific instructions. Do not apply hit-or-miss techniques. This section of the manual contains 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

The first two operations show if 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 operations, equipment becomes undependable and subject to break-down when it is needed most.

b. FEEL. The feel operation is used to determine whether transformers and electrical connections are overheated. Feeling will show the need for lubrication or the existence of other defects requiring correction. The maintenance man must become familiar with the normal operating temperatures of transformers and other parts to recognize signs of overheating.

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

c. INSPECT. Inspection is the most important operation in PM. A careless observer will overlook evidences of minor trouble. Although minor defects may not at the moment interfere with performance of the equipment, time and effort can be saved if they are corrected before they lead to major and costly 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, 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 areas, look for fungus growth and mildew.

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

d. TIGHTEN, CLEAN, AND ADJUST. These operations explain themselves. Specific procedures to be followed in performing them are given whenever necessary throughout sections VI and VII.

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.

e. 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.

24. Vacuum Tubes

Note. Do not work on the tubes immediately after shut-down. Severe burns may result from contact with the envelopes of hot tubes.

a. INSPECT (I). (1) Inspect glass and metal tube envelopes, tube caps, and tube connector clips for dirt and corrosion. Tubes with loose grid 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 from frayed insulation or broken strands.

(3) Inspect the firmness of tubes in their sockets. Make the inspection by pressing the tubes down in the sockets and testing them in that position but not by partially withdrawing the tubes and jiggling them from side to side. Sidewise movement of a tube tends to weaken the pins in the

base and to spread the contacts in the socket. Inspect the sockets when the tubes are removed.

(4) Be careful when removing a tube from its socket. Never jar a warm tube. Always remove connections to the grid caps.

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

c. ADJUST (A). Adjust loose tube connector clips. Do not flatten the clips during adjustment. Flattened clips do not make adequate contact with the surface of the tube cap. If the clip is made of thin metal, it can be adjusted by gently compressing it with the fingers. If it is made of heavy-gage 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 grid connections must be kept free from dirt and dust because of possible leakage between grid terminals and ground. In contrast, tubes operating at low voltages and not having exposed grid caps do not require frequent cleaning; however, do not permit dirt to accumulate on low-voltage tubes.

(2) Remove dust and dirt from the glass or metal envelopes with a clean, lint-free, dry cloth. If proper care is used, the grid caps may be cleaned with a piece of #0000 sandpaper by wrapping the paper around the cap and gently rubbing the surface. Extreme pressure is not needed; nor is it necessary to grip the cap tightly. Wipe the cap with a clean, dry cloth.

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

25. Capacitors

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

(2) Thoroughly inspect the case of each large

fixed capacitor for leaks, bulges, and discoloration.

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

b. **TIGHTEN (T)**. Tighten loose terminals, mountings, and connections on the 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 all connections that are dirty or corroded. The capacitor cases and bushings usually can be cleaned with a dry cloth. However, if the deposit of dirt is hard to remove, moisten the cloth in Solvent, Dry Cleaning (SD).

(2) Thoroughly clean the plates of variable capacitors with a small brush or pipe cleaner. Dust, if present, may cause arcing.

26. Resistors

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

b. **INSPECT (I)**. Inspect the coating of vitreous-enameled resistors for signs of cracking and chipping, especially at the ends. Examine the bodies of all resistors for blistering, discoloration, and other indications of overheating. Inspect all leads and connections for corrosion, dirt, dust, looseness, and broken strands in connecting wires. Check the security of all mountings. Do not attempt to remove resistors with pigtail connections, because there is danger of breaking the connections at the point where they enter the body of the resistor. Such defects cannot be repaired.

c. **TIGHTEN (T)**. Tighten resistor connections and mountings whenever they are found to be loose. If a resistor is allowed to remain 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 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.

27. Fuses

a. **GENERAL**. Fuses used in this equipment are glass encased. They are easily removed for inspection. Blown fuses should be thrown away.

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

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

d. **CLEAN (C)**. Clean fuse ends and fuse clips with #0000 sandpaper and 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.

28. Insulators

a. **DESCRIPTION**. Insulators are used in the receiver, power supply unit, and antenna. They are constructed of ceramic material with a glazed surface. An insulator is no better than its surface. Deposits of foreign substances on the surface reduce the insulation value. Therefore, inspect all insulators frequently.

b. **INSPECT (I)**. Inspect the physical condition of the insulators. They should be clean and 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 path.

c. **TIGHTEN (T)**. The procedure to be used in tightening loose insulators is self-evident. However, one precaution must be observed. *Avoid forcing the nuts or screws down too tight.* If excessive pressure is exerted on the insulators, damage or breakage is almost certain.

d. **CLEAN (C)**. Insulators are easily cleaned. Never use abrasive materials because the glazed finish will be destroyed, 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 solvent (SD). After the surface has been cleaned with solvent (SD), carefully polish it with a dry cloth. Otherwise, a thin film of the solvent will be left which may impair the effectiveness of the insulator.

29. Switches

a. **INSPECT (I)**. (1) Inspect the mechanical action of each switch and, while so doing, look for

signs of dirt or corrosion on all exposed elements. In some cases it will be necessary to examine the elements of the switch visually; in others, check the action of the switch by flipping the control knob or toggle, or by pressing the switch button and noting the freedom of movement and amount of spring tension.

(2) Examine ganged switches SW1A, B, C, D, E, and SW7 to see that the contacts are clean. Inspection is visual. Do not pry the leaves of the switch apart. The rotary members should make good contact with the stationary members. As the former slides into the latter, a spreading of the stationary contact leaves should be visible. Switch action should be free. The wiping action of contacts usually removes any dirt at the point of contact.

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

30. Coils

a. INSPECT (I). Inspect coils L1 through L55 (depending on which model is being used) for cleanliness of the fiber coil form and secureness of mounting supports. Check all connections for proper contact.

b. TIGHTEN (T). Tighten any loose coil mounting or connections by resoldering wires or tightening screws.

c. CLEAN (C). Clean the coil form and coil with a soft brush. Remember the fiber coil form is actually performing the function of a high-voltage insulator. Therefore, the same preventive maintenance will apply to the coil as to high-voltage insulators and bushings.

31. Potentiometers

a. INSPECT (I). (1) Inspect the mechanical condition of potentiometers R26 and R56. 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 potentiometer 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 the exposed contact

surfaces of the potentiometer and the connections whenever they are dirty or corroded.

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

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

(4) Clean the body of the potentiometer with a brush or cloth.

d. LUBRICATE (L). Refer to section VIII.

32. 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 screw driver of correct size. Do not exert too much pressure. Tighten loose connections.

c. CLEAN (C). Clean terminal blocks when they require it. Use a dry brush, or, if necessary, use a cloth moistened with solvent (SD). Thoroughly wipe the blocks with a cloth and then brush them to remove any lint.

33. Cords and Cables

The cables are the life lines of the equipment. Their condition must be observed closely. Operating equipment in all kinds of weather, and moving it on all kinds of roads, subjects cabling to a great deal of punishment.

a. INSPECT (I). Inspect the cables for cracked or deteriorated insulation, for frayed or cut insulation at the connecting and supporting points, for kinks and improper supports, and for improper placement which causes a strain on them.

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 #0000 sandpaper. Clean the entire surface of the connector. Make no attempt to remove individual prongs from cable plugs.

34. Meter

Meters are extremely delicate 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 the leads and connections of the meter. 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). The meter case can usually be cleaned with a dry cloth. If cleaning is difficult, dampen the cloth with solvent (SD). Clean dirty connections with a small brush or with a small piece of cloth dipped in carbon tetrachloride.

d. ADJUST (A). Normally, the meter on the panel should indicate zero when the 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 the bearings and prevents an otherwise normal unit from coming to rest at zero. If adjustment is needed, insert the tip of a suitable screw driver 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 the meter face and pointer *full on* and not from either side. Avoid turning the screw too far, because the needle may be bent or the hairspring damaged.

35. 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 the 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 the connections are dirty or corroded, clean them before soldering.

(2) Screw loose lamps tightly into their sockets.

36. 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 the contacts, or

increase the 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, remove all traces of polish remaining with carbon tetrachloride. Finish off with a clean, dry cloth.

37. Cabinets, Chassis, and Mountings

The cabinets which house the various components of the equipment are constructed of sheet steel, coated with crackle finish.

a. INSPECT (I). Thoroughly inspect the outside and inside of each cabinet. Check the ventilator mountings, the panel screws, and the zero settings of the meter. Inspect the panels for loose knobs, switches, and jacks.

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. Repaint any surface that is found scratched, rusted, or chipped.

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

38. Headset and Loudspeaker

These auxiliary items of equipment are essential to the operation of the radio set. The operator must therefore give them the same care as the set 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.

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

39. Coupling Shafts and Control Knobs

The control of various capacitors, switches, and resistors is effected through coupling shafts that connect these items to control knobs located on the front panel. It is important that these shafts and control knobs be kept tight at all times. Use a small screw driver to tighten these items whenever they are found loose. Refer to section VIII for lubrication information.

40. Gears

a. **INSPECT (I)**. Inspect the teeth of the gears on the band change switch for dirt or corrosion. Check the gears for proper operation by varying the panel tuning controls.

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

c. **LUBRICATE (L)**. Refer to section VIII.

41. Power Transformers, Filter Chokes, and Audio Transformers

Since power transformers, filter chokes, and audio transformers used in the equipment are of similar potted construction, preventive maintenance for them is similar.

a. **FEEL (F)**. As soon as possible after shutdown, feel filter chokes L1 and L2 for abnormal heating which may indicate an overloaded condition, or imminent failure due to moisture absorption or other causes. Likewise feel audio transformers T7 and T8 for abnormal heating. Power transformer T3 normally operates at a warm temperature.

b. **INSPECT (I)**. Inspect power transformer T3, filter chokes L1 and L2, and audio transformers T7 and T8, for signs of blistering, bulging, or leakage of tar or insulating compounds. Inspect for external signs of electrolytic action or corrosion.

c. **TIGHTEN (T)**. Tighten all mounting bolts or screws, but not to the point that threads are destroyed. The securing of such heavy parts as transformers and chokes to the chassis is very important in preventive maintenance. Should a heavy filter choke or transformer break loose from its mounting in vehicular use or in transit, it may smash tubes, resistors, and capacitors, and at the same time sever a large number of connections.

d. **CLEAN (C)**. Clean power transformers, filter chokes, and audio transformers with a dry cloth. Be sure that no dirt, lint, threads, or foreign material is present between terminals. Dirt, lint, and threads absorb moisture which may provide a leakage path for high voltages between these terminals. Be sure that none is present.

Section VII. ITEMIZED PREVENTIVE MAINTENANCE

42. Introduction

For ease and efficiency of performance, preventive maintenance on the equipment is broken down into

operations that can be performed at different time intervals. In this section the PM 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 PM on individual parts are discussed in section VI. These general instructions are not repeated in this section. When performing PM, refer to section VI if more information is required for the following items. Perform all work with the power removed from the equipment. After PM has been performed on a given day, put the equipment into operation and check it for satisfactory performance. (See par. 21.)

43. Tools and Materials Needed

The following PM tools and materials will be needed:

Common hand tools.

Clean cloth.

#0000 sandpaper.

Crocus cloth.

Contact burnishing tool.

Paste metal polish (Signal Corps stock No. 6G1516).

Dry-cleaning solvent (SD).

Carbon tetrachloride.

Note. Gasoline will not be used as a cleaning fluid for any purpose.

44. Item 1, Exterior of Receiver and Power Supply Unit (fig. 16)

OPERATIONS

IC Cabinet.

ITC Jacks.

ITAL Control knobs.

IC Meter.

T Loose screws, nuts, and bolts.

IC Metal accessories.

IT Nuts.

REMARKS. Equipment should not be taken out of operating position because of minor scratches, chips, blisters, or dents in its exterior unless such damage could result in injury to the operator, in improper functioning, or major deterioration of the equipment. Control knobs with minor cuts and chips should not be discarded and replaced except in cases where proper functioning of equipment or operator's safety requires it. Such minor damage should be touched up on the spot, if conditions permit, but should not be considered sufficient cause for replace-

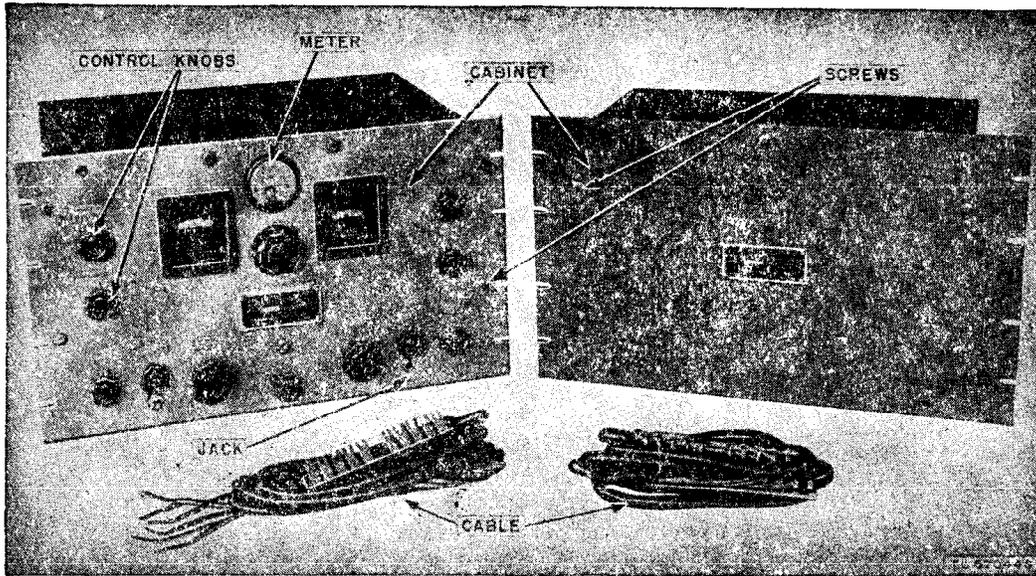


Figure 16. Radio receiver and power supply unit, typical preventive maintenance items, exterior view.

ment of equipment. Remove all dirt, dust, rust, fungus, and other foreign matter. Use solvent (SD) on exposed metal parts. Use a damp cloth on painted parts. Use carbon tetrachloride on exposed electrical contacts such as the antenna, the speaker and phones, the relay, and the power supply terminals located on the back of the receiver and power supply unit. These remarks apply to all other parts of the equipment.

45. Item 2, Cable

OPERATIONS.

IC Cable.

46. Item 3, Headset

OPERATIONS.

I Rubber portion of ear plugs.
 IC Breast clamp.
 IT Sleeve on phone plugs.
 I Metal part of headband.

REMARKS. Tighten any loose sleeves of a phone plug BY HAND ONLY.

47. Item 4, Interior and Power Supply Unit

(fig. 17)

OPERATIONS.

I Chassis.
 I Wiring and soldered joints.

ITC Capacitors.
 ITCA Tubes and sockets.
 FITC Transformers and chokes.
 I Power plug.
 ITC Resistors.
 T Nuts and screws.
 IC Terminal blocks.

48. Item 5, Interior of Receiver (fig. 18)

OPERATIONS.

I Chassis.
 I Wiring and soldered joints.
 ITCA Tubes and sockets.
 I Transformer shields.
 ITC Capacitors.
 I Crystal unit.
 ITC Resistors.
 IT Potentiometers.
 ITC Bushings and insulators.
 I Chokes.
 FITC Audio transformers.
 FITAL Coupling shafts.
 T Nuts and screws.
 ITC Coils.
 ICL Gears.
 IC Terminal blocks.

REMARKS. Do not touch adjusting screws on transformers.

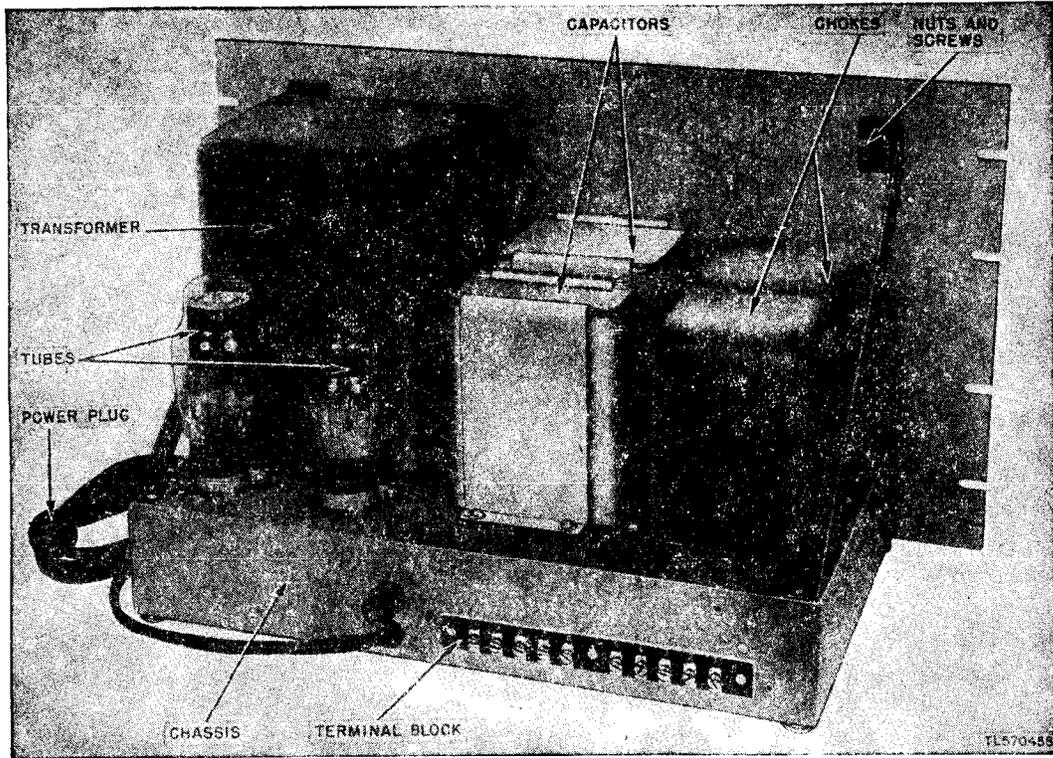


Figure 17. Power supply unit, typical preventive maintenance items, top view of chassis.

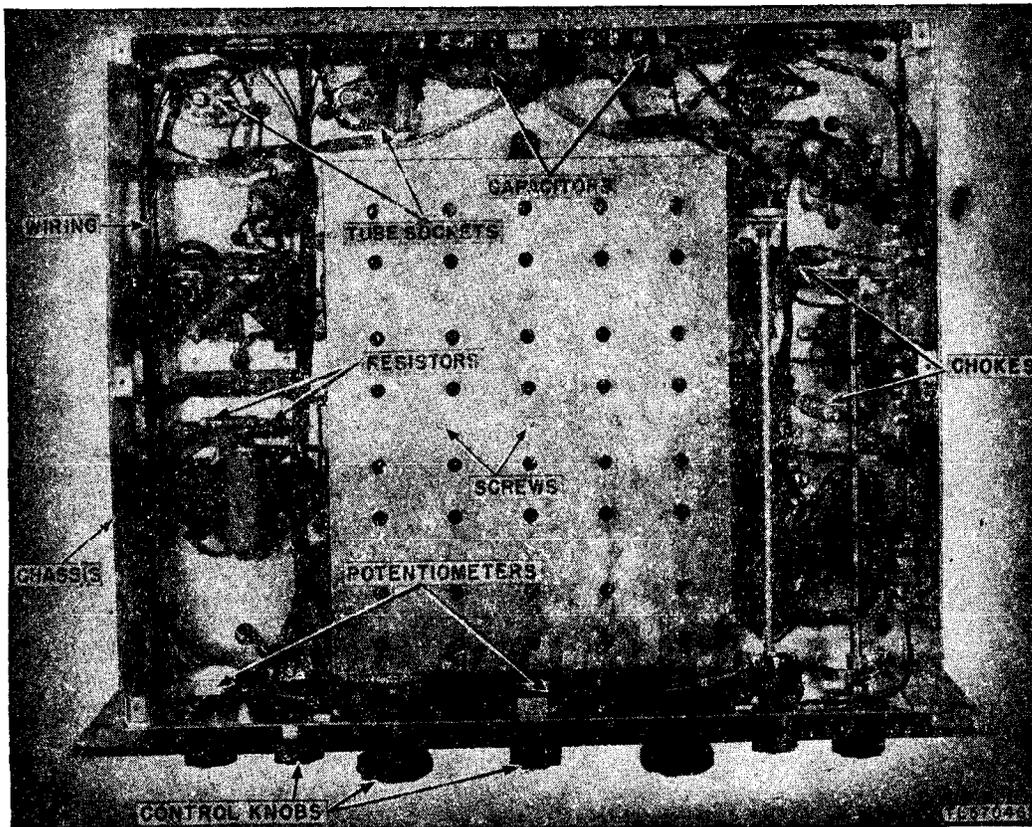


Figure 18. Radio receiver, typical preventive maintenance items, bottom view of chassis.

49. Preventive Maintenance Checklist

The following checklist is a summary of the PM operations to be performed on the equipment. The time intervals shown on the checklist 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 checklist.

The "Maintenance performed by" column indicates those operations performed by the operator and those performed by maintenance personnel. 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				Maintenance performed by
			Daily	Weekly	Monthly	Quarterly	
1	ITCA	Exterior of receiver and power supply unit.	X				O
1	L	Power supply unit				X	O
2	IC	Cable			X		M
3	ITC	Headset	X				O
4	FITCA	Interior of power supply unit.		X			M
5	FITCA	Interior of receiver		X			M
5	L	Interior of receiver				X	M

Note. X indicates when operations are to be performed; O indicates operator; and M indicates maintenance personnel.

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

Section VIII. LUBRICATION

Note. A Lubrication Order has not been issued on these radio sets.

50. Recommended Lubricants and Cleaner

Symbols	Standard nomenclature
PL—SPECIAL	Oil, lubricating, preservative, special.
GL	Grease, lubricating, special.
SD	Solvent, dry-cleaning.

51. Detailed Lubrication Instructions

a. The location of the points on the receivers requiring lubrication and the type of lubricant to be used are illustrated in figure 19. Lubrication is not required at any point not included in the illustration. The recommended lubricants are suitable for all temperatures at which these receivers are operated.

b. Lubricate the equipment before storing it. In-

spect and lubricate it, if it appears to be necessary, before putting it into operation after a period of storage. During a period of normal operation, lubricate the receivers at 3-month intervals. This time interval is based upon a normal usage of approximately 8 hours daily. Lengthen or shorten the interval according to actual operating conditions.

c. When lubricants are to be applied, thoroughly clean the point to be lubricated, and all other parts affected, with solvent (SD) and dry with a lint-free cloth.

d. Apply all lubricants very sparingly to these receivers. Use only one drop at each lubrication point when oil (PL—SPECIAL) is specified. Apply a thin coat of lubricating grease (GL) at points where GL is specified.

e. After the lubricant has been applied, rotate each affected control shaft through at least two complete rotations to distribute the lubricant evenly.

f. Remove excess lubricants.

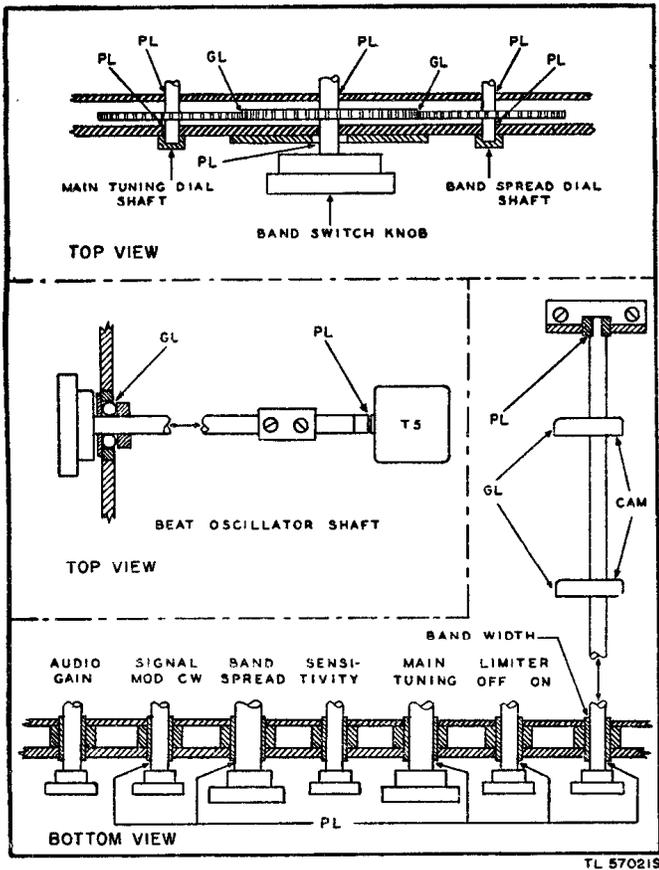


Figure 19. Receiver lubrication diagram.

Section IX. WEATHERPROOFING

52. General

When operated under severe climatic conditions such as prevail in Arctic, desert, or tropical regions, Signal Corps equipment requires special attention.

53. Tropicalization

a. GENERAL. Since fungus growth, insects, corrosion, salt spray, and moisture affect most materials, a special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. Refer to TB SIG 13 for a detailed description of the varnish-spray method and the supplies and equipment required for this treatment.

b. PROBLEMS ENCOUNTERED. The following problems may be encountered:

(1) Resistors, capacitors, coils, chokes, transformer windings, etc., fail because of the effects of fungus growth and excessive moisture.

(2) Electrolytic action, often visible in the form of corrosion, takes place in resistors, coils, chokes, transformer windings, etc., causing eventual breakdown.

(3) Hook-up wire insulation and cable insulation break down. Fungus growth accelerates deterioration.

(4) Moisture forms electrical paths on terminal boards and insulating strips, causing flash-overs and crosstalk.

54. Radio Receivers BC-779-(*), BC-794-(*), BC-1004-(*), and R-129/U

(figs. 20 and 21)

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

b. DISASSEMBLY. (1) Remove the two screws holding the terminal strip cover to the chassis, and remove the cover.

(2) Loosen the 10 screws holding the cable to the terminal strip, and remove the cable. Tighten the screws on the terminal strip.

(3) Remove the eight screws holding the front panel of the receiver in Cabinet CH-104-(A) or in the relay rack, and pull out the chassis.

(4) Remove the 11 knurled screws and lockwashers holding the cover to the front panel and chassis, and take off the cover.

(5) Remove the nine felt feet holding the bottom cover to the chassis, and take off the cover.

(6) Loosen the setscrews holding the beat-oscillator knob and shaft coupling to the capacitor in transformer T5.

(7) Take out the nuts and lockwashers holding the shields of transformers T2, T3, T4, T5, and T6 to the chassis and other components, and remove the shields.

(8) Remove the two upper coil-capacitor assemblies, which control the bandwidth, from their supporting shafts.

(9) Remove the two springs from their supporting shafts.

(10) Remove 33 screws holding the alignment cover to the chassis and remove the cover.

(11) Remove the meter leads from the meter binding posts, unscrew the meter retaining ring, and remove the meter.

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



Figure 20. Radio Receiver BC-1004-C, top view of chassis, showing masking.

d. MASKING. Cover the following components with masking tape:

- (1) Eight capacitors on transformers T2, T3, T4, T5, and T6 (A, fig. 20).
- (2) Drive gears and tuning mechanism (B, fig. 20).
- (3) Supporting shafts on coil-capacitor assemblies (C, fig. 20).
- (4) Cams and levers on bandwidth selector-mechanism shaft (A, fig. 21).
- (5) Capacitors in alinement-adjustment section (B, fig. 21).
- (6) Friction drive wheels of main tuning and band spread selecting mechanism (C, fig. 21).
- (7) Phone jack (D, fig. 21).

e. DRYING. (1) Place equipment in an oven or under heat lamps and dry for 2 or 3 hours at 160° F.

(2) If wax should begin to melt on any of the components, decrease the temperature and increase the baking time approximately 1 hour for each decrease of 10° F.

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

Caution: Varnish spray may have poisonous effects if inhaled. To avoid inhaling spray, use respirator if available, otherwise fasten cheesecloth or other cloth material over nose and mouth. Never spray varnish or lacquer near an open flame. Do not smoke in a room where varnish or lacquer is being sprayed. The spray may be highly explosive.

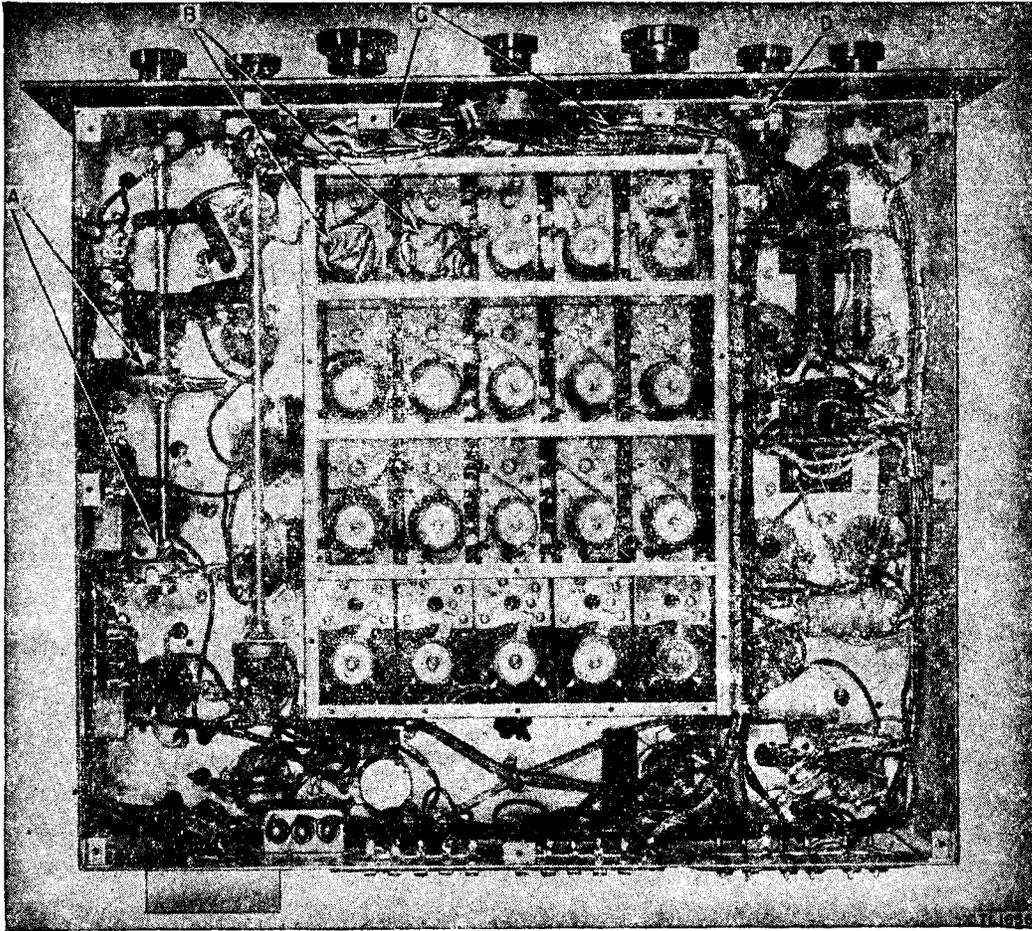


Figure 21. Radio Receiver BC-1004-C, bottom view of chassis, showing masking.

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

(3) Use a brush to varnish components not reached by the spray gun.

g. REASSEMBLY. (1) Remove all masking tape. Be careful not to peel varnish from nearby areas.

(2) Reassemble the receiver and test its operation.

h. MARKING. Mark the letters MFP and the date of treatment at the right of the nameplate on the front panel of the receiver.

Example: MFP—8 Dec 47.

55. Power Supply Units RA-74-(*), RA-84-(*), and RA-94-A (figs. 22 and 23)

a. PREPARATION. Make all repairs and adjustments necessary for the proper operation of the power supply units.

b. DISASSEMBLY. (1) Remove the two screws

holding the terminal strip cover to the chassis, and remove the cover.

(2) Loosen the 10 screws holding the cable to the terminal strip and remove the cable. Tighten the screws on the terminal strip.

(3) Remove the eight screws holding the front panel to the rack, and remove the power supply from the rack.

(4) Remove the eight knurled nuts and lock-washers holding the power supply cover to the front panel and chassis, and remove the cover.

(5) Remove the six screws holding the bottom cover to the chassis and remove the bottom cover.

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. Cover the following components with masking tape:

(1) Contacts of tube sockets (A and B, fig. 22).

(2) Terminals of connector cable (A and B, fig. 23).

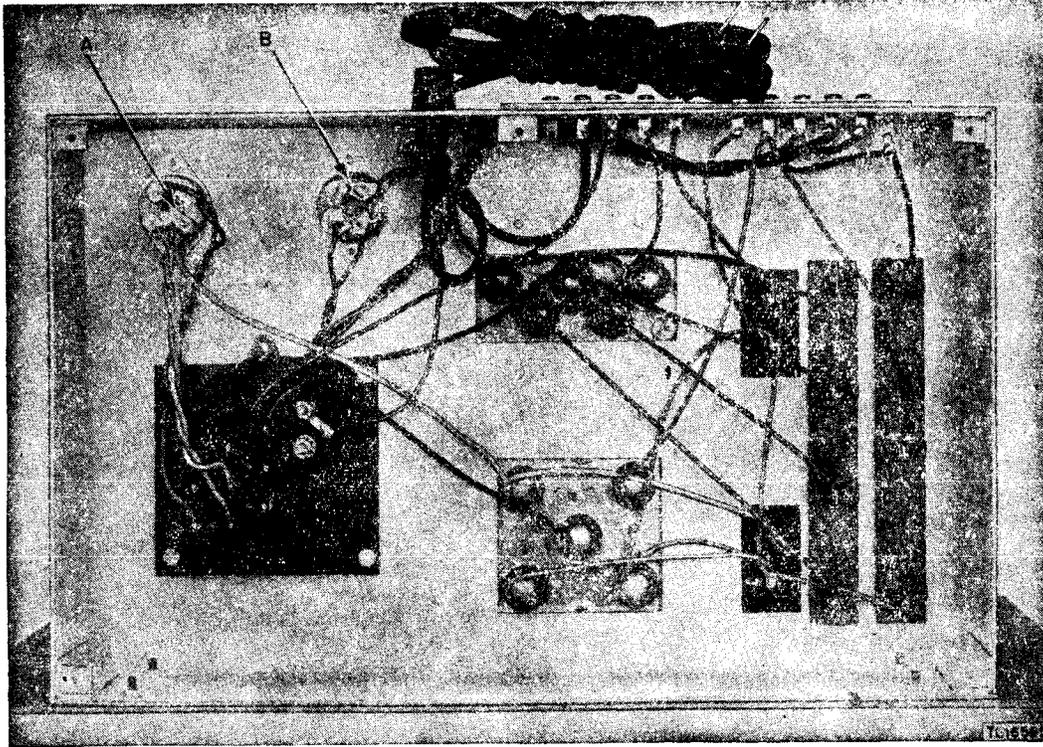


Figure 22. Power Supply Unit RA-94-A, bottom view of chassis, showing masking.

e. DRYING. See paragraph 54e.

f. VARNISHING. See paragraph 54f.

g. REASSEMBLY. (1) Remove all masking tape. Be careful not to peel varnish from nearby areas.
 (2) Reassemble the power supply unit and test its operation.

h. MARKING. Mark the letters MFP and the date of treatment at the right of the nameplate on the front panel of the power supply unit.

Example: MFP—8 Dec 47.

56. Moistureproofing and Fungiproofing after Repairs

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

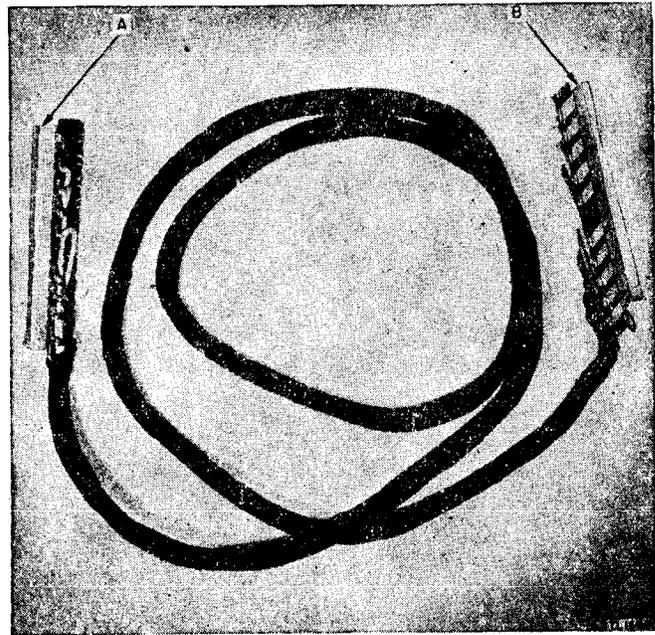


Figure 23. Connector cable, showing masking.

PART FOUR
AUXILIARY EQUIPMENT

(Not used.)

PART FIVE

REPAIR INSTRUCTIONS

Section X. THEORY OF RADIO RECEIVERS

57. General

Except for minor differences in the r-f, mixer, and high-frequency (h-f) oscillator circuits, Radio Receivers BC-779-(*), BC-794-(*), BC-1004-(*), and R-129/U are alike. The information in this section is based on the circuits of Radio Receiver BC-779-A, -B (fig. 56). Differences between the four receiver types are considered in the paragraphs on individual stages and in paragraph 10. For complete schematic diagrams refer to figures 56, 57, 58, and 59.

58. Block Diagram (fig. 24)

Radio Receiver BC-779-B is a superheterodyne receiver with two r-f stages, mixer, h-f oscillator, three i-f stages, a-v-c amplifier, a-v-c rectifier, detector, noise limiter, bfo, and three audio-frequency (a-f) stages. The r-f preselector stages provide image frequency rejection, as well as gain ahead of the mixer to improve the signal-to-noise ratio of the receiver. In the mixer the r-f amplifier output is combined with that of the h-f oscillator to produce the 465-kc intermediate frequency. The i.f. is amplified in the i-f stages and applied simultaneously to the detector and the a-v-c amplifier. The input to the first i-f stage includes a crystal filter to provide single-signal selectivity. The selectivity of the i-f

amplifier is adjustable (par. 62). The detector output can be applied directly or through a noise limiter to the a-f amplifier. The a-v-c amplifier output is rectified and applied as a-v-c voltage to both r-f and first two i-f stages. For the reception of c-w signals the bfo provides an output which beats with the i-f signal to produce an audio-tone output signal. A push-pull arrangement is used in the output stage of the a-f amplifier. The output transformer has two output windings. A 600-ohm output is provided for use when moderate or maximum power is required for the operation of a loudspeaker, recorder, or for a 600-ohm audio transmission line. An 8,000-ohm output is provided for headphone use.

59. R-F Amplifier (fig. 25)

For simplicity, only the circuits for the 2.5- to 5.0-mc band are shown and the band switching arrangement is omitted from figure 25. The band switching circuits are discussed in paragraph 68.

a. FIRST R-F STAGE VI. A doublet antenna is connected through terminals A-A of terminal strip E1 to primary coil L3 of the r-f input transformer (L3, L8). (When a single-wire antenna is used, it is connected to one terminal A and the other terminal A is grounded.) The input impedance of the receiver is approximately 115 ohms. An electrostatic shield between L3 and L8 reduces capacitive coupling to a minimum. The input transformer secondary L8 is tuned by capacitors C1A, C2A, and

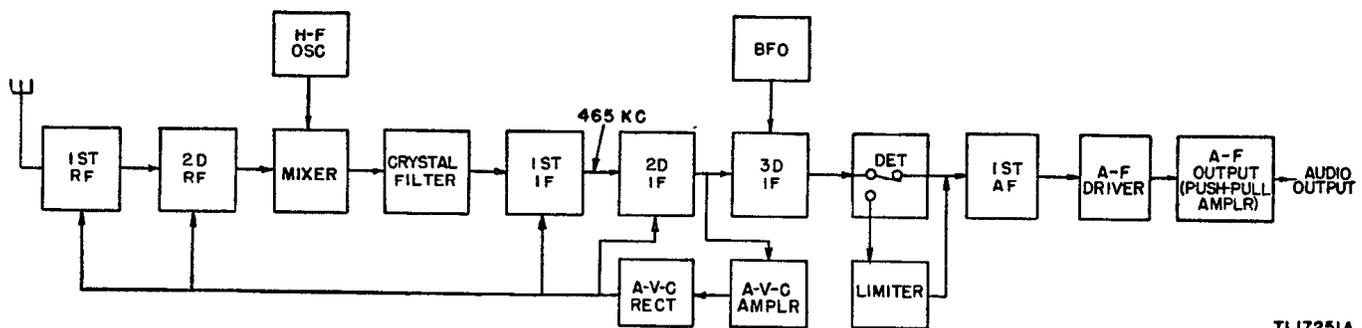


Figure 24. Radio Receiver BC-779-B, block diagram.

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60. Mixer and H-F Oscillator (fig. 27)

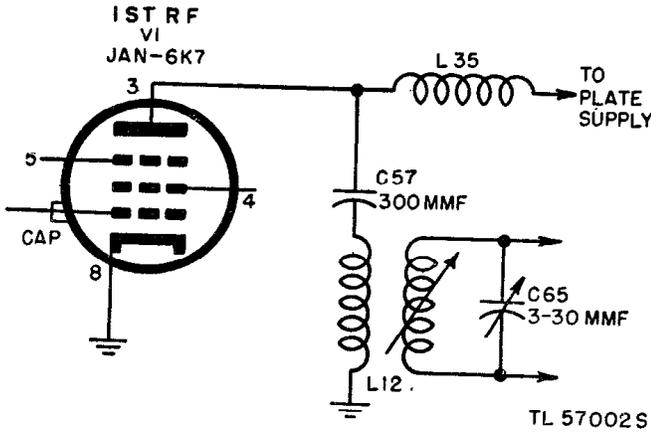


Figure 26. Radio Receiver BC-794-B, functional diagram of 1st r-f stage.

been added to coil assemblies L6 and L11 for the 300- to 540-kc band.

(3) *Selectivity controlling resistors.* In Radio Receivers BC-1004-(*) and R-129/U 20-ohm selectivity controlling (or damping resistors) R57 and R58 are used on the 540- to 1,160-kc band in the tuned input circuits of the second r-f and mixer stages (fig. 58). This additional resistance reduces the Q of the r-f transformers, resulting in less side-band cutting, especially at the l-f end of the band.

a. MIXER TUBE JAN-6L7. For simplicity, capacitor C71, main tuning ganged capacitor C1C, and band spread ganged capacitor C2C are represented as a single variable capacitor C across the inductance trimmed secondary of r-f transformer L18. Signal voltages across C are applied through 600-mmf capacitor C11 to signal grid G1 (top cap) of pentagrid mixer Tube JAN-6L7. Fixed bias from the voltage divider (fig. 31) is applied through a filter circuit (10,000-ohm resistor R10 and 0.01-mf capacitor C12) and 500,000-ohm grid resistor R9 to the signal grid. Screen grid G2 and G4 (pin 4) forms a screen about injection grid G3 (pin 5), and the h-f oscillator output is coupled through 95-mmf capacitor C13 to the injection grid. Since the screen grid shields the signal and injection grids from one another, the tube electron stream is modulated independently by the r-f and oscillator signals. Heterodyne action produces sum and difference frequencies in the mixer output. The primary of transformer T1 is tuned by C21 to the 465-kc *difference* frequency to which the i-f amplifier is also tuned. The i-f voltage across the secondary winding of transformer T1 is applied to the crystal filter.

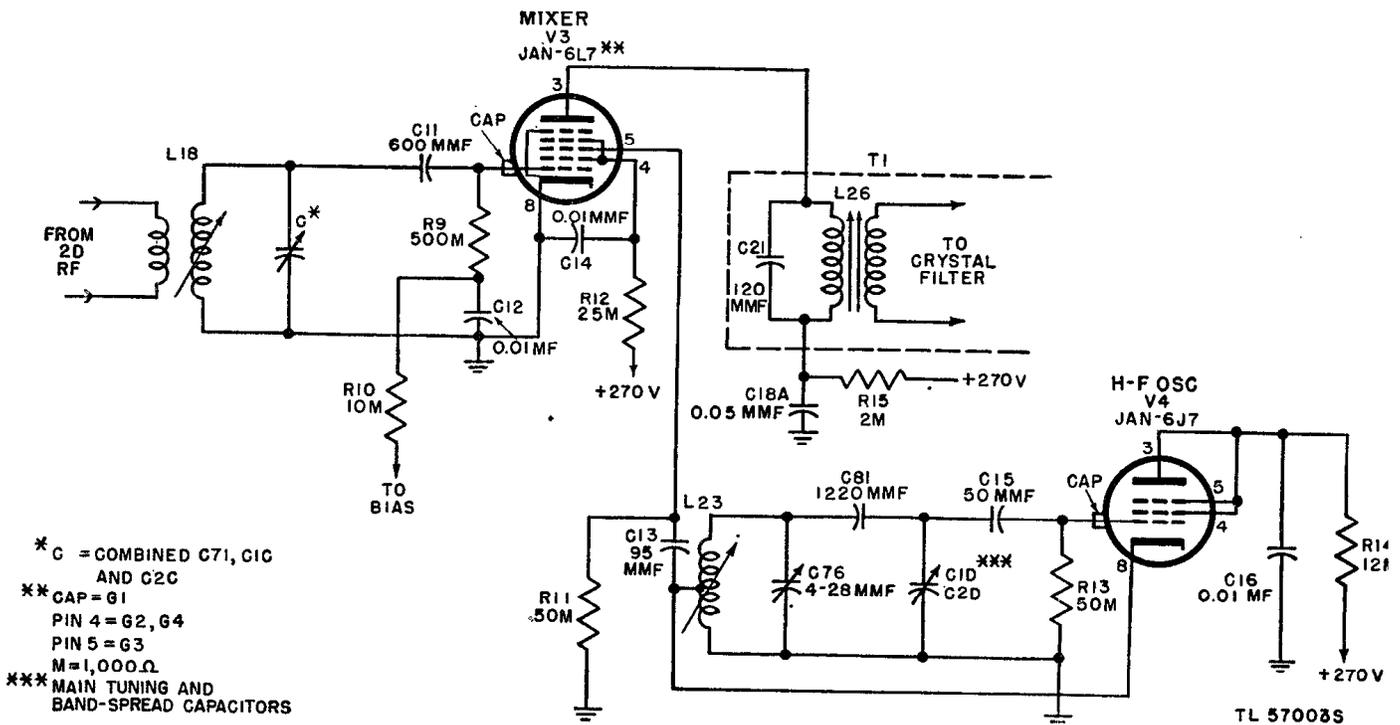


Figure 27. Radio Receiver BC-779-B, functional diagram of mixer and h-f oscillator stages.

b. H-F OSCILLATOR TUBE JAN-6J7. The plate (pin 3), suppressor grid (pin 5), and screen grid (pin 4) of Tube JAN-6J7 are tied together and the tube is used as a triode in a Hartley oscillator circuit. The h-f oscillator operates at a frequency exactly 465 kc higher than that of the received signal except as in *c*(1) below. Plate voltage is shunt-fed by means of a 12,000-ohm resistor R14 and a 0.01-mf capacitor C16. Resistor R14 isolates r-f energy to the oscillating circuit, and capacitor C16 couples the plate to the tank circuit. The cathode is connected to a tap on tank inductance L23. Consequently, tube current passes through a portion of the tank inductance and excites the tank circuit into oscillation. Grid excitation is obtained from the upper (larger) section of tank coil L23 and coupled to the grid (top cap) of V4 by 1,220-mmF capacitor C81, and 50-mmF capacitor C15. Oscillator bias is developed by the grid-leak capacitor combination 50,000-ohm resistor R13 and capacitor C15. The frequency of oscillation is a function of the inductance of L23 and the effective capacitance of capacitors C76, C81, C1D, and C2D. Capacitor C76 is a 4- to 28-mmF trimmer which enables alinement at the h-f end of the main tuning dial; the inductance trimming adjustment of L23 is used for alinement at the l-f end; capacitor C81 is a fixed 1,220-mmF l-f padder; capacitor C1D is the oscillator section of the ganged main tuning capacitor; and capacitor C2D is the oscillator section of the ganged band spread tuning capacitor. The r-f voltage between the tank tap and ground is coupled through 95-mmF capacitor C13 to the injection grid of mixer Tube JAN-6L7. The 50,000-ohm resistor, R11, acts as a grid leak for the injection grid of the mixer tube.

c. DIFFERENCES IN MIXER AND H-F OSCILLATOR CIRCUITS. (1) In Radio Receiver BC-794-B a fixed series capacitor (l-f padder) is not used with 20- to 40-mc band coil L51 (fig. 57) and the oscillator is 465 kc *below* the signal frequency.

(2) In Radio Receiver BC-779-B variable padding capacitors C86 and C87 (fig. 56) are used in parallel with the fixed padders for the 100- to 200-kc and the 200- to 400-kc frequency bands. C86 and C87 are used instead of inductance trimming on oscillator coils L24 and L25. Variable padding capacitors are not used on any other frequency bands.

(3) In Radio Receiver R-129/U (fig. 59) an 11-mmF capacitor has been added to mixer grid coil assembly L16 for the 300- to 540-kc band, and a 50-mmF capacitor has been added to the h-f oscilla-

tor coil assembly, L21. The capacitance of C79 is changed from 4,800 mmF to 190 mmF.

(4) Refer to appendix III for circuit details of Improvement Kit MC-531.

61. Crystal Filter (fig. 28)

a. EQUIVALENT CRYSTAL CIRCUIT. The equivalent electrical circuit of a crystal is shown in "A," figure 28. The circuit, and hence the crystal, are resonant at two frequencies: The frequency at which the reactance of L is equal to the reactance of C (series resonance), and the frequency at which the effective reactance of L-C (in series) is *inductive* and *equal* to the capacitive reactance of C_Y (parallel resonance). At the series-resonant frequency the crystal acts as a low-impedance connection between 1 and 2. At the parallel-resonant frequency the crystal acts as a high impedance between 1 and 2.

b. BASIC FILTER CIRCUIT ("B," fig. 28). Capacitors C22 and C23 (100 mmF each) are connected in series across the secondary of i-f input transformer L26, and their junction is grounded to provide a midpoint connection in the resonant circuit L26-C22-C23. Consequently, the capacitor voltages are always of equal amplitude but 180° out of phase. Phasing capacitor C35 (1.5 to 5 mmF) is connected between 3 and 2, and the crystal is connected between 1 and 2.

c. NEUTRALIZATION OF C_Y . Capacitors C22, C23, C35, and C_Y (the capacity between the crystal holder plates) form a capacity bridge; the input is applied to 1 and 3, the output is taken from 2 and G. When capacitor C35 is adjusted so that its capacitance is equal to that of C_Y , the voltage coupled from 3 through C35 to 2 is equal and opposite to the voltage coupled from 1 through C_Y to 2. Under this condition C_Y is neutralized and the crystal acts as a series-resonant circuit only ("C," fig. 28). Since the crystal is resonant at the intermediate frequency, there is (in effect) a direct connection between 1 and 2. As indicated in "C," figure 28, only the voltage across C22 (one-half the secondary voltage) is applied through the crystal to the grid circuit of the first i-f stage.

d. UNDERNEUTRALIZATION. When the capacitance of C35 is made smaller than that of C_Y , less voltage is coupled through C35 to point 2. C_Y is not neutralized. The crystal then goes into parallel resonance at a frequency slightly higher than its series-resonant frequency, this parallel-resonant frequency being determined by the effective inductive reac-

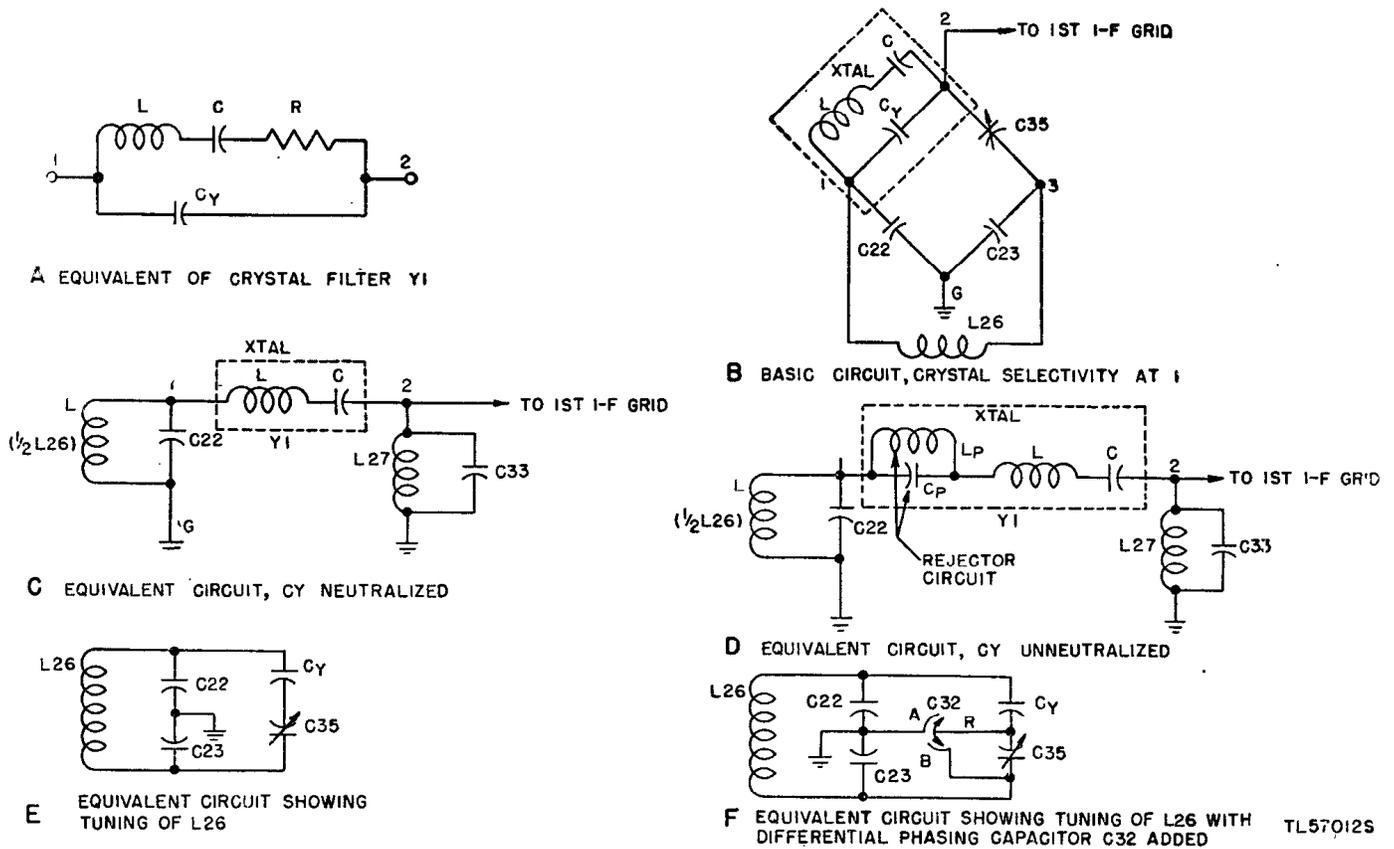


Figure 28. Radio Receiver BC-779-B, functional and equivalent diagrams of crystal filter circuit.

tance of $L-C$ and the capacitive reactance of C_Y . For simplicity the parallel-resonant circuit is denoted as rejector circuit $L_P C_P$ in "D," figure 28. L_P and C_P denote the effective inductance and capacitance at the parallel-resonant frequency. L and C indicate the effective inductance and capacitance of the crystal at the series-resonant frequency, in this case the 465-kc i.f. In other words, unless C_Y is neutralized, the crystal acts simultaneously as a parallel- and series-resonant circuit. The parallel-resonant circuit $L_P C_P$ has no effect on the 465-kc i.f. but presents a high impedance to, and therefore rejects, the frequency to which $L_P C_P$ is resonant. L and C present extremely low impedance to the 465-kc i-f signal voltage and high impedance to voltages at different frequencies. *With underneutralization the resonant frequency of $L_P C_P$ is higher than 465 kc.*

e. OVERNEUTRALIZATION. If the capacitance of C_{35} is made greater than that of C_Y , overneutralization occurs; that is, the voltage coupled from 3 to 2 exceeds that coupled from 1 through C_Y to 2. Under this condition, the voltage and phase relationships are such that the net reactance across C_Y is induc-

tive. The crystal then goes into parallel resonance at a frequency slightly lower than its series-resonant frequency, the parallel-resonant frequency being determined by the effective capacitive reactance of $L-C$ and the effective inductive reactance across C_Y . *With overneutralization the frequency of the parallel resonant circuit, shown as $L_P C_P$, is lower than 465 kc.*

f. CAPACITOR C32. Capacitor C_{35} , in series with capacitance C_Y , is across L_{26} and affects its tuning ("E," fig. 28). To avoid the detuning effect and to enable shifting the rejection frequency to either side of the i.f., differential PHASING capacitor C_{32} ("F," fig. 28) is used in the radio receiver. Stator sections A and B are so arranged that, as rotor R is turned out of one stator into the other, the capacitance of the first *decreases* by the same amount that the capacitance of the second *increases*. Thus, whether the rotor is entirely engaged in stator A, is at a midpoint, or is entirely in stator B, the effective capacitance across A-B, and therefore across L_{26} , remains constant. Assume that C_{32} , the PHASING capacitor, is set at the arrow position of the PHASING control on the front panel and

that C35 is adjusted to neutralize C_Y . At the arrow position, the capacitance of A-R is equal to that of B-R. If the rotor is turned into stator A, the capacitance B-R across C35 is reduced. Consequently, the effective neutralizing capacitance is reduced and the rejection circuit (d above) becomes effective. When the rotor is turned into stator B, the neutralizing capacitance is increased and overneutralization occurs (e above). In practice the rejection frequency can be moved to any point from a few hundred cycles to several thousand cycles on either side of the i.f.

g. CIRCUIT DIFFERENCES. The crystal filter is identical in all the receivers.

62. I-F Amplifier (fig. 29)

a. INPUT STAGE TUBE JAN-6K7 (V5). (1) CRYSTAL SELECTIVITY switch at OFF. With the CRYSTAL SELECTIVITY switch, SW7, at OFF, the crystal filter is shorted. Consequently, the i-f signal is applied directly from input transformer L26 to the parallel-resonant grid circuit (permeability-tuned inductor L27 and 85-mmf capacitor C33) and to the control grid (top cap) of V5. C34 places the lower end of L27 at r-f ground potential. Grid bias is applied from the a-v-c line (par. 65) through 10,000-ohm decoupling resistor R46 which is bypassed by 0.01-mf capacitor C34. Plate (pin 3)

voltage is applied through 2,000-ohm decoupling resistor R17 and primary winding L28 of interstage transformer T2. L28 is tuned by 100-mmf capacitor C36, and 0.05-mf capacitor C19A is a decoupling capacitor which brings the low end of L28 to r-f ground potential. The suppressor grid and cathode are grounded. Screen (pin 4) voltage is applied through 2,000-ohm decoupling resistor R16, and the screen is bypassed by 0.05-mf capacitor C18C. The inductive coupling between primary L28 and secondary L29 of T2 can be varied by adjusting the front panel BAND WIDTH control. The secondary of T2 is tuned by 100-mmf capacitor C37. I-f output is taken from a (low-potential point) tap on the secondary of T2 and applied to the control grid of the 2d i-f stage Tube JAN-6SK7 (V6).

(2) CRYSTAL SELECTIVITY switch at 1. When CRYSTAL SELECTIVITY switch SW7 is placed at 1, the short is removed from the crystal. If the secondary of L26 and the parallel-resonant grid circuit, L27-C33, are tuned to 465 kc, each is the equivalent of a high resistance in series with the equivalent series-resonant circuit of the crystal ("C," fig. 28). Consequently, the Q and therefore the selectivity of the series-resonant (crystal) filter circuit is reduced, and the bandwidth is several kilocycles wider than that of the crystal alone.

(3) CRYSTAL SELECTIVITY at 2, 3, 4, or 5. Advancing the CRYSTAL SELECTIVITY switch

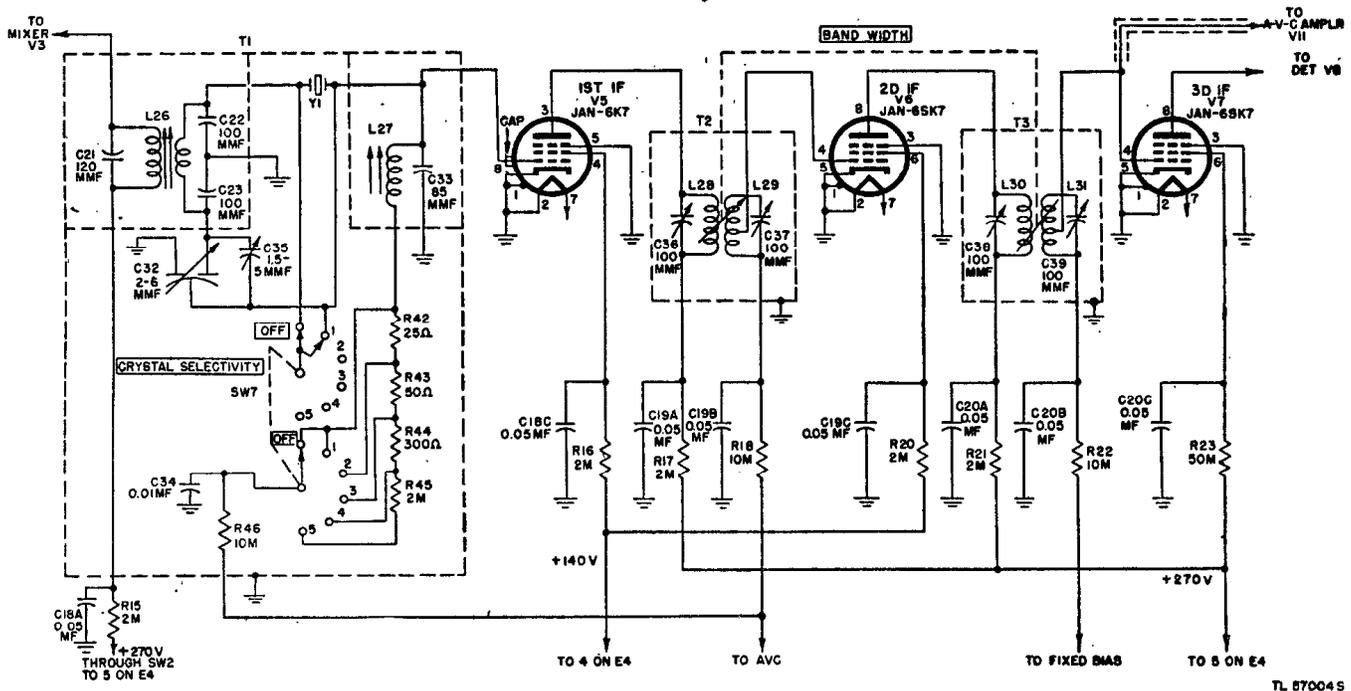


Figure 29. Radio Receiver BC-779-B, functional diagram of i-f amplifier.

to 2 places 25-ohm resistor R42 in series with L27 and C33 in the parallel-resonant grid circuit. The additional resistance, R42, reduces the Q and the *effective* resistance of tuned circuit L27-C33, *thereby reducing the total resistance in series with the crystal*. Under this condition the Q , and therefore the selectivity, of the filter circuit *increases*. As the CRYSTAL SELECTIVITY switch is advanced through 3, 4, and 5, resistors R43 (50 ohms), R44 (300 ohms), and R45 (2,000 ohms) are added successively in series with L27. Consequently, the *effective* resistance of tuned circuit L27-C33 is reduced in successive steps, the Q of the crystal filter circuit is correspondingly increased, and the selectivity of the filter circuit approaches the selectivity of the crystal alone.

b. **2D I-F STAGE TUBE JAN-6SK7 (V6)**. The i-f output of T2 is applied from a tap on L29 to the control grid (pin 4) of 2d i-f stage Tube JAN-6SK7. The suppressor and cathode are grounded. Bias voltage is obtained from the a-v-c line and is series-fed through decoupling resistor R18 (10,000-ohms) and L29 to the control grid. The low-potential end of L29 is grounded (at rf) through 0.05-mf capacitor C19B, which also prevents the bias from being shorted to ground. Screen voltage is obtained from the power supply unit and applied through 2,000-ohm decoupling resistor R20. The screen (pin 6) is bypassed by 0.05-mf capacitor C19C. Plate voltage is applied through 2,000-ohm decoupling resistor R21 and the primary winding of interstage transformer T3. The primary L30 of interstage transformer T3 is tuned by 100-mmF trimmer capacitor C38. The low-potential end of L30 is grounded (at rf) through 0.05-mf capacitor C20A, which also prevents the plate voltage from being shorted to ground.

c. **3D I-F STAGE TUBE JAN-6SK7 (V7)**. The secondary L31 or T3 is tuned by 100-mmF capacitor C39. The coupling between L30 and L31 is adjustable and controlled by means of the front panel BAND WIDTH control. This control also varies the coupling between L28 and L29 as indicated above. Thus the selectivity of the first two interstage transformers (T2 and T3) is adjusted simultaneously whenever the BAND WIDTH control is varied. The i-f output signal is taken from a tap on L31 and applied simultaneously to the control grid (pin 4) of V7 and to the a-v-c amplifier stage Tube JAN-6SK7 (V11). The suppressor and cathode (V7) are grounded. Bias is obtained from a tap on the fixed bias divider (par. 65d) and series-fed

through 10,000-ohm resistor R22 and L31. Capacitor C20B (0.05 mf) bypasses the low-potential end of L31 to ground, but prevents the bias voltage from being shorted to ground. Screen voltage is applied through 50,000-ohm series dropping resistor R23; the screen is bypassed by 0.05-mf capacitor C20C. Plate voltage is applied through 2,000-ohm decoupling resistor R47 (fig. 30) and the primary winding of L32. The primary of L32 is tuned by 100-mmF capacitor C40. The 0.01-mf capacitor C43 bypasses h-f components to ground.

d. **CIRCUIT DIFFERENCES**. The i-f amplifier is identical in all the receivers.

63. Detector (fig. 30)

a. The signal voltages across the untuned secondary of i-f output transformer L32 are applied to diode detector Tube JAN-6H6 (V8). The two diode sections are connected in parallel and the tube acts as a half-wave rectifier. The diode load is composed of 100,000-ohm resistor R48, 75,000-ohm resistor R24, 50,000-ohm resistor R25, and 250,000-ohm resistor R30 in series between L32 (point A) and the cathode of V8 (point C). The entire load resistance is bypassed by 50-mmF capacitor C44 which acts as an r-f filter. Two additional 50-mmF capacitors, C45 and C26, also provide r-f filtering. The rectified diode current passes through the load resistance, and the load voltage variations are a function of the modulation of an incoming signal. The voltage across R25 is taken as output voltage and applied to 250,000-ohm AUDIO GAIN potentiometer R26 (fig. 33).

b. Detector stage V8 is identical in all the receivers.

64. Noise Limiter (fig. 30)

a. **LIMITER CIRCUIT**. The triode sections of Tube JAN-6N7 (V9) are connected in parallel to form a single triode (fig. 30) which is used as a shunt-type limiter. The heater voltage is reduced to approximately 3 volts by 4-ohm series resistor R31 (fig. 56). The control grids (pins 4 and 5) are connected to 0.05-mf capacitor C42, which is grounded at one end, and through 1-megohm (meg) resistor R49 to the most negative point (A) on the diode resistance. The cathode (pin 8) is connected through LIMITER OFF-ON switch SW5 to a point of higher potential (B) with respect to point (A), and the plates (pins 3 and 6) are connected to the point of highest potential (C)

noise pulse is clipped and the noise output cannot become much greater than the signal output. (With the noise amplitude held to a level only slightly greater than the signal, an operator can read signals that would be unreadable without the limiter.) Immediately following the pulse, the original bias voltage across resistor R48 again biases the limiter, and normal reception is restored quickly. In practice the limiter is effective in reducing the effect of noise pulses, such as those produced by the ignition system of an automobile. If the amplitude of the noise pulse is lower than the signal amplitude, the limiter has no effect. In other words, the limiter can only prevent the noise output from rising appreciably above the signal output.

(3) *Changes in signal amplitude.* The limiter stage will affect signals, such as amplitude-modulated voice and music transmissions, which contain amplitude changes. Increases of amplitude above the average level cause the same action that is produced by noise pulses and, therefore, the limiter distorts the signal by clipping the peaks. Clipping and, hence, the distortion may increase considerably if the degree of modulation is high.

(4) *Changes of average signal amplitude.* The time constant of R49-C42 is long enough to prevent bias changes when noise pulses are received. The time constant is short enough, however, to enable automatic readjustment of the bias (voltage of C42) when the average amplitude of the signal changes. For example, if the level of the received signal increases or decreases because of fading, or if the receiver is tuned to a signal of given amplitude and retuned quickly to a stronger or to a weaker signal, the charge of C42 readjusts itself for proper operation under the new conditions.

c. **CIRCUIT DIFFERENCES.** The noise limiter stage is identical in all the receivers.

65. A-V-C Circuit (fig. 31)

An a-v-c circuit which is independent of the detector provides improved a-v-c action. In Radio Receiver BC-779-B the separate a-v-c circuit consists of an a-v-c branch i-f amplifier Tube JAN-6SK7 (V11) and an a-v-c rectifier Tube JAN-6H6 (V12). The rectified and filtered output of V12 is applied as a-v-c voltage to both r-f stages and to the first two i-f stages.

a. **A-V-C AMPLIFIER TUBE JAN-6SK7 (V11).** The output of the 2d i-f stage, V6, is applied simultaneously to the 3d i-f stage, V7 (fig. 29),

and to the control grid (pin 4) of the a-v-c amplifier stage V11 (fig. 31). V7 and V11 have a common grid circuit, including fixed bias. The suppressor and cathode of V11 are grounded; screen voltage is applied to pin 6 through 50,000-ohm series-dropping resistor R37; and the screen is bypassed by 0.05-mf capacitor C29. Plate (pin 8) voltage is applied through 2,000-ohm filter resistor R51 and the primary of transformer L34. The primary of L34 is tuned to 465 kc by 100-mmf capacitor C51, and capacitor C53 (0.01-mf) bypasses high frequencies to ground. The transformer secondary is untuned.

b. **A-V-C RECTIFIER TUBE JAN-6H6 (V12).** The secondary voltage across L34 is applied to a-v-c rectifier Tube JAN-6H6, the two diode sections of which are connected in parallel to form a single half-wave rectifier. The diode (or rectifier) load is composed of 25,000-ohm resistor R53, 5,000-ohm resistor R54, 5,000-ohm resistor R55 and 1,000-ohm variable resistor R41. A 0.005-mf capacitor (C52), across the load, and 0.01-mf capacitors C54 and C55 filter the rectifier output.

c. **S-METER.** When AVC-MANUAL switch SW4 is at AVC, the 0- to 200-microampere meter M1 is connected across the 1,000-ohm calibration resistor R41. The meter reading is a measure of the rectified current through the load. However, the meter is calibrated as a signal strength meter (S-meter). By adjusting R41 and S9 reading may be obtained on an input between approximately 10 and 10,000 microvolts. At the factory R41 is usually adjusted to produce a reading of S9 on a 50-microvolt signal at 3.5 mc. When so adjusted, a change of one S number on the meter indicates a change in signal strength of approximately two to one. The SENSITIVITY control R56 must be turned full on (10). When the S-meter is used for tuning, the BAND WIDTH control must be set at 3 for maximum accuracy. The S-meter is disconnected from the diode load circuit when the AVC-MANUAL switch is at MANUAL.

d. **BIAS VOLTAGE DIVIDER.** Fixed bias voltage is obtained from the power supply (par. 71d) and applied to a voltage divider composed of 3,000-ohm resistor R40, 1,700-ohm resistor R39, and 300-ohm resistor R38. The voltage drop across 300-ohm resistor R38, bypassed by 0.25-mf capacitor C30, is applied as fixed bias to the mixer and 3d i-f stages. A 50,000-ohm SENSITIVITY control, R56, is connected across the series combination of R40 and R39.