

Figure 31. Radio Receiver BC-779-B, functional diagram of a-v-c stages.

e. A-V-C OPERATION. With the AVC-MANUAL switch, at AVC, the a-v-c control voltage is obtained from the junction of R52 and R19 and applied to the r-f stages and the first two i-f stages through the AVC-MANUAL switch and the i-f filter consisting of 1-meg resistor R52 and 0.05-mf paralleled capacitors C56 and C18B. This resistor-capacitor combination establishes the time constant of the a-v-c circuit. The grid resistors and capacitors in the controlled r-f and i-f stages also affect the time constant. The 2-meg resistor, R19, provides an interconnection between the avc and the fixed bias circuit. The SENSITIVITY control can therefore be used to adjust the gain of the receiver during a-v-c operation. This feature is very helpful in a noisy location. When avc is used for c-w code reception, a longer time constant is desirable and is secured by adding a 0.25-mf capacitor C17 in parallel with C56 and C18B. This additional capacitor is connected to one pole of the SIGNAL MOD-CW switch, SW3 (fig. 32), which controls the beat oscillator. Therefore, when the beat

oscillator is turned on for c-w code reception, capacitor C17 is automatically added to the a-v-c system.

f. MANUAL OPERATION. With the AVC-MANUAL, the a-v-c line is disconnected from the a-v-c rectifier output and connected directly to the contact arm of the SENSITIVITY control, R56. Bias is then applied to the two r-f stages and the first two i-f stages. The bias is adjusted by means of the SENSITIVITY control and filtered by capacitor C18B. The bias cannot be reduced below the voltage drop (3 volts) across R38, and this voltage is applied as fixed bias to the mixer and 3d i-f stages.

g. CIRCUIT DIFFERENCES. The a-v-c, bias supply, and S-meter circuits are identical in Radio Receivers BC-779-(*), BC-794-(*), BC-1004-(*), and R-129/U (figs. 56, 57, 58, and 59), except that Radio Receiver BC-1004-D does not contain sensitivity meter M1 and capacitor C30 is included only in Radio Receiver BC-779-(*).

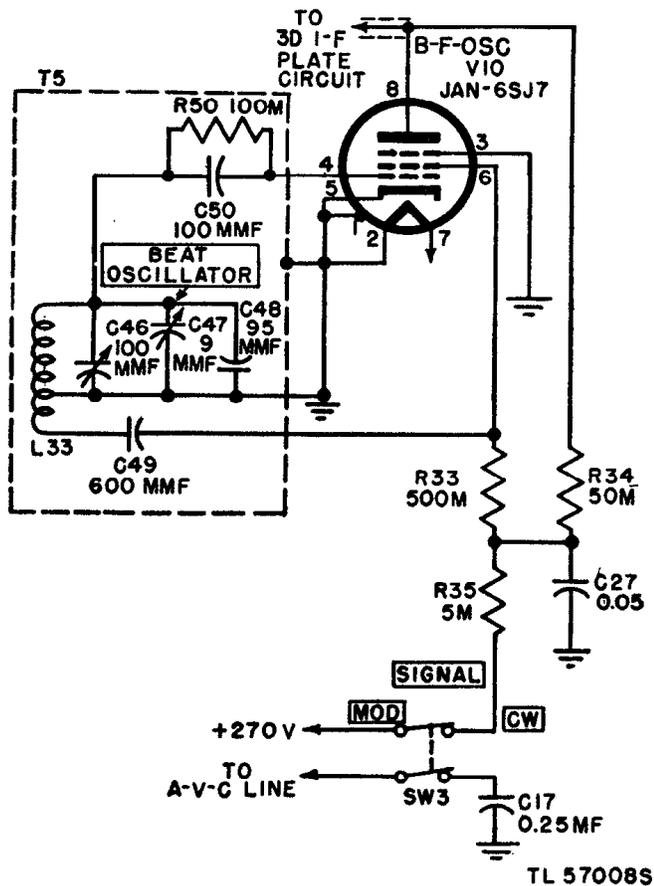


Figure 32. Radio Receiver BC-779-B, functional diagram of beat-frequency oscillator.

66. Beat Frequency Oscillator (fig. 32)

a. Beat frequency oscillator V10 uses Tube JAN-6SJ7 in a pentode-operated electron-coupled oscillator circuit. The cathode, control grid, and screen grid form a series-fed Hartley oscillator. The screen grid of the tube acts as the plate of the Hartley oscillator circuit. When the SIGNAL MOD-CW switch SW3 is in the CW position, screen and plate voltage are applied through decoupling circuit R35, C27, dropping resistor R33 and load resistor R34. R-f current is fed back to the grid tank circuit through capacitor C49 which also serves to prevent the B plus supply from being shorted to ground through L33. The frequency of the oscillator grid circuit, approximately 465 kc, is determined primarily by inductor L33 in parallel with variable capacitor C46 and fixed capacitor C48. C46 is used to place the oscillator at approximately 465 kc. BEAT OSCILLATOR capacitor C47 provides fine adjustment of the oscillator frequency. Grid leak bias is developed by R50 and C50. The r-f voltage across the grid circuit is electron-coupled to the plate circuit

of V10, thus causing an amplified r-f voltage to appear across load resistor R34. Since the electron stream is the coupling medium between the oscillator and the load, and since the suppressor grid (pin 3), which is at r-f ground potential, serves as an electrostatic shield between the oscillator and the plate output circuits thus eliminating capacitive feedback, this type of oscillator is very stable.

b. The r-f voltage across R34, approximately 465 kc, is applied through capacitor C41 to the input circuit C40-L32 of detector stage V8 (fig. 30). This r-f voltage mixes in the detector with the 465-kc i-f signal from the 3d i-f tube, V7, resulting in a beat or difference frequency which is applied to the a-f stages of the receiver. By adjusting the BEAT OSCILLATOR control, C47, the pitch of this difference frequency can be controlled at will. Furthermore, the BEAT OSCILLATOR control may be set to obtain the desired difference frequency tone above or below the intermediate frequency, depending on the side which gives the more satisfactory reception. In addition to being necessary for proper reception of c-w code signals, the bfo is useful for locating weak signals of any kind. As indicated in paragraph 65e, capacitor C17 is connected in parallel with the a-v-c time constant determining capacitors C56 and C18 during a-v-c reception to increase the time constant when the bfo is being used for c-w code signals. When the SIGNAL MOD-CW switch, SW3, is in the MOD position, the bfo does not operate since the plate and screen supply is cut off. In this position the additional timing capacitor, C17, is disconnected from the a-v-c line, since it is required only for a-v-c c-w code reception.

c. The b-f-o stage is identical in all the receivers.

67. A-F Amplifier (fig. 33)

a. 1ST A-F STAGE. The audio output of the detector appearing across AUDIO GAIN potentiometer R26 is coupled by 0.02-mf capacitor C24 to the grid of the 1st a-f Tube JAN-6C5, V13. Grid bias is applied through 500,000-ohm grid coupling resistor R27 from the voltage divider composed of 300-ohm resistor R38, 1,700-ohm resistor R39, and 3,000-ohm resistor R40. The cathode and one side of the filament are grounded. Plate voltage is supplied through 50,000-ohm load resistor R28. The 0.25-mf capacitor, C31A, is the plate supply bypass.

b. A-F DRIVER STAGE. The audio voltage across R28 is coupled by 0.05-mf capacitor C25 to the

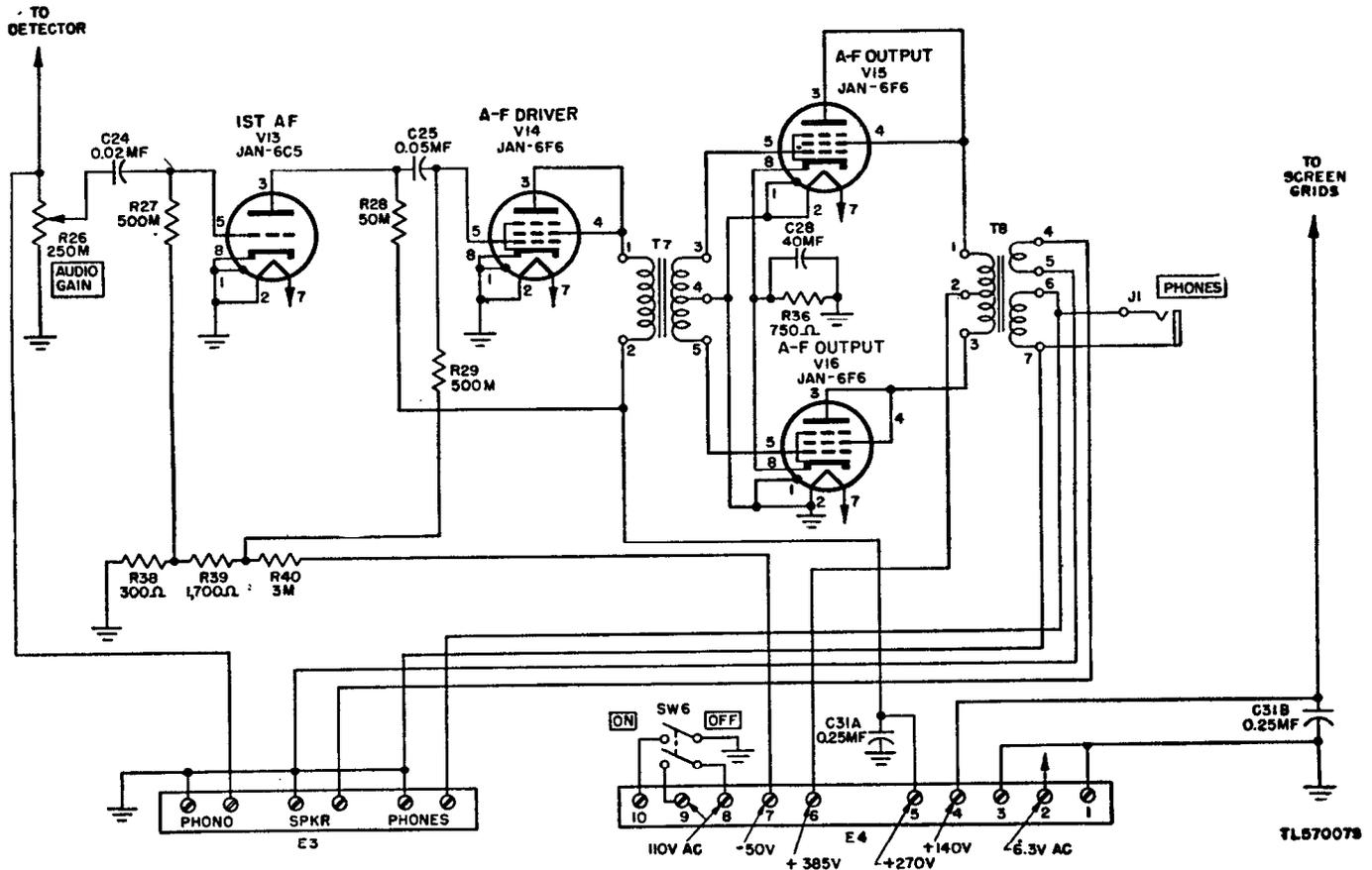


Figure 33. Radio Receiver BC-779-B, functional diagram of a-f amplifier stage.

grid of a-f driver Tube JAN-6F6, V14. Fixed bias from the voltage divider is applied through 500,000-ohm grid resistor R29. The cathode is grounded. V14 is operated as a triode by connecting its plate and screen together. Plate voltage is supplied through the primary winding of push-pull input transformer T7.

c. A-F OUTPUT STAGE. (1) This stage is a push-pull arrangement using two pentode Tubes JAN-6F6, V15 and V16, connected as triodes. The grids are connected to terminals 3 and 5 of push-pull transformer T7. Center tap terminal 4 is grounded. Plate voltage is supplied through the primary of push-pull output transformer T8. Cathode bias is provided by the current flow through 750-ohm resistor R36 which is bypassed by 40-mf capacitor C28 to prevent degeneration. V15 and V16 are operated as class AB₂ amplifiers. This means that grid current flows during some part of the input cycle. For a power output up to approximately 3 watts no grid current flows, and harmonic distortion is negligible. Above 3 watts, and up to 10 watts (maximum output),

grid current steadily increases, causing a corresponding increase in distortion.

(2) Output transformer T8 has two secondary windings: a 600-ohm secondary (4-5) for power output, and a secondary for headphones (6-7) designed to deliver about 3 percent of the output power into an 8,000-ohm resistive load when the 600-ohm secondary is connected to a matching load. The turns ratio and resistance of the headphone winding are such that the power delivered to any load between 8,000 ohms and 80 ohms varies less than 6 decibels, and the power input to a 250-ohm load is only 2 decibels greater than that to a 4,000-ohm load. The power output winding (4-5) is connected to the SPKR terminals on terminal strip E3, which is located at the rear of the receiver. The headphone winding (6-7) applies audio output to PHONES Jack J1 which is in parallel with the PHONES terminals on terminal strip E3. One side of each winding is grounded. The PHONO terminals on E3 provide a convenient means of using the a-f amplifier to amplify an audio-signal.

Volume can then be controlled by the AUDIO GAIN control, R26.

(3) Terminal strip E4 is connected to terminal strip E1 on the power supply unit by a connector cable. When the ON-OFF switch, SW6, is in the ON position, terminals 8 and 9 are shorted on both terminal strips E4 and E1, thus completing the primary circuit of the power supply unit input transformer, T1 (fig. 50). The various operating potentials are then applied through the connector cable to the receiver terminal strip E4.

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

68. Band Switching Circuits

In the discussion of the r-f circuits of the receiver, only the tuned circuits for the 2.5- to 5.0-mc band were covered. Actually, each receiver has five bands. Four r-f stages are involved. With only one or two exceptions, the tuned r-f circuits consist of a low-inductance untuned primary and a tuned secondary in the grid circuits of the 1st r-f, 2d r-f, and mixer stages. The fourth r-f tuned circuit is the oscillator tank circuit. All four r-f tuned circuits

are changed when the band is changed by the 10-pole, 5-position, 5-section band switch, SW-1A, SW-1B, SW-1C, SW-1D, SW-1E. Figure 56 shows the band switch in the 5- to 10-mc position for Radio Receiver BC-779-B. Note that the circuits in the four unused bands are automatically shorted out by the switch contacts. The frequency bands, which vary for the four receivers, are as follows:

BC-779-(*)	BC-794-(*)	BC-1004-(*)	R-129/U
100 kc-200 kc	1,250 kc- 2,500 kc	540 kc- 1,160 kc	300 kc-540 kc
200 kc-400 kc	2.5 mc-5 mc	1,160 kc- 2,500 kc	540 kc- 1,160 kc
2.5 mc-5 mc	5 mc-10 mc	2.5 mc-5 mc	1,160 kc- 2,500 kc
5 mc-10 mc	10 mc-20 mc	5 mc-10 mc	2.5 mc-5 mc
10 mc-20 mc	20 mc-40 mc	10 mc-20 mc	5 mc-10 mc

69. Band Spread Circuits

a. To provide noncritical tuning without an unnecessary amount of dial twisting, the 4-section BAND SPREAD capacitor, C2A, C2B, C2C, C2D,

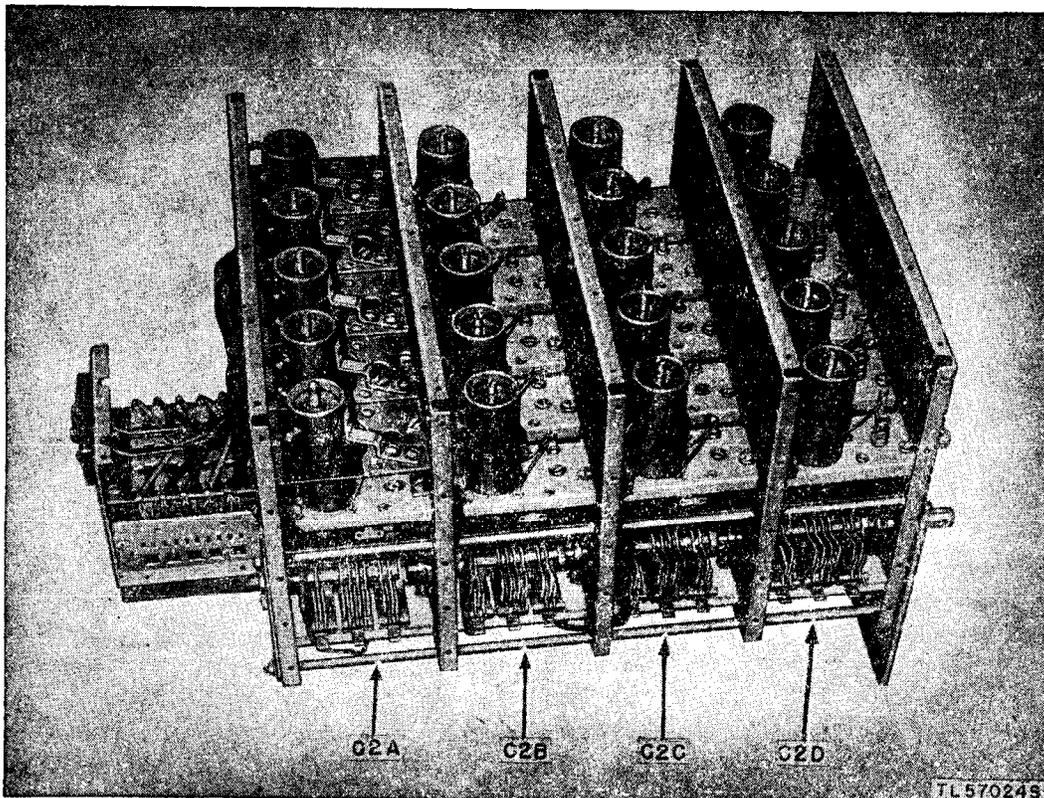


Figure 34. Radio receiver, tuning unit assembly.

is provided. One section is used in each of the four r-f stages (fig. 56). Each section, moreover, is further subdivided into three smaller sections so that effectively 12 band spread capacitors are provided (fig. 34). Each one of the three smaller capacitors in any one r-f stage is used for band spread in only one of the three higher frequency bands. The band switch automatically connects or disconnects these band spread capacitors. The unused band spread capacitors are shorted out. On the two lower frequency bands no band spread is provided since tuning is not too critical. The capacitance range of each of the three smaller sections in any one r-f stage differs since the tuned r-f circuits in each of the three bands require different values of band spread capacitance for satisfactory band spread characteristics.

b. The calibration of the main dial is based on a BAND SPREAD dial setting of 100. Decreasing the setting of the BAND SPREAD dial decreases the resonant frequency of the receiver. Band spread may therefore be obtained by setting the BAND SPREAD dial at 100 and the MAIN TUNING dial to the highest frequency which is desired to be covered with band spread action. When this has been done, a small portion of the adjacent lower frequency side of the band may be tuned by means of the BAND SPREAD dial only.

c. In Radio Receiver BC-794-(*) (fig. 57), the center one of the three smaller capacitors is always connected in the tuned r-f circuits. The other two capacitors are connected in the tuned r-f circuits in the 2.5- to 10-mc and 20- to 40-mc bands, respectively. Thus in Radio Receiver BC-794-(*) the BAND SPREAD control operates continuously throughout the entire tuning range of the receiver, and signals can be spread out in any one of its five bands.

d. In Radio Receiver R-129/U (fig. 59) the band spread has been removed from the 300- to 540-kc band.

Section XI. THEORY OF POWER SUPPLY UNITS AND BATTERY OPERATION

70. Differences in Models

Power Units RA-74-(*), RA-84-(*), and RA-94-A are electrically alike except for variations in power transformers T1, T2, and T3 (figs. 50, 51, and 52). The output of these transformers is the same, but the input requirements vary.

a. Power Unit RA-74-(*) operates from a 95-130-volt (v), 190-260-v, 25-60-cycle power source. The transformer primary is provided with eight taps marked 95, 105, 117, 130, 190, 210, 234, and 260.

b. Power Unit RA-84-(*) is designed to operate from a 105-115-125-v, 50-60-cycle power source. Three primary taps marked 105, 115, and 125 are provided.

c. Power Unit RA-94-A operates from a 115- or 230-v, 50-60-cycle power source. Two taps marked 115 and 230 are provided.

71. Circuit Details

a. An input transformer, T1, T2, or T3, is connected to the power source by 7-foot line cord W1 and is fused by 2-ampere (amp), 250-v fuse F1. Terminals 8 and 9 of terminal strip E1 are connected to terminals 8 and 9 of receiver terminal strip, E4 (fig. 33) by the connector cable. Closing receiver ON-OFF switch SW6 therefore completes the primary circuit of the transformer. The average power consumed is 180 watts.

b. The power unit furnishes filament, plate supply, and bias voltages to the receiver. The filament voltage, 6.3 v ac, is obtained from secondary winding 1-2 on the transformer and applied to the receiver through terminals 1 and 2 on the terminal strips (fig. 50, 51, or 52). Terminal 1 is grounded in the receiver.

c. Plate supply voltage is supplied by the plate supply rectifier Tube JAN-5Z3, V1, connected in a full-wave circuit. The plates are connected to terminals 7 and 10 of the high-voltage center-tapped secondary. The center tap, terminal 8, is grounded. Filament supply is provided by secondary winding 5-6. After the voltage is rectified, it is filtered by the capacitor input pi-section filter consisting of choke L1 and two 8-mf sections of filter capacitor C1. The filtered voltage, which is connected to terminal 6, provides approximately 385 v dc for the plates of a-f output tubes V15 and V16 in the receiver. Further filtering by second filter choke L2 and another 8-mf section of capacitor C1 provides approximately 270 v dc plate and screen supply at terminal 5. Approximately 140 v dc for screen grid supply is obtained from the tap on bleeder resistor R1, which is bypassed by the remaining 8-mf section of capacitor C1. This screen voltage is connected to terminal 4 on terminal strip E1.

d. Bias supply rectifier Tube JAN-80, V2, is used in a half-wave rectifier circuit to supply bias to the receiver. The filament is connected to tap 9 on the high-voltage secondary. The a-c voltage across the 8 and 9 windings of the high-voltage secondary is thus applied to V2. Since tap 8 is grounded, the plate of V2 is at a negative potential. Filament supply for V2 is furnished by winding 3-4. The rectified output of V2 is filtered by the three 8,000-ohm sections of resistor R2 and the four 3-mf sections of filter capacitor C2. When connected to the receiver, the voltage at the end of this filter, terminal 7 on E1, is approximately 50v negative.

e. Terminals 1 through 9 on terminal strip E1 are connected to terminals 1 through 9 on the receiver by the connector cable. Terminal 10 is not used for a-c operation. Terminal 3 is grounded in both the power supply unit and the receiver.

72. Battery Operation

a. Although primarily designed for a-c operation, in an emergency the receiver can be operated from a 6-v storage battery, five 45-v plate supply batteries, and a 45-v bias battery. The 7-foot connector cable which is supplied for battery operation is connected as shown in figure 35. One end of the cable is provided with a terminal strip which connects to the terminal strip on the receiver. Terminals 2 and 8 of the connector cable terminal strip are shorted.

b. The plate supply voltage is always applied to the receiver since the negative terminal of the series-connected batteries is grounded through terminal 3 and the positive terminal is connected to terminals 5 and 6. The 90-v screen supply, connected to terminal 4, is also always applied to the receiver. There are no bleeders in the receiver plate supply circuits so that no current is drawn when there is no filament voltage applied to the tubes.

c. The ON-OFF power switch, SW6, in the ON position turns on the receiver filaments and applies bias to the receiver. The negative end of the 6-v filament supply battery is grounded through terminal 1. The positive terminal of the battery is connected to the filaments through terminal 9, ON position of switch SW6, terminal 8, and the jumper to terminal 2.

d. The positive terminal of the bias supply battery is grounded through terminal 10 and the ON position of switch SW6. The negative 45-v terminal is connected to the receiver through terminal 7.

Section XII. TROUBLE SHOOTING

73. General

No matter how well equipment is designed and manufactured, faults occur in service. When such faults occur, the repairman must locate and correct them as rapidly as possible. This section contains

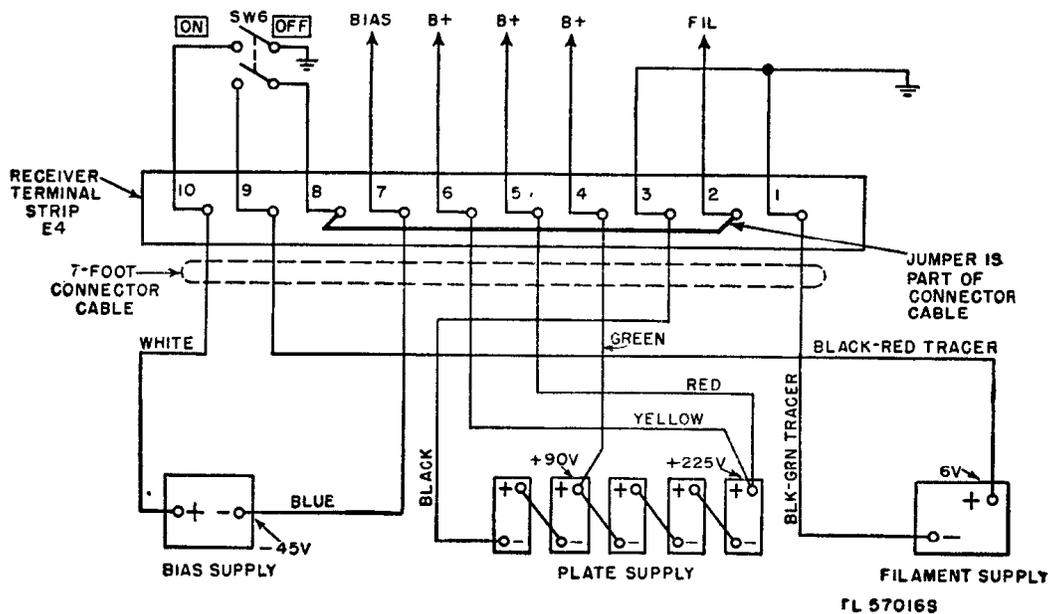


Figure 35. Connections for battery operation, functional diagram.

information to aid personnel engaged in this highly important duty of trouble shooting.

74. Trouble-Shooting Data

Take advantage of the material supplied in this manual. It will help the rapid location of faults. Consult the following trouble-shooting data:

a. RADIO RECEIVER.

Fig. No.	Description
56	Radio Receiver BC-779-A, -B, schematic diagram.
57	Radio Receiver BC-794-A, -B, schematic diagram.
58	Radio Receiver BC-1004-B, -C, schematic diagram.
59	Radio Receiver R-129/U, schematic diagram.
42	Tube socket voltage and resistance chart.
36	Terminal strip, voltages, and resistances.
37	Radio receiver, chassis, top view.
38	Radio Receiver BC-779-(*), chassis, bottom view.
39	Radio Receiver BC-794-(*), chassis, bottom view.
40	Radio Receiver BC-1004-(*), chassis, bottom view.
41	Crystal selectivity unit, side view.
60	Receiver chassis, wiring diagram.
61	Receiver tuning unit, wiring diagram.

b. POWER SUPPLY UNIT.

Fig. No.	Description
50	Power Supply Unit RA-74-B, -C, schematic diagram.
51	Power Supply Unit RA-84-A, -B, schematic diagram.
52	Power Supply Unit RA-94-A, schematic diagram.
45	Tube socket voltage and resistance chart.
43	Power supply unit, chassis, top view.
44	Power Supply Unit RA-94-A, chassis bottom view.

c. PIN CONNECTIONS. 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.

75. 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, r-f arcing, and shorted transformers 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 receiver on the different bands and while operating the various controls may sectionalize the fault to a particular stage or circuit. The meter may indicate whether or not the r-f and i-f stages are functioning. Additional sectionalizing of the fault will be discussed in paragraphs 81 through 84.

b. LOCALIZATION. Paragraphs 85 through 88 describe the method of localizing faults within the individual components. These paragraphs are accompanied by a trouble-shooting chart which lists abnormal symptoms and their probable causes. The chart also gives the 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.

76. Voltage Measurements

Voltage measurements are an almost indispensable aid, for most troubles either *result* from abnormal voltages or *produce* abnormal voltages. Voltage measurements are taken easily, because they are always made between two points in a circuit; 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 because 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.

77. 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.

78. Voltmeter Loading

Voltmeter resistance must be at least 10 times as great 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-v range is 300,000 ohms ($R = 1,000 \text{ ohms per volt} \times 300 \text{ v} = 300,000 \text{ ohms}$).

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

79. 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 l-f 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 ohmmeter 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 test prods are now reversed, the needle will deflect twice as far and then return to the position indicating infinite resistance. 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.

a. **ELECTROLYTIC CAPACITORS.** Electrolytic capacitors will normally show a resistance reading. When an ohmmeter is connected across an electrolytic capacitor, a resistance reading less than about 100,000 ohms indicates a defective capacitor. If the prods are reversed, the resistance reading will normally fall to a low value. Always take both polarity readings to make sure which reading is the higher one.

80. 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, tag each of the leads to it.

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.

81. Visual Inspection

The purpose of inspection is to locate any visible trouble. Through this inspection alone, the repairman 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. When a receiver is brought in from the field for check or repair, remove the cover and inspect the receiver as follows:

a. Examine for burned insulation and resistors. 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 only the cover removed. Usually more harm than good will be caused by the removal of the i-f cans and other inclosed parts. Trouble in these parts can be localized by signal substitution and voltage and resistance measurements.

b. Inspect for broken or defective soldered connections to tube sockets, plugs, and other apparatus. 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 figures 13 and 14. Replace any tubes which have the wrong numbers. Inspect for loose tube sockets.

d. Inspect the fuse in the power supply unit. Check carefully for short circuits if a receiver with a blown fuse is encountered.

e. Inspect the MAIN TUNING, BAND SPREAD, and band switch controls for proper operation. The MAIN TUNING and BAND SPREAD dials should turn smoothly.

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.

82. Power Supply Unit Test

The power supply test prevents further damage to the receiver from possible short circuits. This test also indicates whether the power supply unit is functioning properly.

a. With the receiver and power supply unit connected for operation, place the OFF-ON switch in the ON position. If the receiver fails to operate, check all connections to the power supply unit and to the power source to determine whether the proper voltage is being delivered to the receiver.

b. As the receiver warms up, inspect it for any signs of abnormal operation such as smoking, arcing, or crackling. Try to detect any odors that would indicate burning of parts, insulation, etc. If any abnormal indications are present, turn the power off. Locate the cause of the abnormality by checking each component part of the circuit in which the abnormality was observed. Replace any faulty part and correct any trouble before proceeding.

c. If no abnormal indication appears, measure the voltage and resistance between the terminals of terminal strip E4 and the receiver chassis (fig. 36). Correct readings will indicate that the power supply

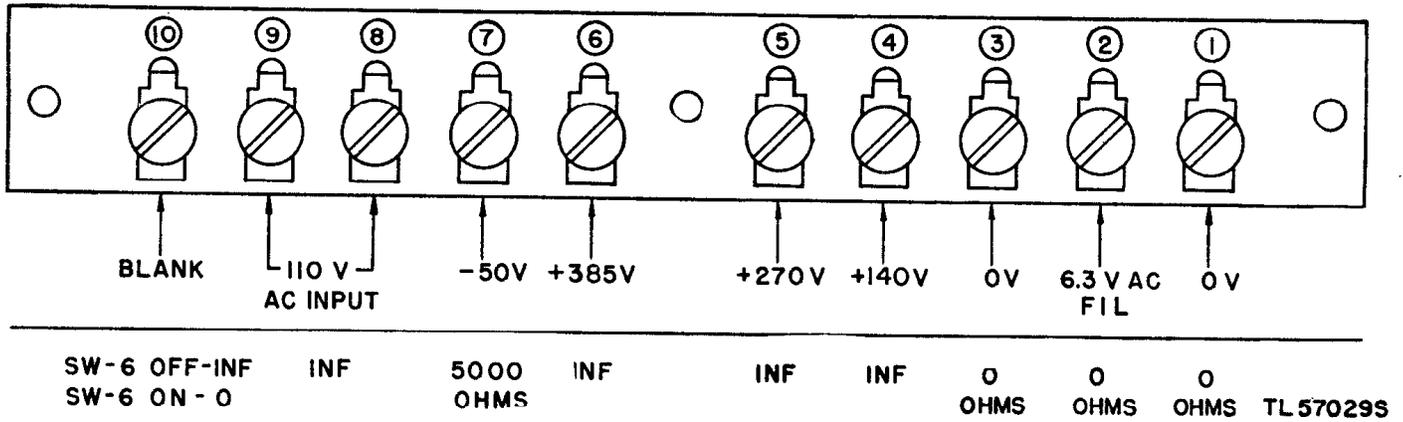


Figure 36. Receiver terminal strip, voltage and resistance measurements.

is functioning properly. Incorrect voltage readings at terminal strip E4 indicate improper operation of the power supply or receiver.

d. After the receiver has been running for about 10 minutes, feel the tubes cautiously to see if they are all warm or hot. No tube should remain cold. If a tube does not warm up, examine the wiring associated with its socket and examine the socket contacts. If there is no wiring trouble and the tube does not warm up, test it. If no vacuum tube test set is available, replace the tube.

83. Equipment Performance Test

The equipment performance test is important because it frequently indicates the general location of the trouble. In many instances the exact nature of the fault can be determined with the information gained. In order for this information to be utilized

fully, all symptoms must be interpreted in relation to each other. The equipment performance test or check list is given in paragraph 21.

84. Trouble-Shooting Chart

The following chart is supplied as an aid in locating trouble in the radio receiver and associated power supply unit. This chart lists the symptoms which the operator may observe, either visually or audibly, while making a few simple tests. The chart also indicates how to sectionalize trouble quickly to the audio, i-f, or r-f stages of the receiver. The signal substitution tests outlined in paragraphs 86, 87, and 88 can then be used to determine the defective stage. A tube check and voltage and resistance measurements of this stage should ordinarily be sufficient to isolate the defective part.

Symptom	Probable trouble	Correction
1. ON-OFF switch in ON position. Receiver fails to operate and dial lamps do not light.	1. Open fuse F1 in power supply unit. Connecting leads to fuse holder broken.	1. Replace fuse. If it blows again, check filter capacitors C1 and C2. Repair leads.
2. No receiver output. With AVC-MANUAL switch at AVC, and SENSITIVITY control at 10. S-meter dips and rises as MAIN TUNING dial is rotated.	2. Defect exists between 2d i-f and a-f output stages.	2. Use headphones, with 0.1-mf capacitor in series with one lead, across grid and plate circuits of successive audio stages to localize defective stage. Test tube in this stage and then, if necessary, make voltage and resistance measurements to locate defective part. An alternate method is to use signal substitution in audio stages (par. 86).

Symptom	Probable trouble	Correction
3. Receiver inoperative. S-meter does not deflect as receiver is tuned. Dial lamps light.	3. Failure of B plus supply..... Defect exists between antenna terminal and detector stage.	3. Remove metal cover from receiver terminal strip E4 and compare voltages measured between each terminal and chassis with values shown (fig. 36). If no B plus voltage is present, check power supply unit tubes. If voltage is low, check filter capacitors C1 and C2. See symptoms 4 and 5.
4. A-f circuits satisfactory but no receiver output is obtained when modulated 465-kc i-f signal is applied through a series capacitor to grid cap of mixer, V3.	4. Faulty i-f stage	4. Use signal substitution in i-f stages (par. 87) to locate defective stage. Test tube and make tube socket voltage and resistance tests.
5. A-f and i-f circuits satisfactory but no output is obtained when r-f modulated signal is applied to antenna A post and receiver is tuned to this signal.	5. Faulty r-f stage	5. Use signal substitution in r-f stages par. 88) to locate defective stage and then the faulty component.
6. A-m signals received but no beat note obtained when SIGNAL MOD-CW switch is turned to CW. Beat note heard when i-f c-w signal is applied to terminal 4 of V7.	6. Defective b-f-o stage V10.....	6. Test V10 and its tube socket resistances and voltages.
7. Reception weak. With no signal tuned in, roaring noise is not heard when AUDIO GAIN and SENSITIVITY controls are turned to maximum setting and CRYSTAL SELECTIVITY switch is at OFF. Tuning S-meter does not rise to customary peaks for reception of known stations.	7. Weak tubes	7. Check tubes. Check voltages and make resistance checks. Realign receiver.
8. Reception distorted	8. Open grid resistor or leaky capacitor in audio circuits.	8. Use headset, with 0.1-mf capacitor in series with one lead, to localize faulty stage. Check grid circuit.
9. Noisy and fading reception.....	9. Faulty gain controls..... Faulty antenna circuit	9. Check slider contact in SENSITIVITY and AUDIO GAIN controls. Check antenna installations for leakage paths to ground, and also for loose connections.
10. Objectionable hum in output.....	10. Shorted or open filter capacitors in power supply unit.	10. Check each capacitor by disconnecting positive lead from each section and charging each, then discharging by shorting to chassis with screw driver whose handle is insulated from the blade. Capacitors which do not seem to store sufficient charge, as indicated by size of discharge spark, may be faulty. Check by connecting new equivalent capacitor for comparison.

Symptom	Probable trouble	Correction
	Shorted turns in power supply unit choke.	Check for shorted turns by measuring resistance of L1 and L2. L1 should be 350 ohms; L2, 1,150 ohms.
	Short between winding and core in power supply unit choke.	Check for open circuit between either filter choke terminal and case or core. If circuit is not open, replace choke.
11. Intermittent noise	11. Defective tube, resistor, or capacitor.	11. 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 to any component.
12. Oscillation (indicated by whistle or howl).	12. Defective tube, poor shielding, interstage coupling, or high-resistance soldered chassis return.	12. Check tubes, and shunt bypass capacitors with capacitors of equal value.

85. Signal Substitution Notes

a. Signal substitution requires a source of audio, i-f, and r-f signals. Signal Generator I-72-() is suitable for this purpose.

b. In addition, a headset or permanent magnet loudspeaker such as Headset HS-30-(*) or Loudspeaker LS-3, respectively, are necessary.

c. An analyzer and tube tester are also needed to isolate the defective part after the faulty stage has been indicated by signal substitution.

d. In the tests indicated in paragraphs 86, 87, and 88, ground one side of the signal generator to the receiver chassis and connect the other side through a capacitor (about 0.05 mf) to the receiver point as directed.

e. Note the volume, and listen for serious distortion from the loudspeaker or headset at the various points in the signal substitution procedure. If possible, compare with a receiver known to be in good condition.

f. Check the wiring and soldering in each stage during the procedure.

Note. Do not remove the shield can of the tuned unit until the trouble has been traced to that particular unit. Do not damage the wiring by pushing it back and forth during inspection. Be careful not to damage the receiver in any other way.

g. Misalignment of one or more stages of the receiver will cause reduced output. Misalignment of the h-f oscillator may prevent any output.

h. When trouble is localized in a given stage, first test the tube if such a test is indicated; then

measure the voltage; and finally measure the resistance at the tube socket of that stage.

i. Trouble in a circuit or stage may not cause changes in voltage and resistance measurements at the tube socket. The notes included in this paragraph are merely a guide and should suggest other procedures, such as voltage and resistance measurements on individual parts.

j. Remove only *one* tube at a time when testing. Check the number of the tube, test it, and, if it is not defective, return it to its proper socket before another tube is removed.

k. Each step presupposes the satisfactory completion of all previous steps. Any trouble located should be isolated and cleared before proceeding with any succeeding steps.

86. A-F Tests

a. TERMINAL 3 OF V15 AND V16 (PLATES OF A-F OUTPUT). Apply an audio signal through a series capacitor (approximately 0.05 mf.) to terminal 3 of V15 and V16 in turn. Listen for the signal in the headset which is connected to the PHONES jack. The volume will be very low. If a speaker is connected to the SPKR terminals at the rear of the receiver chassis, a low signal should be heard. If no signal is heard, inspect the leads to transformer T8 and the PHONES and SPKR connections.

b. TERMINAL 5 OF V15 AND V16 (GRIDS OF A-F OUTPUT). Place the audio signal on terminal 5 of V15 and V16 in turn. Listen for an increased

output in the headset, or speaker if used. The output should be the same for either terminal. If the output is weaker for one terminal, test the tube associated with that terminal. If no signal is heard, check resistor R36. Also check the plate supply voltage for V15 and V16.

c. TERMINAL 3 OF V14 (PLATE OF A-F DRIVER). Introduce the signal at terminal 3 of V14 and listen for signal in the headset or speaker. If there is no signal, check the primary of T7 for an open circuit. Note that if plate voltage is obtained at the plate, terminal 3, of V14, the primary of T7 is not open.

d. TERMINAL 5 OF V14 (GRID OF A-F DRIVER). Place the audio signal on terminal 5 of V14. The output signal should be much louder than when it was applied to the plate terminal. If there is no signal or a weak signal, test V14 and the voltages at the socket terminals. Check the wiring and soldered connections.

e. TERMINAL 3 OF V13 (PLATE OF 1ST AF). Introduce the signal at terminal 3 of V13 and listen for the signal. If there is no signal, coupling capacitor C25 may be open. Check for an open by paralleling C25 with another 0.05-mf capacitor.

f. TERMINAL 5 OF V13 (GRID OF 1ST AF). Place

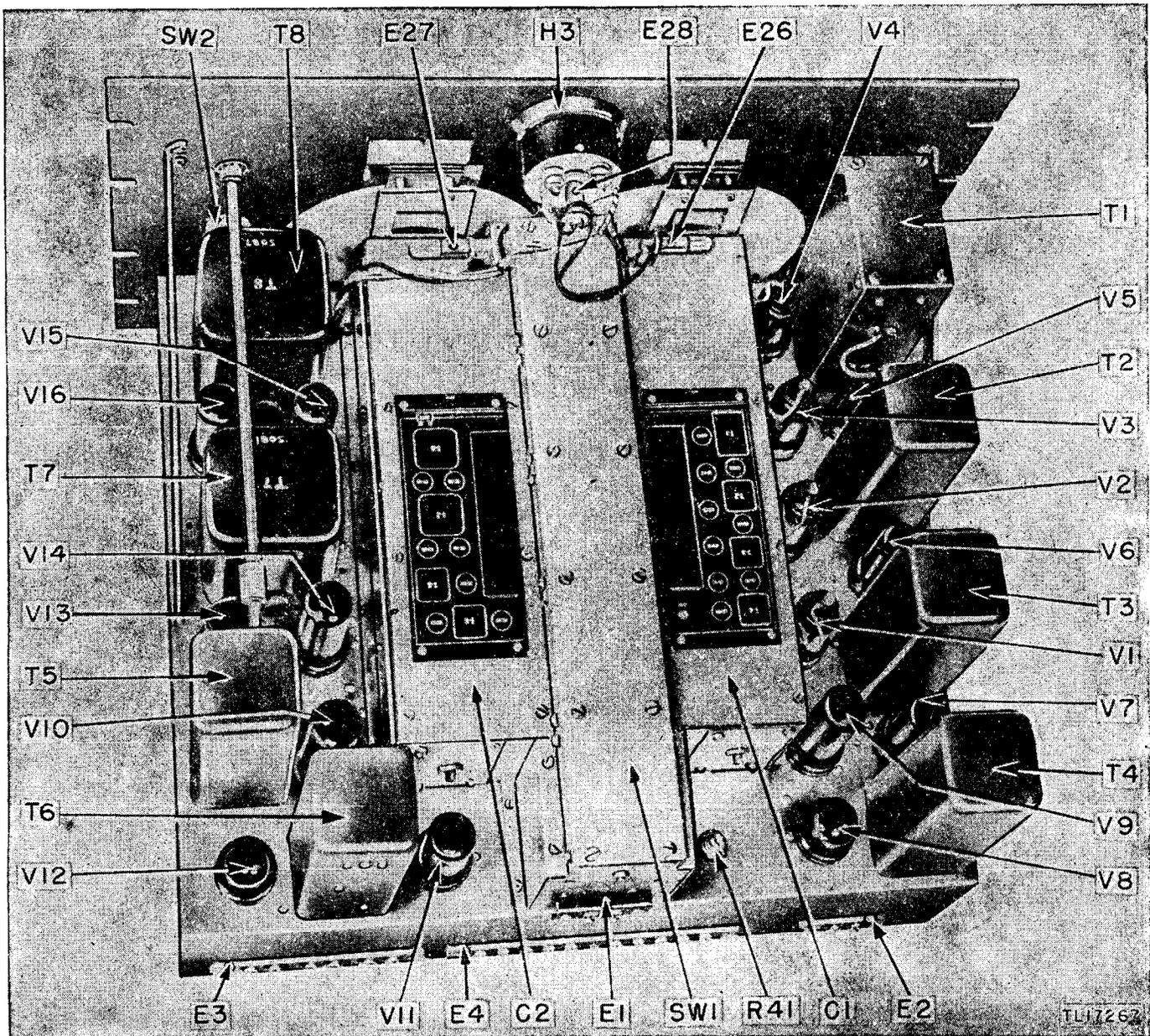


Figure 37. Radio receiver, chassis, top view.

the audio signal on terminal 5 or V13. Reduce the signal input. If there is no signal from the headset or loudspeaker, test V13. Measure the voltages at the tube socket terminals.

g. AUDIO GAIN POTENTIOMETER R26. Apply the audio signal in turn to the center and then to the ungrounded lug of R26. In the latter position, the volume of the signal in the headset should vary as the AUDIO GAIN control is rotated. If no signal is heard, check capacitor C24 for an open circuit. If the signal output is obtained with the audio input applied to the center lug but is not obtained with the audio input applied to the ungrounded lug of R26, check R26.

h. PHONO TERMINALS. Apply the audio signal

to the ungrounded PHONO terminal. If no signal is heard, check the connection from the terminal to R26.

i. TERMINALS 3 AND 5 OF V8 (PLATES OF DETECTOR). Place the audio signal on terminal 3 or 5 of V8. The signal should be heard in the headset. If the signal is not heard, check L32, R48, and R24, for an open circuit. Check C45 for a short circuit.

j. TERMINAL 8 OF V9 (CATHODE OF LIMITER). Apply the audio signal to terminal 8 of V9. The signal should be heard when the LIMITER OFF-ON switch is placed in the ON position. If the signal is not heard, check the LIMITER OFF-ON switch, SW5.

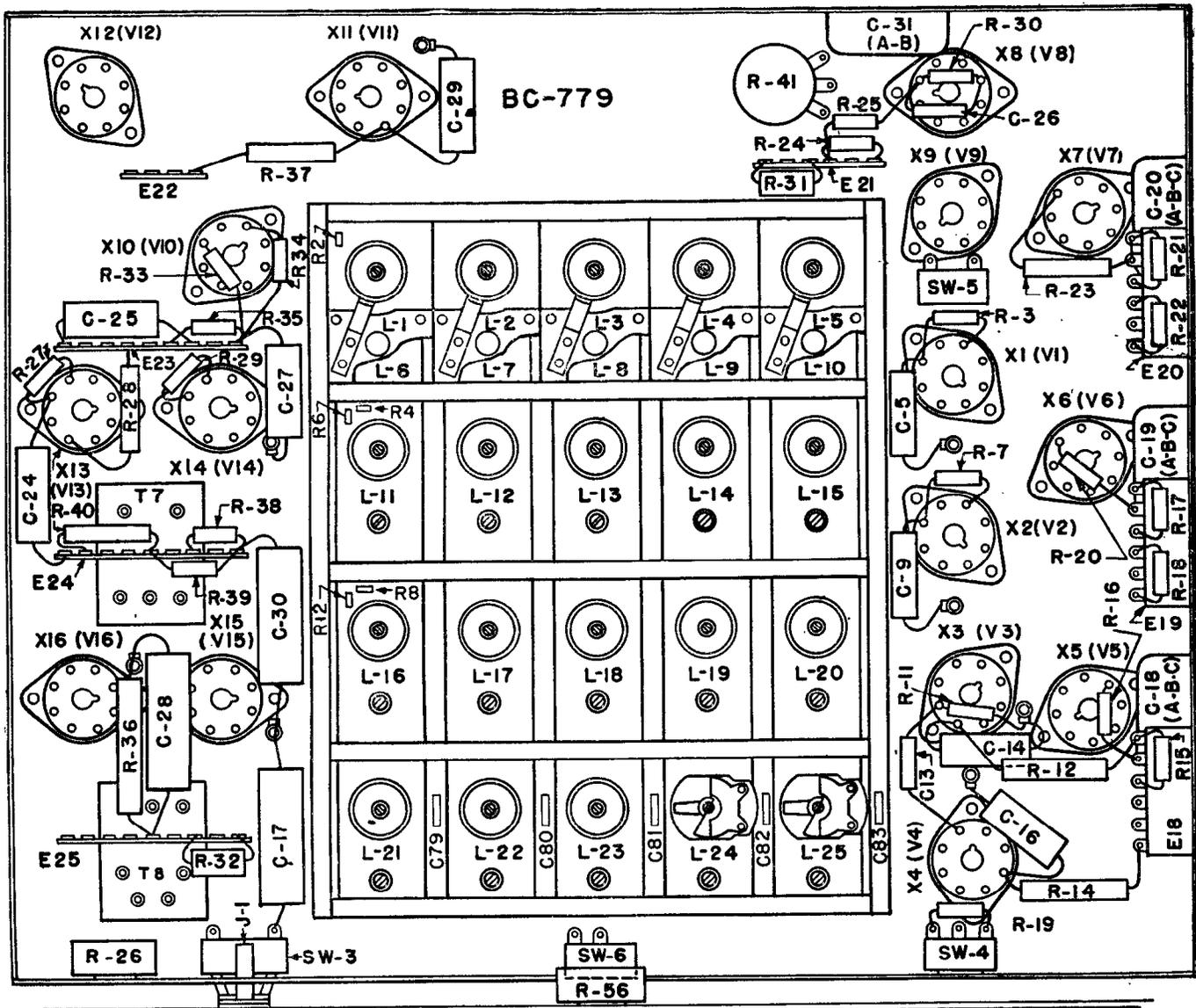


Figure 38. Radio Receiver BC-779-(*), chassis, bottom view.

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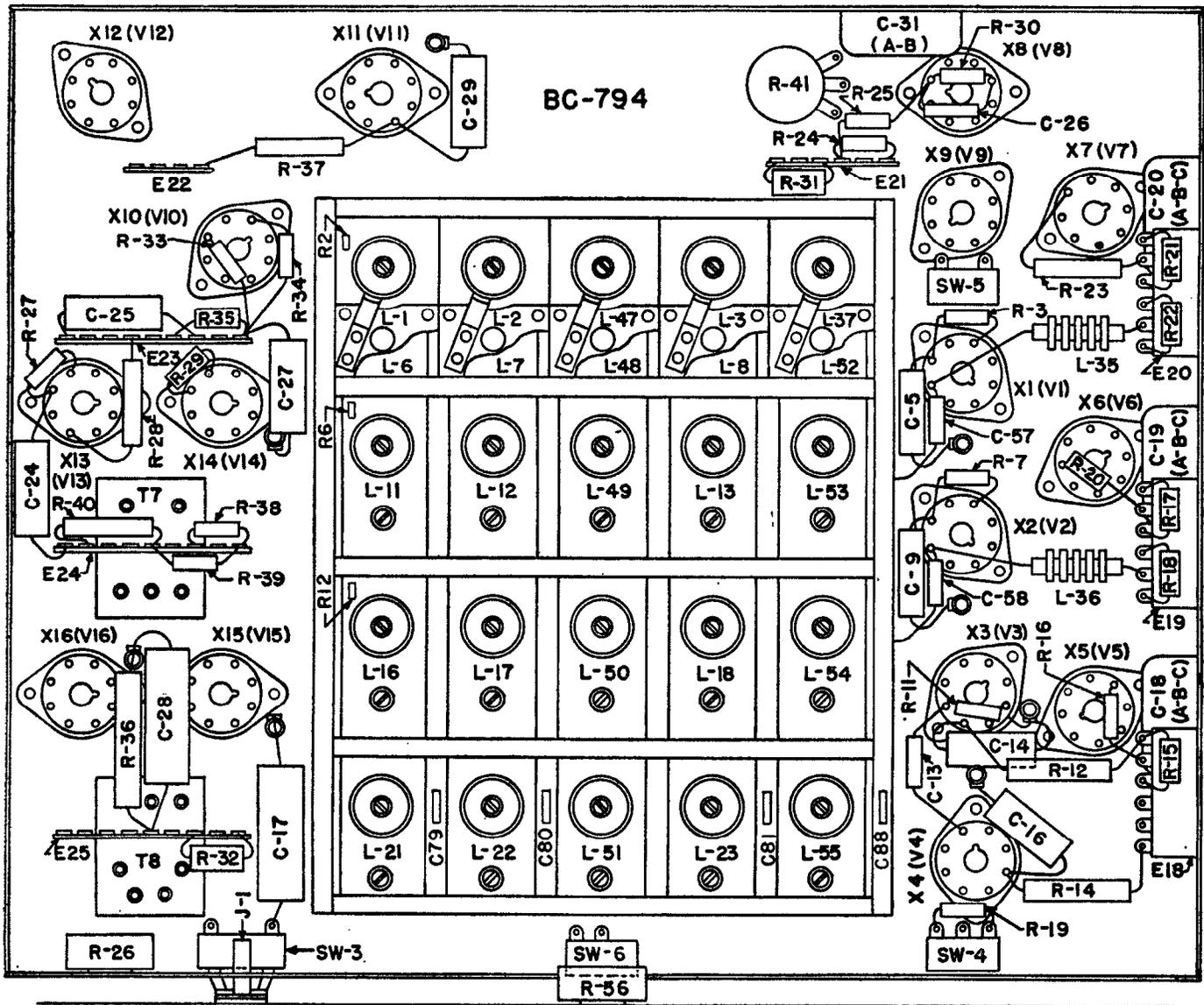
87. I-F Tests

a. TERMINAL 8 OF V7 (PLATE OF 3D I.F.). Set the controls as follows:

Control	Setting
SENSITIVITY	Maximum
AUDIO GAIN	Maximum
SIGNAL MOD-CW	MOD
AVC-MANUAL	MANUAL
LIMITER	OFF
CRYSTAL SELECTIVITY	OFF
SEND-REC	REC
BAND WIDTH	3

Then apply a modulated 465-kc i-f signal to terminal 8 of V7 through the series capacitor. A weak signal should be heard in the headset. If no signal output is obtained, but a signal is heard when the 465-kc i-f signal is applied to terminal 3 or 5 of V8, check the primary of L32 for continuity. Plate voltage at terminal 8 of V7 indicates that the primary of L32 is not open.

b. TERMINAL 4 OF V7 (GRID OF 3D I.F.). Place the 465-kc i-f signal through the series capacitor on terminal 4 of V7. The output signal should increase in volume. If no output is obtained, C40 may be misaligned. Also test the tube and tube socket voltages and resistances.



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Figure 39. Radio Receiver BC-794-(*), chassis, bottom view.

c. BEAT-FREQUENCY OSCILLATOR V10. Remove the modulation from the i-f signal applied to terminal 4 of V7. Turn the SIGNAL MOD-CW switch to CW. A tone should be heard in the headset. Rotate the BEAT OSCILLATOR control and note that the pitch of the tone changes. If these results are not obtained, check the b-f-o tube, V10, and associated circuit.

d. TERMINAL 8 OF V6 (PLATE OF 2D I.F.). Turn the SIGNAL MOD-CW switch to MOD and introduce a 465-kc modulated signal through the series capacitor at terminal 8 of V6. A signal should be heard in the headset. The output volume is less than the output volume is with the same signal

applied to terminal 4 of V7 (grid of 3d i.f.). If no signal is obtained, check the alinement of C39. Also check continuity of L30.

e. TERMINAL 4 OF V6 (GRID OF 2D I.F.). Place the modulated i-f signal on terminal 4 of V6. The output signal should be louder than the signal obtained with the same signal applied to terminal 4 of V7 (grid of 3d i. f.). If no signal or a weak signal is obtained, check V6. Check alinement of C38. Measure the tube socket voltage and resistances of V6.

f. TERMINAL 3 OF V5 (PLATE OF 1ST I.F.). With the i-f signal on terminal 3 of V5, listen for a signal output in the headset. This output signal is weaker

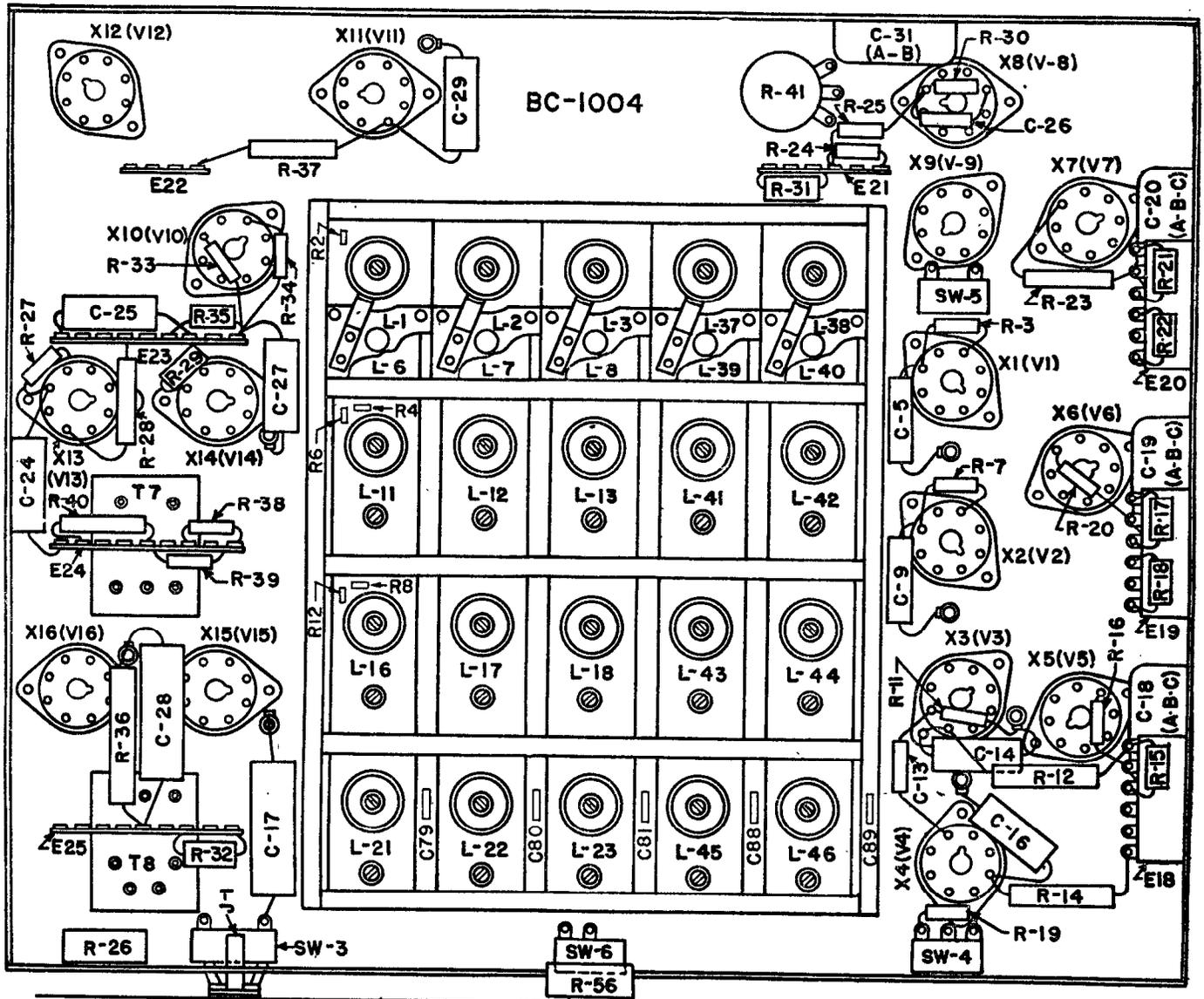


Figure 40. Radio Receiver BC-1004-(*), chassis, bottom view.

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than with the same level i-f signal applied to terminal 4 of V6 (grid at 2d i.f.). If no signal is heard, check alinement of C37 and C36. Also check continuity of L28.

g. GRID CAP OF 1ST I.F., V5. Place the i-f modulated signal on the grid cap of V5. The output signal should be louder than when the same input is applied to terminal 4 of V6 (grid of 2d i.f.). If the output is too weak or if no output is obtained, check V5 and the alinement of C36. Check the voltages and resistances at the tube socket terminals of V5.

h. TERMINAL 3 OF V3 (PLATE OF MIXER). Apply the i-f signal to terminal 3 of V3. The output should be less than with the same input signal applied at the grid of V5. If no signal is obtained, check the continuity of L26. Do not tamper with the adjustment of L27. Check the leads to terminal 3 of V3 for a possible short to ground.

i. GRID CAP OF MIXER, V3. Introduce the i-f signal at the grid cap of V3. The output of the

receiver should be louder than when the same level i-f signal is applied to the grid cap of the 1st i.f., V5. If this result is not obtained, check V3 and the alinement of L26. If the trouble is still not cleared, measure the voltages and resistances at the tube socket of V3.

j. CRYSTAL SELECTIVITY CIRCUIT. Turn the CRYSTAL SELECTIVITY switch to 5. Apply the signal generator i-f output to the grid cap of the mixer, V3; and adjust the signal generator frequency, the output controls, and the receiver SENSITIVITY control so that a weak receiver output is obtained. Rotate the CRYSTAL SELECTIVITY control through positions 4, 3, 2, 1, and OFF. The receiver output should successively increase. If no signal is obtained in positions 1 through 5, try another crystal. If no signal is obtained in any one position but obtained in other positions of the CRYSTAL SELECTIVITY switch, check the switch contacts and R42, R43, R44, and R45. Place the CRYSTAL SELECTIVITY switch at OFF.

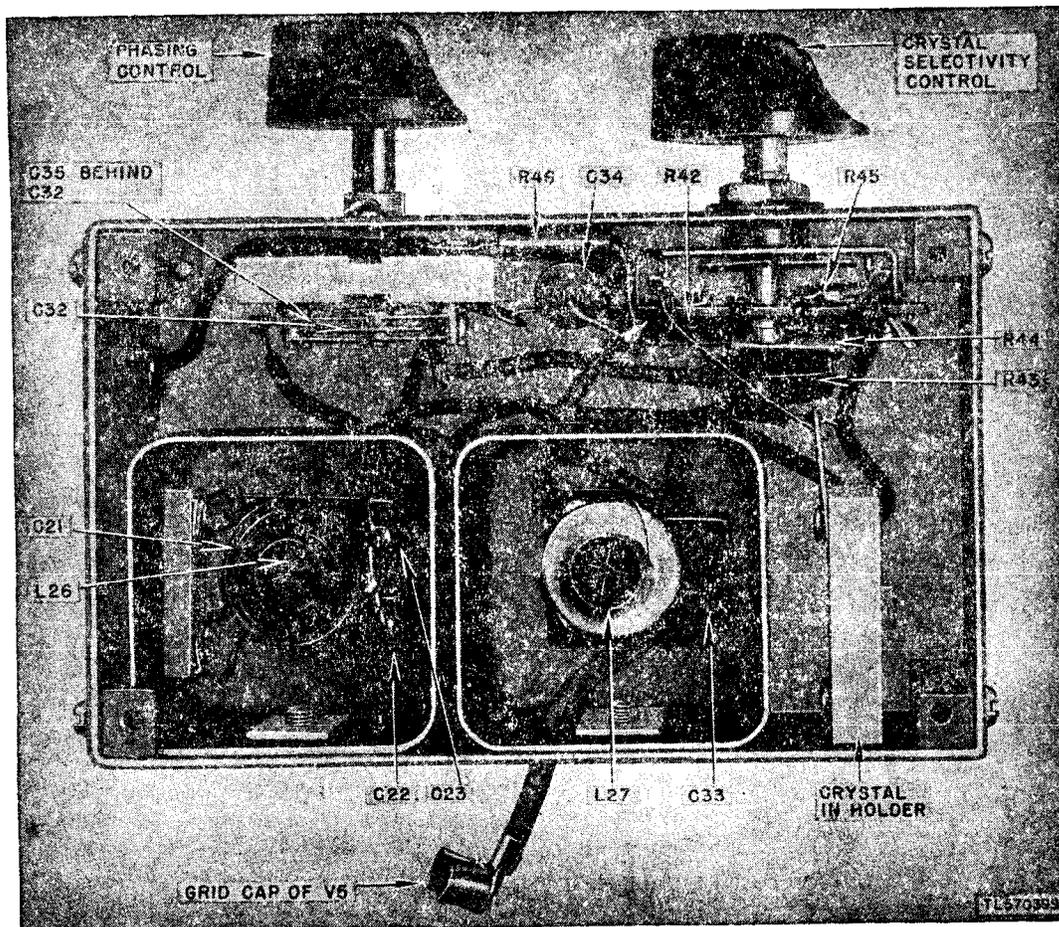


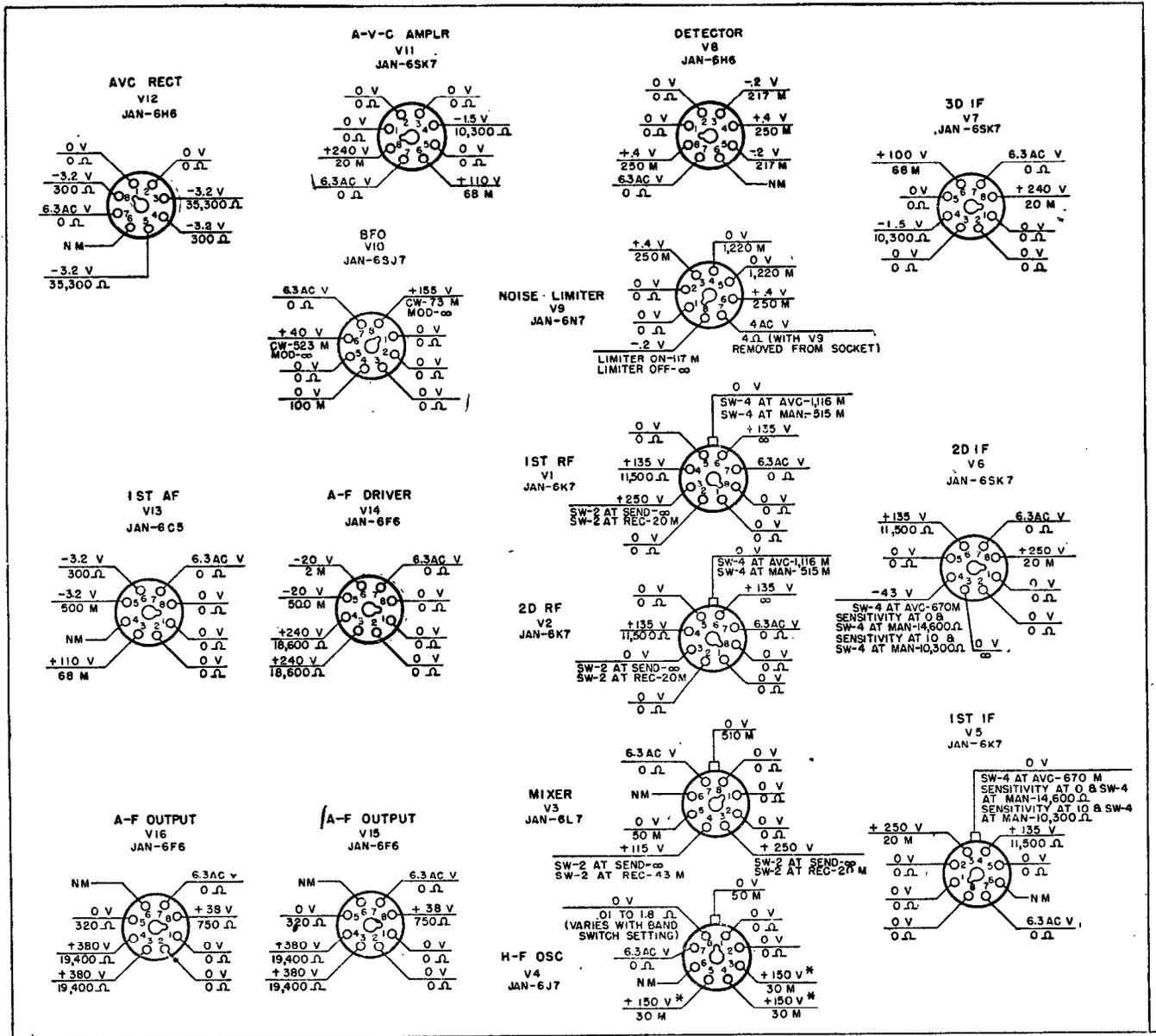
Figure 41. Crystal selectivity unit, side view.

88. R-F Tests

a. GRID CAP OF MIXER, V3. Apply an r-f modulated signal through a series capacitor to the grid cap of the mixer, V3. Loosely winding the signal generator lead around the grid cap should be sufficient. Set the receiver to approximately the frequency of the r-f source and tune for output in the headset. If it is impossible to obtain the modulation

of the r-f signal, either the source of r-f signal is not providing voltage on the grid cap of V3 or the h-f oscillator of the receiver is not functioning. In the latter case, check V4, the tube socket voltages and resistances, and associated elements. Capacitor C13 or resistor R11 may be defective. The band switch contacts SW-1E may be faulty.

b. TERMINAL 3 OF V2 (PLATE OF 2D RF). Introduce the r-f modulated signal through the series



NOTES:

FRONT

- 1 READINGS BASED ON AN A-G LINE VOLTAGE EXACTLY EQUAL TO THE PRIMARY TAP ON THE POWER SUPPLY UNIT POWER TRANSFORMER. HIGHER OR LOWER LINE VOLTAGE SHOULD RESULT IN CORRESPONDING VARIATIONS IN THESE READINGS.
- 2 VOLTAGES AND RESISTANCES MEASURED TO CHASSIS WITH A 1,000 OHM-PER-VOLT METER.
- 3 SENSITIVITY AND AUDIO GAIN AT 0.
- 4 SIGNAL MOD-CW SWITCH AT CW.
- 5 AVC-MANUAL SWITCH AT MANUAL.
- 6 SEND-REG SWITCH AT REG.
- 7 LIMITER SWITCH AT ON.
- 8 * VARIES WIDELY WITH DIFFERENT TUBES; ALSO WITH DIAL SETTING.
- 9 NM INDICATES NOT MEASURED
- 10 M=1,000 Ω.

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Figure 42. Radio receiver, tube socket voltage and resistance diagram.

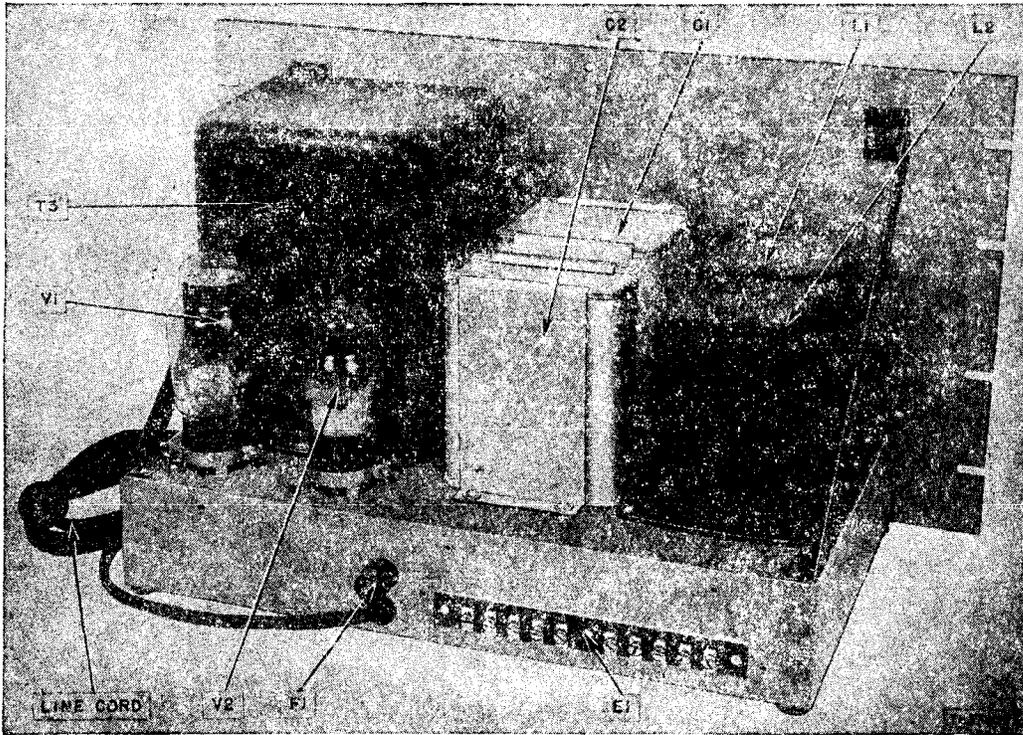


Figure 43. Power Supply Unit RA-94-A, chassis, top view.

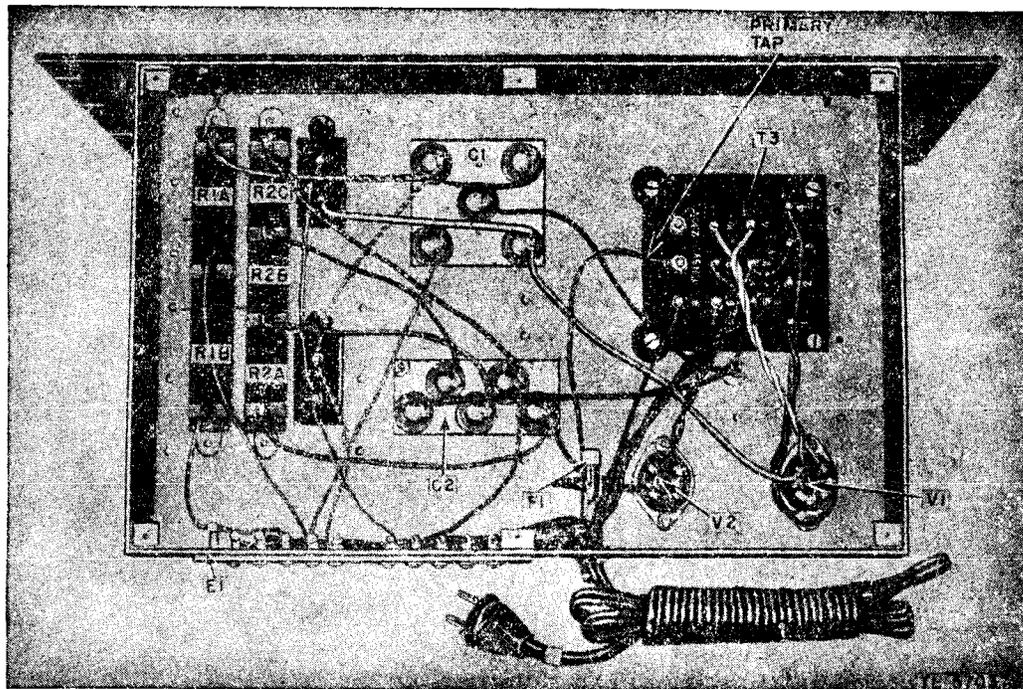


Figure 44. Power Supply Unit RA-94-A, chassis, bottom view.

capacitor at terminal 3 of V2. The output of the receiver should be approximately the same as with the same signal applied to the grid cap of V3. If no output or a weak output is obtained, check C11 for an open.

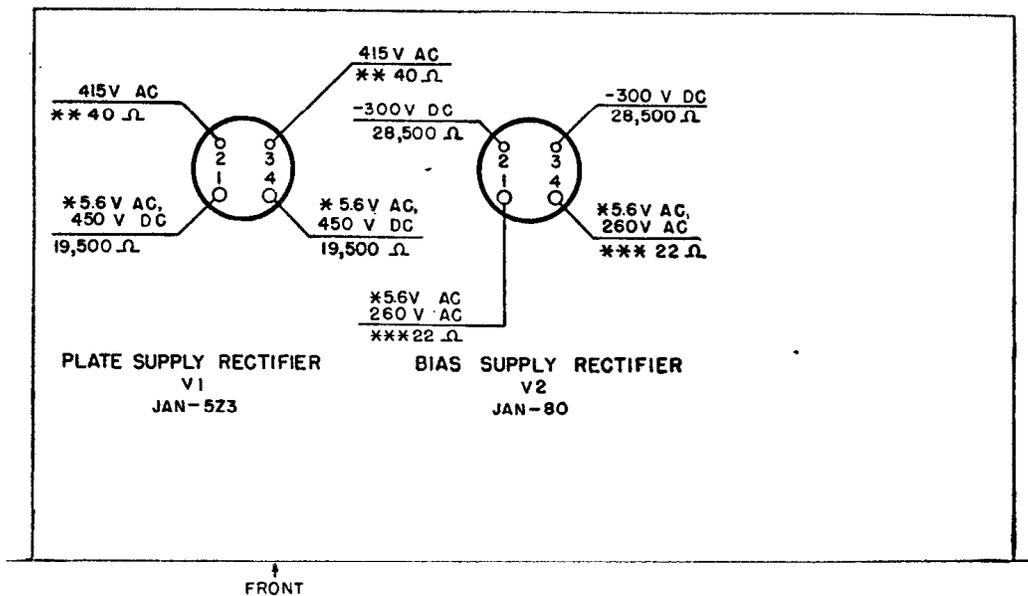
c. GRID CAP OF 2D RF, V2. Introduce the r-f signal at the grid cap of V2. It will probably be necessary to adjust the SENSITIVITY control in order to obtain an output signal in the headset. The SENSITIVITY control adjusts the bias for V1 and V2 but not for V3. If no signal output is obtained in the headset, check V2. Measure the tube socket voltages and resistances and check the associated circuit elements.

d. TERMINAL 3 OF V1 (PLATE OF 1ST RF). Place the r-f signal at terminal 3 of V1. The signal output of the receiver should be approximately the same as with the same signal applied to the grid cap of V2. If no output is obtained, capacitor C7 may be open. If trouble is suspected in the band change switch contacts, try a different receiver band and adjust the frequency of the signal generator to the new frequency setting of the receiver. If a signal

output is obtained, either the suspected band change switch contacts or the leads to them are faulty.

e. GRID CAP OF 1ST RF, V1. A very loud receiver output should be obtained as the signal generator lead is brought near the grid cap of V1. If this result is not obtained, test V1. Make tube socket voltage and resistance measurements and check the associated circuit elements.

f. ANTENNA TERMINALS AA. Place the r-f signal at either antenna A post at the rear of the receiver. A very loud signal should be heard. If there is no signal output, check C3 for an open circuit. Check the wiring to the antenna A terminals for a possible short circuit to ground. The band switch contacts SW-1A and SW-1B can be checked by trying different bands and adjusting the frequency of the signal generator accordingly. With no signal applied to the receiver, and the SENSITIVITY and AUDIO GAIN controls at maximum setting, a roar should be heard in the headset. If no roar is obtained, one or more tubes may be weak. If the roar changes to a hiss when the SIGNAL MOD-CW is placed at CW, the bfo is functioning.



NOTES:

- 1 A-C LINE VOLTAGE EQUAL TO PRIMARY TAP ON POWER TRANSFORMER.
- 2 LOADED BY PROPERLY CONNECTED RECEIVER.
- 3 VOLTAGES AND RESISTANCES MEASURED TO CHASSIS WITH A 1,000 OHM-PER-VOLT METER.
- 4 * MEASURED ACROSS FILAMENTS.
- 5 ** 55 OHMS FOR RA-74-C.
- 6 *** 34 OHMS FOR RA-74-C.

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Figure 45. Power supply unit, tube socket voltage and resistance diagram.

Section XIII. REPAIRS

89. Adjustment of Dial Gearing and Friction Drive

a. MAIN TUNING DIAL GEARING. A heavy shock may cause the idler gear controlling the main tuning dial mask to jump out of mesh. This will result in faulty operation of the dial mask when the band switch knob is turned. The idler gear is located between the S-meter and the main tuning dial escutcheon. Use a long screw driver to spring the idler gear carefully back into line while slightly rocking the band switch knob back and forth to permit the gear teeth to engage. If the dial mask does not properly synchronize with the band switch dial, turn the dial mask by hand to the correct position while holding the idler gear out of mesh.

b. MAIN TUNING DIAL MASK. If the front panel is bent, it will cause the main tuning dial escutcheon to press heavily enough against the main tuning dial guides to pinch them in on the dial mask. The mask is driven through gears by the band switch knob, and any extra friction on the mask will make the band switch difficult to turn. Relieve this condition by springing the dial guide assembly back sufficiently to permit the mask to rotate freely.

c. FRICTION DRIVE. Remove the bottom cover plate from the receiver and make sure that the two friction disks are tightly squeezing the edges of the main tuning and band spread dials, respectively. These disks are held on the friction drive shaft by a hexagonal nut which can be tightened with a wrench or pliers. If a heavy shock has caused the dial to jump completely out from between the disks, remove the outer disk and replace it with the dial in its proper position. Replace the washers exactly as they were originally assembled.

90. Replacement of Tuning Dial Setscrews

When the setscrews holding the tuning dial assemblies to the shafts of tuning capacitors work loose, replace them with a self-locking, cup-point type setscrew (Screw, set: 8-32 x 1/8", knurled, cup-point, self-locking, Allen head; Signal Corps stock No. 6L18503-2.39-2).

91. Rustproofing and Repainting

When the finish on the receiver or power supply unit case has been badly scarred or damaged, pre-

vent rusting and corroding by touching up the bared surface as follows:

a. Use #00 or #000 sandpaper to clean the surface down to the bare metal. Obtain a bright, smooth finish.

Caution: Do not use steel wool. Minute particles of steel wool frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. When numerous scars and scratches warrant complete repainting, remove the radio set chassis and spray paint over the entire case. Remove rust from the case by cleaning corroded metal with solvent (SD). In severe cases it may be necessary to use solvent (SD) to soften the rust and then sandpaper to complete the preparation for painting. Paint will be authorized and consistent with existing regulations.

92. Unsatisfactory Equipment Report

a. WD AGO FORM 468 (UNSATISFACTORY EQUIPMENT REPORT) FOR EQUIPMENT USED BY ARMY GROUND FORCES AND TECHNICAL SERVICES. WD AGO Form 468 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 UNITED STATES AIR FORCE. AAF Form 54 will be filled out and forwarded to Commanding General, Air Matériel Command, Wright Field, Dayton, Ohio, in accordance with AAF Regulation 15-54.

Section XIV. ALINEMENT AND ADJUSTMENT

93. Test Instruments Used for Alinement and Adjustment

a. SIGNAL GENERATOR. The signal generator should be an accurately calibrated instrument producing modulated r-f signals, such as Signal Generator I-72-(*). In addition to 465 kc (the i-f of the receiver), the frequency range required of the signal generator depends on the tuning range of the receiver to be alined. The alinement frequencies required for Radio Receivers BC-779-(*), BC-794-(*), BC-1004-(*), and R₂-129/U are

shown in figures 46, 47, 48, and 49, respectively. If necessary, the second harmonic can generally be used when the fundamental frequency is not available. For example, a signal generator covering all frequencies from 100 kc to 20 mc, in addition to being ideal for checking Radio Receiver BC-779-(*), could be used to check Radio Receiver BC-794-(*), by using the second harmonic of 20 mc instead of the 40 mc called for in figure 47. The signal generator should have an output of about 100 microvolts and an output impedance of approximately 100 ohms for best results when alining the r-f and h-f oscillator circuits. For i-f alinement these values are not critical. The frequency calibration of the signal generator is extremely important in order that the receiver dial calibration be correct.

b. **OUTPUT METER.** The output meter should respond to the modulation frequency of the signal generator, preferably 400 cycles per second (cps), and should provide at least half-scale deflection for 10v. Its resistance should be greater than 500 ohms. Test Set I-56-() is satisfactory.

c. **FREQUENCY METER.** This equipment is required for testing the accuracy of the signal generator at its various settings during alinement. Frequency Meter SCR-211-() is adequate if available.

d. **HEADSET OR PM LOUDSPEAKER.** These items are to be used during alinement. Loudspeaker LS-3, or equivalent, can be used.

e. **ALINEMENT TOOL.** A suitable alinement tool such as an insulated screw driver $\frac{9}{64}$ inch wide and 0.025 inch thick at the bit is required for alinement of the receiver.

94. Calibration of Signal Generator

Accurate alinement of the h-f oscillator in the receiver requires the use of the frequency meter to check the signal generator setting, as follows: Place the signal generator and the frequency meter near each other. Turn on both equipments and allow them to warm up for a least 15 minutes. Attach a piece of wire to the signal generator output connection and place the wire near the frequency meter antenna. Calibrate the frequency meter according to instructions furnished with the meter. Set the frequency meter to the exact frequency at which the signal generator is to be used. While listening to the headset, which is connected to the frequency meter, tune the signal generator to the approximate frequency until a zero beat is heard. The signal generator is now set for the exact frequency desired.

Turn off the frequency meter and remove the wire attached to the signal generator output connection.

95. I-F Alinement Procedure

a. Throw the OFF-ON switch to ON and let the receiver warm up for about an hour before beginning adjustments. Connect the output meter to the SPKR terminals located at the rear of the receiver chassis.

b. Adjust the signal generator to approximately 465 kc, and connect the output to the control grid cap of mixer tube V3 through a fixed capacitor (anything larger than 100 mmf will do).

c. Set the panel controls as follows:

Control	Setting
SENSITIVITY	0
AVC-MANUAL	MANUAL
SIGNAL MOD-CW	MOD
SEND-REC	REC
BAND SWITCH	2.5-5.0-mc.
AUDIO GAIN	10
CRYSTAL SELECTIVITY	OFF
PHASING	on arrow
BAND WIDTH	3
BAND SPREAD dial	100

d. Set the MAIN TUNING dial near 2.5 mc, but be careful not to tune in a powerful local signal.

e. Tune the signal generator to the proper alinement frequency as follows: Set the CRYSTAL SELECTIVITY switch on 3, the AVC-MANUAL switch on AVC, and advance the SENSITIVITY control to 10. Turn off the modulation of the signal generator and slightly adjust its frequency until maximum deflection of the S-meter is obtained. If necessary, reduce the output of the signal generator to keep the S-meter needle on scale. The adjustment of the signal generator frequency in this manner is necessary in order to get exact agreement with the natural period of the particular quartz crystal in the receiver being checked.

f. After reducing the SENSITIVITY control to 0, switch on the modulation of the signal generator. *Do not alter* the tuning of the signal generator until the b-f-o alinement procedure in paragraph 97 has been completed. Return the CRYSTAL SELECTIVITY and AVC-MANUAL controls to their original settings of OFF and MANUAL, and advance the SENSITIVITY control until a suitable output meter reading is secured. A half-scale reading of about 5 or 10 v is suitable.

g. Aline the single trimmer in T4 for peak reading of the output meter. Then aline in turn the grid (upper) and plate (lower) air trimmer capacitors in i-f transformers T3 and T2 for peak reading of the output meter. If one or more of these adjustments results in a sizable increase of output, reduce the SENSITIVITY control enough to bring the meter reading back to half-scale. Alinement of the plate circuit of crystal filter T1 can be tested in the same way by means of the lower adjusting screw on the side of the unit. This screw varies the position of the powdered iron core in coil L26.

Caution: Do not change the setting of the upper adjusting screw which tunes grid coil L27; this circuit cannot be adjusted properly with the output meter. It can be alined by the visual method, using a frequency-modulated (f-m) signal generator and cathode-ray oscilloscope as described in paragraph 100.

96. A-V-C Alinement Procedure

Leaving all other controls as directed above, and without changing the signal generator frequency, reduce the AUDIO GAIN to 0, switch to AVC, and increase SENSITIVITY to 10. Increase AUDIO GAIN to restore half-scale reading on the output meter and adjust the single trimmer capacitor in T6 for *minimum* output meter reading. The S-meter reading should peak at the same time the output meter dips.

97. Beat-frequency Oscillator Alinement Procedure

Continuing with the controls set as above, disconnect the output meter and plug in a pair of headphones, or replace the meter with a suitable loudspeaker such as Loudspeaker LS-3. Remove the modulation from the signal generator. Throw the SIGNAL MOD-CW switch to CW and make sure that the BEAT OSCILLATOR control is exactly on 0. If the tone in the headphones or speaker is not very low in pitch, readjust the trimmer capacitor near the bottom of T5 until it is. If the bfo is in perfect alinement when this test is made, no sound will be heard, since the signal generator and the bfo will be oscillating at the same frequency and there will be no audible difference or beat. Check this by turning the BEAT OSCILLATOR control knob slightly off 0 toward one side or the other. If this brings a tone rising in pitch as the pointer is turned away from 0 to either side, the bfo is perfectly alined.

98. H-F Oscillator Calibration Procedure

a. The accuracy of the MAIN TUNING dial calibration depends solely on the h-f oscillator operating frequency, which in these receivers is 465 kc (the i-f frequency) *higher* than the signal frequency, except the 20- to 40-mc band of Receiver BC-794-B, in which instance the h-f oscillator is 465 kc *below* the signal frequency. For example, when the receiver is tuned to a 10.0-mc signal, the frequency of the h-f oscillator must be 10.465 mc. Although the frequency of the h-f oscillator can be measured directly if accurate frequency-measuring equipment is on hand, it is far simpler to check it by tuning in signals of known frequency and noting the MAIN TUNING dial readings. If the readings do not agree with the known frequency of the signals being received, the calibration is off.

Caution: Be sure the BAND SPREAD dial is set at 100 when making this test.

b. To correct dial calibration, refer to an alinement chart, figure 46, 47, 48, or 49 for the location of the h-f oscillator adjustments as well as the signal frequencies at which the settings should be made. If the 2.5- to 5.0-mc band is to be corrected, the signal generator may be *accurately* set to 2.5 mc and its second harmonic (if strong enough) used for the 5.0-mc end of the band. In either case, whether the 5.0-mc frequency is the fundamental or second harmonic, the 5.0-mc frequency *must* be accurate. This requires that the setting of the signal generator be accurately adjusted by the use of a frequency meter as described in paragraph 94. The output of the signal generator should be unmodulated and the SIGNAL MOD-CW switch on the receiver turned to CW. Set the BEAT OSCILLATOR control at 0, the AUDIO GAIN at 10, and the AVC-MANUAL switch on MANUAL. Disconnect the output meter and use headphones or loudspeaker to make the necessary adjustments by the zero beat method. Connect the signal generator to the antenna terminals for this test.

c. Set the receiver MAIN TUNING dial to the 5.0-mc end and then tune it to zero beat with the 5.0-mc output of the accurately calibrated signal generator. Notice the approximate dial error. Then turn the MAIN TUNING dial slightly toward the 5.0-mc calibration line until the beat note rises to a high pitch. Do not turn the dial far enough to raise the beat note so high that you cannot hear it. With the alinement screw driver adjust the trimmer capacitor marked H-F OSC-5.0 MC (fig. 46, 47,

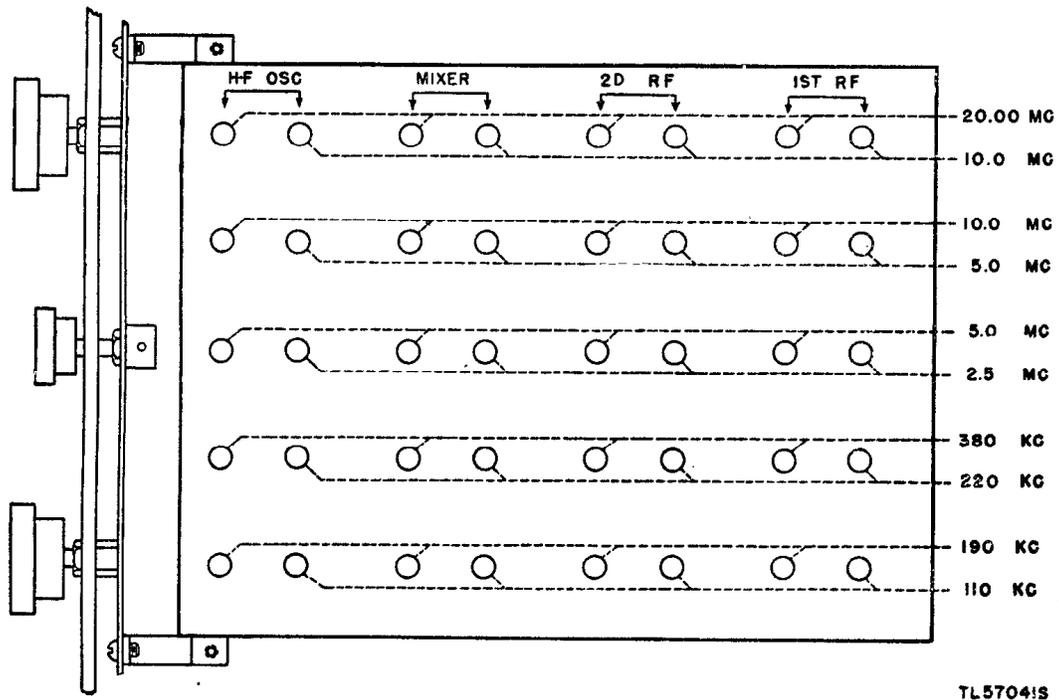


Figure 46. Radio Receiver BC-779-(*), alinement chart.

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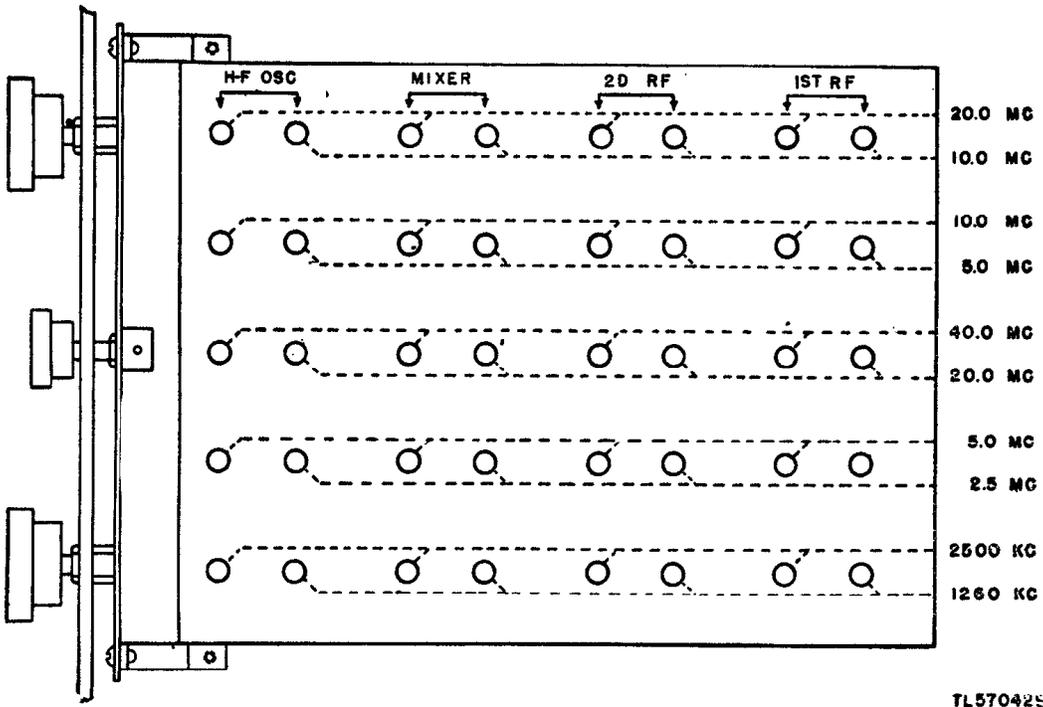
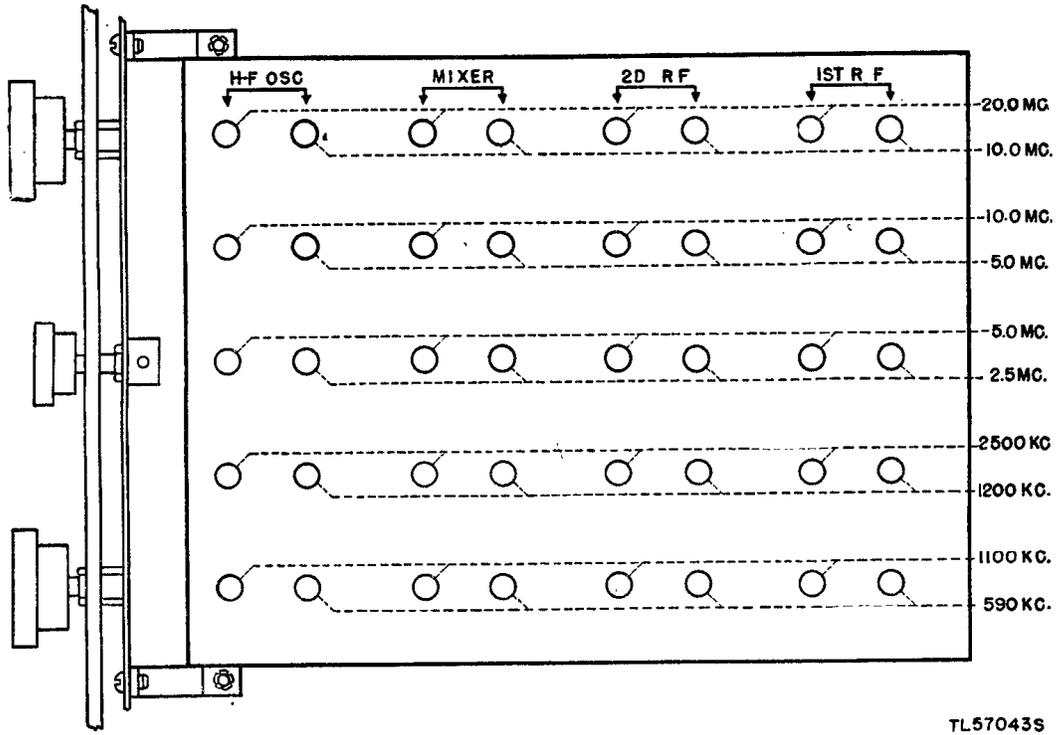


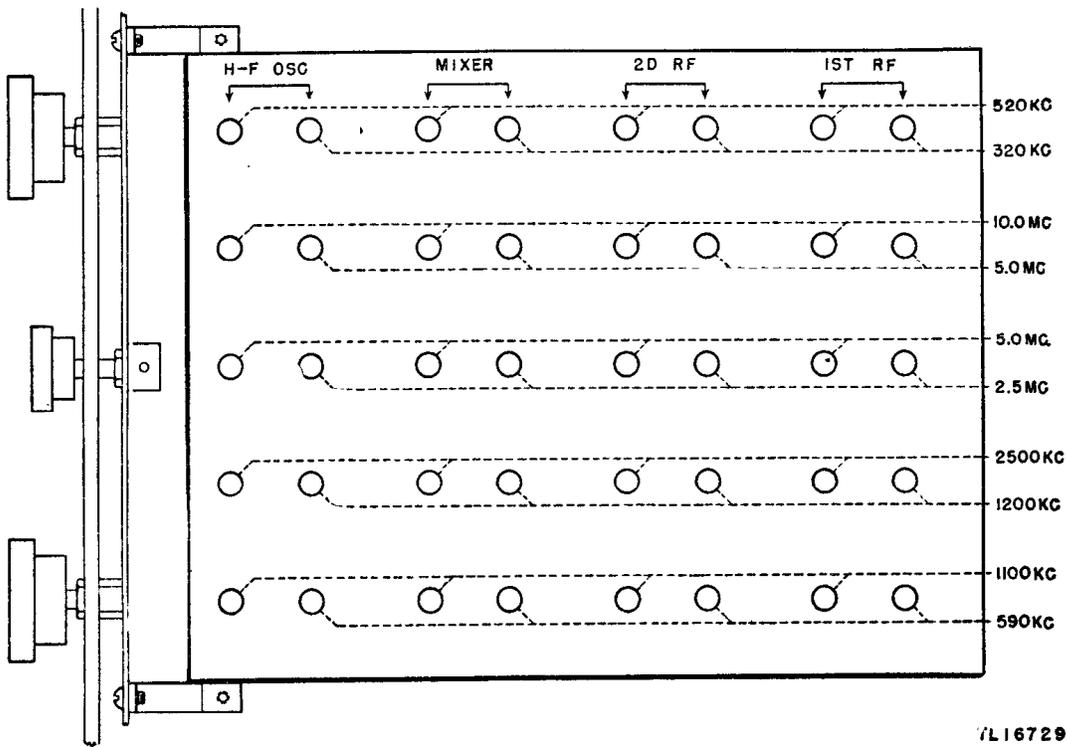
Figure 47. Radio Receiver BC-794-(*), alinement chart.

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Figure 48. Radio Receiver BC-1004-(*), alinement chart.



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Figure 49. Radio Receiver R-129/U, alinement chart.