TM 11-4008

WAR DEPARTMENT TECHNICAL MANUAL

RADIO RECEIVER

BC-652-A

REPAIR INSTRUCTIONS

RESTRICTED. DISSEMINATION OF RESTRICTED MATTER. No person is entitled solely by virtue of his grade or position to knowledge or possession of classified matter. Such matter is entrusted only to those individuals whose official duties require such knowledge or possession. (See also paragraph 23b, AR 380-5, 15 March 1944.)

WAR DEPARTMENT · *MAY 1945*

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WAR DEPARTMENT

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TM 11-4008, Radio Receiver BC-652-A, Repair Instructions is published for the information and guidance of all concerned.

[AG 300.7 (11 Apr 44)]

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Refer to FM 21-6 for explanation of distribution formula.

WARNING

HIGH VOLTAGE

is used in the operation of
this equipment.

DEATH ON CONTACT

may result if operating personnel fail
to observe safety precautions.

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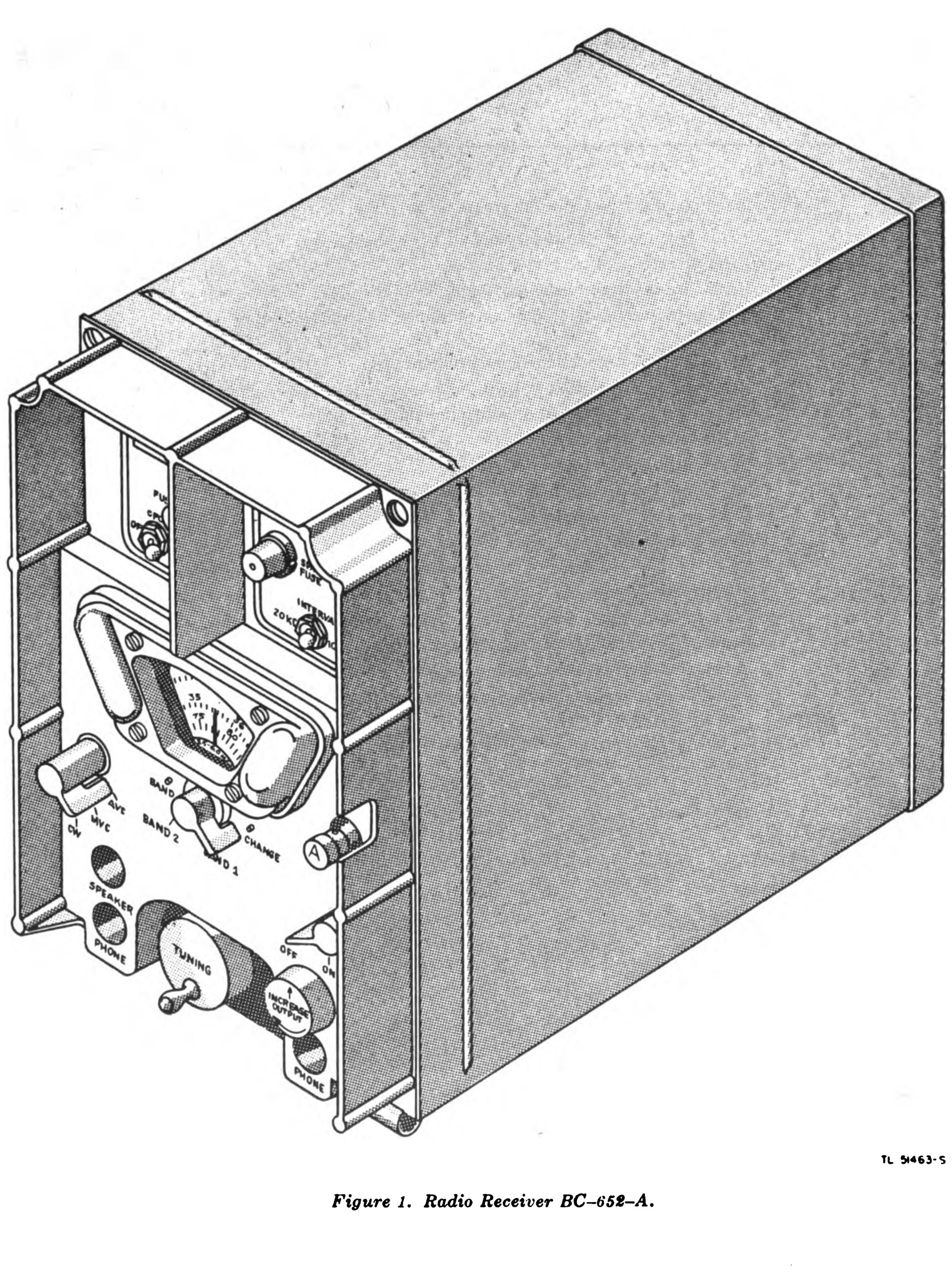
CONTENTS—*Cont.*



TL 5463-S

Figure 1. Radio Receiver BC-652-A.

SECTION I

DESCRIPTION OF RADIO RECEIVER BC–652–A[1]

1. Characteristics

a. GENERAL. Radio Receiver BC–652–A is a combined superheterodyne receiver and crystal-frequency-calibrator unit, operated in conjunction with Radio Transmitter BC–653–A. The receiver and transmitter rest on Mounting FT–253–A and are components of Radio Set SCR–506–A. Power supply leads to the receiver and interconnections between receiver and transmitter are made when the radio receiver is slid into place on the mounting.

b. RECEIVER UNIT. The receiver is an eight tube superheterodyne circuit designed to receive c-w (continuous-wave) and voice signals in a frequency range from 2 to 6 mc (megacycles) in two bands: 2–3.5 mc in band 1, and 3.5–6 mc in band 2. The receiver output may be coupled to either a headset or loudspeaker.

c. CRYSTAL - FREQUENCY - CALIBRATOR UNIT. The crystal-calibrator unit is a three tube crystal controlled multivibrator circuit furnishing either a 20-kc (kilocycle) or a 100-kc output, as selected by the INTERVAL switch, and is used for calibrating Radio Receiver BC–652–A and Radio Transmitter BC–653–A. The output is capacitively coupled to the antenna post of the receiver.

d. POWER SUPPLY. Power for Radio Set SCR–506–A is supplied by either a 12-volt or a 24-volt storage battery through Mounting FT–253–A. On the 12-volt battery, drain for Radio Set SCR–506–A averages 42 amperes; on the 24-volt storage battery, 30 amperes. The receiver unit draws about 50 watts. High voltage is supplied by Dynamotor DM–40–A or Dynamotor DM–41–A. Dynamotor DM–40–A operates from a 12- to 14-volt source, and Dynamotor DM–41–A operates from a 24- to 28-volt source. Insertion of the proper dynamotor for the available supply voltage automatically adjusts the receiver filament circuits correctly.

[1]See TM 11–630 for installation, operation, and other maintenance data on this equipment.

2. Theory of Operation

a. GENERAL. The block diagrams for the receiver and the crystal-frequency-calibrator circuits of Radio Receiver BC–652–A are shown in figure 2. The block diagram for the receiver unit shows the signal path from the input at the antenna to the output at the headset or loudspeaker. The block diagram for the crystal-frequency-calibrator shows the path of the output from the crystal-frequency oscillator to the output at the antenna post of the receiver.

b. RECEIVER UNIT. (1) *Radio-frequency stage.* The input signal from the antenna post is coupled (inductively and capacitively in band 1, and inductively in band 2) to a tuned resonant circuit. The output from this circuit is capacitively-coupled to the grid of the r-f (radio-frequency) amplifier Tube JAN–12SG7 (V301).

(2) *First detector and converter stage.* The output of the r-f stage is coupled inductively to a tuned resonant circuit which in turn, is capacitively coupled to the grid of the first detector and converter stage Tube JAN–12K8 (V302). In this stage the incoming signal is mixed with the output of the high-frequency oscillator, to produce an i-f (intermediate-frequency) of 915 kc. This oscillator is a tuned plate type and uses the triode section of Tube JAN–12K8 (V302).

(3) *Intermediate-frequency stages.* The 915 kc output of the converter stage is inductively coupled through the first i-f transformer to the grid of first i-f amplifier Tube JAN–12SK7 (V303). The amplified output of the first i-f stage is inductively coupled through the second i-f transformer to the grid of second i-f amplifier Tube JAN–12C8 (V304). The pentode section of this tube amplifies the i-f signal and the diode section is used as a noise limiter. The output of the second i-f stage is inductively coupled through the third i-f transformer to the grid of third i-f amplifier Tube JAN–12SK7 (V305). The cathode of this stage is connected to grounding switch in Radio Transmitter BC–653–A through Mounting FT–253–A. When the trans-

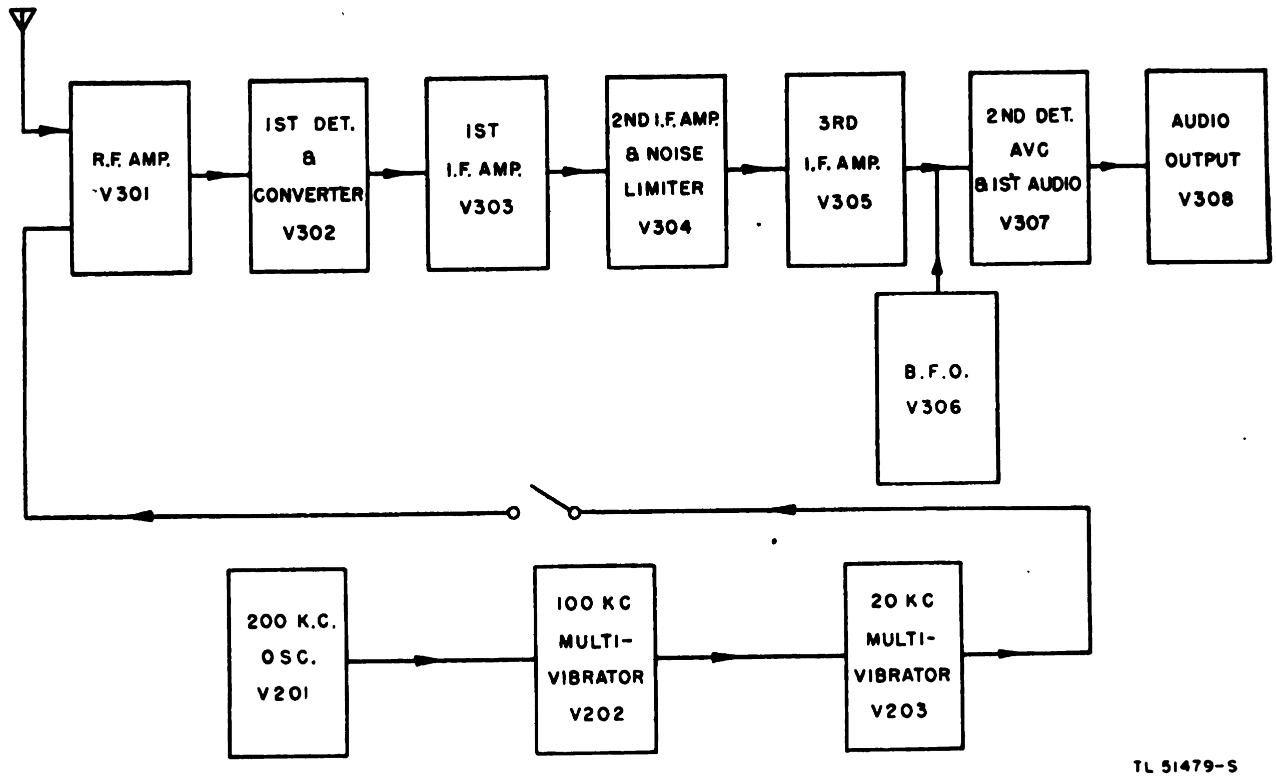


Figure 2. Block diagram, Radio Receiver BC–652–A.

mitter is operated, a break-in relay in the transmitter opens the cathode grounding circuit, thereby making the receiver inoperative.

(4) *Beat-frequency oscillator stage.* The beat-frequency oscillator stage consists of a Hartley oscillator circuit using Tube JAN–12K8 (V306) as the oscillator tube. The output from the plate of this tube is coupled to the plate of tube V305 in the third i-f amplifier stage.

(5) *Second detector and audio stages.* The output of the third i-f amplifier stage is inductively coupled through the fourth i-f transformer to the diode sections of the second detector and first audio amplifier Tube JAN–12SR7 (V307) which rectify the i-f signal producing both an audio voltage and a voltage used for automatic volume control. The audio voltage is coupled to the grid of the triode section (first audio stage) of this same tube and amplified; the a-v-c (automatic-volume-control) voltage is applied to the grids of the r-f and i-f tubes, controlling the over-all gain of the receiver. The output of the first audio stage is capacitively coupled to the grid of audio-frequency output amplifier Tube JAN–6Y6G (V308). The output of this tube is coupled through an audio output transformer to loudspeaker and headset jacks. Sidetone is fed from the transmitter to the receiver output during transmission, enabling the operator to monitor the c-w keying and voice transmission.

c. CRYSTAL - FREQUENCY - CALIBRATOR UNIT. (1) *200-KC oscillator stage.* The 200-kc oscillator stage is a combined crystal-controlled oscillator and buffer amplifier. The oscillator uses the triode section of Tube JAN–6K8 (V201) with the 200-kc crystal in the grid circuit and a resonant tank circuit in the plate circuit. The output of the triode oscillator is electron-coupled to the pentode buffer amplifier section of this tube. The plate circuit of the buffer amplifier has a resonant tank circuit tuned to 200 kc.

(2) *Multivibrator stages.* The 200-kc output of the crystal oscillator feeds into the 100 kc multivibrator stage which uses Tube JAN–6SC7 (V202). The 100 kc multivibrator generates harmonic signal frequencies in steps of 100 kc. When the INTERVAL switch is set at 20 kc, the signal from the 100-kc multivibrator is capacitively coupled to the grid input circuit of the 20 kc multivibrator which uses Tube JAN–6SC7. (V203). This causes the 20 kc multivibrator to generate harmonic signal frequencies in steps of 20 kc. The 100 kc and 20 kc harmonics are fed to the antenna post of the receiver.

SECTION II

DIFFERENCES BETWEEN MODELS

(Not applicable)

SECTION III

INITIAL REPAIR PROCEDURE

NOTE. Before making any repairs or adjustments, all authorized MWO's should be applied. See War Department Pamphlet 12-6 for list of applicable MWO's.

3. General

Maintenance personnel should follow the procedure outlined in this manual when repairing and overhauling Radio Receiver BC-652-A. The repair information in this and the following sections is presented in the order in which the repairman should actually perform the various operations on the equipment in the repair shop. This procedure will permit repair of the equipment in the shortest time possible and will result in performance comparable to that of new equipment.

4. Tools, Test and Cleaning Equipment

The equipment in table I should be available for the proper repair of Radio Receiver BC-652-A.

Table I

Tools, test and cleaning equipment.

Item	Description
Dental mirror	
Assorted hand tools	Soldering iron, pliers, screwdrivers, small socket wrenches, small adjustable wrench, and two Allen head pocket wrenches (fastened in back of case)
Flashlight or probing light	
Solvent, Dry-Cleaning (SD)	
Assorted brushes	
Compressed air	Clean, dry low-pressure
Sandpaper	Fine grade
Crocus cloth	
Tube tester	Dynamic or emission type
Vacuum-tube voltmeter (VTVM)	Range 0-150 volts a-c; 0-300 volts d-c
R-f signal generator with metered output	Range 200-8,000 kc with provision for modulating the output at 400 cycles
Output meter	4,000-ohm impedance
Voltohmmeter	Sensitivity of 1,000 ohms per volt, with ranges from 0-10 volts and 0-150 volts
Dummy antenna	100-mmf mica capacitor
Output load resistor	8,000-ohm, 5-watt, noninductive resistor
Plug PL-55	With two 6-in. wires terminating in alligator clips
Heterodyne frequency meter	Range 200-8,000 kc
Radio Transmitter BC-653-A	With Dynamotor DM-42-A
Mounting FT-253-A	With Cords CO-280
Key J-45	
Loudspeaker LS-3	
Cord CD-314	
Headset HS-18 or HS-23-A	High impedance
Storage battery	12 volts

5. Removal of Crystal-Frequency-Calibrator Chassis

a. PRELIMINARY. Loosen two front wingnuts holding Radio Receiver BC-652-A to its Mounting FT-253-A and slide the receiver forward, thereby disconnecting rear plug P302 (figs. 3 and 4) of the receiver from its socket in the mounting. Lift the receiver off its mounting. Loosen the two Dzus fasteners in the front panel and one in the lower rear of the case, which holds the receiver to the case. Pull the receiver out of the case.

b. CRYSTAL-FREQUENCY-CALIBRATOR CHASSIS. The crystal-frequency-calibrator chassis is located in the upper section of Radio Receiver BC-652-A. Remove the two fuses from the upper face of the front panel by unscrewing the plastic fuse holders. Remove plug P251 (figs. 3 and 4) from the receiver (lower section) chassis, by pressing side spring clips and pulling plug up. Remove grid clip from rear of antenna binding post A. Remove the two rear screws holding the crystal-frequency-calibrator chassis to the vertical supporting posts. Remove the screws and posts. Support the chassis with the free hand and remove the six screws which hold the upper section to the front panel. Remove the crystal-frequency-calibrator chassis from the main (receiver) chassis.

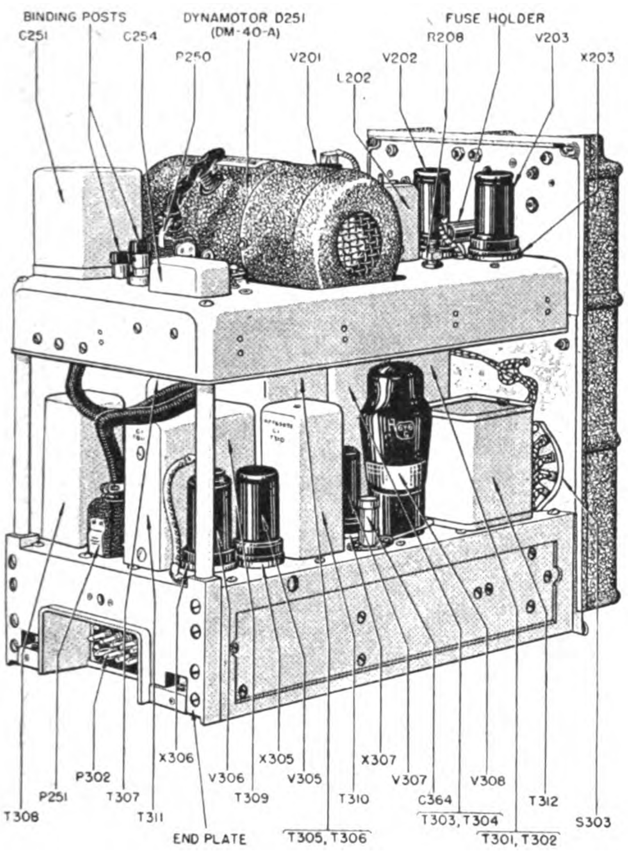


Figure 3. Radio Receiver BC-652-A, without case, rear oblique, left-side view.

6. Removal of Parts From Receiver Chassis

a. DIAL LIGHTS. Remove four screws holding the plastic cover plate to the front panel, and remove the cover plate. Remove the two bayonet type dial lights by pressing them into their sockets, turning one-quarter turn counterclockwise and lifting them out.

b. BOTTOM PLATE. Remove screws holding bottom plate to the chassis and remove bottom plate.

c. TUBES. Remove grid clips from Tubes JAN-12K8, (V302), JAN-12C8 (V304) and JAN-12K8 (V306). All eight tubes can now be removed by pulling them up from their sockets.

7. Cleaning, Inspecting, and Lubricating Receiver Chassis

Use clean, dry, low-pressure compressed air to blow out all dust particles in the unit. Use clean brush to remove dust from corners and other spots difficult to reach. Remove corrosion from terminals, pins and unpainted parts of unit using a fine grade of sandpaper. *Do not use abrasives on switch contacts.* Apply dry-cleaning solvent (SD) with a brush, to switch contact points and other parts difficult to reach. Blow out loosened particles with compressed air. Inspect wires for broken connections, frayed ends, shorts, and poor insulation. Check resistors, capacitors, and other components for broken parts, charred spots, and other signs of overload. Inspect safety glow Lamp LM-54 (V309, fig. 5) for breakage and loose or damaged connections. Inspect terminals to see that they are secure and properly soldered. Check for chipped and broken parts in sockets, plugs, switches, jacks, and binding posts. Check for loose, bent, or broken prongs and pins on plugs. Tighten all screws and nuts. Straighten all bent parts of chassis. Repaint all painted surfaces that are worn and chipped after removing corrosion. Clean the tuning capacitor gear drive assembly with dry-cleaning solvent, applied with a brush. Check for smoothness of operation in moving and rotating parts throughout the limit of their motion. Check for backlash and slipping of controls. Check toggle and rotary switches to see that they snap firmly into each contact position. Insert appropriate plugs into the jacks to check for firm seating and good contact.

8. Cleaning, Inspecting, and Testing Removed Parts of Receiver Chassis

a. TUBES. Inspect the removed tubes. Clean pins of each tube with dry-cleaning solvent, applied with a brush. For heavier corrosion use crocus cloth applied with care to nickel-plated surfaces of pins. Inspect tubes for bent pins, also internal and external breaks. Shake tubes to detect loose pins and loose elements. Check tubes on tube tester, allowing sufficient time for tubes to warm up. Tap tubes gently during test for loose or defective elements. Check for shorts between elements.

b. DIAL LIGHTS. Clean bases of pilot lights with dry-cleaning solvent, applied with a brush, and remove corrosion with crocus cloth.

c. BOTTOM PLATE. Remove corrosion with a fine grade of sandpaper. Blow away all loosened particles. Clean surfaces with dry-cleaning solvent. Straighten all bent parts.

9. Removal of Parts from Crystal-Frequency-Calibrator Chassis

a. TUBES. Remove grid clip from Tube JAN-6K8 (V201). All three tubes can now be removed by pulling them up from their sockets.

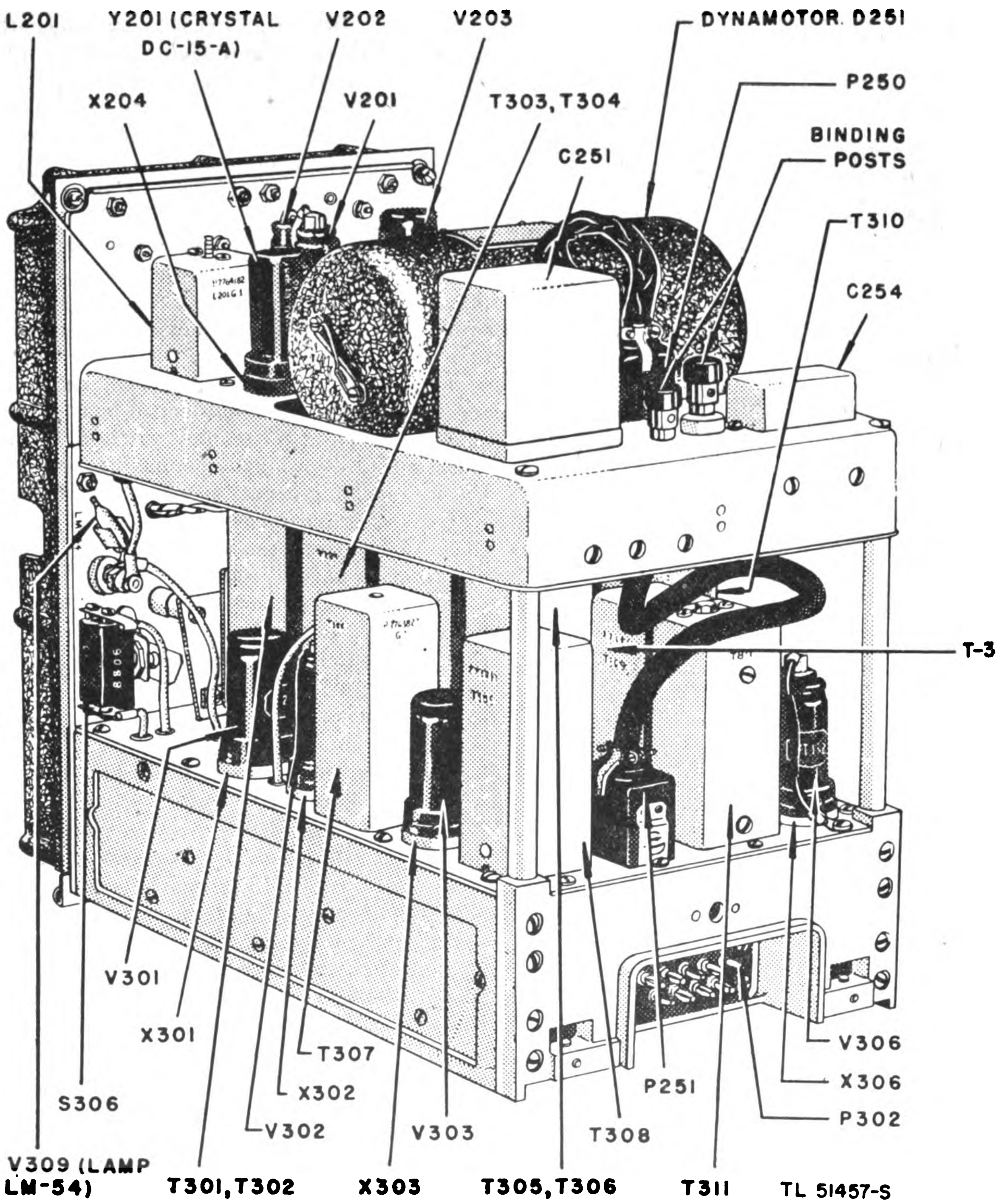


Figure 4. Radio Receiver BC-652-A, without case, rear oblique, right-side view.

b. CRYSTAL. Loosen screw holding crystal spring clamp. Turn clamp and remove crystal. *Note the V marks, indicating the contacts into which the crystal prongs are inserted.*

c. DYNAMOTOR. Remove dynamotor plug P250 (figs. 3 and 4) from its socket by pressing the side spring clip (fig. 6) and pulling up. Press snap slides together on both sides of the dynamotor and lift dynamotor from the chassis.

d. BOTTOM PLATE. Remove screws holding bottom plate to the chassis. Slide the plate to one side and push rubber grommet out of slot in bottom plate. Remove bottom plate.

e. FUSES. Remove fuses from the front of chassis by unscrewing the two holders housing the fuses.

10. Cleaning and Inspecting Crystal-Frequency-Calibrator Chassis

Use clean, dry, low-pressure compressed air to blow out all dust particles in unit. Use clean brush to remove dust from corners and other spots difficult to reach. Exercise care when cleaning terminal contact points, switches, jacks, binding posts, and other nickel-plated parts. Remove corrosion from terminals, pins and unpainted parts of unit using a fine grade of sandpaper. Apply dry-cleaning solvent with a brush

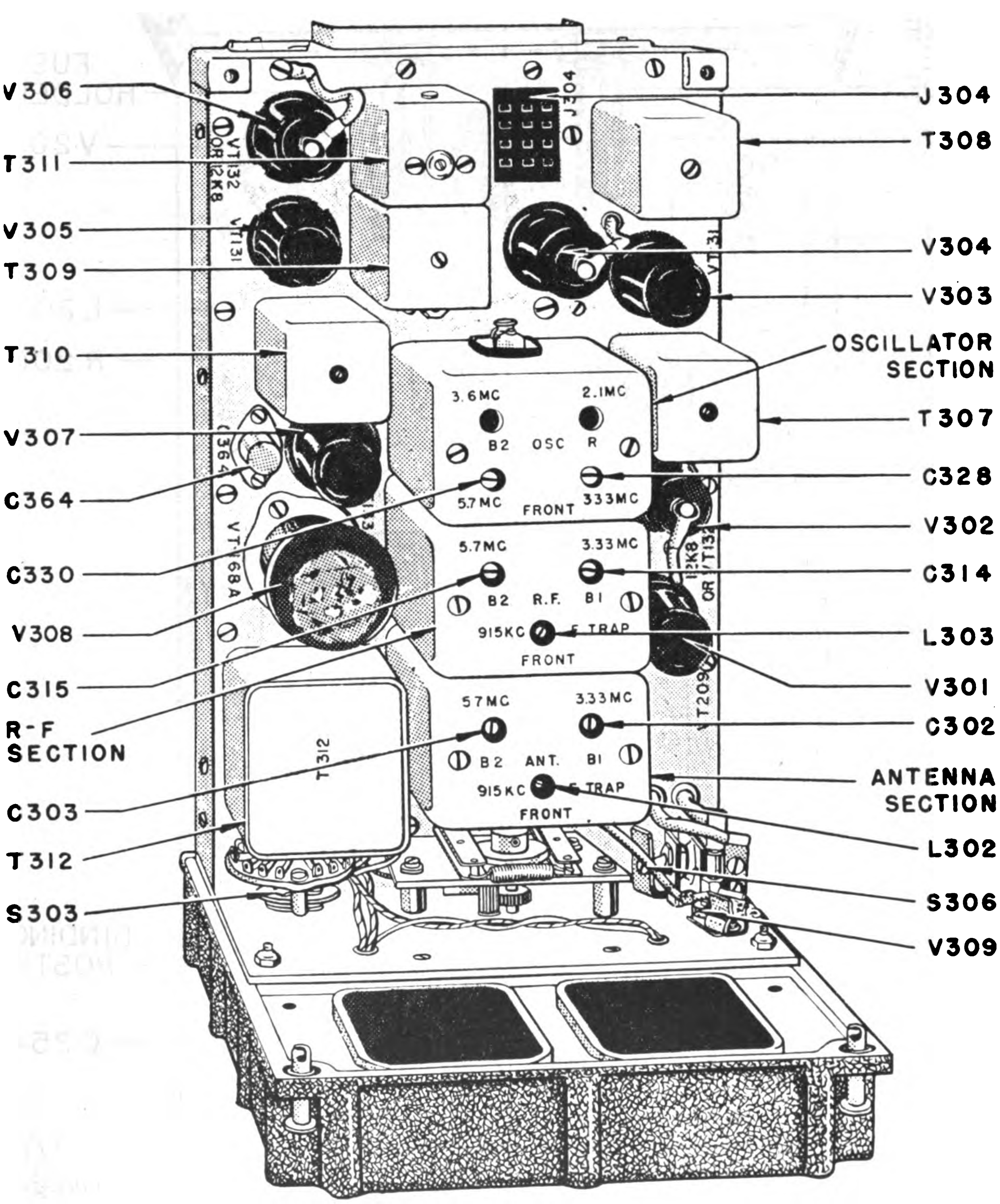


Figure 5. Top view of receiver unit, Radio Receiver BC-652-A.

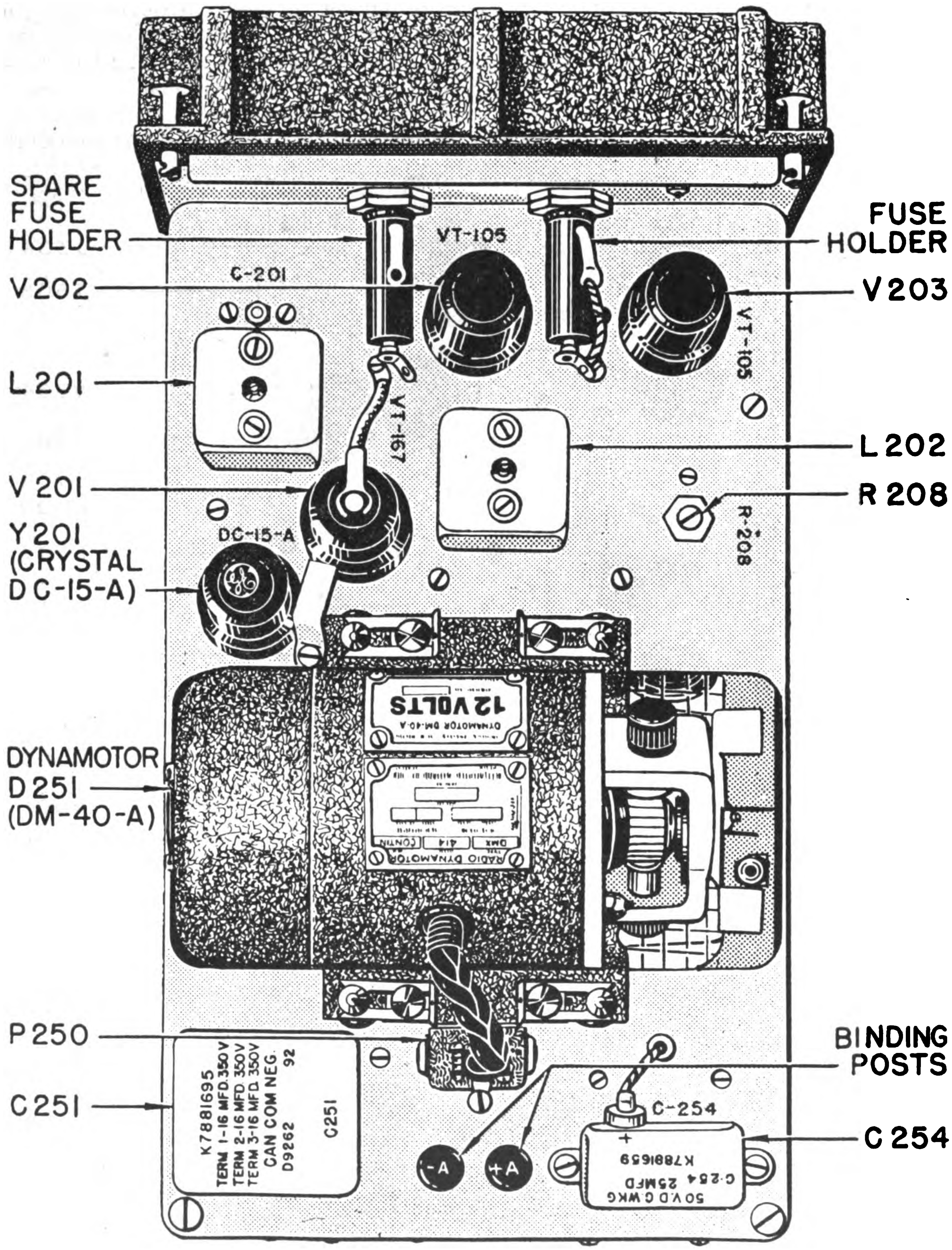


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Figure 6. Top view of crystal-frequency-calibrator chassis, Radio Receiver BC-652-A.

to parts difficult to reach. Blow out loosened particles with compressed air. Inspect wires for broken connections, frayed ends, shorts, and poor insulation. Check resistors, capacitors, and other components for broken parts, charred spots and other signs of overload. Inspect terminals to see that they are secure and properly soldered. Check for chipped and broken parts in sockets, plugs, switches, jacks, binding posts, and other elements. Check for loose, bent, or broken prongs and pins on plugs. Tighten all screws and nuts. Straighten all bent parts of chassis. Repaint all painted surfaces that are worn or chipped after removing corrosion. Check toggle switches to see that they snap firmly into each contact position.

11. Cleaning, Inspecting, Testing, and Lubricating Removed Parts of Crystal-Frequency-Calibrator Chassis

a. CRYSTAL. Clean pins of crystal with dry-cleaning solvent applied with a brush. For heavier corrosion, use crocus cloth applied with care to nickel-plated surfaces of pins. Inspect crystal for bent or loose pins, or cracked housing.

b. FUSES. Remove fuses from their holders, and clean metal contacts with dry-cleaning solvent. Inspect for broken glass, or other broken elements. Replace faulty fuses with new ones. Insert fuses into their holders.

c. DYNAMOTOR. Cut lockwires which hold end bell screws, loosen two screws on either end of dynamotor, and remove end bells. Remove four screws holding dynamotor bracket support to dynamotor. Note the two types of screw washers on each side of the bracket (the larger ones are on the inside curve), and when assembling, replace nuts and washers in the same manner. Note also that the bracket projects over the low voltage (LV) end and when replacing bracket, reassemble it properly. Remove fan on LV end by loosening screw holding the fan to the armature shaft. Note that the blades extend outward. Remove the brush-holder caps and brushes on both low- and high-voltage ends. Mark each brush so that it can be replaced in the same position and in the same hole. Clean brushes with a cloth moistened with petroleum spirits. Replace worn or broken brushes. Clean the bearing brackets and brush holders with petroleum spirits applied with a clean cloth or brush. Blow out loose dust and dirt with compressed air. Clean metal parts, if corroded, with a fine grade of sandpaper. Blow out loosened particles with compressed air. Clean commutator with a lintless cloth and petroleum spirits. Do not oil or lubricate commutators in any manner. Clean commutators lightly with No. 0000 sandpaper. Remove all dust and dirt after sanding. *Do not use emery cloth for cleaning commutator.* If commutators are badly scored, replace dynamotor with a new unit. If new brushes are installed, run the dynamotor for 5 hours without load to seat the brushes properly. Remove two flathead screws holding end bearing plates over roller bearings on both high- and low-voltage ends. Remove end bearing plates. The roller bearings are then exposed. Remove old and hardened lubricant from bearings and cover plates with a brush and petroleum spirits. *Use no abrasives.* Insert sufficient Grease, General Purpose No. 2 to cover bell retainers. *Do not pack hard. Keep grease off commutators.* Replace end bearing plates. Replace fan on LV end. Clean bell end and remove corrosion with a fine grade of sandpaper. Blow out all loosened particles. To reassemble dynamotor replace brushes and brush caps in the same receptacle and in the same position they occupied before disassembly. Replace end covers and screws, and insert lockwires through screwheads to prevent screws from loosening. Check dynamotor with available dynamotor test equipment for output at rated load, as shown in table II. Check for vibration and chattering. Replace dynamotor bracket support on the dynamotor.

Table II

ELECTRICAL RATINGS OF DYNAMOTORS, DM-40-A AND DM-41-A

Unit	Input voltage (volts)	Input current (amp)	Output voltage (volts)	Input current (amp)
Dynamotor DM-40-A	14	3.5	172	138
Dynamotor DM-41-A	28	1.7	172	138

d. TUBES. Inspect the removed tubes. Clean pins of each tube with dry-cleaning solvent applied with a brush. For heavier corrosion, use crocus cloth applied with care to nickel-plated surfaces of pins. Inspect tubes for bent pins, and internal and external breaks. Shake tubes to detect loose pins and loose elements. Check tubes on tube tester, allowing sufficient time for tubes to warm up. Tap tubes gently during test for loose or defective elements. Check for shorts between elements.

e. BOTTOM PLATE. Remove corrosion with a fine grade of sandpaper. Blow away all loosened particles. Clean surfaces with dry-cleaning solvent. Straighten all bent parts.

12. Cleaning, Inspecting and Repairing Outer Case

Use clean, dry, low-pressure compressed air to blow out all dust particles in the unit. Remove corrosion with a fine grade of sandpaper. Blow out all loosened particles with compressed air. Straighten all bent parts of case. Inspect felt washers in rear and around air filters to see that they are in good condition. Replace felt washers if torn or missing. Examine air filters located on left side and rear of receiver case. If dirty, use compressed air and blow out dirt that has accumulated within the filters. Should the accumulation of dirt be too great to remove in this manner, discard the filter pads and insert new ones. The filter pads can be replaced by loosening four screws on the outer faces of the case. *When handling the spun glass air filter, take care to prevent small splinters of glass from entering the fingers.* Repaint all painted surfaces that are worn or chipped.

13. Replacement of Defective Parts

a. Before replacing any part which, on inspection, indicates improper electrical operation, or signs of overload, such as charring and burning, make a thorough electrical check of the circuit to discover the cause of improper operation. Check voltages and resistances as outlined in section VIII, and correct trouble before replacing defective parts.

b. Replace all wires having charred or poor insulation. Resolder all broken or poor connections. Replace broken rubber grommets. Replace all defective parts, lamps, and tubes. If crystal is changed, capacitor C201 must be readjusted as outlined in paragraph 20. Replace all missing or defective screws, washers, bolts and nuts.

14. Replacement of Removed Parts

a. DYNAMOTOR. Place dynamotor into crystal-frequency-calibrator chassis. Press snap slides together until dynamotor is properly seated over lugs in chassis. Push snap slides into lugs until they engage the lugs firmly. Place dynamotor plug P250 into chassis socket.

b. TUBES. Replace tubes in both chassis in their proper sockets and attach grid clips to proper tubes.

c. CRYSTAL. Replace crystal in its socket on crystal-frequency-calibrator chassis.

d. FUSES. Replace fuses into their proper positions on front panel of crystal-frequency-calibrator chassis.

e. DIAL LIGHTS. Replace dial lights into their sockets on receiver chassis and fasten plastic cover plate to the front panel with four screws.

SECTION IV

PRELIMINARY TROUBLE-SHOOTING PROCEDURES

15. Input Resistance Measurements

a. General. Trouble within the superheterodyne receiver and crystal-frequency-calibrator unit can often be detected by checking the resistance of the filament and high voltage circuits at the power input terminals before applying power to the equipment, thereby, preventing damage to the unit or the power supply.

b. Preparation. (1) Make certain that plug P251 (figs. 3 and 4) is not plugged into receptacle on receiver chassis.

(2) Turn receiver and the crystal-frequency-calibrator unit ON-OFF switches to ON position, and CW-MVC-AVC switch to CW.

c. Procedure. (1) *Input resistance check of crystal-frequency-calibrator unit.* Check the input resistance to ground (crystal-frequency-calibrator chassis) from the six terminals of the crystal-frequency-calibrator chassis receptacle J–250 (fig. 8) (bottom view) as shown in table III below:

Table III

INPUT RESISTANCES AT TERMINALS OF RECEPTACLE J-250

Receptacle	Pin No.	Resistance (ohms)
J-250	1	0
	2	0
	3	1
	4	0
	5	1
	6	80

(2) *Input resistance check of receiver BC–652–A.* Insert crystal-frequency-calibrator connector plug P251 into its receptacle J304 on the receiver chassis. Check the input resistance to ground (receiver chassis) from the 12 terminals of receptacle J304 (fig. 5) and the nine pins of plug P302 (figs. 3 and 4) which connects Radio Receiver BC–652–A to Mounting FT–253–A, as shown in table IV below:

Table IV

INPUT RESISTANCES AT RECEPTACLE J–304 AND PLUG P–302

Receptacle	Pin No.	Resistance (ohms)
J–304	1	1
	2	Infinite
	3	0
	4	0.3
	5	Infinite
	6	1
	7	0
	8	Infinite
	9	400
	10	80
	11	5,000
	12	Infinite
P–302	1	0
	2	0
	3	0
	4	0
	5	0
	6	Infinite
	7	29
	8	Infinite
	9	Infinite

(3) *Trouble location.* If the input resistances do not agree with the values shown in tables III and IV, see paragraph 35.

16. Preliminary Operating Tests

a. Preparation. (1) Replace the connection from crystal-frequency-calibrator unit to stud at the rear of the antenna post.

(2) Complete the receiver protective circuit by grounding pin No. 8 on plug P302.

(3) Unscrew Fuse FU–42 (F251) located on the front panel.

(4) Connect a 12-volt battery to the binding posts on the rear of the crystal-frequency-cali-

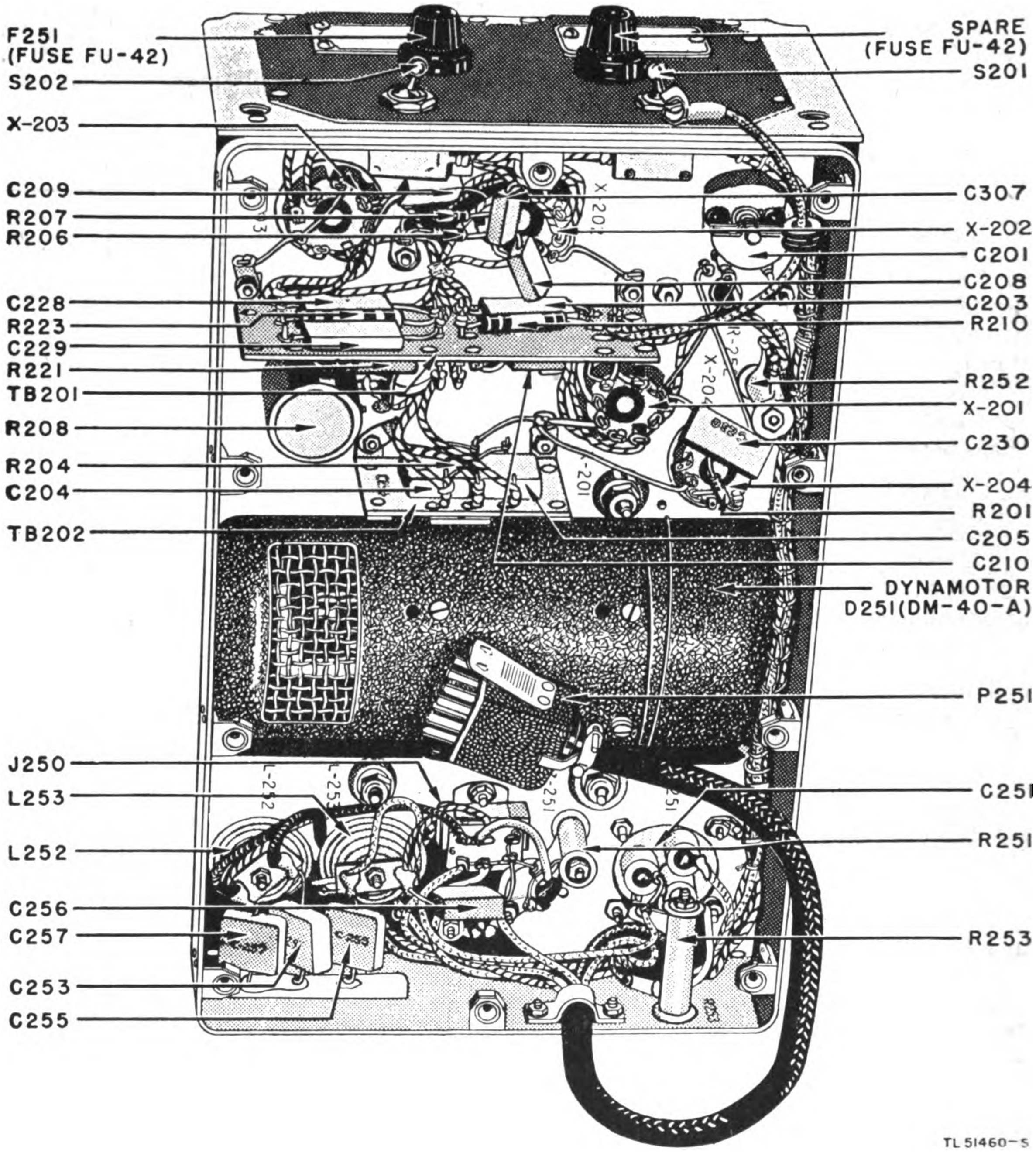

Figure 7. Bottom view from front of crystal-frequency-calibrator chassis, Radio Receiver BC–652–A.

brator unit chassis. Make sure Dynamotor DM–40–A is in use.

(5) Turn CFC ON-OFF switch to ON and INTERVAL switch to 20 kc.

b. **Procedure.** (1) Turn on receiver by screwing fuse F251 into socket on front panel. The dial lamps should light. If they fail to light, replace fuse with spare fuse.

(2) After power is turned on, inspect set for any signs of abnormal operation, such as smoking, arcing, crackling, or burning.

(3) Touch the dynamotor case to check whether it is operating at too high a temperature. This should be done after the set has been operating for a short period of time.

(4) If signs of abnormal operation are indi-

cated, turn off the set immediately. See figures 7 through 10 to determine the reference numbers of the faulty parts. See the schematic wiring diagram, figure 29, and determine the stage in which the part is included. Correct the fault, see section VIII.

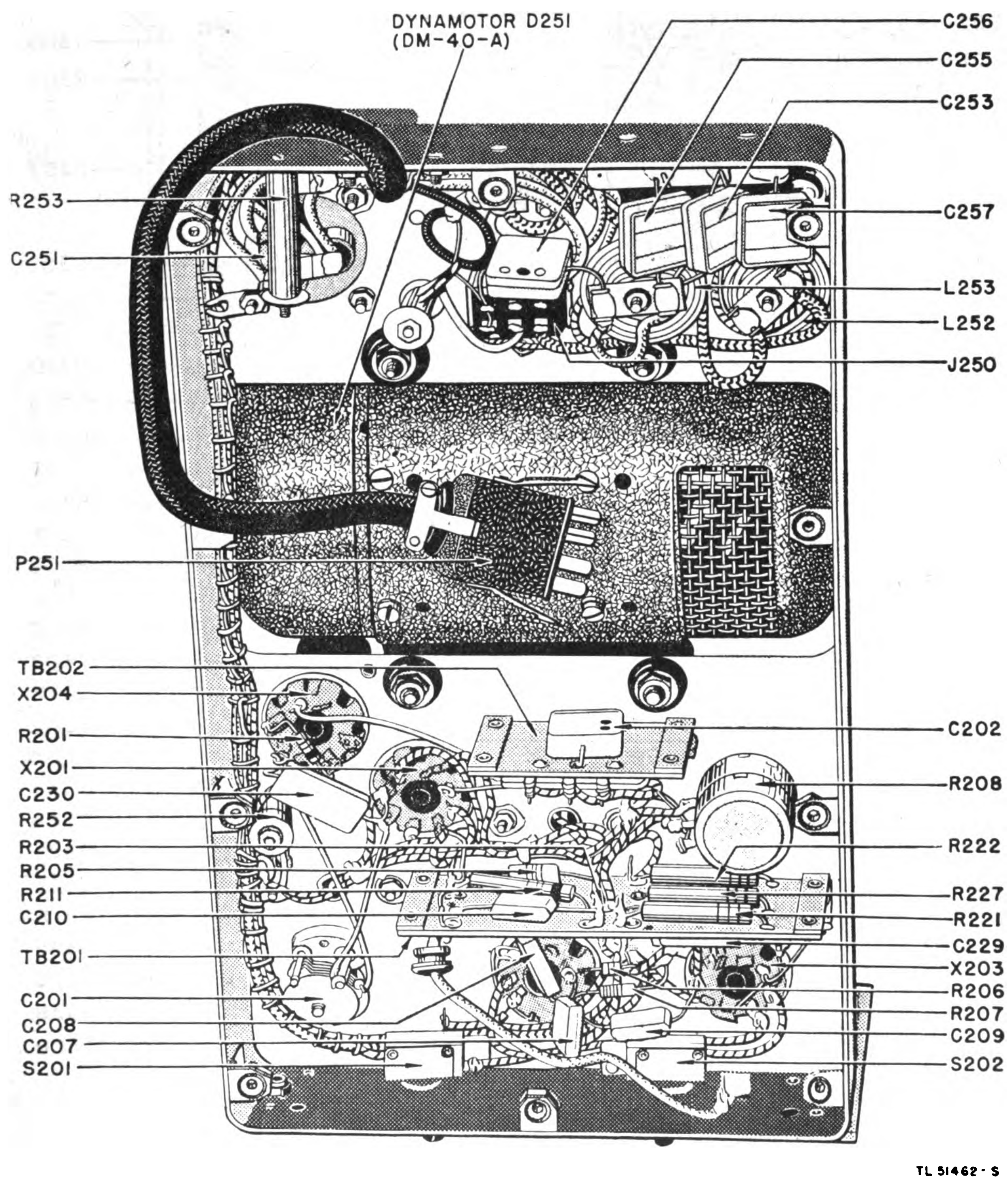

Figure 8. Bottom view from rear of crystal-frequency-calibrator chassis, Radio Receiver BC–652–A.

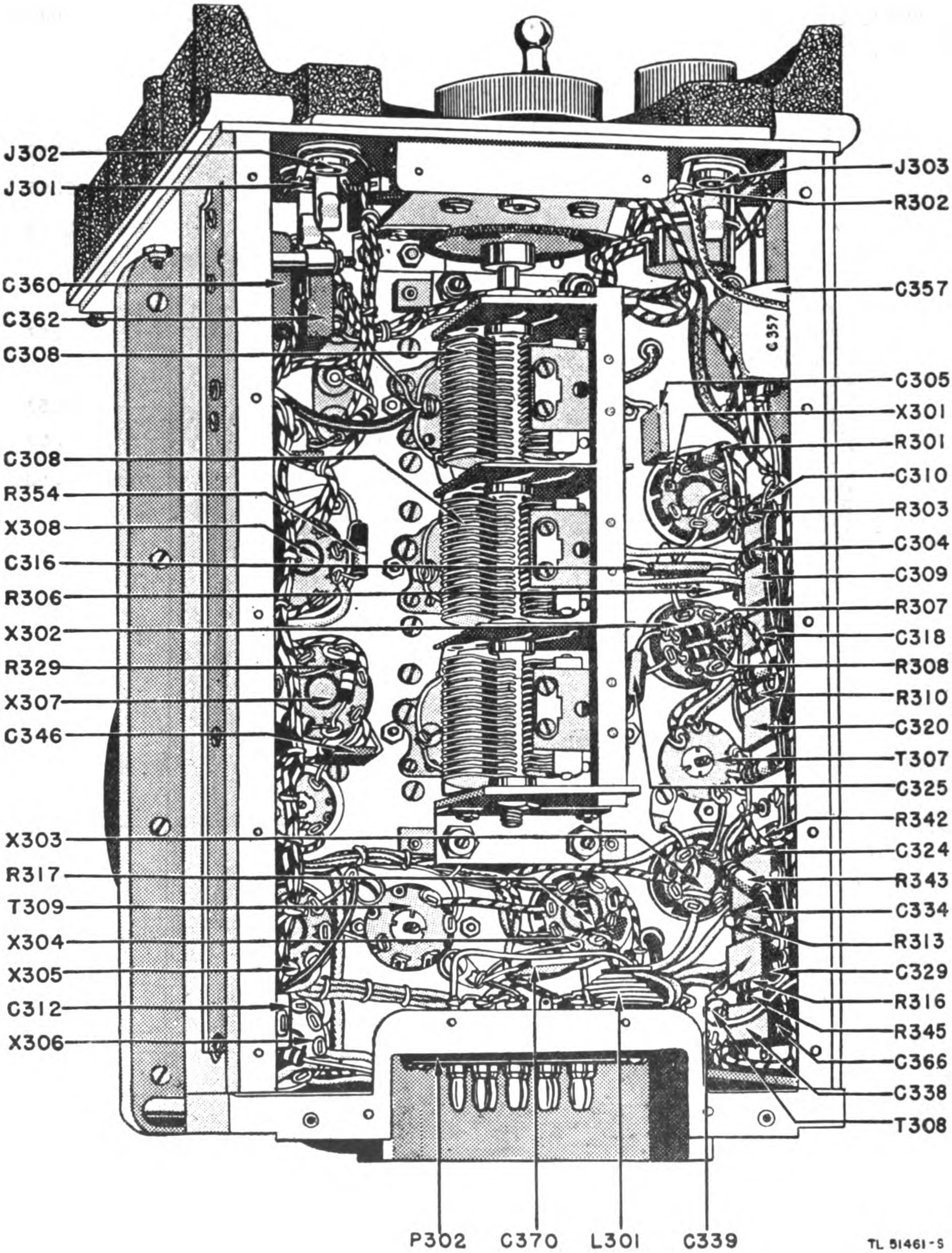

Figure 9. Bottom view of receiver unit chassis, oblique left-side view, Radio Receiver BC–652–A.

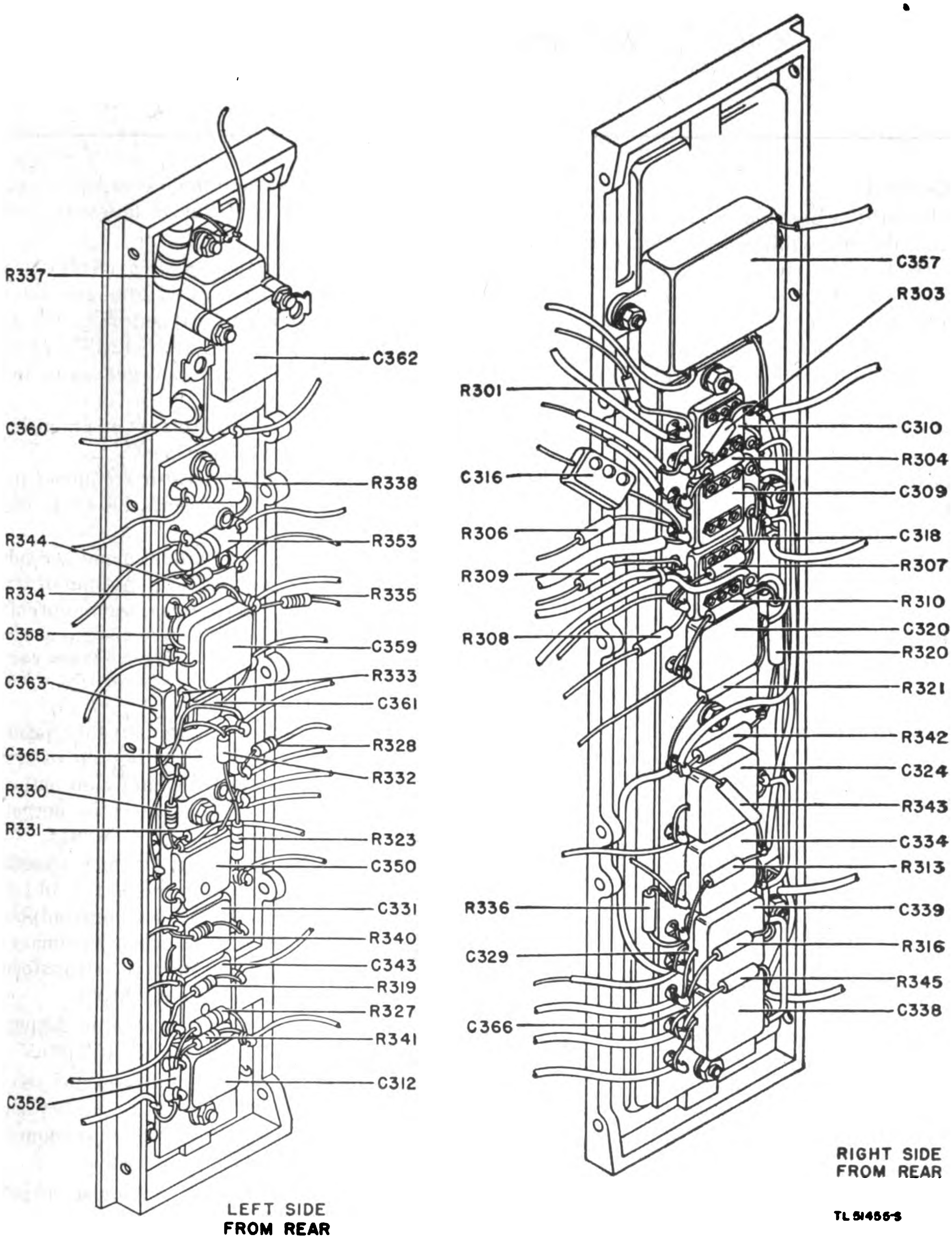

Figure 10. Receiver unit chassis, lower side panels, Radio Receiver BC–652–A.

SECTION V

ALIGNMENT PROCEDURE

17. General

If during the progress of alignment, a stage is reached where improper operation is indicated, the trouble should be located and the cause of faulty operation corrected before proceeding further. See section VI, for the procedure for localizing the trouble to the faulty stage. After trouble has been localized to a particular stage, refer to the data given for that stage in section VIII. Figure 11 shows the locations of the controls mentioned in the text and the reference numbers for the front panel components. Figure 12 shows the socket and tube layout for the receiver and crystal-frequency-calibrator units.

NOTE. Allow receiver and signal generator to warm up at least 15 minutes before proceeding with alignment.

18. Preparation

a. Power is supplied to the receiver by means of a 12-volt storage battery connected to the binding posts at the rear of the crystal-frequency-calibrator chassis.

b. The power of the set is turned off by unscrewing fuse F251, located on the crystal-frequency-calibrator front panel.

c. Plug P251 is inserted in receptacle J304 on the receiver chassis.

d. Terminal 8 of plug P302 on the receiver chassis is connected to ground, by means of a jumper.

e. Connect the 4,000-ohm output meter to Plug PL–55 and insert the plug into the SPEAKER jack. Plug a headset into one of the PHONE jacks.

f. Set INCREASE OUTPUT control for maximum output, CW–MVC–AVC switch to MVC and CFC ON-OFF switch to OFF.

19. Receiver Unit

a. RECEIVER ALIGNMENT POINTS. Receiver alignment points are shown in figure 13. Use an insulated aligning screw driver when making adjustments.

CAUTION: High voltages exist at the underside of the chassis when the power is on. Never clip leads onto parts of the set unless the power is off.

b. INTERMEDIATE - FREQUENCY STAGE. (1) Connect the high side of the signal generator in series with a 100-mmf capacitor to the grid, terminal No. 4 of Tube JAN–12SK7 (V305). Ground the low side of signal generator to the chassis.

(2) Ground the stator plates of ganged tuning capacitors C308B and C308C.

(3) Set the signal generator frequency to exactly 915 kc with 30 percent, 400-cycle modulation.

(4) Adjust fourth i-f transformer secondary adjusting screw, located on the bottom of transformer assembly T310, for maximum output.

NOTE. Reduce signal generator output, as alignment progresses so that the output meter indication does not exceed 25 volts. Listen to the receiver output and make sure that the note is undistorted.

(5) Adjust fourth i-f transformer primary adjusting screw, located on the top of transformer assembly T310, for maximum output.

(6) Connect the signal generator output to the grid cap of Tube JAN–12C8 (V304).

(7) Adjust third i-f transformer secondary adjusting screw, located on the bottom of transformer assembly T309, for maximum output.

(8) Adjust third i-f transformer primary adjusting screw, located on the top of transformer assembly T309, for maximum output.

(9) Conect the signal generator output to terminal 4 of Tube JAN–12SK7 (V303).

(10) Adjust second i-f transformer secondary adjusting screw, located on the bottom of transformer assembly T308, for maximum output.

(11) Adjust second i-f transformer primary adjusting screw, located on the top of transformer assembly T308, for maximum output.

(12) Connect the signal generator output to the grid cap of Tube JAN–12K8 (V302).

(13) Adjust first i-f transformer secondary

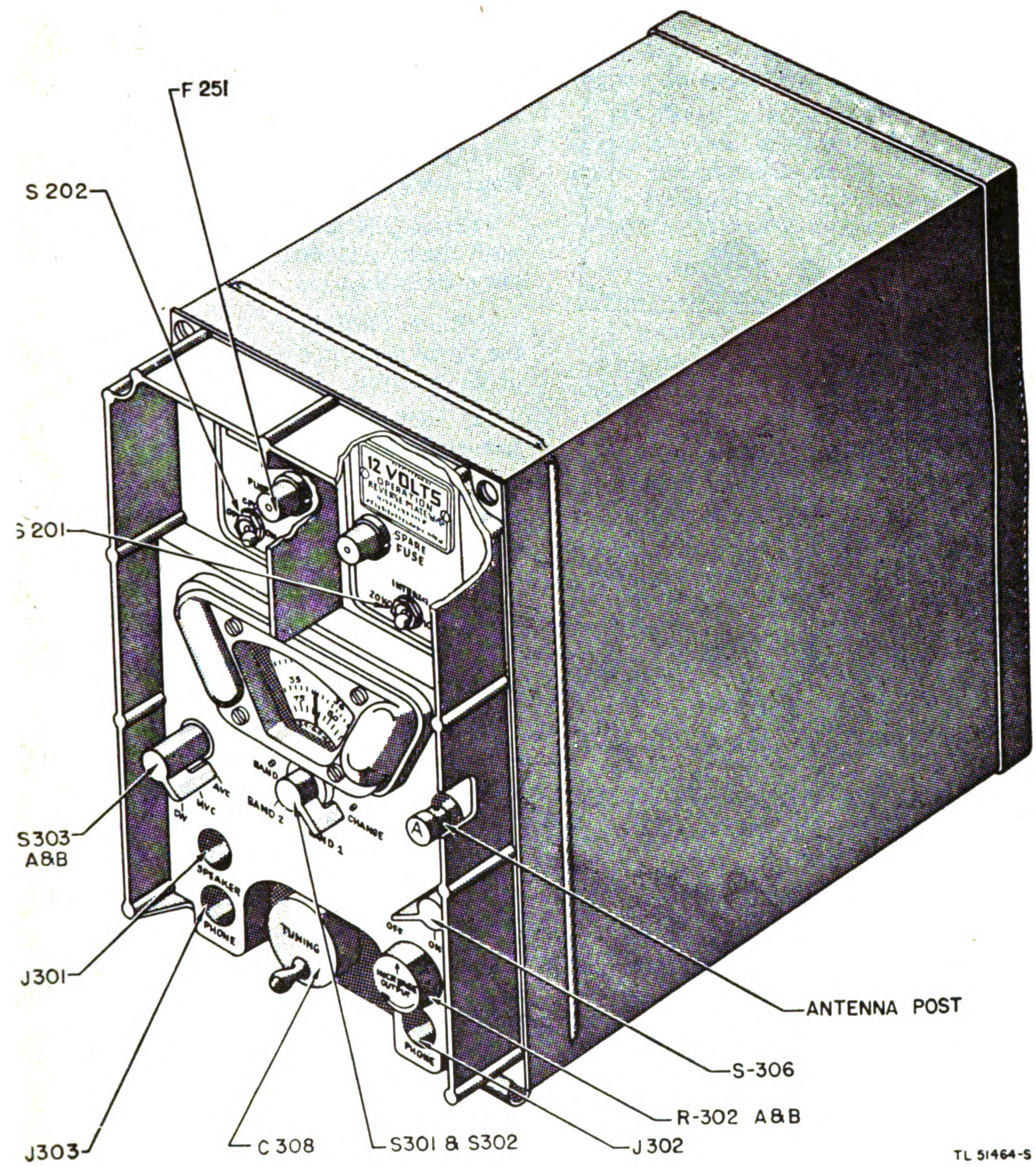

Figure 11. External parts, Radio Receiver BC–652–A.

adjusting screw, located on the bottom of transformer assembly T307, for maximum output.

(14) Adjust first i-f transformer primary adjusting screw, located on the top of transformer assembly T307, for maximum output.

c. BEAT-FREQUENCY OSCILLATOR. (1) The signal generator is connected to the grid cap of Tube JAN–12K8 (V302) and its frequency is set to 915 kc.

(2) Turn CW-MVC-AVC switch to CW and turn off signal generator modulation.

(3) Adjust screw of C356, on top of assembly T311 until a desirable output tone (between 400 cycles and 1,000 cycles) is heard in the headset. Either side of the intermediate-frequency may be used.

(4) Set CW-MVC-AVC switch to MVC.

d. HIGH-FREQUENCY OSCILLATOR. (1) Re-

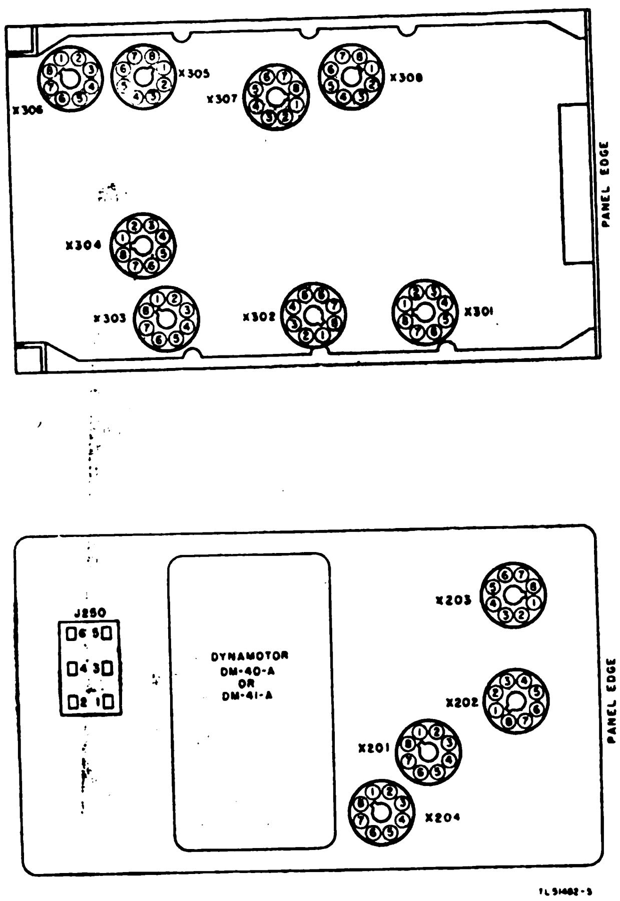

Figure 12. Tube socket lay-out, Radio Receiver BC-652-A.

move the grounding jumper from the stator plates of ganged tuning capacitor C308C.

(2) Connect the signal generator through the 100-mmf capacitor to the antenna post.

(3) Set the signal generator to 3.33 mc with 30 percent 400-cycle modulation, and set the receiver dial to 3.33 mc on band 1.

(4) Adjust capacitor C328 for maximum output.

(5) Set the signal generator frequency to 2.1 mc, and set the receiver dial to 2.1 mc on band 1.

(6) Adjust the 2.1 mc screw (T305 coil slug) for maximum output.

(7) Repeat steps (3) through (6) above until tracking is obtained at both the high and low ends of the band.

(8) Set signal generator to 5.7 mc with 30-percent, 400-cycle modulation, and set the receiver dial to 5.7 mc on band 2.

(9) Adjust capacitor C 330 for maximum output.

(10) Set the signal generator frequency to 3.6 mc, and set the dial to 3.6 mc on band 2.

(11) Adjust the 3.6-mc screw (T306 coil slug) for maximum output.

(12) Repeat steps (8) through (11) above until tracking is obtained at both the high and low ends of the band.

e. RADIO-FREQUENCY STAGES. (1) Connect the signal generator output to the antenna post of the receiver.

(2) Remove the grounding jumper from the stator plates of capacitor C308B.

(3) Set the signal generator frequency to 3.33 mc with 30-percent, 400-cycle modulation and set the receiver dial to 3.33 mc.

(4) Adjust r-f trimmer capacitor C314 for maximum output.

(5) Adjust antenna trimmer capacitor C302 for maximum output.

(6) Set the signal generator frequency to 5.7 mc with 30-percent, 400-cycle modulation, and set the receiver dial to 5.7 mc.

(7) Adjust r-f trimmer capacitor C315 for maximum output.

(8) Adjust antenna trimmer capacitor C303 for maximum output.

f. WAVE-TRAP TUNING. (1) With signal generator connected to the receiver antenna binding post, set the signal generator frequency to 913 kc modulated 30-percent at 400-cycles, and set the receiver dial to 2.2 mc.

(2) Adjust coils L303 and L302 for minimum indication on the output meter.

(3) Turn off and disconnect the signal generator. Disconnect the output meter.

20. Crystal-Frequency-Calibrator Unit

a. CRYSTAL - FREQUENCY - CALIBRATOR ALIGNMENT POINTS. Crystal - frequency - calibrator alignment points are shown in figure 14. Use an insulated aligning screw driver when making adjustments.

b. ADJUSTMENT OF CAPACITOR C201. (1)

Turn CFC switch to ON and set INTERVAL switch to 100 KC.

(2) Connect the output grid clip of the crystal-frequency-calibrator to a heterodyne frequency meter. Allow the crystal-frequency calibrator and the frequency meter to warm up for at least 10 minutes.

(3) When using Crystal Unit DC–15–A, adjust capacitor C201 to secure 200 kc crystal-frequency.

(4) When using Crystal Holder FT–241–A, set capacitor C201 at maximum capacity (red dot at rear; slot in line with mounting screws).

c. ADJUSTMENT OF COIL L201. (1) Turn off receiver and disconnect frequency meter.

(2) Connect the signal generator which is in series with a 75,000-ohm resistor, so that it is in parallel with coil L201. Also connect an a-c (alternating-current) vacuum-tube voltmeter in series with a 0.01-mf capacitor, in parallel with L201. Make connections so that minimum stray capacity is shunted across the coil.

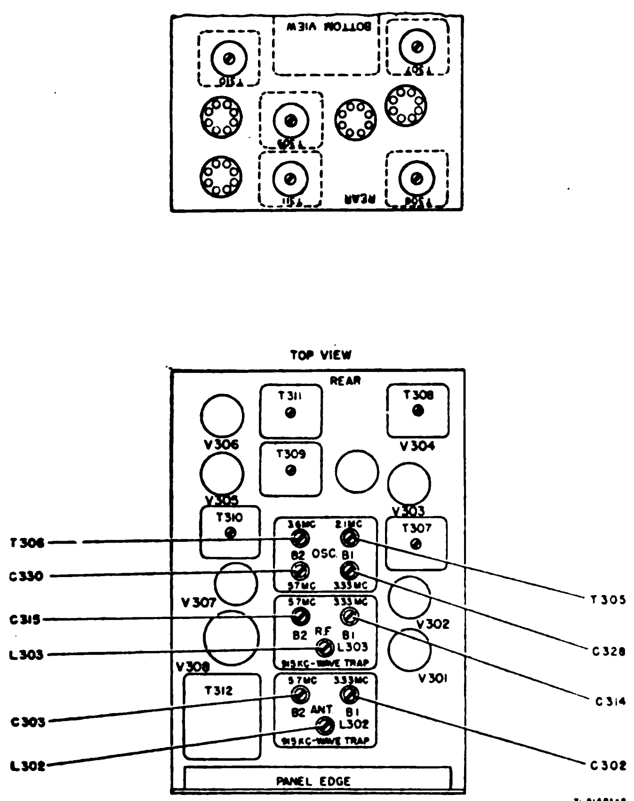

Figure 13. Receiver unit alignment points, Radio Receiver BC–652–A.

(3) When using Crystal Unit DC–15–A, set the signal generator to 235 kc, unmodulated, and adjust the slug of coil L201 for maximum indication on the vacuum-tube voltmeter.

(4) When using Crystal Holder FT–241–A, set the signal generator to 200 kc, unmodulated, and adjust the slug of coil L201 for maximum indication on the vacuum-tube voltmeter, with CFC ON-OFF switch at OFF position.

(5) Disconnect the signal generator and vacuum-tube voltmeter.

d. ADJUSTMENT OF COIL L202. (1) Connect an a-c vacuum-tube voltmeter in series with a 0.01-mf capacitor from the high side of coil L202 to ground.

(2) Turn on the receiver and crystal-frequency calibrator.

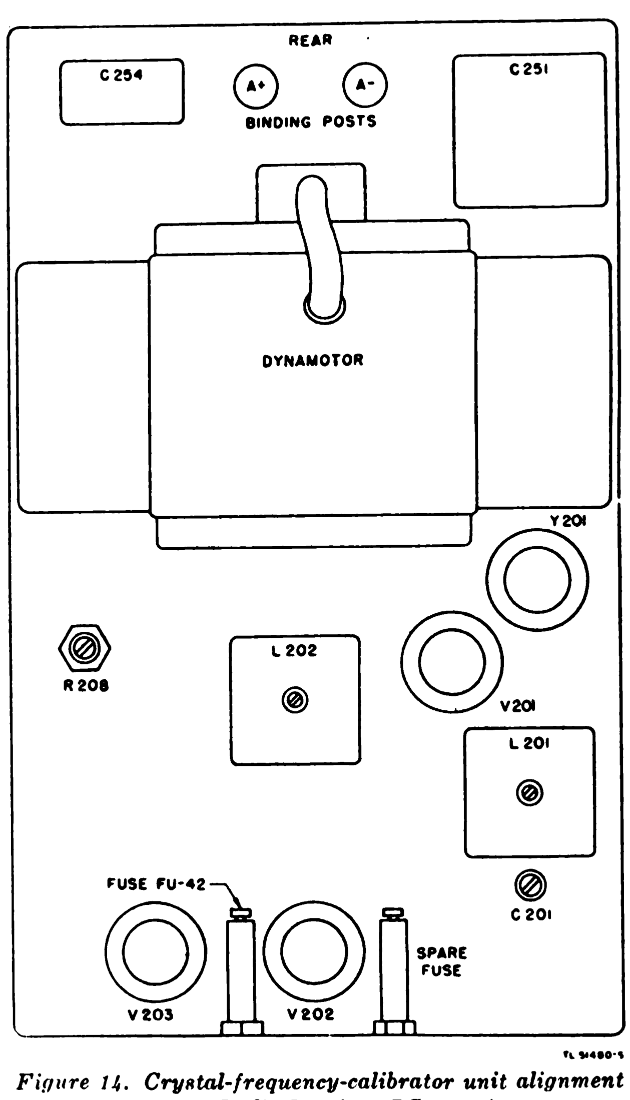

Figure 14. Crystal-frequency-calibrator unit alignment points, Radio Receiver BC–652–A.

(3) Adjust the slug of coil L202 for maximum indication on the vacuum-tube voltmeter.

(4) Turn off the set and disconnect the vacuum-tube voltmeter. Connect the CFC output lead to the stud in back of the receiver antenna post.

e. ADJUSTMENT OF RESISTOR R 208. (1) Turn on the set. The CFC switch should be ON and the INTERVAL switch should be set to 100 KC.

(2) Plug a headset into one of the receiver PHONE jacks.

(3) Set the receiver dial to 2.0 mc. Turn CW-MVC-AVC switch to CW and listen for a beat note in the headset.

(4) Set the receiver dial to 2.1 mc and listen for a beat note in the headset.

(5) Set the INTERVAL switch to 20 KC.

(6) Turn the receiver from 2.0 mc to 2.1 mc and count the number of beats. There should be four, one every 20 kc.

(7) If more or less than four beats are obtained, adjust resistor R208 until four are obtained.

NOTE. Loosen the locknut on resistor R208 before making any adjustments.

(8) Tune the receiver to one of the four beat notes and adjust resistor R208 each way until the beat falls out. Correct adjustment is midway between the fall-out points. When operating region is less than 120°, check for faulty tubes.

(9) Tighten the locknut when adjustment is completed.

(10) Turn the set off. Disconnect the batteries and the headset.

SECTION VI

DETAILED TROUBLE-SHOOTING PROCEDURES

21. General

a. PURPOSE. The purpose of this section is to give the procedure for localizing trouble to a stage. When trouble has been localized to a particular stage, see the data given for that stage in section VIII.

b. PREPARATION. (1) Power is supplied to the set by means of a 12-volt storage battery connected to the binding posts at the rear of the crystal-frequency-calibrator chassis.

(2) The power of the set is turned off by unscrewing fuse F251 located on the crystal-frequency-calibrator front panel.

(3) Plug P251 is inserted in receptacle J304 on the receiver chassis.

(4) Terminal 8 of plug P302 on the receiver chassis is connected to ground by means of a jumper.

(5) Connect the 4,000-ohm output meter to Plug PL-55 and insert the plug into the SPEAKER jack. Plug a headset into one of the PHONE jacks.

(6) Set INCREASE OUTPUT control for maximum output, CW-MVC-AVC switch to MVC and CFC ON-OFF switch to OFF.

22. Receiver Unit

a. GENERAL. The alignment procedure of section V localizes any trouble which may occur in the stages preceding the third i-f amplifier stage. Thus trouble localization procedure is given in this section only for the third i-f amplifier, second detector and first audio, and audio output stages.

b. PROCEDURE. (1) Connect the high side of the signal generator in series with a 100-mmf capacitor to the grid, terminal No. 4 of Tube, JAN-12SK7 (V305). Ground the low side of the signal generator to the chassis.

(2) Ground the stator plates of ganged tuning capacitors C308B and C308C.

(3) Set the signal generator frequency to exactly 915 kc with 30 percent 400-cycle modulation.

(4) If the output meter does not indicate with a signal generator output voltage of 1 volt, connect the low side of an a-c vacuum-tube voltmeter to the chassis ground and the high side to an insulated test prod through a 0.01-mf series capacitor. Test for voltages at the points listed in table V until the faulty circuit is bracketed.

Table V

SIGNAL TRACING FOR RECEIVER UNIT

Test point	Faulty circuit (if no indication on the a-c VTVM is obtained)
Term. 1, transformer T310	Third i-f amplifier stage, V305
Term. 4, transformer T310	Assembly T310
Pin 2, tube V307	Second detector section, V307
Pin 6, tube V307	First audio section V307
Pin 5, tube V308	Grid circuit, audio output stage, V308
Pin 3, tube V308	Audio output stage, V308
Term. 5, transformer T312	Transformer T312

23. Crystal-Frequency-Calibrator Unit

a. GENERAL. If, during the alignment of the crystal - frequency - calibrator unit, no 200-kc beat is obtained in the heterodyne frequency meter, check the circuit as described in *b* below.

b. PROCEDURE. (1) Turn the CFC switch to ON and set the INTERVAL switch to 100 kc.

(2) Connect the low side of an a-c vacuum-tube voltmeter to the chassis and the high side, in series with a 0.01-mf capacitor to an insulated test prod.

(3) Check for r-f voltage at the points listed in table VI until the faulty stage is bracketed.

Table VI

SIGNAL TRACING FOR CRYSTAL-FREQUENCY-CALIBRATOR UNIT

Test point	Faulty circuit (if no indication on the a-c VTVM is obtained)
Pin 6, tube V201	Triode section, oscillator stage
Pin 3, tube V201	Buffer section, oscillator stage
Pine 3, tube V203	100-kc multivibrator stage
Crystal-frequency-calibrator output clip	20-kc multivibrator stage

24. Moistureproofing, Fungiproofing, and Refinishing

After the repairs have been completed on the receiver, check the date of last moistureproofing and fungiproofing treatment. If a new treatment is required, see TB SIG 13 for method of application. If the receiver case has been scarred or chipped, remove any rough spots with fine sandpaper and apply paint to spots with small brush. If the case is sufficiently scarred and scratched to warrant complete refinishing, remove the chassis from the case, and remove all dirt and rust with kerosene when necessary. Spray entire case with the proper paint authorized by existing regulations.

SECTION VII

FINAL TESTING

25. Alignment Check

Although the unit was correctly aligned during the repair procedure, a recheck of the alignment is necessary after moistureproofing and fungiproofing have been completed. Check alignment as given in section V.

26. Over-All Performance Tests

a. TESTS. After the alignment has been checked, the following performance tests are to be made:

Sensitivity and noise (mcw).
Sensitivity and noise (cw).
Selectivity.
Image-frequency rejection ratio.
Intermediate-frequency rejection ratio.
Automatic volume control.
Crystal-frequency-calibrator output.
Operational test.

b. PREPARATION.

Caution: Operation of this equipment involves the use of high voltages which are dangerous to life. Operating personnel must at all times observe all safety regulations. When working on the electrical connections of mounting FT-253-A or on its supply line fuse FU-22, the main battery switch must be off.

(1) Replace all tubes in their sockets. Replace bottom plate of receiver chassis. Insert grommet of grid clip wire into slot in bottom of crystal-frequency-calibrator chassis and replace bottom plate. Place crystal-frequency-calibrator on the two rear supporting posts and replace the two screws. Replace the six screws that hold the crystal-frequency-calibrator chassis to the front panel. Replace the grid clip on the stud in the rear of the antenna binding post. Insert plug P251 into socket J304 on the receiver chassis.

(2) Install Dynamotor DM-40-A on the crystal-frequency-calibrator chassis.

(3) Make certain that the 200-kc crystal is properly installed in its socket.

(4) Replace the receiver in its case, fastening the two Dzus fasteners on the upper corner of the front panel and the one on the rear of the case.

(5) Remove the patch cover at the right end of the top shield of Radio Transmitter BC-653-A and note that the six links are set for 12-volt operation.

(6) Make sure that Dynamotor DM-42-A is installed in the transmitter and that the nameplate on the front panel of the Radio Transmitter BC-653-A is set for 12-volt operation.

(7) Remove the three patch covers on top of Radio Transmitter BC-653-A by loosening the Dzus fasteners. Insert the vacuum tubes in their respective sockets. Note that the sockets of Tubes VT-100 and VT-154 are equipped with clamps which secure these larger tubes in place. Tighten these clamps by turning them one-quarter turn in a clockwise direction, using the long-bladed screw driver located to the left of Tube VT-100, as viewed from the rear of the radio transmitter. Replace the patch covers.

(8) Make sure that all fuses are in. Slide Radio Receiver BC-652-A and Radio Transmitter BC-653-A into position on Mounting FT-253-A and secure them in position with the five wingnuts provided along the lower edge of the front panels. This operation automatically connects the power supply leads and the interconnections to the radio transmitter. Ground Mounting FT-253-A to an external ground.

(9) With receiver ON-OFF switch set to OFF, and with the battery switch off, connect the ends of Cords CO-280 to the 12-volt battery posts. *Be absolutely certain that the polarity marking of the wire and the post correspond. The plus wire from Mounting FT-253-A must be connected to the plus post in the terminal box.*

c. PRELIMINARY OPERATIONAL TEST. (1) Turn on the main battery switch, and turn the receiver ON-OFF switch to ON.

(2) Plug in Headset HS-18 or HS-23-A and rotate the INCREASE OUTPUT control until

receiver hiss is heard, indicating that the vacuum tubes have warmed up and are functioning.

(3) Turn the CFC ON-OFF switch ON.

(4) With the receiver CW-MVC-AVC switch at CW rotate the TUNING control and listen to the crystal signals. These signals will occur at either 20 or 100 kc intervals, depending upon the position of the INTERVAL switch on the crystal-frequency-calibrator.

(5) Start Radio Transmitter BC–653–A by turning the POWER AND EMISSION switch to CAL & NET. The dynamotor will start and the red pilot lamp will glow.

(6) Plug in Key J–45 and close it. The antenna break-in relay within Radio Transmitter BC–653–A will operate, and Radio Receiver BC–652–A will be desensitized each time the key is closed. A 1,000-cycle sidestone will be heard in Headsets HS–18 or HS–23–A.

(7) Set the METER SW switch to PA FIL and adjust the PA FIL rheostat until the needle on the FIL & PL CURRENT meter points to the white triangle.

(8) While holding Key J–45 closed, turn the receiver ON-OFF switch to OFF. IF INSTALLATION AND ADJUSTMENTS HAVE BEEN PROPERLY MADE, THIS WILL SHUT DOWN BOTH RADIO TRANSMITTER BC–653–A AND RADIO RECEIVER BC–652–A.

(9) Turn the transmitter POWER AND EMISSION switch OFF, and open Key J–45.

(10) Set receiver CW-MVC-AVC switch to MVC.

(11) Set receiver INCREASE OUTPUT control for maximum volume.

(12) Set receiver CFC switch to OFF.

(13) Connect signal generator through a 100-mmf dummy antenna capacitor to the antenna post of the receiver.

(14) Connect the 4,000-ohm output meter to PLUG PL–55 and insert the plug into receiver SPEAKER jack.

(15) Turn receiver ON-OFF switch to ON.

d. Sensitivity and Noise (Modulated Continuous Wave). (1) Set the signal generator output to 5.7 megacycles with 30-percent, 400-cycle modulation. Accurately tune the receiver to this frequency.

(2) Set the signal generator output antennuator for 4 microvolts and reduce the setting of the INCREASE OUTPUT control so as to obtain 6.3-volts indication on the output meter. It is a requirement that this condition be obtainable.

NOTE. When measuring output voltages, first set the meter to the highest available range and then adjust to the appropriate range.

(3) Turn off the signal generator modulation. The new indication on the output meter must not be more than 2.0 volts.

(4) Repeat steps (1) through (3) above at each of the check-point frequencies of table VII.

Table VII

MCW SENSITIVITY AND NOISE

Frequency (mc)	Signal generator output voltage (mc)	Receiver noise plus signal output (volts)	Receiver noise output (volts)
5.7	4	6.3	2.0 max
3.6	4	6.3	2.0 max
3.3	4	6.3	2.0 max
2.1	4	6.3	2.0 max

e. Sensitivity and Noise (Continuous Wave). (1) Set the signal generator output to 5.7 megacycles with 30-percent, 400-cycle modulation. Accurately tune the receiver to this frequency.

(2) Set the signal generator output voltage to 2 microvolts and turn off the modulation.

(3) Set the receiver CW-MVC-AVC switch to CW and adjust the INCREASE OUTPUT control to obtain an indication upon the output meter of 6.3 volts. It is a requirement that this condition be obtainable.

(4) Set the receiver CW-MVC-AVC switch to MVC. The new indication of the output meter must not be more than 2.0 volts.

f. Selectivity. (1) Set the receiver CW-MVC-AVC switch to MVC.

(2) Set the signal generator output to 5.700 megacycles with 30-percent, 400-cycle modulation. Accurately tune the receiver to this frequency.

(3) Set the signal generator output voltage to 4 microvolts and adjust the receiver INCREASE OUTPUT control to obtain a 6.3-volt indication upon the output meter.

(4) Increase the output of the signal generator to 40 microvolts and, without changing any of the receiver control settings, vary the signal generator frequency, in turn, to 5.711 megacycles and 5.689 megacycles. At both of these frequencies the output meter indication must not be more than 6.3 volts.

(5) Repeat steps (2) through (4) above at the check-point frequencies of 3.6 mc, 3.3 mc, and 2.1 mc. At each of these frequencies the signal generator output should first be set for 4 microvolts with 30-percent, 400-cycle modulation and the INCREASE OUTPUT control set so as to obtain 6.3 volts indication on the output meter. The signal generator output should then be increased to 40 mv (microvolts) and its frequency detuned by plus 11 kc and then by minus 11 kc. At the detuned frequencies the output meter indication must not be more than 6.3 volts.

g. IMAGE-FREQUENCY REJECTION RATIO. (1) Set the signal generator output to 5.7 megacycles with 30-percent, 400-cycle modulation. Accurately tune the receiver to this frequency.

(2) Set the signal generator output attenuator for 4 mv and adjust the setting of the INCREASE OUTPUT control so as to obtain 6.3-volt indication on the output meter.

(3) Without changing any of the receiver control settings increase the frequency of the signal generator to 7.530 mc and increase its output voltage to 12,000 mv. Vary the signal generator frequency slightly until the output meter indication reaches a maximum value. This value must not be more than 6.3 volts.

(4) Repeat steps (1) through (3) above at each of the check-point frequencies of table VIII.

Table VIII

IMAGE-FREQUENCY REJECTION RATIO

Tune receiver to: (mc)	Approximate image-frequency (mc)	Signal generator input at image-frequency (mv)	Max output meter indication (volts)
5.700	7.530	12,000	6.3
3.600	5.430	32,000	6.3
3.300	5.130	14,000	6.3
2.100	3.930	120,000	6.3

h. INTERMEDIATE - FREQUENCY REJECTION RATIO. (1) Set the signal generator output to 2.1-mc with 30-percent, 400-cycle modulation. Accurately tune the receiver to this frequency.

(2) Set the signal generator output attenuator for 4 mv and adjust the setting of the INCREASE OUTPUT control so as to obtain 6.3 volts indication on the output meter.

(3) Without changing any of the receiver control settings, reduce the frequency of the signal generator to 915 kc and increase its output to 400,000 mv.

(4) The indication on the output meter must not be more than 6.3 volts.

(5) Repeat steps (1) through (4) above with the receiver tuned to 3.6 mc.

i. AUTOMATIC VOLUME CONTROL. (1) Set the signal generator output to 2.1 megacycles with 30-percent, 400-cycle modulation. Accurately tune the receiver to this frequency.

(2) Set the signal generator output attenuator for 50 mv. Turn the receiver CW-MVC-AVC switch to AVC.

(3) Set the INCREASE OUTPUT control to obtain a 10-volt indication on the output meter.

(4) Increase the signal generator output voltage to 500,000 mv. The indication on the output meter must not be more than 30 volts.

j. CRYSTAL-FREQUENCY-CALIBRATOR OUTPUT. (1) Turn off the signal generator. Disconnect output meter.

(2) Set CFC switch to ON.

(3) Set INTERVAL switch to 20 kc.

(4) Set receiver CW-MVC-AVC switch to CW.

(5) Tune receiver to 5.760 kc.

(6) Connect an 8,000-ohm, 5-watt, noninductive resistor to a phone Plug PL-55 and insert the phone plug into the SPEAKER jack. Connect a 0-to 150-volt, 1,000 ohm-per-volt a-c voltmeter in parallel with the 8,000 ohm resistor.

(7) Plug the high-impedance headset into one of the PHONE jacks. Adjust the beat note by slightly detuning the receiver to give a beat frequency of approximately 1,000 cycles.

(8) Set the INCREASE OUTPUT control for maximum volume. The indication on the output meter must not be less than 140 volts.

(9) Set INTERVAL switch to 100 kc.

(10) Tune receiver to 5,800 kc.

(11) Adjust beat note as in step (7) above.

(12) With the INCREASE OUTPUT control set for maximum output, the indication on the output meter must not be less than 140 volts.

k. OPERATIONAL TEST. (1) Turn the receiver ON-OFF switch OFF and disconnect the 8,000-ohm resistor and the a-c voltmeter from the receiver SPEAKER jack. Connect Loudspeaker LS-3 to the SPEAKER jack using cord CD-314.

(2) Connect an antenna wire to the receiver antenna post.

(3) Set CFC switch to OFF and the CW-MVC-AVC switch to MVC.

(4) Turn the receiver ON-OFF switch to ON and tune in a voice-modulated station on the receiver.

(5) Make certain that the output is free from regenerative squeals or whistles, unusual noise and distortion. Rock the INCREASE OUTPUT control back and forth and make sure that noise due to intermittent contact is not present.

(6) Repeat step (5) above with the CW-MVC-AVC switch set to AVC.

(7) Plug a headset into each of the receiver PHONE jacks in turn and check to see that reception is obtained.

(8) Set the CW-MVC-AVC switch to CW, the CFC INTERVAL switch to 100 kc and the CFC switch to ON.

(9) Set the receiver dial to 2.1-mc and check for a beat note in the loudspeaker. Turn the receiver TUNING control counterclockwise. The next beat note should occur when the dial is set to 2.2 mc.

(10) Set the CFC INTERVAL switch to 20 kc. With the receiver dial set to 2.2 mc, turn the receiver TUNING control clockwise to 2.1 mc. Check for beat notes at 2.180, 2.160, 2.140 and 2.120 mc.

(11) Turn the transmitter POWER AND EMISSION switch to CAL & NET and insert Key J–45 into the transmitter KEY jack.

(12) Depress the transmitter key and check that the receiver is desensitized. Check also for 1,000-cycle sidetone.

(13) Turn the transmitter POWER AND EMISSION to OFF, the receiver CFC switch to OFF, and the receiver ON-OFF switch to OFF. Disconnect the antenna wire from the receiver antenna post. Disconnect the power supply.

SECTION VIII

INDIVIDUAL STAGE AND CIRCUIT REPAIR DATA

27. Radio-Frequency Amplifier Stage

a. STAGE DATA. (1) Radio-frequency stage schematic shown in figure 15.

(2) Voltage and resistance values for socket terminals of Tube JAN-12SG7 (V301) to ground, shown on stage schematic.

(3) Parts data for radio-frequency amplifier stage, table IX.

Table IX
(fig. 15)
PARTS DATA, R-F AMPLIFIER STAGE

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C301	3D9010-17	CAPACITOR, fixed: mica; 10-mmf ±10%; 500-vdcw; (wave trap ant.)
C302	3D9050V-41	CAPACITOR, variable: 50-mmf; air trimmer; (ant. band 1)
C303	3D9050V-28	CAPACITOR, variable: 50-mmf; air trimmer; (ant. band 2)
C304	3D9005-16	CAPACITOR, fixed: mica; 5-mmf ∓10%; 500-vdcw; (band 1 capacity cplg.)
C305	3D9400-15	CAPACITOR, fixed: mica; 400-mmf ±10%; 500-vdcw; (r-f grid cplg.)
C307	3D9040-7	CAPACITOR, fixed: mica; 40-mmf ±10%; 500-vdcw; (ant. tuning)
C308A	3D9236	CAPACITOR, variable: 3 sec; 236-mmf; (included with C308; r-f amplr.)
C308B	3D9236	CAPACITOR: same as C308A; (1st det.)
C309	3DA6-47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300 vdcw; (r-f screen)
C310	3DA6-47	CAPACITOR: same as C309; (r-f cathode)
C311	3D9030-9	CAPACITOR, fixed: mica; 30-mmf ±10%; 500-vdcw; (r-f plate wave trap)
C313	3DA6-47	CAPACITOR: same as C309; (r-f plate bypass)
C314	3D9050V-41	CAPACITOR, variable: 50-mmf; air trimmer; (r-f band 1)
C315	3D9050V-28	CAPACITOR, variable: 50-mmf; air trimmer; (r-f band 2)
C317	3D9040-7	CAPACITOR, fixed: mica; 40-mmf ±10%; 500 vdcw; (r-f tuning)
C357B	3DB12-11	CAPACITOR, electrolytic; dual sec; 12 mf +100%, —10%; 50 vdcw; (included in C357; m-v-c bypass)
L302	2C4452A/C2	COIL: (915-kc wave trap (ant.))
L303	2C4452A/C3	COIL: (915-kc wave trap)
R301	3Z6801-19	RESISTOR: metallized; 1.0 meg ±10%; ½ w; (r-f grid)
R302A	2C4452A/R1	RESISTOR: dual adjustable; 20,000 ohm max.; volume control; (included in R302; m-v-c sensitivity)
R303	3Z6033-2	RESISTOR: metallized; 330 ohm ±5%; ½ w; (r-f cathode)
R304	3Z6120-5	RESISTOR: metallized; 1,200 ohm ±5%; ½ w; (r-f screen filter)
R305	3Z6220-3	RESISTOR: metallized; 2,200 ohm ±10%; ½ w; (r-f plate filter)
R343	3Z6627-3	RESISTOR: metallized; 27,000 ohm ±10%; 1 w; (m-v-c control bleeder)
S301A	2C4452A/S1	SWITCH: included with S301; (ant. section band)
S301B	2C4452A/S1	SWITCH: included with S301; (ant. section band)
S301C	2C4452A/S1	SWITCH: included with S301; (ant. section band)
S302A	2C4452A/S2	SWITCH: included with S302; (r-f section band)
S302B	2C4452A/S2	SWITCH: included with S302; (r-f section band)
S302C	2C4452A/S2	SWITCH: included with S302; (r-f section band)
S303A	2C4452A/S3	SWITCH: included with S303; (CW-MVC-AVC)
T301	2C4452A/C4	COIL: (ant. band 1)
T302	2C4452A/C5	COIL: (ant. band 2)
T303	2C4452A/C6	COIL: (r-f band 1)
T304	2C4452A/C7	COIL: (r-f band 2)
V301	2T209	TUBE JAN-12SG7 (VT-209): (r-f)
X301	2C6530-653A/S9	SOCKET: (r-f tube)
V309	2Z5954	LAMP LM-54: (input voltage limiter)
		ANTENNA POST

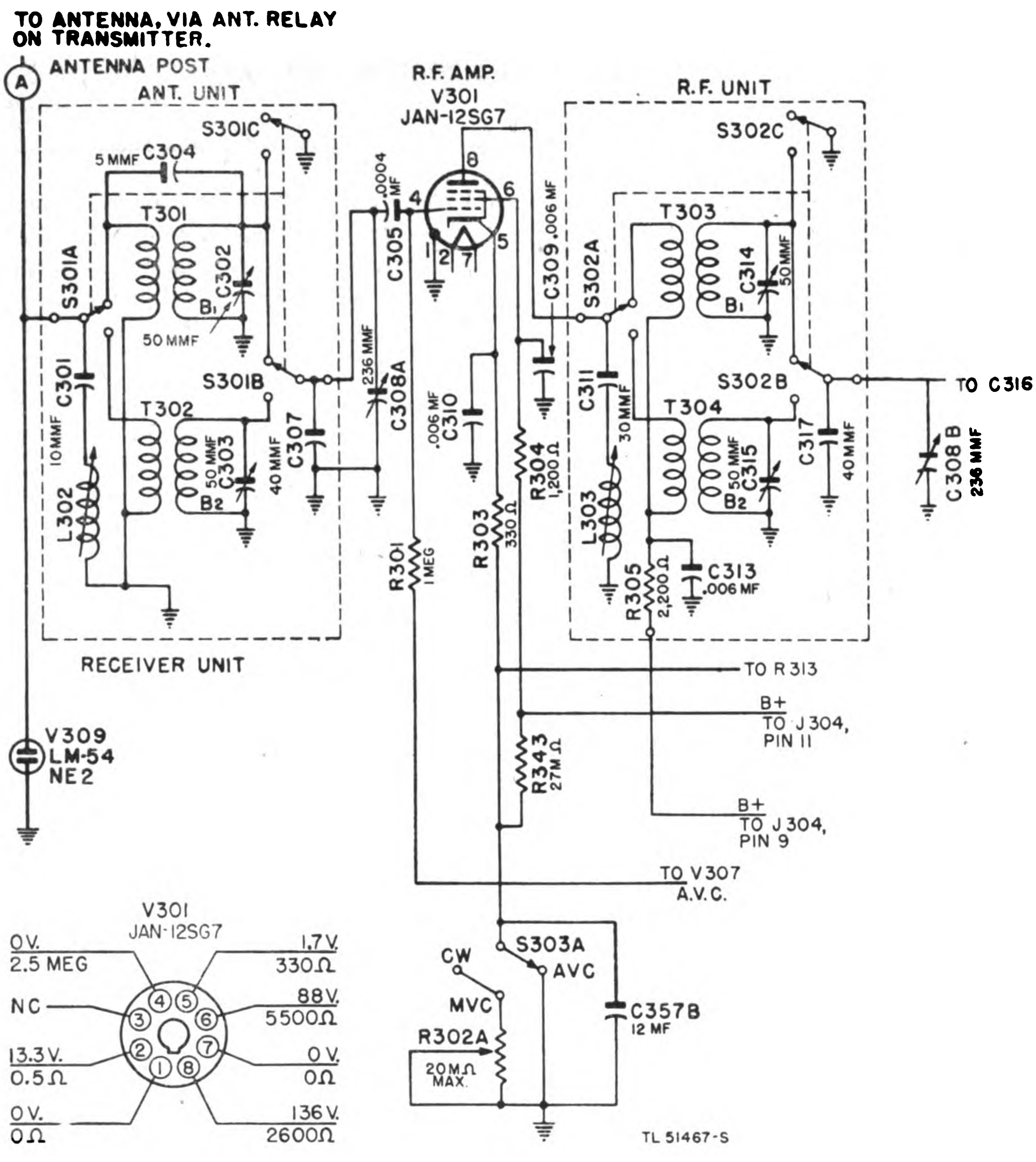

Figure 15. Radio-frequency amplifier stage schematic, Radio Receiver BC-652-A.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from the socket. Test with the tube checker and replace with a new tube if necessary. When replacing the tube, see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground with the diagram shown on the radio-frequency stage schematic. After trouble has been localized to a particular portion of the stage make a check of each component associated with that portion of the stage. Check the resistance from terminal No. 8 with the BAND CHANGE switch in both positions. The voltage of terminal No. 4 will have an appreciable negative value when measured with a d-c vacuum-tube voltmeter.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity

check, referring to the parts location drawings, figures 9 and 10. Check switches in all positions. Check for broken leads, faulty soldered joints and shorts.

(4) *Additional checks.* (*a*) If the stage does not operate on one particular band, and if the foregoing procedure gives no indication of the cause, test the transformers for that particular band. Apply the signal generator output to the antenna input terminals. Set its frequency to a frequency in the band in question and set the receiver dial to the same frequency. Set the signal generator output to 1 volt. Connect a test prod, in series with a 0.01-mf capacitor to the r-f terminal of an a-c vacuum-tube voltmeter. Starting with the input transformer, use the vacuum-tube voltmeter to test for r-f voltage at the inputs and outputs of the transformers of the band in question until the faulty transformer is bracketed.

(*b*) If the stage gain is suspected of being low on both bands, check capacitors C309 and C310 for open-circuit by paralleling each with

Table X

(fig. 16)

FIRST DETECTOR AND CONVERTER STAGE

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C308C	3D9236	CAPACITOR, variable: 3 sec; 236-mmf; (included with C308; osc)
C316	3D9400-15	CAPACITOR, fixed: mica; 400-mmf ±10%; 500-vdcw; (mixed grid cplg)
C318	3DA6-47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (mixer cathode bypass)
C319	3D9050-43	CAPACITOR, fixed: mica; 50-mmf ±5%; 250-vdcw; (osc grid)
C320	3DA6-47	CAPACITOR, fixed: paper; 6,000-mmf —10% +30%; 300-vdcw; (mixer screen bypass)
C321	3D9500-53	CAPACITOR, fixed: mica; 500-mmf ±5%; 250-vdcw; (included with T307; i-f transf No. 1 pri)
C322	3D9500-53	CAPACITOR: same as C321; (i-f transf No. 1 sec)
C323	3DA6-47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (included with T307; mixer plate bypass)
C324	3DA6-16	CAPACITOR, fixed: mica; 6,000-mmf ±10%; 300-vdcw; (1st i-f grid bypass)
C325	3D9500-42	CAPACITOR, fixed: mica; 500-mmf ±10%; 500-vdcw; osc plate blocking)
C326	3D9650	CAPACITOR, fixed: mica; 650-mmf ±0.5%; 250-vdcw; (osc padder band 1)
C327	3DA1.100-1	CAPACITOR, fixed: mica; 1,100-mmf ±0.5%; 250-vdcw; (osc padder band 2)
C328	3D9050V-14	CAPACITOR, variable: 25-mmf; air trimmer; (osc band 1)
C330	3D9025V-15	CAPACITOR, variable: 25-mmf; air trimmer; (osc band 2)
C332	3D9030-11	CAPACITOR: 30-mmf +10%, —0%; (h-f osc band 1 and band 2)
C333	3D9030-7	CAPACITOR, fixed: mica; 30-mmf ±5%; 250-vdcw; (osc tuning band 2)
C368	3D9030-6	CAPACITOR: 30-mmf ±5%; (band 1 padder comp)
R306	3Z6801-19	RESISTOR: metallized; 1.0 meg; (mixer grid)
R307	3Z6033-2	RESISTOR: metallized; 330-ohm ±5%; ½ w; (mixer cathode bias)
R308	3Z6651-1	RESISTOR: metallized; 51,000-ohm ±5%; ½ w; (osc grid)
R309	3Z6639	RESISTOR: metallized; 39,000-ohm ±5%; ½ w; (osc plate)
R310	3Z6611-6	RESISTOR: metallized; 12,000-ohm ±5%; ½ w; (mixer screen)
R311	3Z6220-3	RESISTOR: metallized; 2,200-ohm ±10%; ½ w; (included with T307; mixer plate filter)
R312	3Z6647-3	RESISTOR: metallized; 47,000-ohm ±10%; ½ w; (included with T307; 1st r-f grid filter)
R347	3Z6682	RESISTOR: metallized; 82,000-ohm ±10%; ½ w; (included with T307; i-f transf)
R348	3Z6682	RESISTOR: same as R347; (i-f transf)
S305A	2C4452A/S4	SWITCH: (included with S305; osc section band)
S305B	2C4452A/S4	SWITCH: (included with S305; osc section band)
S305C	2C4452A/S4	SWITCH: (included with S305; osc section band)
T305	2C4452A/C8	COIL: (osc band 1)
T306	2C4452A/C9	COIL: (osc band 2)
T307	2C4452A/T7	TRANSFORMER: (1st i-f)
V302	2T132	TUBE: JAN-12K8 (VT-132); or JAN-12K8Y (VT-132); (converter)
X302	2C6530-653A/S9	SOCKET: (converter tube)

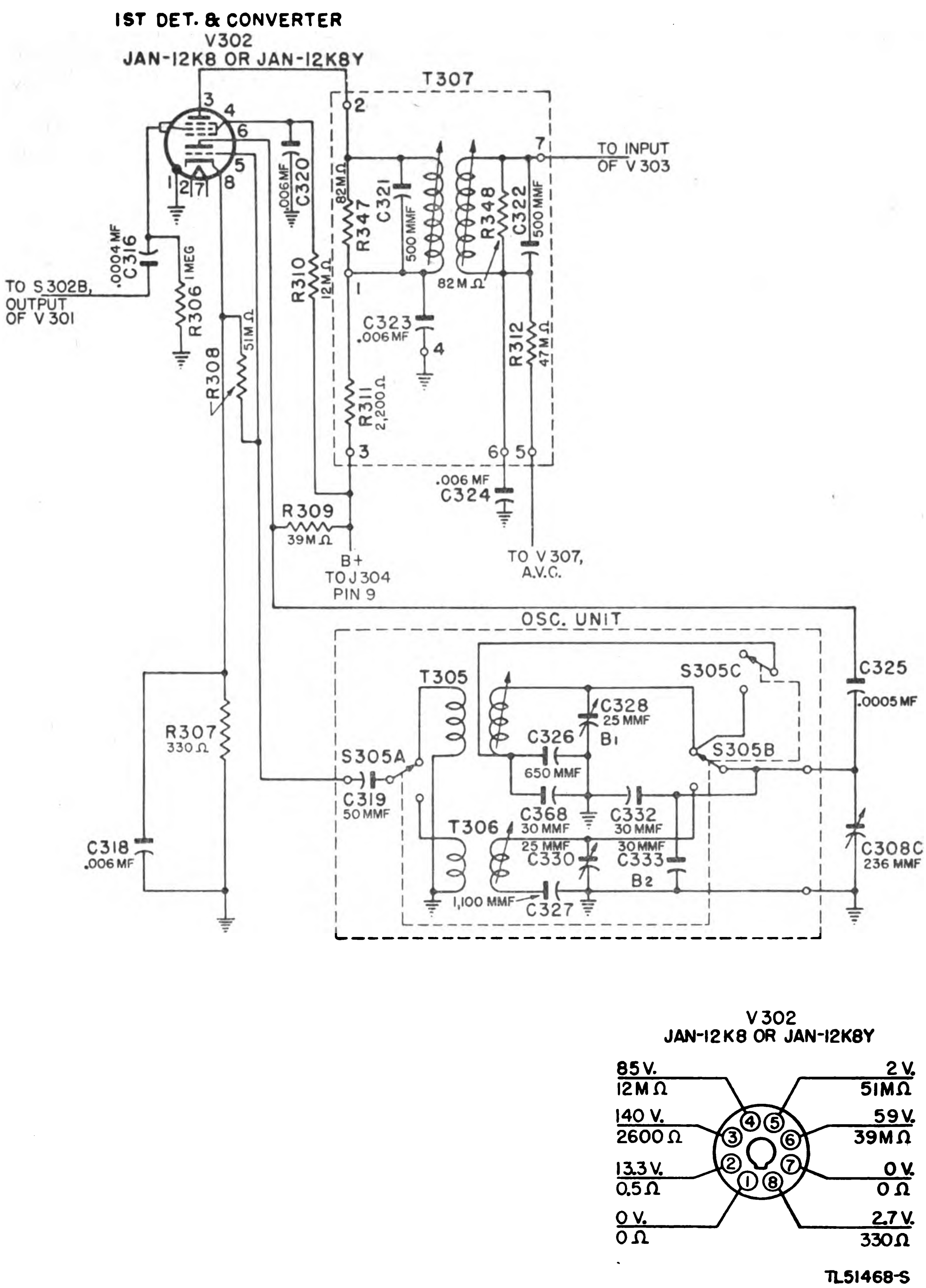

Figure 16. First detector and converter stage schematic, Radio Receiver BC-652-A.

a 0.006-mf capacitor and noting the effect upon the gain.

c. REPLACEMENT OF PARTS. (1) *Ganged tuning capacitor.* (See par. 41.)

(2) *Antenna or radio-frequency coil assemblies.* (See par. 42.)

28. First Detector and Converter Stage

a. STAGE DATA. (1) First detector and converter stage schematic shown in figure 16.

(2) Voltage and resistance values for socket terminals of Tube JAN–12K8 (V302) to ground, shown on stage schematic.

(3) Parts data for first detector and converter stage, table X.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground with the diagram shown on the first detector and converter stage schematic. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage. The voltage on terminal No. 5 of tube V302 may have an appreciable negative value when measured with a d-c vacuum-tube voltmeter if the oscillator is operating.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the parts location drawings, figures 9 and 10. Check the switches in all positions. Check for broken leads, faulty soldered joints and shorts.

(4) *No oscillation on one band.* Check the transformer connections corresponding to the particular band in question.

(5) *No oscillation on both bands.* (*a*) Check that the resistance to ground from the stator plates of capacitor C308C is infinite. Make the check with the BAND CHANGE switch in both positions and with various positions of the tuning capacitor.

(*b*) Check capacitor C318 for open-circuit by paralleling it with a 0.006 mf capacitor and note the effect upon the oscillation.

c. REPLACEMENT OF PARTS. (1) *Ganged tuning capacitor.* (See par. 41.)

(2) *Oscillator coil assembly.* (See (par. 42.)

(3) *Transformer assembly T307.* (See par. 43.)

Table XI

(fig. 17)

PARTS DATA, FIRST I-F AMPLIFIER STAGE

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C334	3DA6–47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (1st i-f cathode bypass)
C335	3D9500–53	CAPACITOR: molded silver cap; mica; 500-mmf ∓5%; 250-vdcw; (included with T308; i-f transf No. 2 pri)
C336	3D9500–53	CAPACITOR: same as C335; (i-f transf No. 2 sec)
C337	3DA6–47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (included with T308; 1st i-f plate bypass)
C338	3DA6–47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (2d i-f grid bypass)
R313	3Z6120–5	RESISTOR: metallized; 1,200-ohm ±5%; ½ w; (1st i-f cathode bias)
R314	3Z6220–3	RESISTOR: metallized; 2,200-ohm ±10%; ½ w; (included with T308; 1st i-f plate filter)
R315	3Z6647–3	RESISTOR: metallized; 47,000-ohm ±10%; ½ w; (included with T308; 2d i-f grid filter)
R336	3Z6033–2	RESISTOR: 330-ohm ±5%; ½ w; (1st i-f cathode bias)
R349	3Z6682	RESISTOR: metallized; 82,000-ohm ±10%; ½ w; (included with T308; i-f transf)
R350	3Z6682	RESISTOR: same as R349; (i-f transf)
T308	2C4452A/T8	TRANSFORMER: (2d i-f)
V303	2T131	TUBE JAN-12SK7 (VT-131): (1st i-f)
X303	2C6530–653A/S9	SOCKET: (1st i-f tube)

29. First Intermediate-Frequency Amplifier Stage

a. STAGE DATA. (1) First i-f amplifier stage schematic shown in figure 17.

(2) Voltage and resistance values for socket terminals of Tube JAN–12SK7 (V303) to ground, shown on stage schematic.

(3) Parts data for first i-f amplifier stage, table XI.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test with the tube checker and replace with a new tube if necessary. In replacing the tube, see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground with the diagram shown on the first i-f amplifier stage schematic. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage. The voltage of terminal No. 4 may be appreciably negative when measured with a d-c vacuum-tube voltmeter.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the parts identification drawings, figures 9 and 10. Check for broken leads, faulty soldered joints and shorts.

(4) *Low gain.* Check capacitor C334 for open-circuit by paralleling it with a 0.006-mf capacitor and noting the effect upon the output.

c. REPLACEMENT OF TRANSFORMER ASSEMBLY T308. For replacement of transformer assembly T308, see paragraph 43.

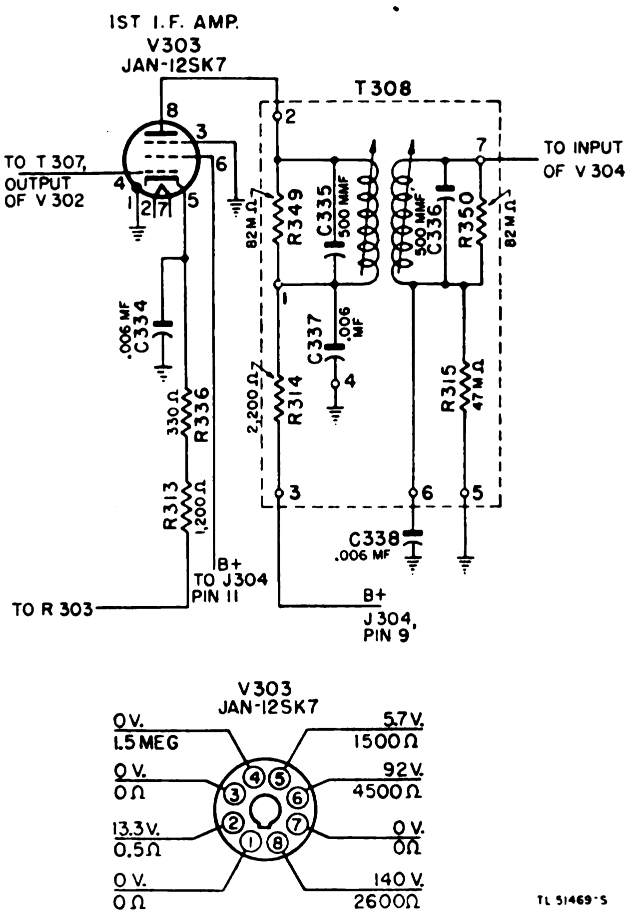

Figure 17. First intermediate-frequency amplifier stage schematic, Radio Receiver BC–652–A.

30. Second Intermediate-Frequency Amplifier and Noise Limiter Stage

a. STAGE DATA. (1) Second i-f amplifier and noise limiter stage schematic shown in figure 18.

(2) Voltage and resistance values for socket terminals of Tube JAN–12C8 (V304) to ground, shown on stage schematic.

(3) Parts data for second i-f amplifier and noise limiter stage, table XII.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube, see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground with the diagram shown on the second i-f amplifier and noise limiter stage schematic. After trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check referring to the parts identification drawings, figures 9 and 10. Check for broken leads, faulty soldered joints, and shorts.

(4) *Low gain.* If the stage gain is low, check capacitor C339 for open-circuit by paralleling it with a 0.006-mf capacitor and noting the effect upon the output.

c. REPLACEMENT OF TRANSFORMER T309. (See paragraph 43 when replacing transformer assembly T309).

Table XII

(fig. 18)

PARTS DATA, SECOND I-F AMPLIFIER AND NOISE LIMITER STAGE

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C339	3DA6–47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (2d i-f cathode bypass)
C340	3D9500–53	CAPACITOR, fixed: mica; 500-mmf ±5%; 250-vdcw; (included with T309; i-f transf No. 3 pri)
C341	3D9500–53	CAPACITOR: same as C340; (i-f transf No. 3 sec)
C342	3DA6–47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (included with T309; 2d i-f plate bypass)
C366	3DA6–47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (screen bypass)
R316	3Z6033–2	RESISTOR: metallized; 330-ohm ±5%; ½ w; (2d i-f cathode bias)
R317	3Z6805A6	RESISTOR: metallized; 5.6-meg ±10%; ½ w; (noise suppressor)
R318	3Z6220–3	RESISTOR: metallized; 2,200-ohm ±10%; ½ w; (included with T309; 2d i-f plate filter)
R345	3Z6647–3	RESISTOR: metallized; 47,000-ohm ±10%; ½ w; (screen filter)
R351	3Z6682	RESISTOR: metallized; 82,000-ohm ±10%; ½ w; (included with T309; i-f transf)
R352	3Z6682	RESISTOR: same as R351; (i-f transf)
T309	2C4452A/T9	TRANSFORMER: (3d i-f)
V304	2T153	TUBE JAN-12C8 (VT-169): (2d i-f and noise suppressor)
X304	2C6530–653A/S9	SOCKET: (2d i-f and noise suppressor tube)

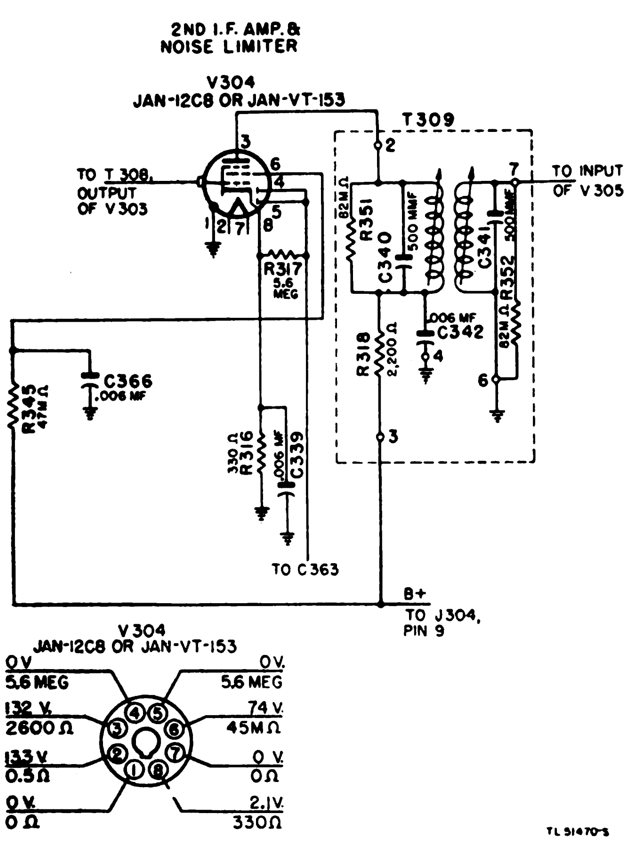

Figure 18. Second intermediate-frequency and noise limiter stage schematic, Radio Receiver BC–652–A.

31. Third Intermediate-Frequency Amplifier Stage

a. STAGE DATA. (1) Third i-f amplifier stage shown in figure 19.

(2) Voltage and resistance values for socket terminals of Tube JAN–12SK7 (V305) to ground, shown on stage schematic.

(3) Parts data for third i-f amplifier, table XIII.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Ground terminal No. 8 of plug P302 and check the voltages and resistances from the socket terminals to ground with the diagram shown on the third i-f amplifier stage schematic. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check referring to the parts identification draw-

ings, figures 9 and 10. Check for broken leads, faulty soldered joints and shorts.

(4) *Low gain.* Check capacitor C343 for open-circuit by paralleling it with a 0.006-mf capacitor and noting the effect upon the output.

c. REPLACEMENT OF TRANSFORMER ASSEMBLY T310. See paragraph 43 for the method of replacing transformer T310.

Table XIII

(fig. 19)

PARTS DATA, THIRD I-F AMPLIFIER STAGE

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C331	3DA6–47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (screen bypass)
C343	3DA6–47	CAPACITOR: same as C331; (cathode bypass)
C344	3D9525	CAPACITOR, fixed: mica; 525-mmf ±5%; 250-vdcw; (included with T310; i-f transf No. 4 pri)
C345	3D9215	CAPACITOR, fixed: mica; 215-mmf ±5%; 250-vdcw; (included with T310; i-f transf)
C347	3DA6–47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (included with T310; plate bypass)
C348	3D9200–19	CAPACITOR, fixed: mica; 200-mmf ±10%; 500-vdcw; (included with T310; diode filter)
C349	3D9300–3	CAPACITOR, fixed: mica; 300-mmf ±10%; 500-vdcw; (included with T310; diode filter)
R319	3Z6051	RESISTOR: metallized; 510-ohm ±5%; ½ w; (cathode bias)
R322	3Z6082–1	RESISTOR: metallized; 820-ohm ±10%; ½ w; (included with T310; plate filter)
R324	3Z6639–7	RESISTOR: metallized; 39,000-ohm ±10%; ½ w; (included with T310; diode filter)
R340	3Z6615–22	RESISTOR: metallized; 15,000-ohm ±5%; ½ w; (screen filter)
T310	2C4452A/T10	TRANSFORMER: (4th i-f)
V305	2T131	TUBE JAN–12SK7 (VT–131): (3d i-f)
X305	2C6530–653A/S9	SOCKET: (3d i-f tube)

32. Beat-Frequency-Oscillator Stage

a. STAGE DATA. (1) The beat-frequency-oscillator stage is shown in figure 20.

(2) Voltage and resistance values for socket terminals of Tube JAN–12K8 (V306) to ground, shown on stage schematic.

(3) Parts data for beat-frequency oscillator stage, table XIV.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from the socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* With the CW-MVC-AVC switch set to CW, check the voltages and resistances from the socket terminals to ground with the diagram shown on the beat-frequency oscillator stage schematic. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic, figure 20. Check the switches in all positions. Check for broken leads, faulty soldered joints and shorts.

(4) *Additional checks.* Measure the voltage of terminal No. 6 of Tube V306 with an a-c vacuum-tube voltmeter. If no r-f voltage is indicated and the previously described checks have been made, transformer T311 is probably faulty and should be replaced.

c. REPLACEMENT OF TRANSFORMER T311. (1) *Removal.* Remove end plate (fig. 3) from receiver unit chassis by removing eight screws on sides and four screws on top of end plate. Unsolder and tag the wires from plug P302. Trace wire leads from the transformer to their terminals. Unsolder wires and tag the terminals, noting color scheme of wires. Loosen the two nuts holding the transformer to the chassis.

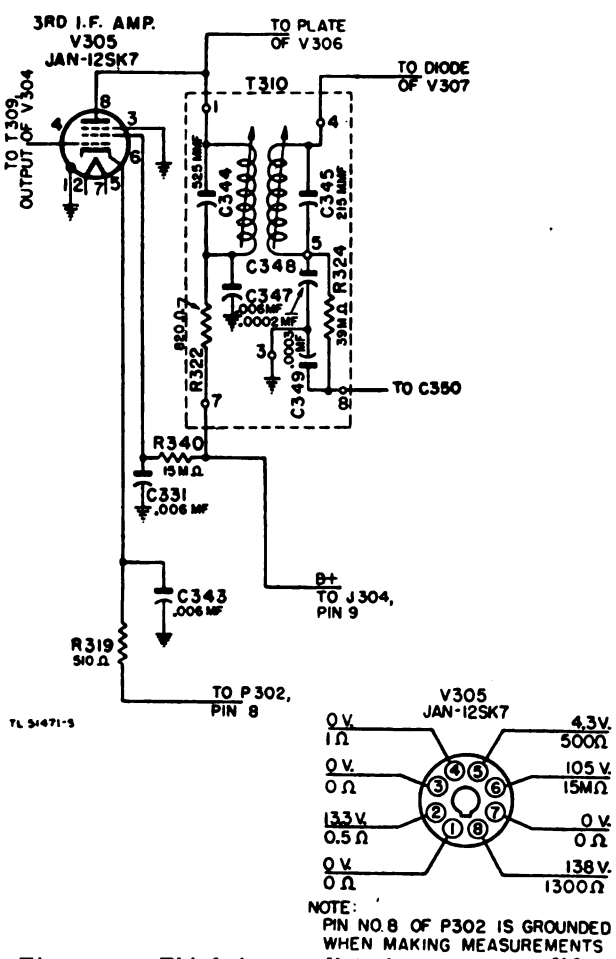

Figure 19. Third intermediate-frequency amplifier stage schematic, Radio Receiver BC–652–A.

Pull transformer and leads from the chassis.

(2) *Replacement.* Insert leads of the new transformer into the hole in the chassis, and fasten the transformer to the chassis by means of the two nuts. Remove all excess solder from disconnected wires and lugs. Resolder transformer leads to their proper lugs. Replace end plate of chassis by means of the 12 screws. Resolder wires from the receiver to the power plug.

33. Second-Detector, A-V-C, and First Audio-Amplifier Stage

a. STAGE DATA. (1) Second detector, a-v-c and first audio-amplifier stage, shown in figure 21.

(2) Voltage and resistance values for socket terminals of Tube JAN–12SR7 (V307) to ground, shown on stage schematic.

(3) Parts data for second detector, a-v-c and first audio-amplifier stage, table XV.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from the socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube, see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground with the diagram shown on the stage schematic. After trouble

Table XIV
(fig. 20)

PARTS DATA, BEAT-FREQUENCY OSCILLATOR STAGE

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C312	3DA6–47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (plate filter)
C351	3D9025–17	CAPACITOR, fixed: mica; 25-mmf ±10%; 500-vdcw; (included with T311; grid blocking)
C352	3DA6–47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (screen by-pass)
C353	3D9500–42	CAPACITOR, fixed: mica; 500-mmf ±10%; 500-vdcw; (included with T311; plate blocking)
C354	3D9025–18	CAPACITOR: 25-mmf ±5%; (included with T311; (compensator)
C355	3D9345–1	CAPACITOR, fixed: mica; 345-mmf ±0.5%; 250-vdcw; (included with T311; tuning)
C356	3D9050V–28	CAPACITOR, variable: 50-mmf; air trimmer; (tuning)
R325	3Z6715–14	RESISTOR: metallized; 150,000-ohm ±5%; ½ w; (included with T311; (grid)
R326	3Z6624	RESISTOR: metallized; 24,000-ohm ±5%; ½ w; (included with T311; (plate)
R327	3Z6612–6	RESISTOR: metallized; 12,000-ohm ±10%; ½ w; (screen)
R339	3Z6022–7	RESISTOR: metallized; 220-ohm ±10%; ½ w; (cathode bias)
R341	3Z6220–3	RESISTOR: metallized; 2,200-ohm ±10%; ½ w; (plate filter)
S303C	2C4452A/S3	SWITCH: (included in S303; CW–MVC–AVC)
T311	2C4452A/T11	TRANSFORMER: (b-f-o)
V306	2T132	TUBE JAN–12K8 (VT–132); or JAN–12K8Y (VT–132): (b-f-o)
X306	2C6530–653A/S9	SOCKET: (b-f-o tube)

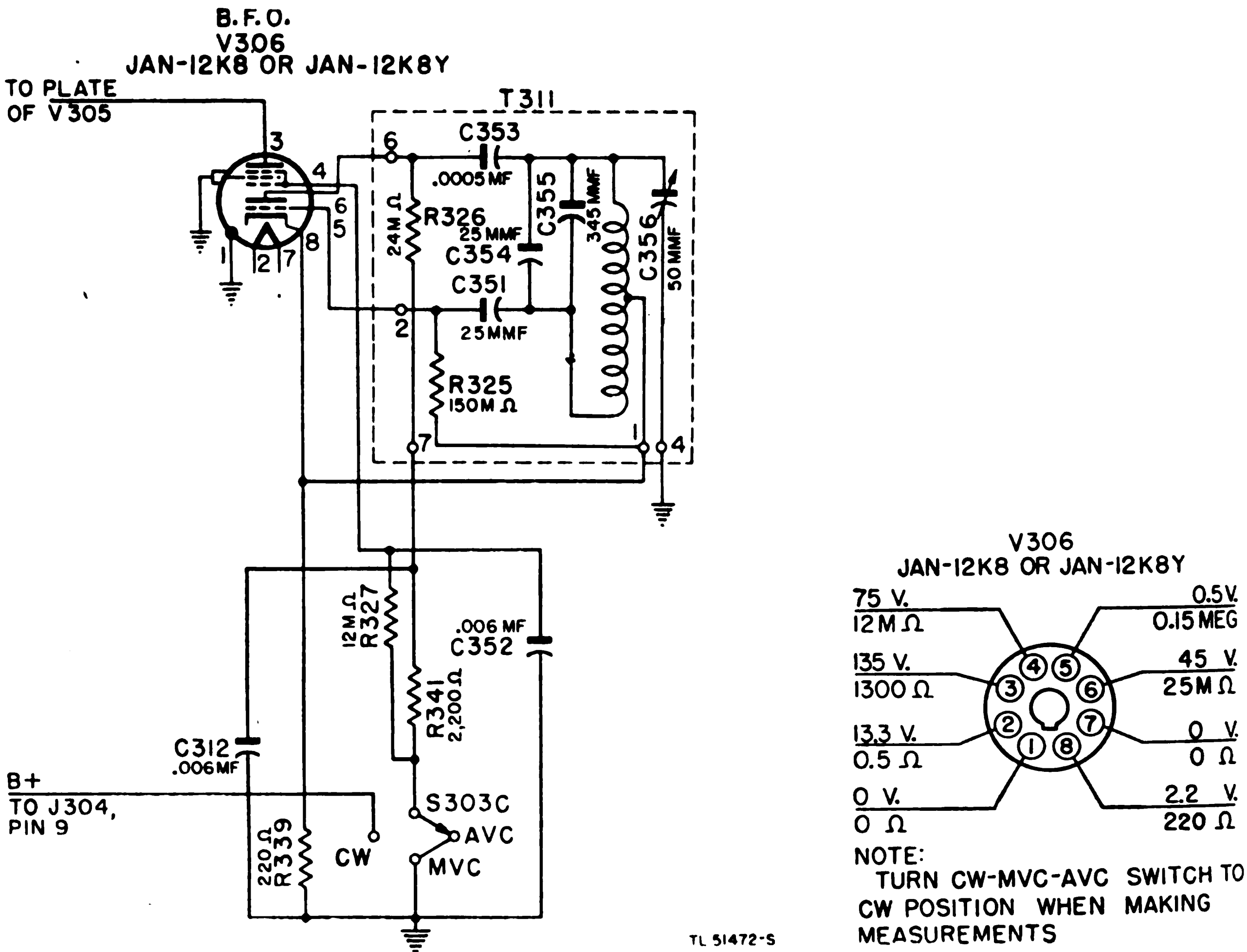

Figure 20. Beat-frequency oscillator stage schematic, Radio Receiver BC-652-A.

has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage. (The voltage on terminal No. 5 of V307 may have an appreciable negative value when measured with a d-c vacuum-tube voltmeter.)

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of the trouble, perform a point-to-point continuity check, referring to the parts identification diagrams, figures 9 and 10. Check for broken leads, faulty soldered joints and shorts.

(4) *Low audio output.* Check capacitor C357A by connecting a 12-mf, 50-vdcw, electrolytic capacitor from terminal No. 3 of tube V307 to ground, with its negative terminal grounded, and noting the effect on the gain.

(5) *Distortion.* Check capacitor C361 for open circuit by connecting a 500-mmf capacitor from terminal No. 6 of tube V307 to ground and noting the effect on the output.

(6) *Noise.* See that the resistance of terminal No. 2 of tube V307 to ground varies smoothly as the INCREASE OUTPUT control is rocked back and forth with the CW-MVC-AVC switch set to AVC.

c. Replacement of Transformer Assembly T310. See paragraph 43 for the procedure for replacing transformer assembly T310.

34. Audio-Output Amplifier Stage

a. Stage Data. (1) Audio-output amplifier stage schematic shown in figure 22.

(2) Voltage and resistance values for socket terminals of Tube JAN–6Y6G (V308) to ground, shown on stage schematic.

(3) Resistance values for audio-output transformer terminals to ground are shown on stage schematic.

Table XV

(fig. 21)

PARTS DATA, SECOND DETECTOR, A-V-C AND FIRST AUDIO STAGE

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C346	3D9050-33	CAPACITOR, fixed: mica; 50-mmf ±10%; 500-vdcw; (a-v-c diode cplg)
C357A	3DB12-11	CAPACITOR: electrolytic; dual sec; 12-mf +100%, —10%; 50-vdcw; (included with C357; 1st a-f cathode bypass)
C350	3DA6-16	CAPACITOR, fixed: mica; 6,000-mmf ±10%; 300-vdcw; (1st a-f cplg)
C358	3DA6-16	CAPACITOR, fixed: mica; 6,000-mmf ±10%; 300-vdcw; (2d a-f cplg)
C361	3D9500-42	CAPACITOR, fixed: mica; 500-mmf ±10%; 500-vdcw; (1st audio plate bypass)
C365	3DA6-16	CAPACITOR, fixed: mica; 6,000-mmf ±10%; 300-vdcw; (a-v-c line filter)
R302B	2C4452A/R1	RESISTOR: dual sec; 800,000-ohm max; (included with R302; m-v-c sensitivity)
R323	3Z6751	RESISTOR: metallized; 510,000-ohm ±5%; ½ w; (diode load)
R328	3Z6801-19	RESISTOR: metallized; 1.0-meg ±10%; ½ w; (a-v-c filter)
R329	3Z6751	RESISTOR: metallized; 510,000-ohm ±5%; ½ w; (a-v-c diode load)
R330	3Z6610-47	RESISTOR: metallized; 10,000-ohm ±5%; ½ w; (delay voltage divider)
R331	3Z6150-20	RESISTOR: metallized; 1,500-ohm ±10%; ½ w; (1st a-f cathode bias)
R332	3Z6675-11	RESISTOR: metallized; 75,000-ohm ±5%; ½ w; (delay voltage divider)
R333	3Z6700-43	RESISTOR: metallized; 100,000-ohm ±10%; ½ w; (1st a-f plate load)
S303B	2C4452A/S3	SWITCH: (included with S303; CW-MVC-AVC)
V307	2T133	TUBE JAN-12SR7 (VT-133): (1st a-f)
X307	2C6530 653A/S9	SOCKET: (1st a-f tube)

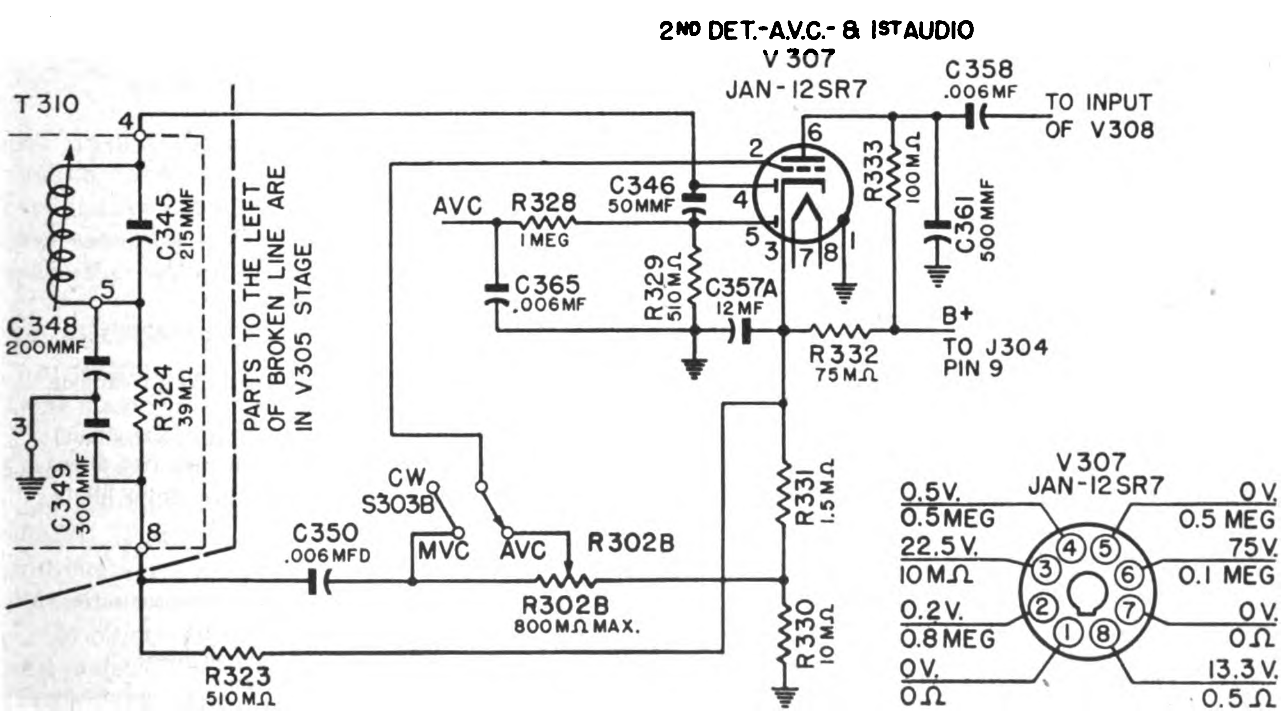

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Figure 21. Second detector, a-v-c and first audio-amplifier stage schematic, Radio Receiver BC-652-A.

(4) Parts data for audio-output amplifier stage, table XVI.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test with the tube checker and replace with a new tube if necessary. When replacing the tube, see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground with the diagram shown on the audio-output amplifier stage schematic. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage.

(3) *Resistance check at transformer terminals.* Check the resistances from the terminals of the audio-output transformer to ground in the plate circuit using the diagram shown on the schematic for audio-output amplifier stage.

(4) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the parts identification diagrams, figures 9 and 10. Check for broken leads, faulty soldered joints and shorts.

(5) *Low gain.* Check capacitor C360 for open-circuit by connecting a 50-mf, 25-vdcw, electrolytic capacitor between terminal No. 8 of tube V308 and ground, connecting the negative side to ground, and noting the effect upon the output.

(6) *Distortion.* Check capacitor C362 for open circuit by paralleling it with a 0.01-mf capacitor and noting the effect upon the output.

c. REMOVAL AND REPLACEMENT OF AUDIO-OUTPUT TRANSFORMER T312. (1) *Removal.* Remove the bottom plate of receiver chassis. Remove two nuts holding capacitor C362 to posts of each side of capacitor C360, and push capacitor C362 to one side. Remove nuts and screws holding capacitor C360 to the side of the chassis, and unsolder the leads to terminal of capacitor, marking all leads. Loosen two nuts in the bottom of the chassis, holding the audio-output transformer to the chassis. Unsolder and mark all leads to the six transformer terminals. It may be necessary to cut cabling cord to unsolder red, white and black leads from transformer terminals. Note the position of the No. 1 terminal and remove the output transformer.

(2) *Replacement.* Place the new transformer on the chassis with its anchoring screws inserted in their proper holes. Place terminal angle strips over the terminal, and tighten the nuts. Resolder all the leads to the proper terminals of the output transformer. Replace

Table XVI

(fig. 22)

PARTS DATA, AUDIO OUTPUT STAGE

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C359	3DA6-16	CAPACITOR, fixed: mica; 6,000-mmf ±10%; 300-vdcw; (noise suppressor cplg)
C360	3DB50-5	CAPACITOR: electrolytic; 50-mf +100%, —10%; 25-vdcw; (2d a-f cathode bypass)
C362	3DA10-76	CAPACITOR, fixed: mica; 10,000-mmf ±10%; 600-vdcw; (2d a-f plate shunt)
C363	3D9200-19	CAPACITOR, fixed: mica; 200-mmf ±10%; 500-vdcw; (audio high freq filter)
C364	3DA50-53	CAPACITOR, fixed: paper; 50,000-mmf ±10%; 400-vdcw; (h-v supply filter)
J301	2C4452A/J1	JACK JK-34-A: (loudspeaker)
J302	2C4452A/J1	JACK JK-34-A: (phone)
J303	2C4452A/J1	JACK JK-34-A: (phone)
R334	3Z6768	RESISTOR: metallized; 680,000-ohm ±10%; ½ w; (noise suppressor series)
R335	3Z6733-1	RESISTOR: metallized; 330,000-ohm ±10%; ½ w; (2d a-f grid)
R337	3Z6022-6	RESISTOR: wire-wound; 220 ohm ±10%; 2 w; (2d a-f cathode bias)
R344	2Z6051′	RESISTOR: metallized; 510-ohm ±5%; ½ w; (output screen)
R346		RESISTOR: metallized; 6,800-ohm ±10%; ½ w; (phone jack series)
R354	3Z6100-48	RESISTOR: metallized; 1,000-ohm ±10%; ½ w; (audio stabilizing)
R355		RESISTOR: metallized; 6,800-ohm ±10%; ½ w; (phone jack series)
T312	2C44528/T12	TRANSFORMER: (output)
V308	2T168A	TUBE JAN-6Y6G (VT-168-A): (audio output)
X308	2Z8367	SOCKET: (audio output tube)

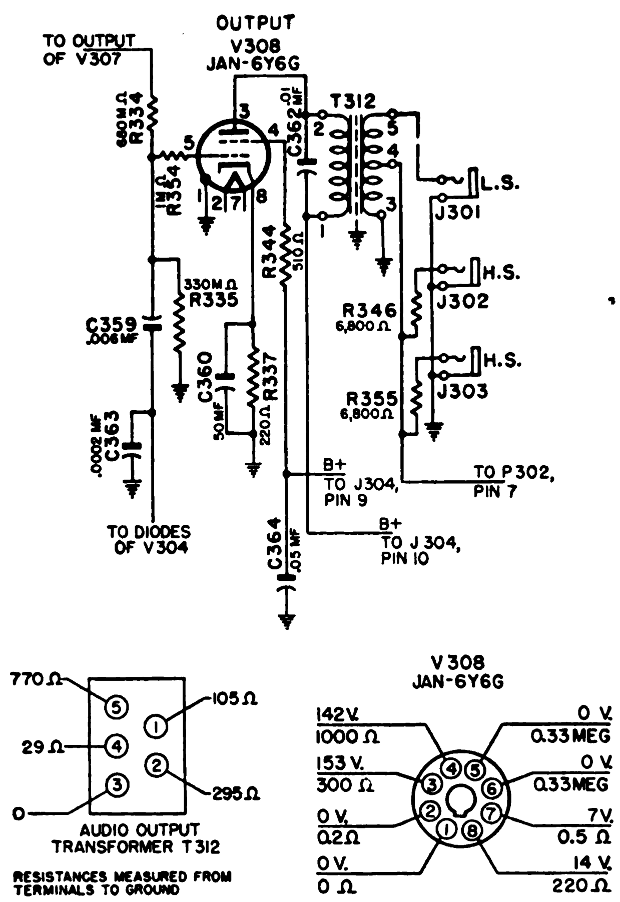


Figure 22. Audio output amplifier stage schematic, Radio Receiver BC–652–A.

and fasten capacitor C360 to the receiver chassis, and resolder leads to the capacitor terminal. Replace capacitor C362 on posts over capacitor C360, and tighten the nuts. Replace the bottom plate of the receiver chassis.

35. Power Circuit Connections Stage

a. STAGE DATA. (1) Power circuit connections stage shown in figure 23.

(2) Parts data for power circuit connections stage, table XVIII.

b. TROUBLE LOCATION. (1) *Lamps and fuse check.* Remove Lamps LM–52 and fuse F251, and check for continuity with ohmmeter. Replace if necessary.

(2) *Dynamotor check.* Remove dynamotor and inspect and clean as outlined in section III. Check dynamotor on a dynamotor test set using table II as a guide.

(3) *Power receptacles voltage and resistance check.* Check the voltages and resistances from the power receptacle terminals to ground against the values given in table XVII. After the trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage. Make resistance measurements with batteries disconnected. Voltages given are applicable when Dynamotor DM–40–A is used. Plugs P250 and P251 are inserted in their respective receptacles, except where otherwise specified.

Table XVII

VOLTAGES AND RESISTANCES AT POWER RECEPTACLES

Receptacle	Pin No.	Resistance (ohms)	Voltage (volts)
J304*	1	Infinite	14
	2	Infinite	0
	3	0	0
	4	0	13.3
	5	Infinite	0
	6	1	7
	7	0	0
	8	Infinite	0
	9	19,000	143
	10	Infinite	172
	11	14,000	92
	12	Infinite	0
J250†	1	0	0
	2	0	0
	3	1	14
	4	0	0
	5	Infinite	14
	6	19,000	172
P302	1	0	14
	2	0	14
	3	0	14
	4	0	14
	5	0	0
	6	Infinite	0
	7	29	0
	8	Infinite	0
	9	Infinite	0

* Resistance measurements are made with plug P251 removed from receptable J304.

† Resistance measurements are made with plug P250 removed from receptacle J250.

(4) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of the trouble, perform a point-to-point continuity check, referring to the parts locations diagrams, figures 7 through 10. Check for broken leads, faulty soldered joints and shorts.

(5) *Oscillation, motorboating.* Check filter capacitors C251–A, C251–B and C251–C by put-

Table XVIII
(fig. 23)

PARTS DATA, POWER CIRCUIT CONNECTIONS STAGE

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C251A	3DB16–2	CAPACITOR: electrolytic; 3 sec; 16-mf +75%, —10%; 350-vdcw; (included with 251; h-v filter)
C251B	3DB16–2	CAPACITOR: same as 251A; (h-v filter)
C251C	3DB16–2	CAPACITOR: same as 251A; (h-v filter)
C253	3DA6–47	CAPACITOR: paper; 0.006-mf —10%, +30%; 300-vdcw; (dynamotor input filter)
C254	3DB25–9	CAPACITOR: electrolytic; 25-mf +100%, —10%; 50-vdcw; (dynamotor input filter)
C255	3DA6–47	CAPACITOR: paper; 6,000-mmf —10%, +30%; 300-vdcw; (supply filter)
C256	3DA6–47	CAPACITOR: same as C255; (supply filter)
C257	3DA6–47	CAPACITOR: same as C255; (dynamotor input)
C258	3DA30–10	CAPACITOR: dielectric; paper; 0.03-mf +40%, —10%; 400-vdcw; (hash filter)
C329	3DA6–47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (screen bypass)
C370	3DA6–47	CAPACITOR: paper; 6,000-mmf —10%, +30%; 300-vdcw; (lead filter)
D251	3H1640A	DYNAMOTOR DM–40–A: d-c input, 14 v, 3.4 amp; d-c output, 172 v, 0.139 amp; 23.7 w; (receiver)
D252	3H1641A	DYNAMOTOR DM–41–A: d-c input, 28 v, 1.7 amp; d-c output, 172 v, 0.138 amp; 23.7 w; (receiver)
F251	3Z1942	FUSE FU–42; 20-amp; 25-v; (receiver input)
J250	6Z7799–6	RECEPTACLE: 6 contact; (dynamotor plug)
J304	2Z7403–3	RECEPTACLE: 12 contact; (crystal cable plug)
L252	2C4452A/C12	COIL: (dynamotor input choke)
L253	2C4452A/C12	COIL: (supply filter choke)
L301	2C4452A/C12	CHOKE COIL: (A supply r-f)
P250	2Z7228–17	PLUG: (dynamotor)
P251	2Z7228–16	PLUG: 12 contact; (connects cal. to receiver)
P302	2C4452A/P2	PLUG: 9 prong; banana plugs; (connects receiver to mounting)
R251	3Z6010–34	RESISTOR: wire-wound; 100-ohm ±5%; (filament ballast)
R252	3Z6008–2	RESISTOR: wire-wound; 80-ohm ±5%; (filament ballast)
R253	3Z6031A5	RESISTOR: wire-wound; 315-ohm ±5%; (B filter)
R320	3Z6300–16	RESISTOR: metallized; 3,000-ohm ±5%; 1 w; (screen divider)
R321	3Z6633–1	RESISTOR: metallized; 33,000-ohm ±10%; 1 w; (screen bleeder)
R338	3Z6001E9	RESISTOR: wire-wound; 15-ohm ±10%; 1 w; (dail lamp bleeder)
R342	3Z6300–16	RESISTOR: metallized; 3,000-ohm ±5%; 1 w; (screen bleeder)
R353	3Z6001E9	RESISTOR: wire-wound; 15-ohm ±10%; 1 w; (dial lamp bleeder)
S202	3Z8933	SWITCH: SPST; 3-amp, 250-v; (CFC ON-OFF switch)
S306	2C4452A/S5	SWITCH: (includes knob; receiver and trans modulator filament off-on)
V310	2Z5952	LAMP LM–52: (indicating)
V311	2Z5952	LAMP LM–52: (indicating)
X310	2C6530–653A/S11	SOCKET: (indicating lamp)
X311	2Z8724	SOCKET: (indicating lamp)

ting each in parallel with a 16-mf, 300-vdcw, electrolytic capacitor and noting whether the oscillation is stopped.

36. 200-KC Oscillator Stage

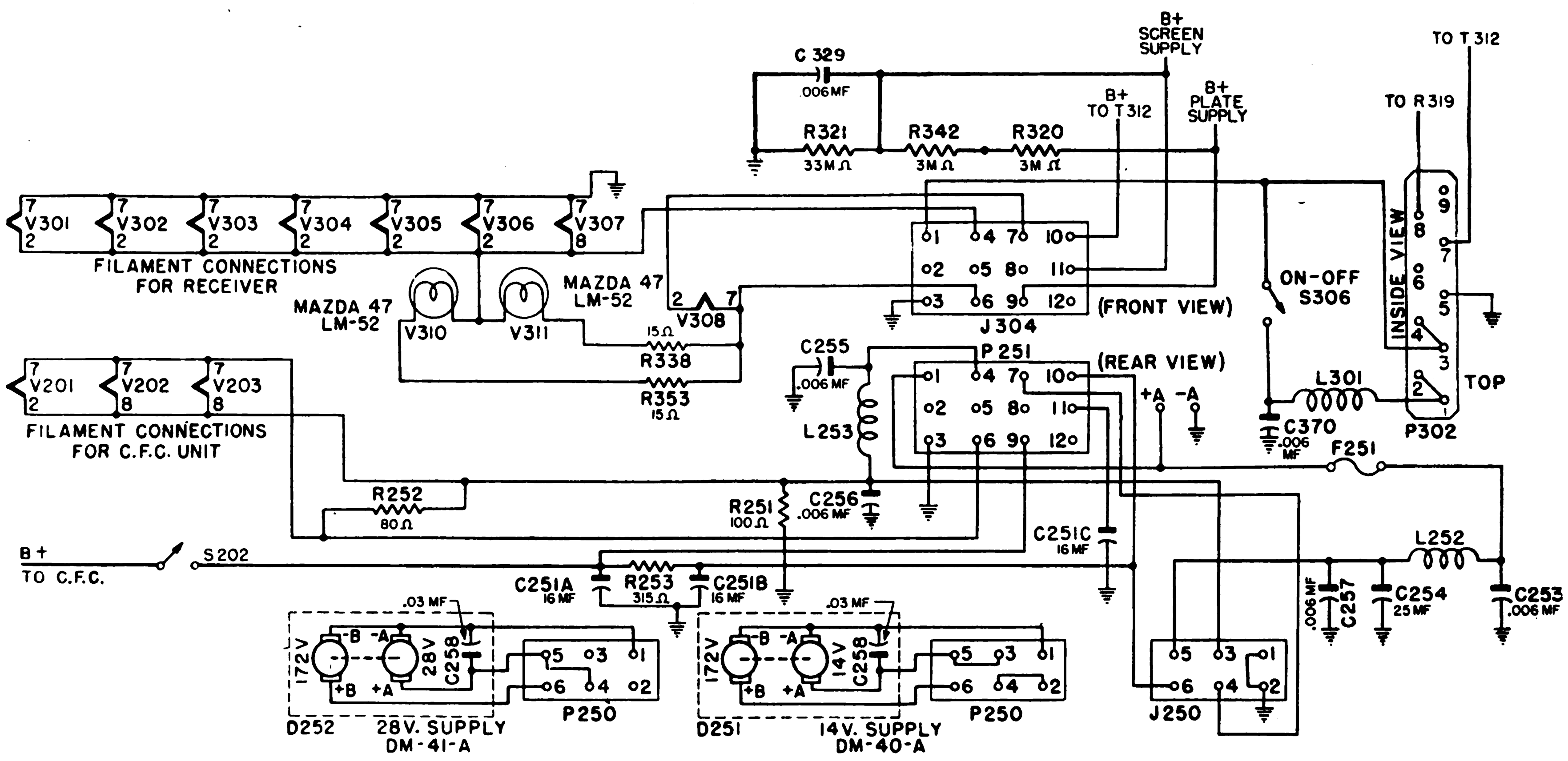
a. STAGE DATA. (1) 200-kc oscillator stage, shown in figure 24.

(2) Voltage and resistance values for socket terminals of Tube JAN–6K8 (V201) to ground, shown on stage schematic.

(3) Parts data for 200-kc oscillator stage, table XIX.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground with the diagram



PINS	1	2	3	4	5	6	7	8	9
RES.	0	0	0	0	0	INF	29	INF	INF
VOLTS	14	14	14	14	0	0	0	0	0

TESTS FOR PLUG P302

NOTE:
THESE TESTS ARE MADE WITH THE CASE REMOVED AND 14 VOLTS APPLIED TO THE BINDING POSTS ON THE C-F-C- CHASSIS
READINGS "INF" ARE CONSIDERED INFINITE

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Figure 23. Power circuit connections, Radio Receiver BC-652-A.

shown on the 200-kc oscillator stage schematic. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of the trouble, perform a point-to-point continuity check, referring to the parts location diagrams, figures 7 and 8. Check for broken leads, faulty soldered joints and shorts.

(4) *No oscillation.* Test for oscillation by measuring the voltage of terminal No. 6 of tube V201 to ground with an a-c vacuum-tube volt meter. If no indication is obtained, make the following checks:

(*a*) Check that the grid cap of V201 is connected to ground.

(*b*) Check capacitor C230 and its wiring for open circuit by connecting a 50-mmf capacitor between terminal No. 5 and terminal No. 6 of tube V201 and noting whether oscillation starts.

(*c*) Check capacitor C204 for open circuit by connecting a 6,000-mmf capacitor from terminal No. 8 of tube V201 to ground, and noting the effect upon the oscillation.

(*d*) Replace the crystal with a new unit.

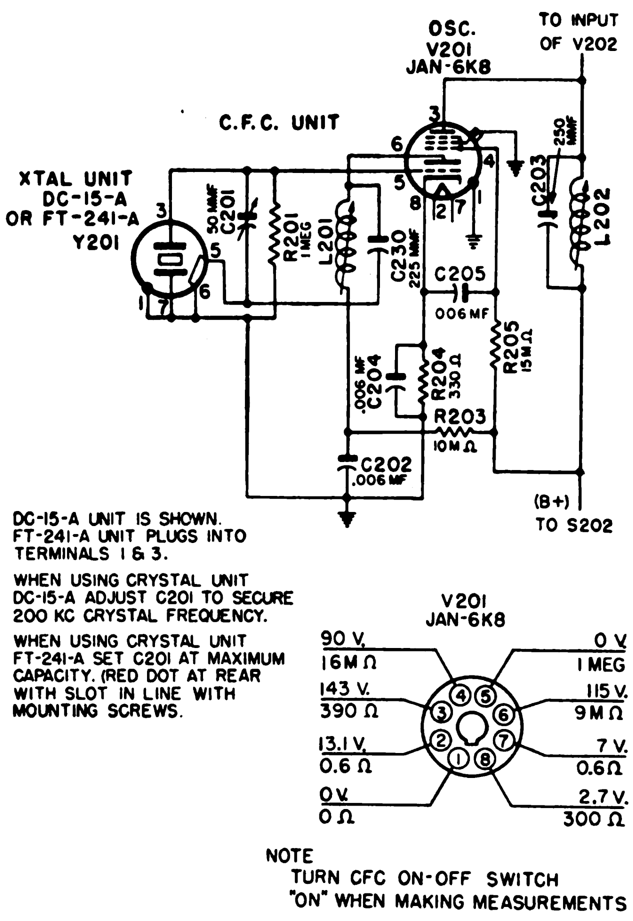

Figure 24. 200-kc oscillator stage schematic, Radio Receiver BC-652-A.

Table XIX
(fig. 24)
PARTS DATA, 200 KC OSCILLATOR STAGE

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C201	3D9050V-28	CAPACITOR, variable: 50-mmf air trimmer; (crystal padder)
C202	3DA6-47	CAPACITOR, fixed: molded paper; 6,000-mmf —10%, +30%; 300-vdcw; (crystal-oscillator plate bypass)
C203	3D9250-27	CAPACITOR, fixed: silver mica; 250-mmf ±5%; 250-vdcw; (hexode tank ckt)
C204	3DA6-47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (crystal-oscillator cathode bypass)
C205	3DA6-47	CAPACITOR, fixed: paper; 6,000-mmf —10%, +30%; 300-vdcw; (crystal-oscillator screen bypass)
C230	3D9225	CAPACITOR, fixed: mica; 225-mmf ±5%; 250-vdcw; (crystal-oscillator tank ckt)
L201	2C4452A/C10	COIL: (crystal-oscillator tank ckt)
L202	2C4452A/C11	COIL: (crystal-oscillator amplr tank ckt)
R201	3Z6801-19	RESISTOR: metallized; 1.0-meg ±10%; ½ w; (crystal-oscillator grid)
R203	3Z6610-47	RESISTOR: metallized; 10,000-ohm ±10%; ½ w; (crystal-oscillator plate)
R204	3Z6033-2	RESISTOR: metallized; 330-ohm ±10%; ½ w; (crystal-oscillator cathode)
R205	3Z6615-4	RESISTOR: metallized; 15,000-ohm ±10%; 1 w; (crystal-oscillator screen)
V201	2T167	TUBE JAN-6K8 (VT-167): (crystal-oscillator)
X201	2C6530-653A/S9	SOCKET: (crystal-oscillator tube)
X204	2C6530-653A/S9	SOCKET: (crystal)
Y201	2Z3501-15A or 2Z3501-24-A	CRYSTAL DC-15-A: 200 kc. CRYSTAL DC-24-A: 200 kc; in Holder FT-241-A

37. 100-KC Multivibrator Stage

a. STAGE DATA. (1) 100-kc multivibrator stage, shown in figure 25.

(2) Voltage and resistance values for socket terminals of Tube JAN-6SC7 (V202) to ground, shown on stage schematic.

(3) Parts data for 100kc multivibrator stage, table XX.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test with the tube checker and replace with a new tube if necessary. When replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground with the diagram shown on the 100-kc multivibrator stage schematic. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of the trouble, perform a point-to-point continuity check, referring to the parts location diagrams, figures 7 and 8. Check for broken leads, faulty soldered joints and shorts.

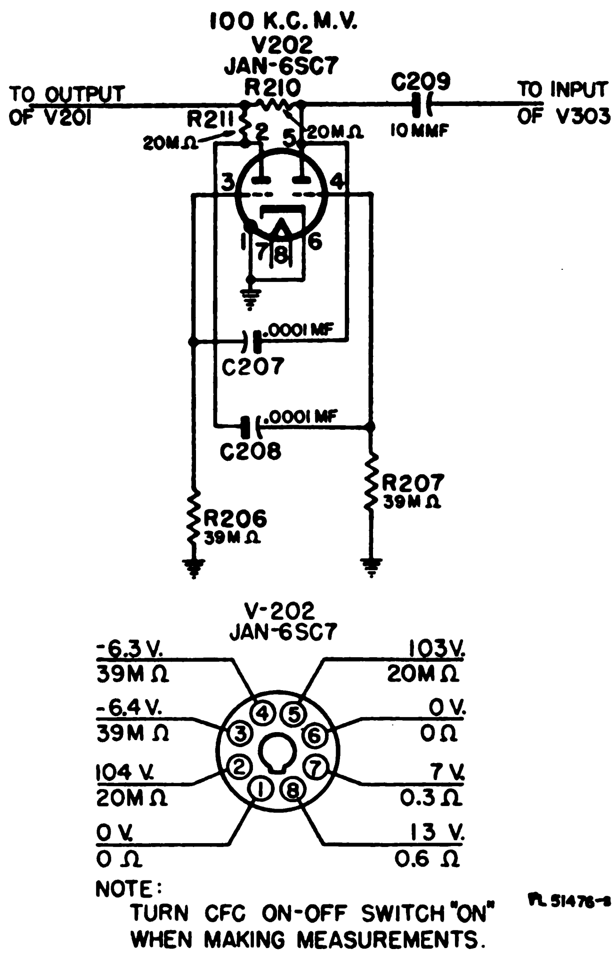

Figure 25. 100-kc multivibrator stage schematic Radio Receiver BC-652-A.

Table XX
(fig. 25)

PARTS DATA, 100-KC MULTIVIBRATOR STAGE

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C207	3D9100-54	CAPACITOR, fixed: mica; 100-mmf ±10%; 500-vdcw; (feedback)
C208	3D9100-54	CAPACITOR: same as C207; (feedback)
C209	3D9010-16	CAPACITOR, fixed: mica; 10-mmf ±10%; 500-vdcw; (cplg)
R206	3Z6639	RESISTOR: metallized; 39,000-ohm ±5%; ½ w; (grid)
R207	3Z6639	RESISTOR: same as R206; (grid)
R210	3Z6620-11	RESISTOR: metallized; 20,000-ohm ±5%; 1 w; (plate)
R211	3Z6620-11	RESISTOR: same as R210; (plate)
V202	2T105	TUBE JAN-6SC7 (VT-105); (100-kc multivibrator)
X202	2C6530-653A/S9	SOCKET: (100-kc multivibrator tube)

38. 20-KC Multivibrator Stage

a. STAGE DATA. (1) 20-kc multivibrator stage, shown in figure 26.

(2) Voltage and resistance values for socket terminals of Tube JAN-6SC7 (V203) to ground, shown on stage schematic.

(3) Parts data for 20-kc multivibrator stage, table XXI.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test with the tube checker and replace with a new tube if necessary. When replacing the tube, see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground with the diagram shown on the 20-kc multivibrator stage schematic. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of the trouble, perform a point-to-point continuity check, referring to the parts location diagrams, figures 7 and 8. Check for broken leads, faulty soldered joints and shorts.

Table XXI

(fig. 26)

PARTS DATA, 20 KC MULTIVIBRATOR STAGE

Ref. symbol	Signal Corps stock No.	Name of part, description and function
C210	3D9005-15	CAPACITOR, fixed: mica; 5-mmf ±10%; 500-vdcw; (output cplg)
C228	3D9400-13	CAPACITOR, fixed: silver mica; 400-mmf ±5%; 250-vdcw; (feedback)
C229	3D9400-13	CAPACITOR: same as C228; (feedback)
R208A		RHEOSTAT: 2 sec; 35,000-ohm max. ±20%; (adjustable grid)
R208B		RHEOSTAT: same as R208A; (adjustable grid)
R221	3Z6620-11	RESISTOR: metallized; 20,000-ohm ±5%; 1 w; (grid)
R222	3Z6620-11	RESISTOR: same as R221; (grid)
R223	3Z6651-2	RESISTOR: metallized; 51,000-ohm ±5%; 1 w; (plate)
R227	3Z6639-1	RESISTOR: metallized; 39,000-ohm ±5%; 1 w; (plate)
S201	3Z8933	SWITCH: SPST; 3 amp; 250 v; (100 to 20-kc interval)
V203	2T105	TUBE JAN-6SC7 (VT-105); (20-kc multivibrator)
X203	2C6530-653A/S9	SOCKET: (20-kc multivibrator tube)

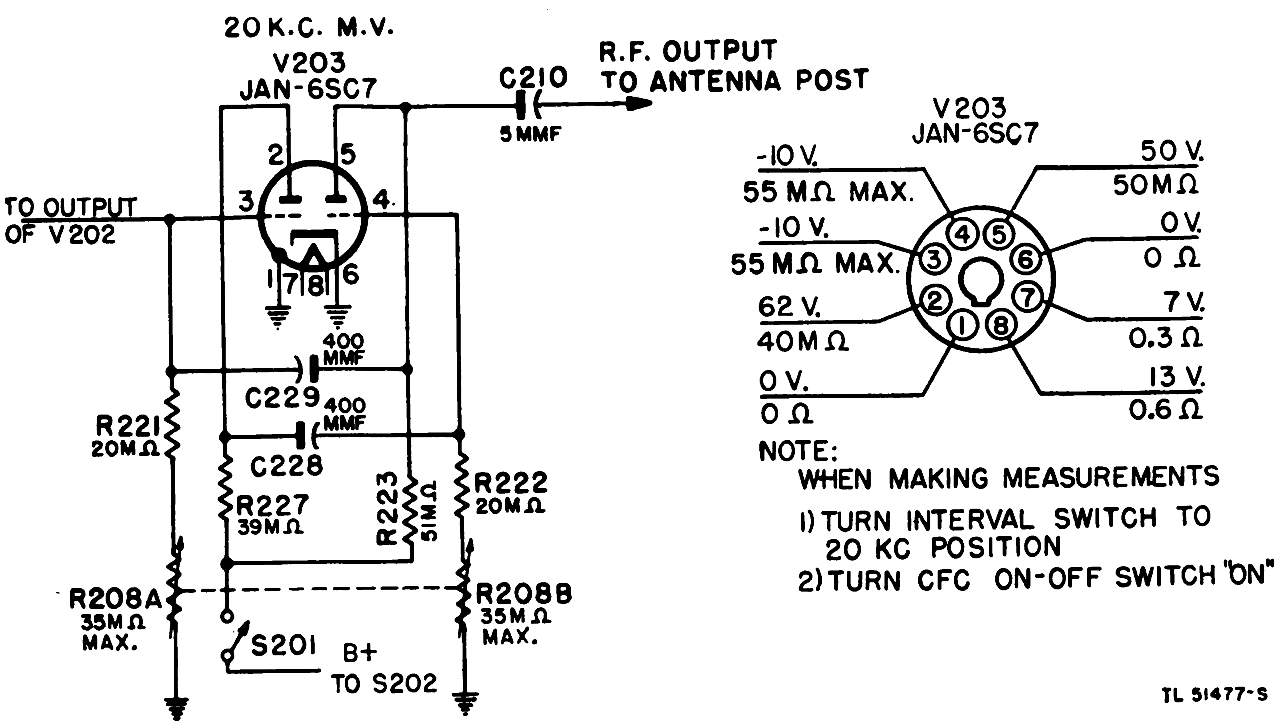

Figure 26. 20-kc multivibrator stage schematic, Radio Receiver BC-652-A.

SECTION IX

SUPPLEMENTARY DATA

39. Removal and Replacement of Front Panel

a. REMOVAL. Remove the crystal-frequency-calibrator chassis. Remove bottom plate of receiver chassis. Turn CW-MVC-AVC switch to AVC; turn BAND CHANGE knob to BAND 1 and turn ON-OFF switch to OFF. Turn INCREASE OUTPUT knob to maximum clockwise position. Using the Allen wrench clipped to back of outer case, loosen the two setscrews holding each knob and remove the knobs. Remove the TUNING knob by loosening two setscrews. Remove the washer and the spring clip from shaft of TUNING knob. Remove three screws from each side of the front panel and the two screws from the lower side of the panel. The clip angle in back of the panel will come loose. Remove the felt washers from the CW–MVC–AVC shaft and the ON-OFF shaft. Remove the plastic escutcheon on the front panel by loosening the four screws. Remove the pilot lamps and unsolder the wires from the lugs of the lamp socket. Remove front panel.

b. REPLACEMENT OF FRONT PANEL. Thread the wire lamp leads through the holes in the front panel, and place the front panel in position on the front of the receiver chassis. Be sure the lugs on the back of the front panel fit snugly into the holes of the front end of the receiver chassis. Fasten three screws on each side of the front panel. Resolder the lamp wires to the proper terminals of the lamp socket. Insert the bayonet type lamps into the sockets on the front panel, and replace the plastic escutcheon on the front panel with four screws. Place the angle clip on the back of the receiver front panel, and fasten the lower two screws through the front panel into the angle clip. Replace the metal and felt washers on the ON-OFF shaft and on the CW–MVC–AVC shaft. Replace the spring clip and the washer on the TUNING shaft. Replace all the knobs in the same position they occupied when removed, and tighten the setscrews in each knob with the Allen wrench. Replace the crystal-frequency-calibrator chassis and the bottom plate of receiver chassis.

40. Removal and Replacement of Tube Sockets

a. REMOVAL. To remove a tube socket, unsolder all the wires from the lugs and, with a screw driver, pry off the spring washer which holds the socket to the chassis, and press the tube socket out of the chassis. Note carefully the position of the keyway.

b. REPLACEMENT. Install the new socket with its keyway in exactly the same location as the one removed. Place the spring washer around the socket and press the spring washer down with a screw driver so that it slips into the grove of the socket.

41. Removal and Replacement of Ganged Tuning Capacitor

a. REMOVAL. Remove the bottom plate of the receiver chassis. Unsolder all connections to the lugs of the capacitor and mark the leads for proper reassembly. Turn the TUNING knob so that the concentric holes in the split spring gear on the ganged tuning capacitor shaft are accessible. Insert the tight-fitting pins through both holes of the split gears. Loosen the four nuts holding the unit to the receiver chassis and remove the unit.

b. REPLACEMENT. Carefully place the new or repaired unit into the receiver, making sure that the gears mesh properly. Fasten the unit to the chassis with four nuts. Resolder all wires to the proper lugs of the rotor and stator assembly. Turn the TUNING knob to the position where the pins holding the split spring gears can be removed, and remove the pins without bending the gears. Turn the TUNING knob to insure smooth operation. Replace the bottom plate of the receiver chassis.

42. Removal and Replacement of Antenna, Radio-Frequency, or Oscillator Assemblies

a. REMOVAL. Remove the crystal-frequency-calibrator chassis. Remove the bottom plate of the receiver chassis. Loosen the setscrew in the collar (back of panel) holding the shaft to the BAND CHANGE switch. Remove tube V304 in the rear of the OSC. coil can and pull the BAND CHANGE shaft out through the back. Remove the two screws located at the top of the can. Remove the two nuts located under the receiver chassis from threaded lugs attached to the can. Lift the can off. Trace the leads leaving the coil to their terminating point under the receiver chassis. Tag and unsolder these connections under the receiver chassis. Remove the four screws holding the coil to the chassis and remove the coil.

b. REPAIR. See figure 27 for parts location within the coil assemblies.

c. REPLACEMENT. Replace the new or repaired unit on the receiver chassis. Draw the leads through the receiver chassis, and bolt the coil to the chassis by means of the four bolts. Resolder the connections under the receiver chassis. Replace the can over the coil and replace the two screws on the top of the can, and the two nuts underneath the receiver chassis. Push the BAND CHANGE shaft through the cans into the collar and tighten the setscrew in the collar with the Allen wrench. Replace tube V304. Replace the crystal-frequency-calibrator chassis.

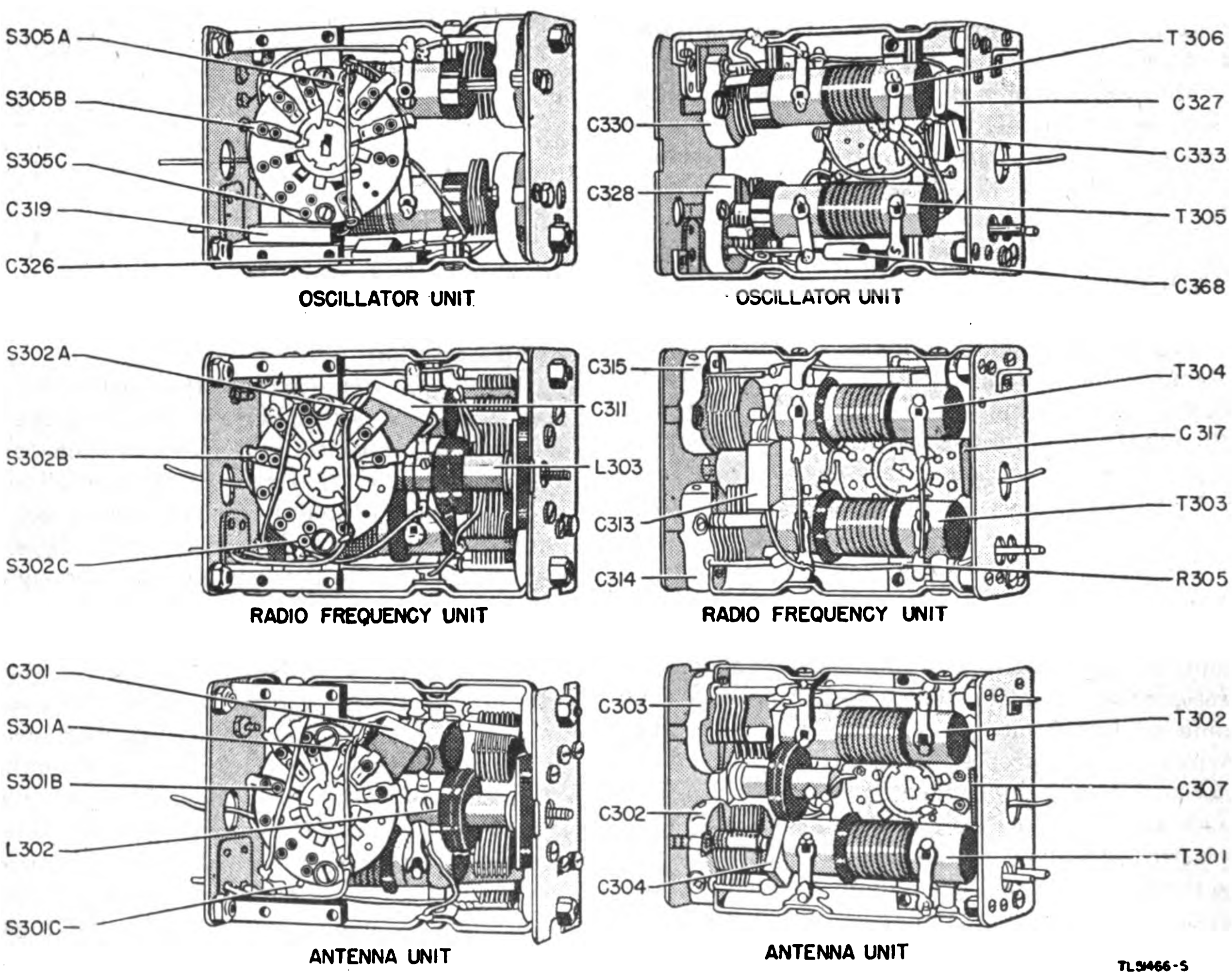

Figure 27. Antenna, radio-frequency and oscillator coil assemblies, Radio Receiver BC–652–A.

43. Removal and Replacement of Transformers T307, T308, T309, or T310

a. REMOVAL. Remove crystal-frequency-calibrator chassis. Remove the plate from the bottom of the chassis. Unsolder and tag all the leads connected to the lugs of the transformers. Note the position of lug No. 1, and when installing new transformer see that lug No. 1 occupies the same position. Remove the nuts from the screws that hold the transformer to the chassis, and remove the transformer.

b. REPLACEMENT. Set the new transformer on the chassis with lug No. 1 in the original position. Fasten the nuts to the screws holding the transformer to the chassis. Remove all the excess solder from the disconnected wires, and resolder the wires to the proper lugs. Replace the bottom plate on the receiver chassis, and replace the crystal-frequency-calibrator chassis.

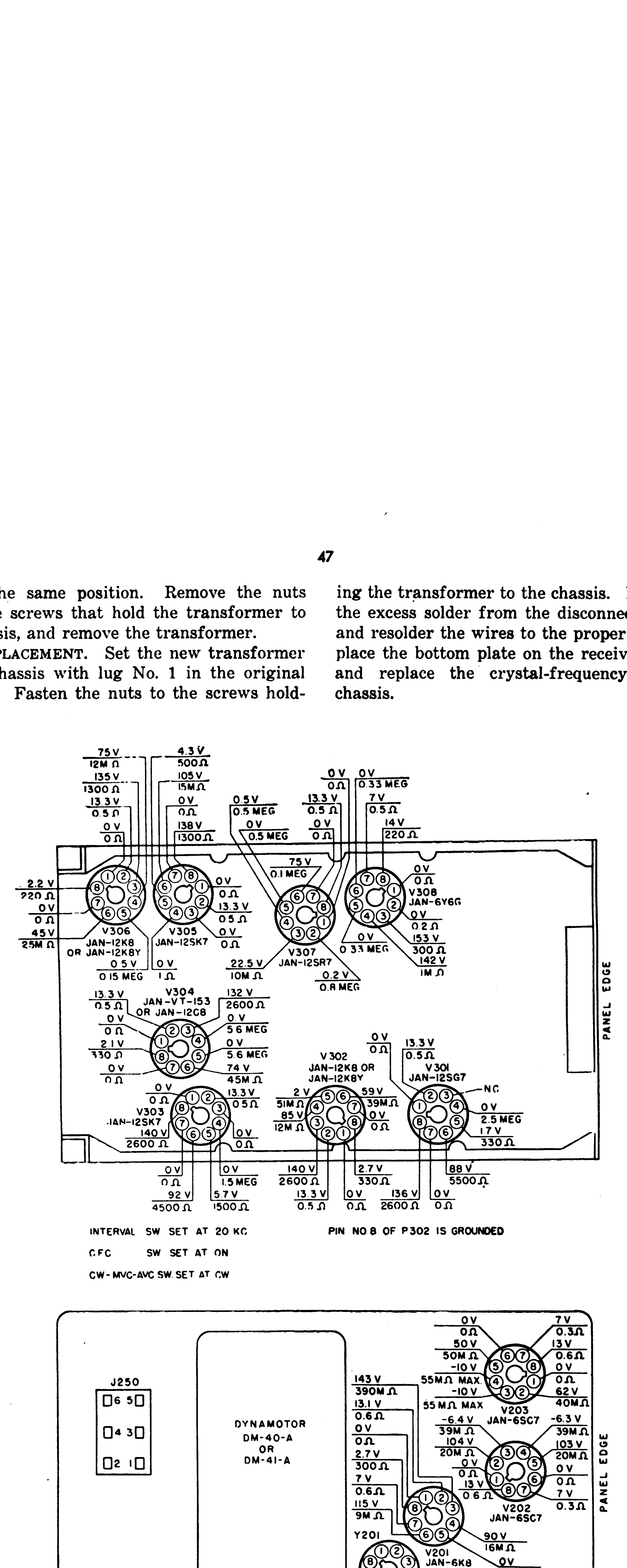

Figure 28. Tube socket voltages and resistances, Radio Receiver BC-652-A.

C201	50
C202	6000
C203	250
C204	6000
C205	6000
C207	100
C208	100
C209	10
C210	5
C228	400
C229	400
C230	225
C251A	16
C251B	16
C251C	16
C253	6000
C254	25
C255	6000
C256	6000
C257	6000
C258	.03
C301	10
C302	50
C303	50
C304	5
C305	400
C307	40
C308A	236
C308B	236
C308C	236
C309	6000
C310	6000
C311	30
C312	6000
C313	6000
C314	50
C315	50
C316	400
C317	40
C318	6000
C319	50

TM 11-4009

DEPARTMENT TECHNICAL MANUAL

RADIO RECEIVER AND TRANSMITTER BC-1306

REPAIR INSTRUCTIONS

RESTRICTED. DISSEMINATION OF RESTRICTED MATTER. No person is entitled solely by virtue of his grade or position to knowledge or possession of classified matter. Such matter is entrusted only to those individuals whose official duties require such knowledge or possession. (See also paragraph 23b, AR 380–5, 15 March 1944.)

DEPARTMENT • MAY 1945

WAR DEPARTMENT TECHNICAL MANUAL

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TM 11–4009, Radio Receiver and Transmitter BC–1306, Repair Instructions, is published for the information and guidance of all concerned.

[AG 300.7 (18 Apr 45).]

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Chief of Staff

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Refer to FM 21–6 for explanation of distribution formula.

WARNING

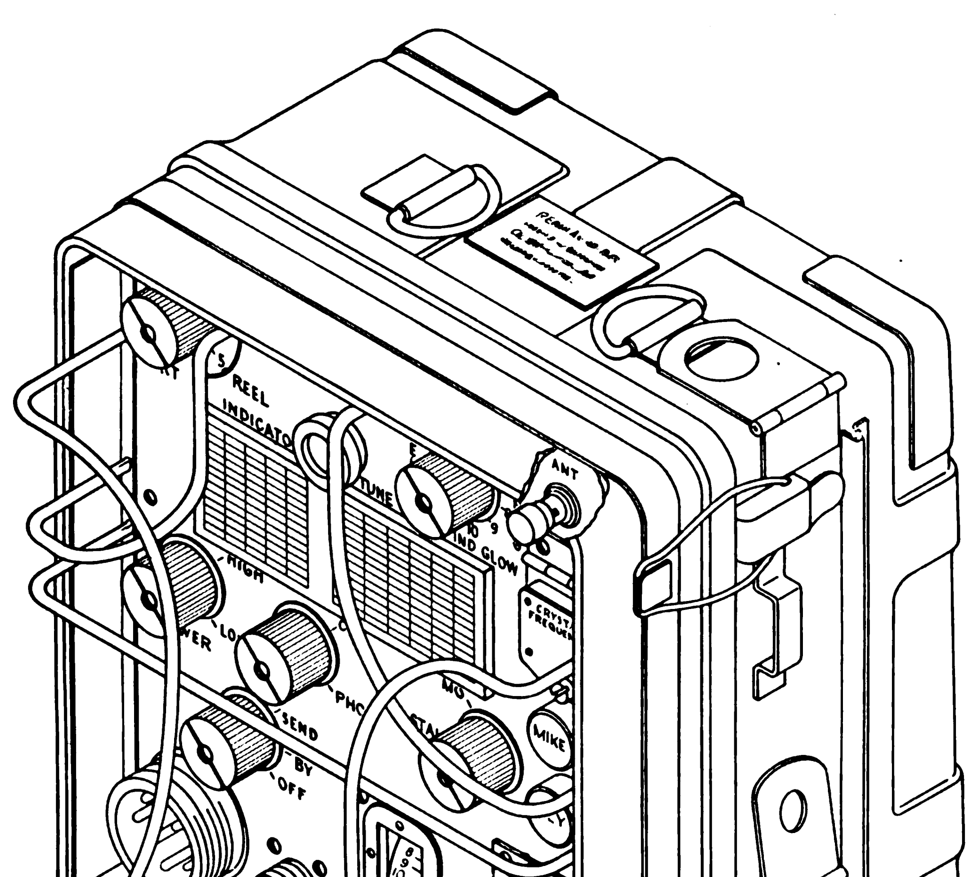
HIGH VOLTAGE

is used in the operation of
this equipment

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

CONTENTS



TL 70751

Figure 1. Radio Receiver and Transmitter BC-1306.

SECTION I

DESCRIPTION OF RADIO RECEIVER AND TRANSMITTER BC–1306*

1. General

a. USE. Radio Receiver and Transmitter BC–1306 is the basic component of a two-way telephone (phone) and radiotelegraph c-w (continuous-wave) set, designed to provide communication between moving or stationary vehicles, or as a portable field set. (See fig. 1.) Radio Receiver and Transmitter BC–1306 will transmit and receive amplitude-modulated radio telephone, and tone-modulated radiotelegraph (modulated-continuous-wave) signals. All types of transmission are master-oscillator-controlled or crystal-controlled.

b. FREQUENCY RANGE. Radio Receiver and Transmitter BC–1306 covers the frequency range of 3,800 to 6,500 kc (kilocycles). Crystals used in the transmitter operate at one-half the transmitted frequency.

c. OPERATING RANGE. Transmission and reception of voice communication up to 15 miles and radiotelegraph signals up to 30 miles may be secured.

d. POWER INPUT. The power necessary for operation of the transmitter and receiver is secured from a hand-driven Generator GN–58, or a gasoline engine-driven Power Unit PE–162, or Vibrator Power Unit PE–237, using appropriate cables. Power necessary to operate the receiver alone or STANDBY of the transmitter is provided by Battery BA–48, using Cord CD–1119.

e. POWER OUTPUT. The power output of the transmitter varies over wide limits, depending upon the type of power unit used and the position of the POWER switch 137. The normal power output under these various conditions is given in the following table:

Table I

Power Switch	Vibrator Power Unit PE–237		Generator GN–58	
Position	Phone	CW	Phone	CW
High	8.5 watts	25 watts	6 watts	17 watts
Medium ...	4.5 watts	21 watts	4 watts	14 watts
Low	2.2 watts	13 watts	2 watts	8.5 watts

Note. Vacuum-tube tolerances may decrease these outputs by 20 percent.

2. Theory of Operation

a. GENERAL. Radio Receiver and Transmitter BC–1306 may be rapidly switched manually from receive to transmit positions, using the same antenna system for transmission and reception. The receiver dial is directly calibrated in megacycles while the transmitter dial is calibrated 0 to 3,000. The signal path through the receiver and transmitter respectively, is shown in block diagram. (See figs. 2 and 3.)

*Refer to TM 11–230C for installation, operation, and other maintenance data on this equipment.

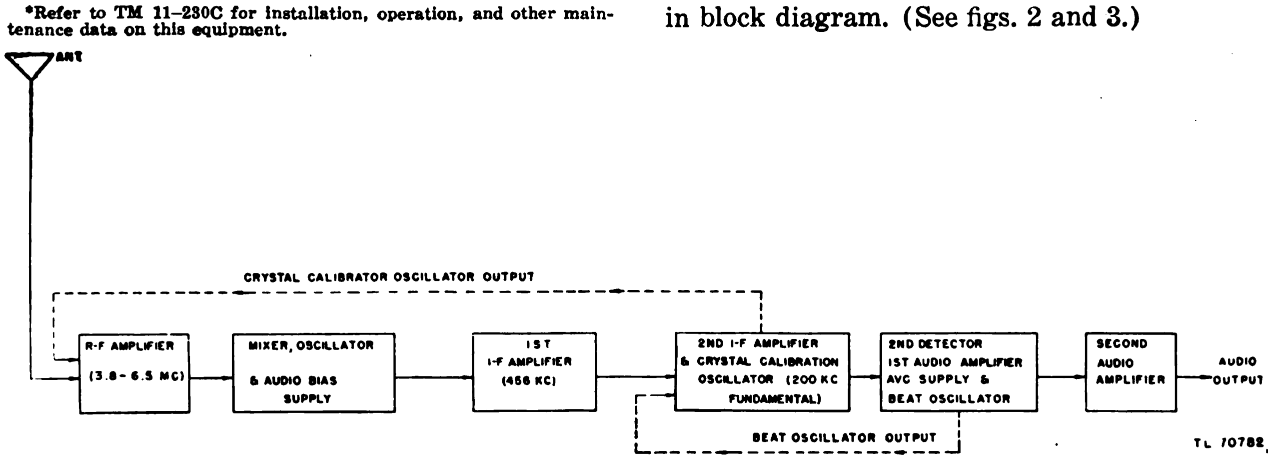


Figure 2. Block diagram, receiver of Radio Receiver and Transmitter BC–1306.

b. Receiver. The receiver section is a six-tube superheterodyne designed for the reception of c-w signals and for amplitude-voice modulated signals, in the band of 3.8 to 6.5 mc (megacycles). The received signal picked up by the antenna is coupled to the control grid of the r-f (radio-frequency) amplifier Tube JAN–1L4. The output of this tube is coupled to grid No. 6 of the mixer-oscillator Tube JAN–1R5 where it is mixed with the output of the h-f (high-frequency) oscillator circuit to produce an i-f (intermediate-frequency) of 456 kc. The h-f oscillator circuit also supplies bias voltage for the audio-output stage. The output of the mixer tube is coupled to the control grid of the first i-f amplifier Tube JAN–1L4. The amplified output of this stage is coupled to grid No. 6 of the second i-f amplifier Tube JAN–1R5. The i-f output of this stage is fed to the diode (second detector) section of Tube JAN–1S5. This stage develops the a-v-c (automatic-volume-control) voltage which is fed to the control grid of the first r-f amplifier and the first i-f amplifier stages. A portion of the audio output of the diode is fed to the pentode (first audio-amplifier) section of Tube JAN–1S5 where it is amplified and then coupled to the audio-output amplifier Tube JAN–3Q4. The amplified output of this tube is coupled through an audio-output transformer to the output PHONE jacks.

The bfo (beat-frequency oscillator), section of Tube JAN–1S5 operates at one-half the intermediate-frequency. The oscillator output is coupled to grid No. 6 of the second i-f amplifier stage where its second harmonic is mixed with the i-f. The bfo is made inoperative when the PHONE-CW-NET-CAL switch is in the PHONE position. The 200 kc crystal oscillator is used for dial calibration purposes. It employs the cathode, first control grid, and the anode grid of Tube JAN–1R5. The r-f voltage developed across the crystal is coupled to the control grid of the r-f amplifier, Tube JAN–1L4. The calibrator oscillator is operative only when the PHONE-CW-NET-CAL is in the CAL position.

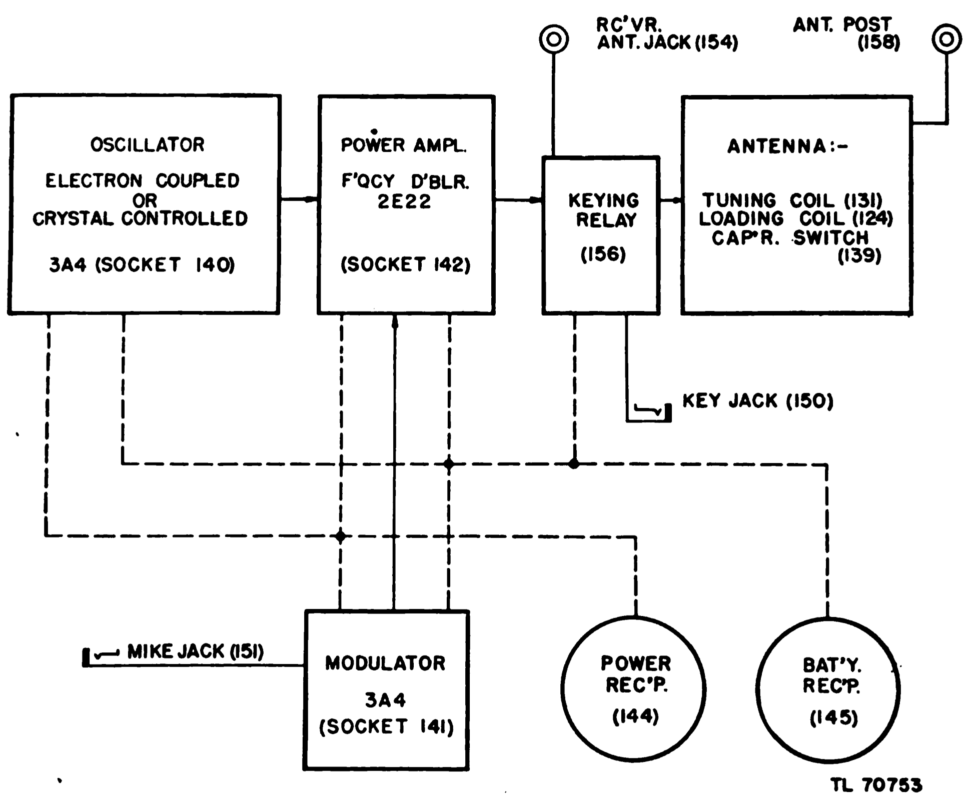


Figure 3. Block diagram, transmitter of Radio Receiver and Transmitter BC–1306.

c. TRANSMITTER. Fundamentally, the transmitter is a master oscillator power amplifier for c-w transmission and amplitude modulated by a modulator stage when MCW and PHONE operation is required. The oscillator stage, Tube JAN–3A4, generates a radio-frequency signal at a frequency either self-excited as a master oscillator, or crystal controlled. The plate circuit of the oscillator drives the grid circuit of the p-a (power amplifier) Tube JAN–2E22. This grid circuit is tuned to twice the oscillator frequency. The plate circuit of the p-a tube furnishes r-f power output to a keying relay which when keyed, transfers the r-f to the antenna post via the antenna tuning network. When modulated types of transmissions are used, the modulator stage, Tube JAN–3A4, furnishes the necessary a-f (audio-frequency) power to modulate the suppressor grid of the power amplifier Tube JAN–2E22. During modulated-continuous-wave transmission, the modulator tube is converted to an audio oscillator. A sidetone circuit permits the operator to monitor his transmissions.

SECTION II

DIFFERENCES BETWEEN MODELS

(Not Applicable)

SECTION III

INITIAL REPAIR PROCEDURES

3. General

Note. Before making any repairs or adjustments, all Modification Work Orders should be applied. See WD Pamphlet 12–6 for list of applicable Modification Work Orders.

Maintenance personnel should follow the procedure outlined in this manual when repairing and servicing Radio Receiver and Transmitter BC–1306. The repair data in this and the following sections is presented in the order in which the repairman should actually perform the various operations on the equipment in the repair shop. This procedure permits repair of the equipment in the shortest time possible, and results in performance comparable to that of new equipment.

4. Tools, Test and Cleaning Equipment

The equipment and materials shown in table II should be available for the proper servicing of Radio Receiver and Transmitter BC–1306.

Table II

Item	Description
1. Assorted tools.	*a.* Pliers: diagonal and long-nose. *b.* Screw drivers: several sizes. *c.* Soldering iron. *d.* Resin core solder. *e.* Wrenches: No. 4–5–6; spintite type. *f.* Flashlight or probing light. *g.* Dental mirror. *h.* Burnishing tool (for relay contacts).
2. Fiber alignment tools.	*a.* Screw drivers: insulated. *b.* Socket wrenches: with nonmetallic shafts.
3. Dummy antennas.	*a.* Receiver: One each 110-mmf, 250-mmf, and 0.01-mf capacitors. *b.* Transmitter: One 5,000-ohm 20-watt carbon or noninductive resistor. One r-f metering circuit TL–70774.
4. Test leads.	*a.* One pair with prods. *b.* One pair with clips.
5. Special cords.	*a.* CD–1119. *b.* CD–1086 (7 ft and 44 in.). *c.* CD–318–A. *d.* Circuit test cable (receiver).
6. Voltohmmeter.	Sensitivity of 1,000 ohms per volt with multiple ranges up to 750 volts; high, medium, and low resistance ranges.
7. Vacuum-tube voltmeter.	For measuring a-c and d-c voltages with multiple scales up to 500 volts.
8. Output meters.	*a.* Receiver: 4,000-ohm impedance, multiple voltage scales. *b.* Transmitter: 0- to 115-current squared galvonometer and 0- to 2-thermocouple ammeter.
9. Frequency meter.	Calibrated, similar to Frequency Meter Set SCR–211, or equivalent.
10. R-f signal generator.	To cover ranges from 175 kc to 7,500 kc, capable of 30% modulation at 400 cps.
11. A-f oscillator.	Variable frequency range 30 to 15,000 cycles.
12. Cathode-ray oscilloscope.	3-in. tube (minimum).
13. Tube tester.	Either dynamic or emission type.
14. Headset.	HS–30–( ) with Cord CD–933.
15. Key.	J–45 or equivalent.
16. Microphone.	T–17, T–45, or equivalent.
17. Test plugs.	PL55 or equivalent. PL51 or equivalent.
18. Neon test lamp.	For checking presence of r-f.

Table II (Contd.)

Item	Description
19. Cleaning materials.	*a.* Solvent, dry-cleaning (SD). *b.* Petroleum spirits. *c.* Instrument oil. *d.* Clean cloth (nonlintable). *e.* Assorted brushes. *f.* Pipe cleaners. *g.* 4/0 sandpaper. *h.* Crocus cloth. *i.* French cloth. *j.* Compressed air or air dryer or blower.
20. Power sources.	*a.* Battery BA-48. *b.* Vibrator Power Unit PE-237. *c.* Generator GN-58.

5. Disassembly of Receiver for Cleaning, Inspecting, and Lubricating

a. PRELIMINARY. Release the two retainer clamps on each side of case, and remove receiver from case by pulling forward. (See fig. 4.)

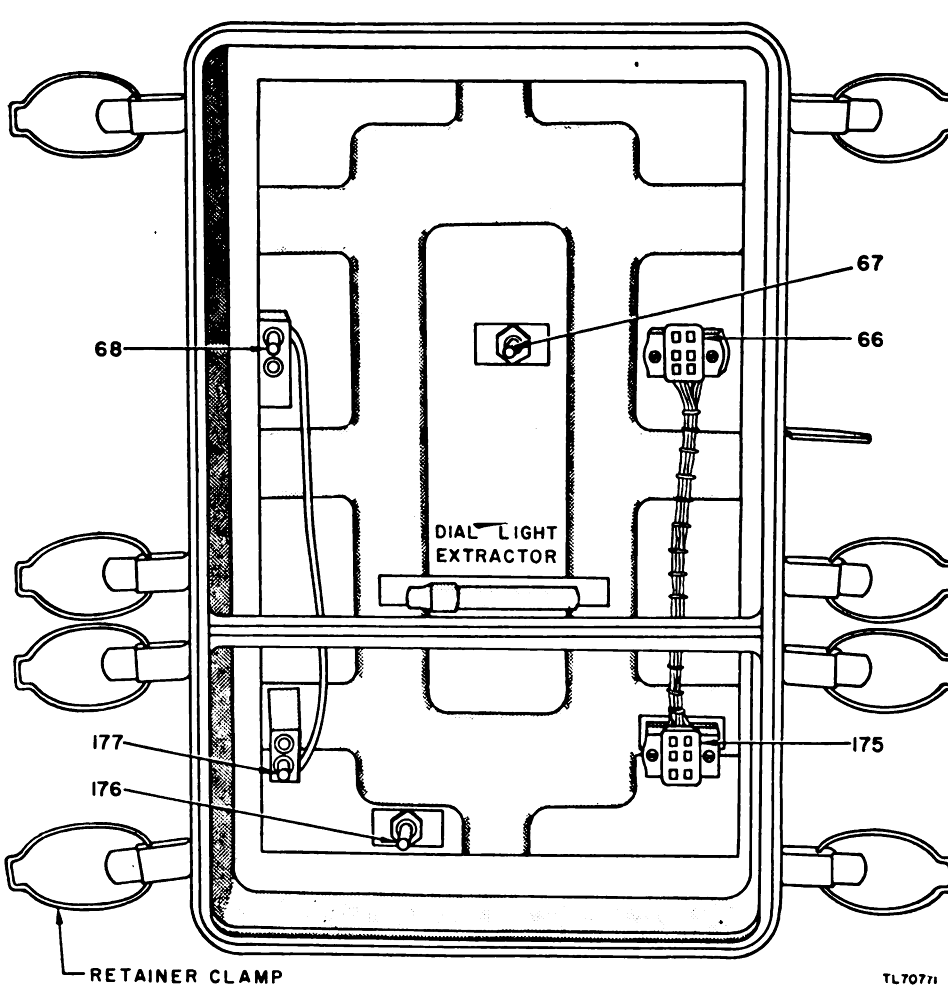


Figure 4. Case components of Radio Receiver and Transmitter BC-1306.

b. TUBES. Release the tube shield assembly by loosening snap fasteners located on each side, and lift the assembly out. Remove all tubes from sockets by lifting straight up.

c. CRYSTAL. The calibrating crystal holder (fig. 5), is accessible after removing the tube shield assembly. Remove the holder by pulling straight upward.

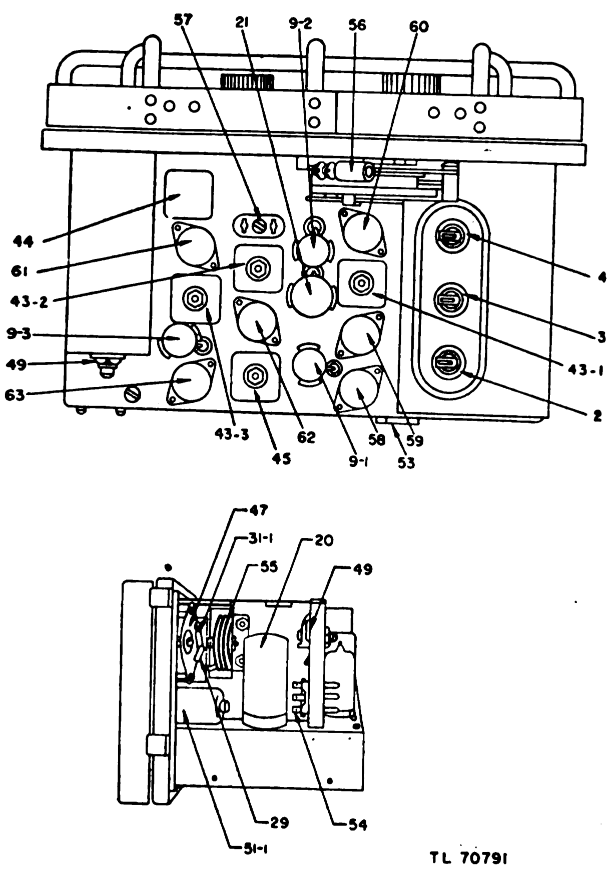


Figure 5. Parts identification, top and end view of receiver, Radio Receiver and Transmitter BC-1306.

d. DIAL LIGHT. Use the dial light extractor furnished with the set (the extractor is clamped to the interior of the case back of the receiver unit, and is readily accessible when the receiver is out of the case). (See fig. 4.) Push the dial light extractor over the bulb, turn bulb counterclockwise and pull it out of socket.

e. SHIELDING. Remove screws and washers holding bottom plate to chassis and remove plate. Remove screws and washers holding ganged tuning capacitor shielding and remove shielding. Remove screws and washers holding shield of SENSITIVITY switch and remove shield. Remove nuts holding shield of PHONE-CW-NET-CAL switch and remove shield.

6. Cleaning, Inspecting, and Lubricating of Receiver Chassis

a. CLEANING. Thorough cleaning of the receiver is necessary to insure optimum performance and to prevent corrosion, rust, and dirt from damaging parts or causing arc-over or low-resistance leakage between high-voltage points and ground. Remove loose dust and dirt with a brush or blower. Remove dirt or grease which adheres to the chassis or parts with a brush or cloth and dry-cleaning solvent (SD). Remove dust or dirt between plates of the ganged tuning capacitors with a pipe cleaner and blower. Clean tuning capacitor bearings and rotor-grounding springs with dry-cleaning solvent (SD). Clean rusted or corroded spots on chassis with solvent, dry cleaning applied with cloth, or with fine sandpaper. Clean contact-making parts of sockets, power plug, antenna jack, ground jack, switches, and phone jacks with dry-cleaning solvent (SD), applied with a rag or pipe cleaner.

b. INSPECTING. After the chassis has been thoroughly and carefully cleaned, make a visual inspection of parts and wiring for loose connections, frayed or burned insulation, loose screws, and burned or charred resistors and coils. Make a careful inspection of tube sockets for broken contacts, and switches for loose or bent contacts or broken insulation. Inspect all tuning-dial gears, and setscrews. Inspect parts made of porcelain, glass, or moulded material for chips or cracks. Inspect all mechanical movable parts for smooth working action, and all switches for good contact.

c. LUBRICATING. The receiver tuning-dial bearings and gears are lubricated at the time of manufacture with sufficient lubricant to last the life of the equipment under normal conditions. However, if lubrication becomes necessary after cleaning or because of abnormal use, apply a drop of instrument oil, by means of a toothpick, to the shaft bearings of the ganged tuning capacitor, SENSITIVITY switch, PHONE-CW-NET-CAL switch and VOLUME control.

7. Cleaning, Inspecting, and Testing of Removed Parts (Receiver)

a. TUBES. Clean pins of each tube with dry-cleaning solvent (SD) applied with brush and, for heavier corrosion, use crocus cloth applied with care. Inspect tube for bent pins, also internal and external breaks. Shake the tube to detect loose pins and elements. Check tube in tube tester, allowing sufficient time for tube to heat up. Tap tube gently during test for loose or defective elements. Check for shorts between elements.

b. DIAL LIGHT. Clean contacts of dial light bulb with dry-cleaning solvent (SD), and for heavier corrosion use crocus cloth applied with care.

c. CRYSTAL HOLDER. Clean prongs of crystal holder with dry-cleaning solvent (SD), and for heavier corrosion use crocus cloth applied with care.

d. SHIELDS. Remove dust, rust, and corrosion, oil and grease, from shields with dry-cleaning solvent (SD), and careful use of crocus cloth.

8. Repair or Replacement of Defective Parts (Receiver)

Before replacing any part which on inspection indicated improper electrical operation, or signs of overload, such as charring and burning, make a thorough check of the circuit to discover the cause. Check voltages and resistances, as outlined in section VIII, and correct trouble before replacing defective parts. Replace all wires having broken or poor connections. Replace all defective screws, bolts, and nuts.

9. Reassembly of Removed Parts (Receiver)

After making the foregoing initial inspection and replacement of the parts visibly defective, replace the parts previously removed, but do not replace bottom plate at this time. Consult the tube lay-out diagram (on the end of the receiver chassis) for proper socket corresponding to each tube type. Before attempting to insert a tube in its socket, line up the blank space on the socket with the corresponding space on the tube base. Insert all tubes and the crystal. Push the tube shield down over the tubes until the catches snap in place. Replace the dial light bulb with the fingers, simultaneously pushing the bulb downward and twisting clockwise. Do not replace receiver in case at this time.

10. Disassembly of Transmitter for Cleaning, Inspecting, and Lubricating

a. PRELIMINARY. Remove the transmitter from case by releasing the two retainer clamps on each side of case. (See fig. 1.) Securely grip the panel guard and pull the unit straight out. Firm seating of the rubber seal may cause the unit to adhere to the case. *Be careful not to break the Tube JAN–2E22 (left rear of chassis), or damage the rubber seal around the rear of the front panel.*

b. NEON BULB. Remove polaroid indicator cover by turning the rear knurled rim counterclockwise and unscrewing. Remove neon bulb by pressing in gently and twisting slightly to the right. The bulb has a bayonet type base for easy removal.

c. TUBES. Remove the oscillator tube by loosening the tube holder (fig. 6), and lifting tube out of socket.

The modulator tube may be removed after removing its tube shield. (See fig. 7.) The p-a tube must have its plate cap removed and its clamping ring loosened before it can be removed. (See figs. 7 and 8.)

The voltage regulator tube must have its clamping ring loosened before removal. (See figs. 7 and 8.)

Note. Remove all tubes carefully by side circular rotation while lifting out of socket.

d. CRYSTALS. Remove crystals by opening the cover of socket 149 on the front panel. Pull the crystal straight out.

11. Cleaning, Inspecting, and Lubricating of Transmitter Chassis

a. INSPECTING. A complete and thorough visual inspection should be made for damaged tubes, loose connections, broken components, defective components, charred insulation, defective switches, and other abnormal occurrences. A careful inspection should be made of the mechanical condition of all component parts. Examine tube sockets for broken contacts, switches for faulty contacts or broken parts, loose screws, unsoldered connections, or broken wires.

b. CLEANING. Collections of dust, rust, or corrosion may cause leakage between high-voltage points and ground, and impair operation. Remove loose dust with a brush or blower. Heavy dirt or grease collections adhering to the chassis or other parts should be removed with a brush or cloth and dry-cleaning solvent (SD). Rusted or corroded spots should be removed with fine sandpaper and dry-cleaning solvent (SD), if necessary. Contact-making parts of sockets, plugs, jacks, and switches should be cleaned, where necessary, by an application of dry-cleaning solvent (SD).

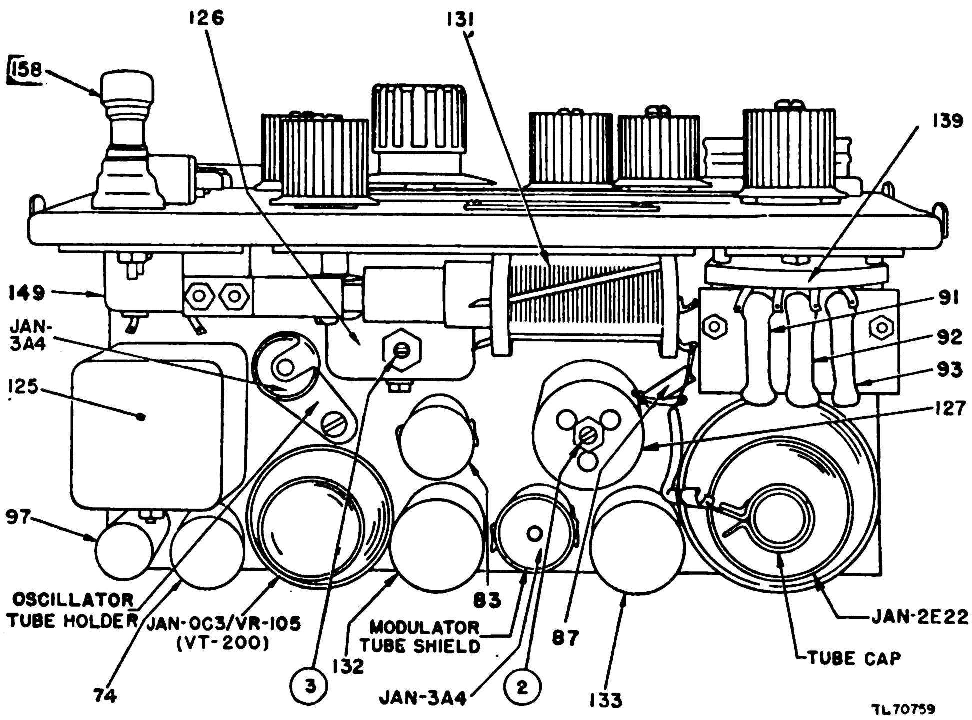


Figure 6. Parts identification of transmitter, top view, of Radio Receiver and Transmitter BC–1306.

c. LUBRICATING. Switch contacts that are not corroded may receive a drop of instrument oil to prevent sticking and allow smoother operation. If necessary, apply a slight amount of lubricant to the rack and pinion assembly of antenna tuning coil 131. (See fig. 8.)

12. Cleaning, Inspecting, and Testing of Removed Parts (Transmitter)

a. GENERAL. All removed parts should be properly serviced before replacement. Component parts are to be tested for short circuits, open circuits, and grounds. All parts must conform to proper values as listed in section VIII, and replacement parts must meet these values before installation. Switch contacts, tube socket contacts, and plug prongs should be cleaned only when necessary to remove corrosion. *Do not remove silver plating from any contacts and NEVER use emery cloth.*

b. TUBES. Examine all tubes for corroded prongs, bent pins, cracked glass, loose elements, or other abnormalities. Test tubes in tube tester, if available, and replace where necessary. Clean all tube prongs with application of dry-cleaning solvent (SD), and for heavier corrosion use crocus cloth applied with care. This applies also to the contacts of neon bulb in socket 152.

c. CRYSTAL HOLDERS. Discoloring or corrosion on pins may be removed with an eraser. If crocus cloth is used, *do not* remove silver plating.

d. COVER SHIELD OF GANGED TUNING CAPACITOR. Rust, corrosion, oil or grease collections should be removed by scraping or brushing and dry-cleaning solvent (SD).

13. Repair or Replacement of Defective Parts (Transmitter)

Before replacing any part which showed signs of overload, or upon inspection indicating improper electrical operation, a thorough check of the circuit should be made to discover the cause. For voltage checks see figure 9, and for resistance checks see figure 10 and data contained in section VIII, and correct trouble before replacing defective parts.

Renew all wiring where necessary and resolder any defective connections. Replacement values of defective parts may be secured by referring to section VIII.

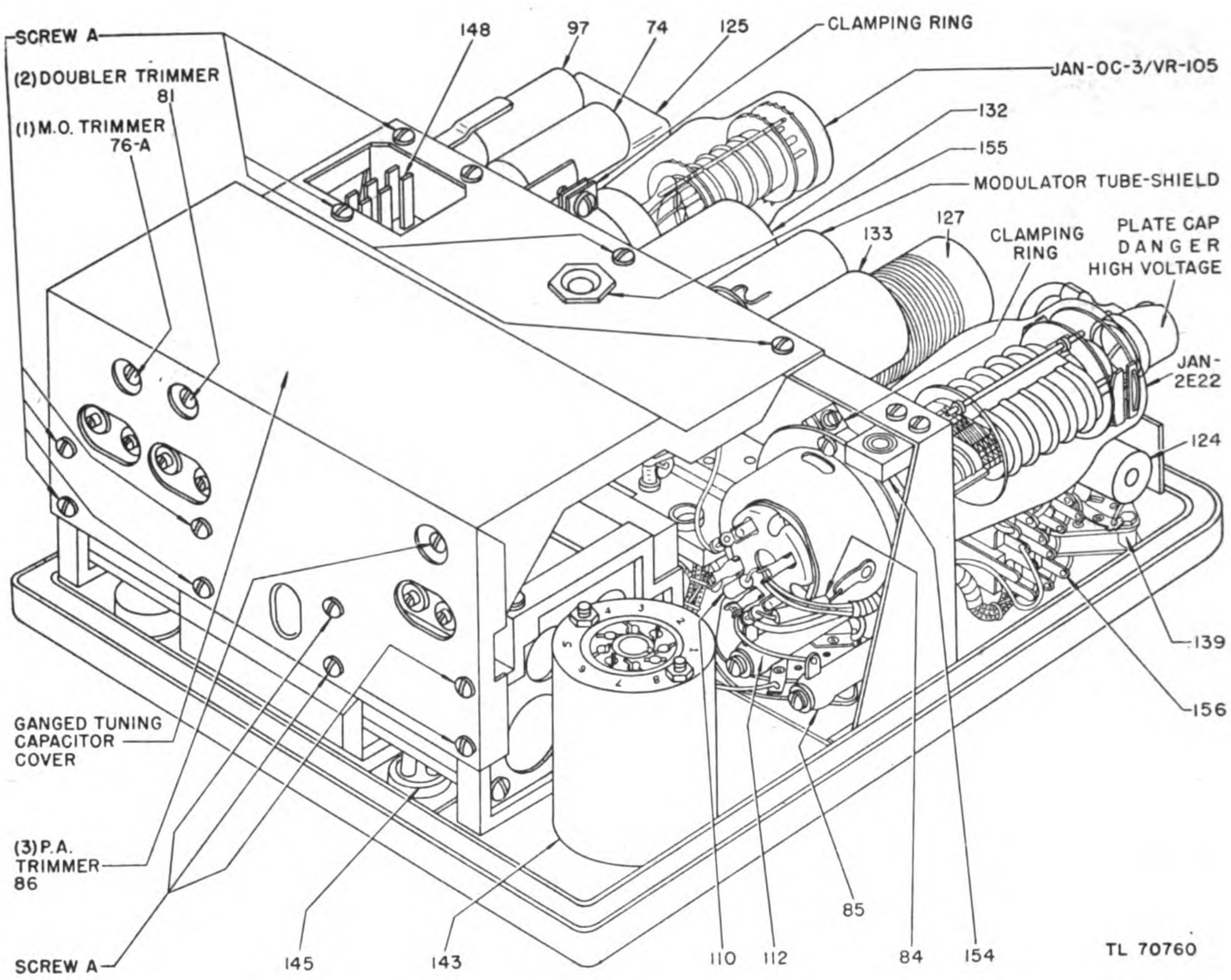


Figure 7. Parts identification, rear view, of transmitter of Radio Receiver and Transmitter BC–1306.

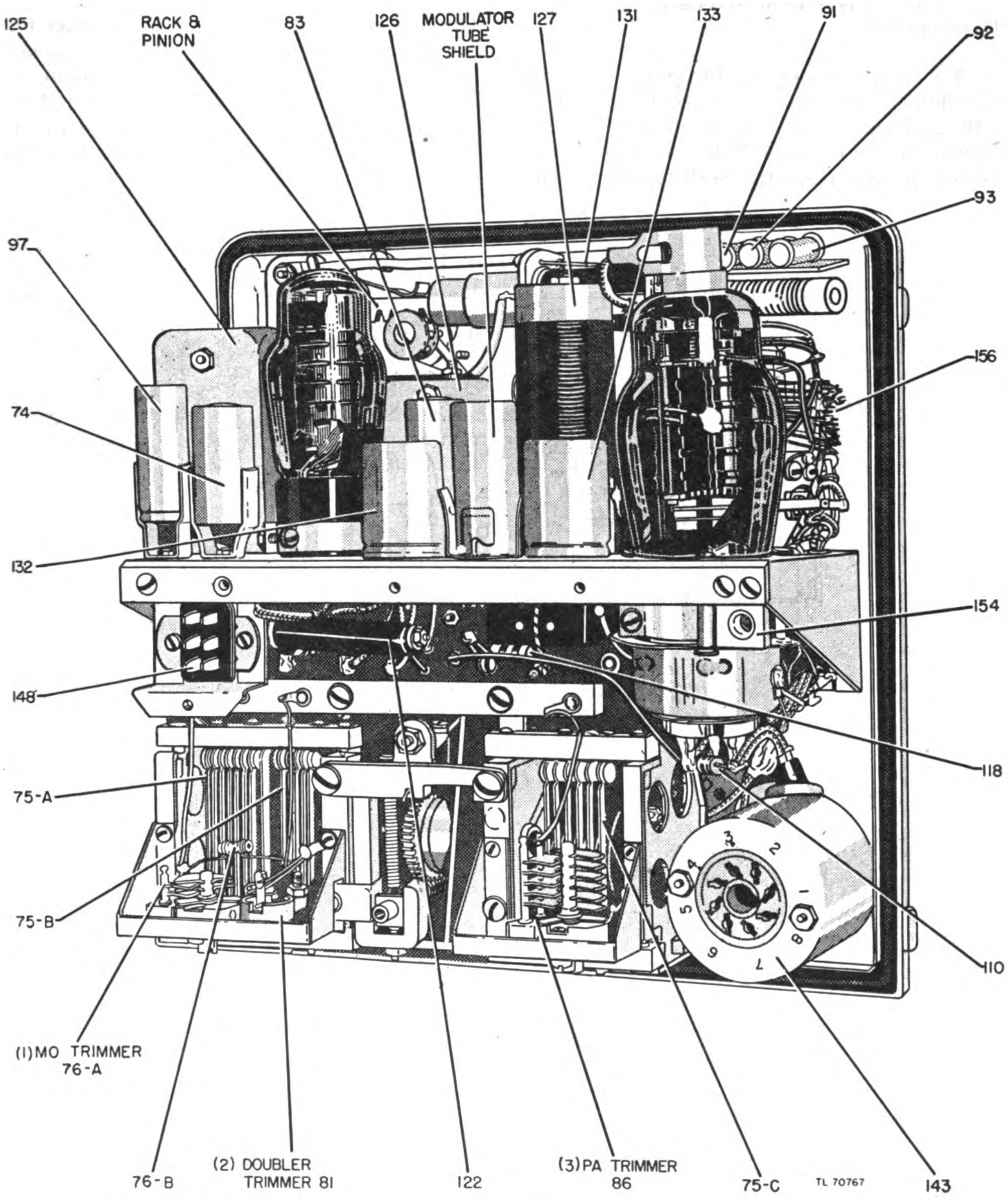
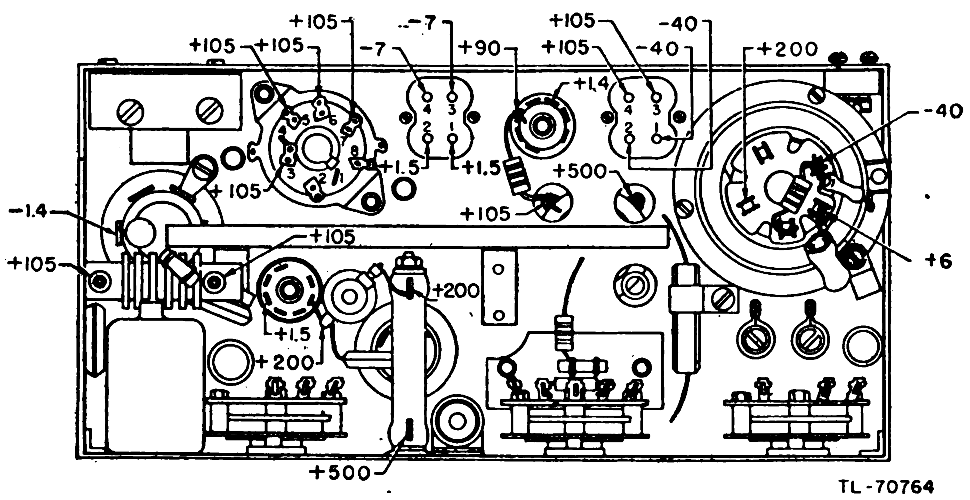


Figure 8. Transmitter of Radio Receiver and Transmitter BC-1306, rear view, cover removed from ganged tuning capacitor.

14. Reassembly of Removed Parts (Transmitter)

At the completion of the foregoing visual inspection and repair of any defective component parts, all parts that were previously removed should now be replaced. Tubes should be firmly seated in their respective sockets, tube shields in place, and clamping rings securely tightened. The crystals are inserted securely in socket 149 and the socket cover is then firmly refastened to the panel. The neon lamp having been reinstalled in socket 152 should be covered by polaroid indicator 159. Set switch 138 to the OFF position but do not replace transmitter in the case at this time.



TEST CONDITIONS

(1) MIKE CIRCUIT CLOSED
(2) CW-MCW-PHONE SWITCH IN PHONE POSITION
(3) HIGH-MED-LOW POWER SWITCH IN HIGH POSITION
(4) SEND-STAND-BY-OFF SWITCH IN SEND POSITION

Figure 9. Normal voltage chart, Transmitter of Radio Receiver and Transmitter BC-1306.

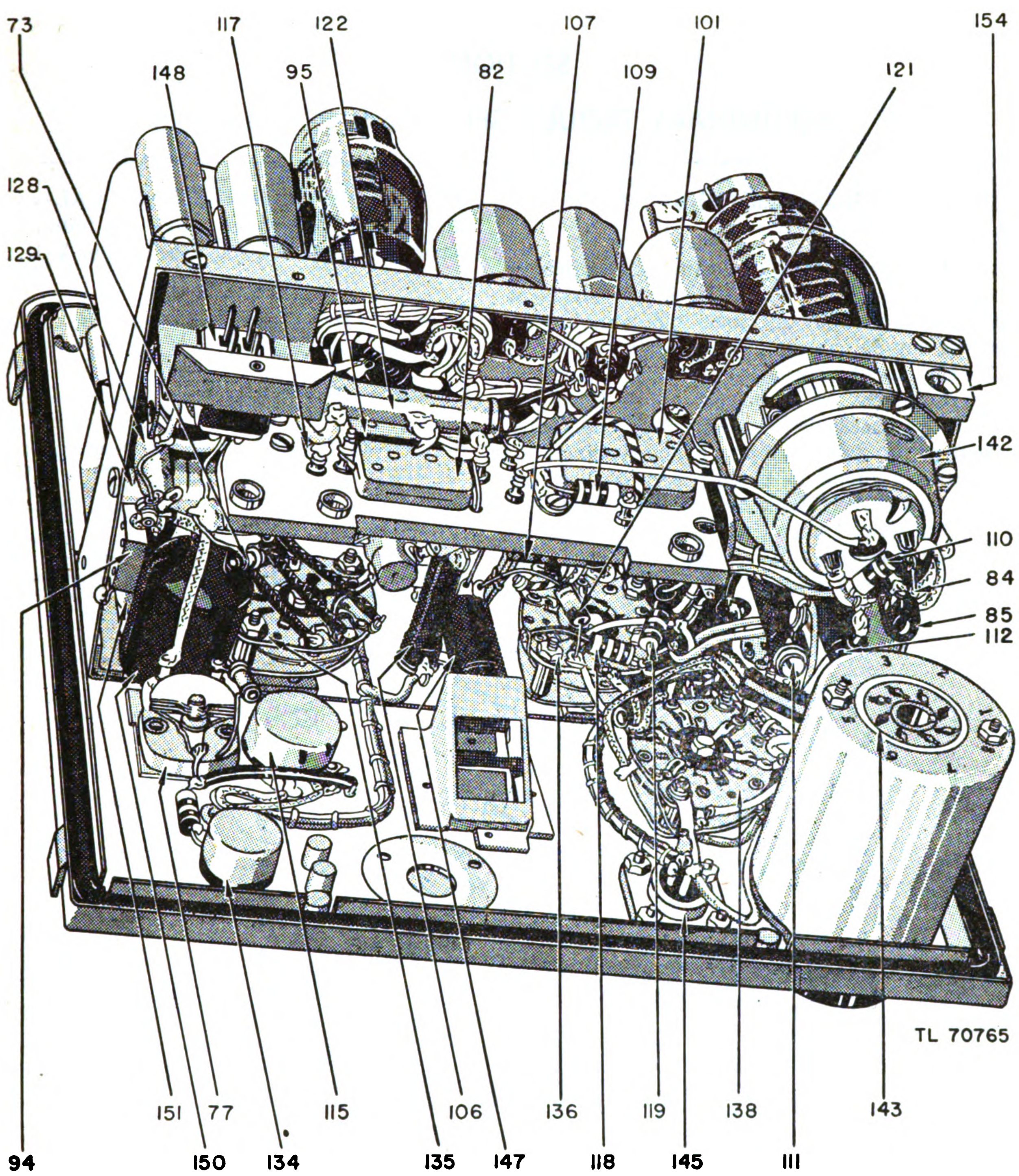


Figure 10. Parts identification, rear view, less ganged tuning capacitor and cover, for Transmitter of Radio Receiver and Transmitter BC–1306.

SECTION IV

PRELIMINARY TROUBLE-SHOOTING PROCEDURES

15. Input Resistance and Cable Continuity Checks

a. General. Trouble within the equipment can often be detected by checking resistances at the power input terminals and continuity of power supply cables before applying power to the equipment, thereby preventing damage to the equipment or its power supply. Make the following checks before connecting the equipment to the power supply. If the readings obtained are found to be incorrect, see section VIII, and correct fault before proceeding.

b. Receiver Input Check. By means of an ohmmeter, measure the resistance between each prong of power plug 54 and chassis (figs. 11 and 12) with PHONE-CW-NET-CAL switch in PHONE position. If values are found to be incorrect see paragraph 34*a*, section VIII.

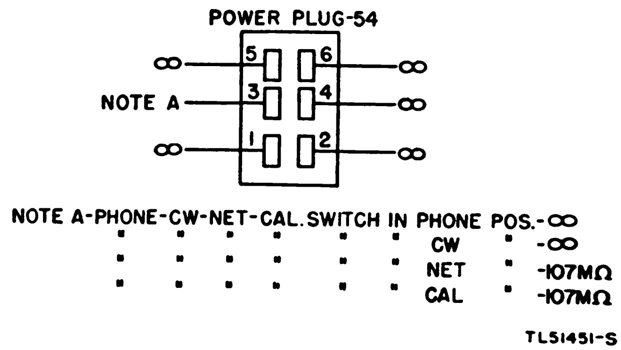


Figure 11. Power plug input resistances for receiver of Radio Receiver and Transmitter BC–1306.

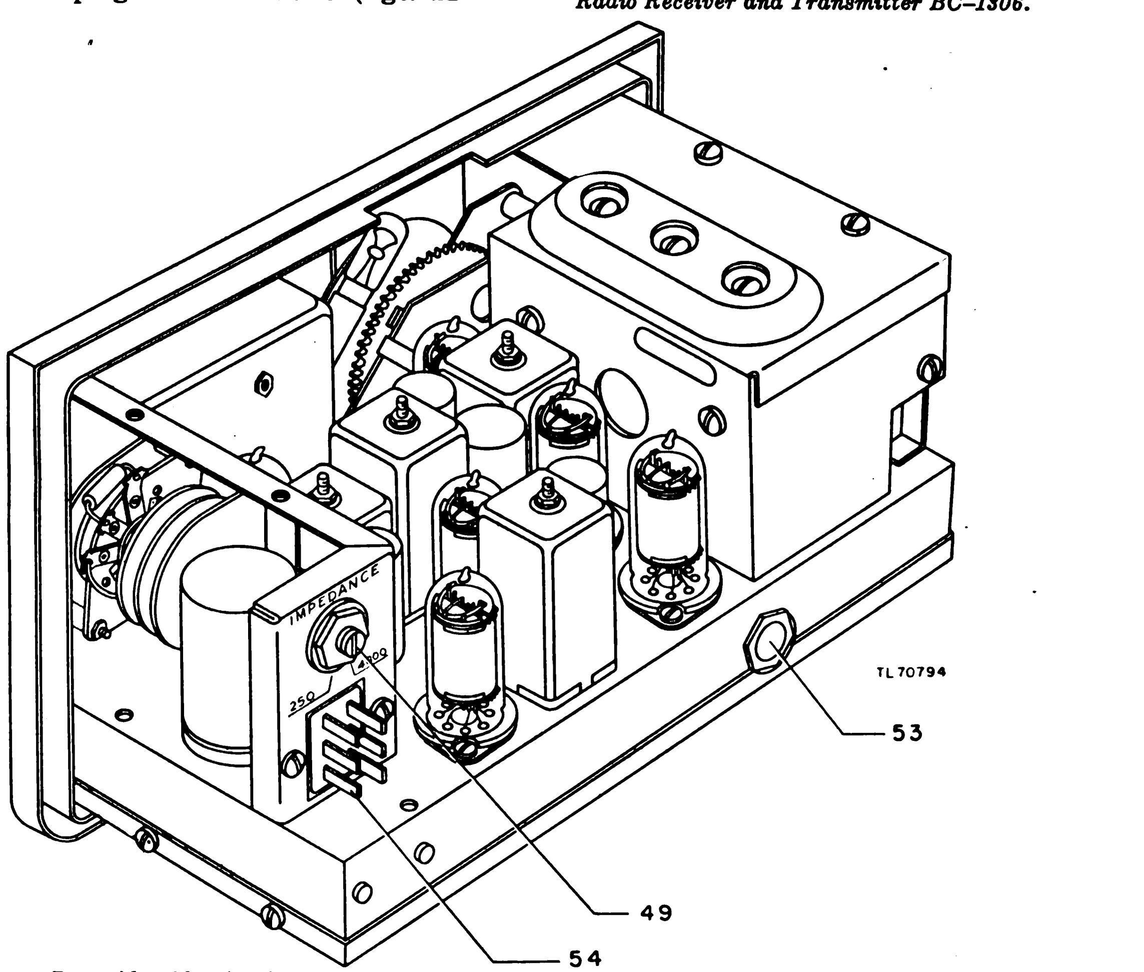


Figure 12. Parts identification for receiver, rear view, of Radio Receiver and Transmitter BC–1306.

c. Cable Continuity Checks. Referring to figures 13, 14 and 15, and case wiring diagram, figure 16, check all cables for continuity, short circuits, and grounds.

Figure 13. Circuit test table for receiver, of Radio Receiver and Transmitter BC-1306.

Figure 14. Cord CD-1086, for transmitter, of Radio Receiver and Transmitter BC-1306.

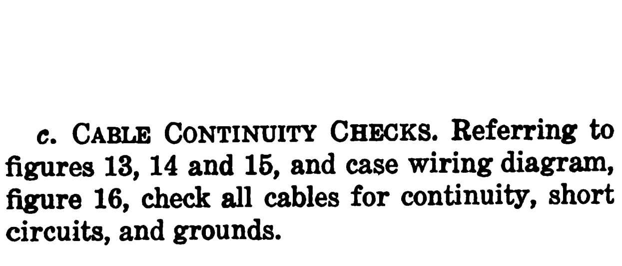


Figure 15. Cord CD-1119 for transmitter, of Radio Receiver and Transmitter BC-1306.

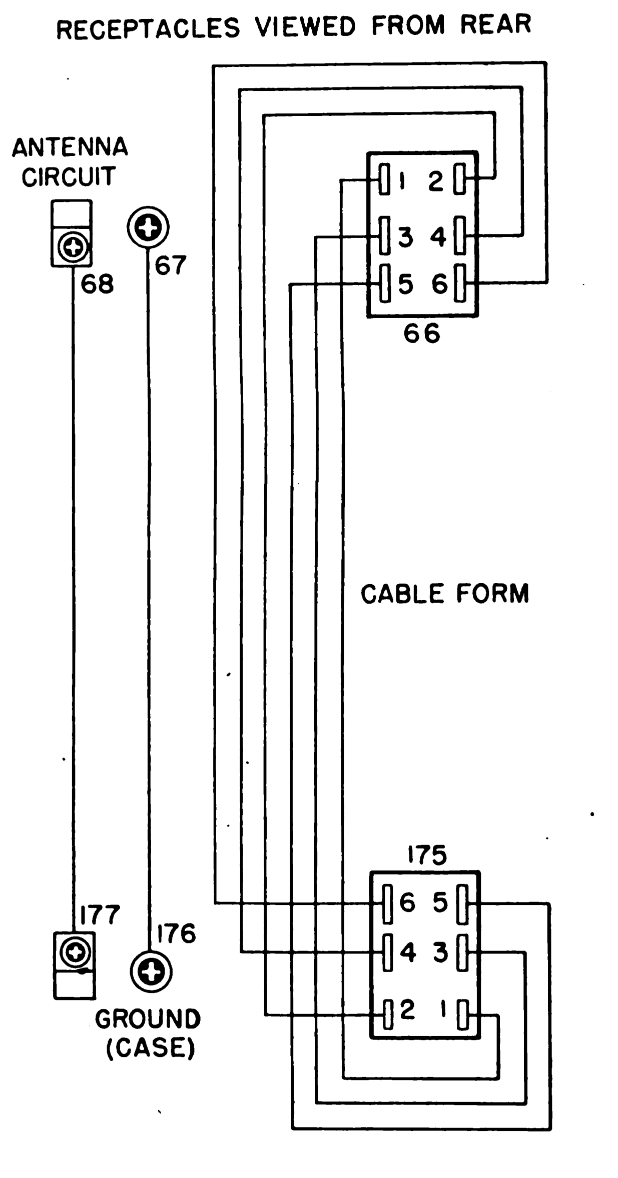


Figure 16. Case wiring diagram, Radio Receiver and Transmitter BC-1306.

d. TRANSMITTER INPUT CHECKS. (1) Check power receptacle 144 (fig. 17) as follows: with switch 138 in OFF position and using prong 53 as common, all prongs should show open circuit resistance values. High values of resistance may be observed at prongs 45, 47, and 54, which indicate leakage value of capacitors 100, 101 and 99, respectively. Any capacitor showing low values of resistance should be replaced accordingly. Shorted wiring or grounded switch con tacts which show up must be corrected before any voltages are applied.

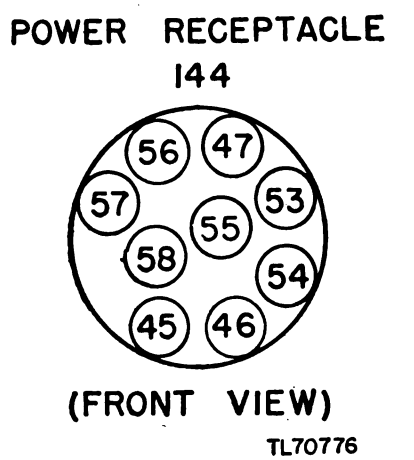


Figure 17. Power receptacle 144 of transmitter, front view, of Radio Receiver and Transmitter BC–1306.

(2) Battery receptacle 145 (fig. 18) should be checked as follows: with switch 138 in OFF position and using prong B as common, all other prongs should show open circuit resistance readings for normal circuit operation. Grounded switch contacts or shorted wiring must be repaired before battery supply is connected.

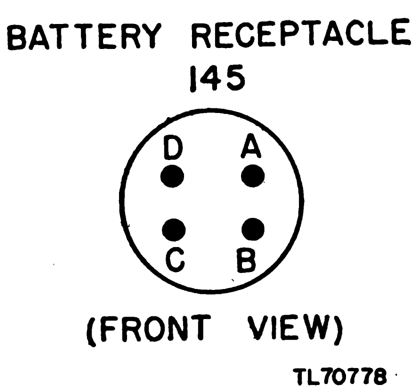


Figure 18. Battery receptacle 145 of transmitter, front view, of Radio Receiver and Transmitter BC–1306.

16. Operational Tests

a. TRANSMITTER. It is imperative that the transmitter unit must be loaded at all times before power is applied.

(1) Connect dummy load (fig. 19) across transmitter output terminal.

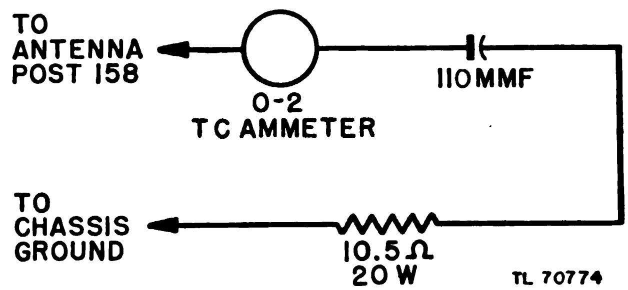


Figure 19. Dummy load r-f metering circuit for transmitter of Radio Receiver and Transmitter BC–1306.

(2) Plug the female connector of Cord CD–1086 into receptacle 144, making sure the retaining ring is screwed up tight, and attach male connector of same cord to the source of power.

(3) Set switch 137 at LOW, switch 136 at CW, turn switch 138 to SEND, insert key in jack 150, and close the circuit.

(4) With the application of power to the transmitter, a rapid visual observation should be made for evidence of overheating or any other unusual occurrences. Watch for the plate of Tube JAN–2E22 turning excessively hot, smoke arising from resistors, burning wires, arcing switches, intermittent sparks, capacitors shorting or arcing over, etc. Power should be turned OFF *immediately* as soon as any unusual occurrence is noted.

(5) If no abnormal conditions are noted with switch 137 in LOW position, the transmitter should then be checked with switch 137 in MED. and HIGH positions. Reference should be made to section VIII, and any abnormalities corrected before tests are made.

(6) Turn power OFF, disconnect Cord CD–1086 from receptacle 144.

(7) Replace transmitter in the case, being careful not to damage Tube JAN–2E22 and enter all plug-in connections properly without forcing. Secure all four retainer rings holding transmitter in case.

b. RECEIVER. Referring to figure 20, connect the female end of the circuit test cable to plug 54 on rear of receiver and connect the other end of the cable to receptacle 175 on the case. Fasten alligator grounding clips on both ends of cable to chassis and case.

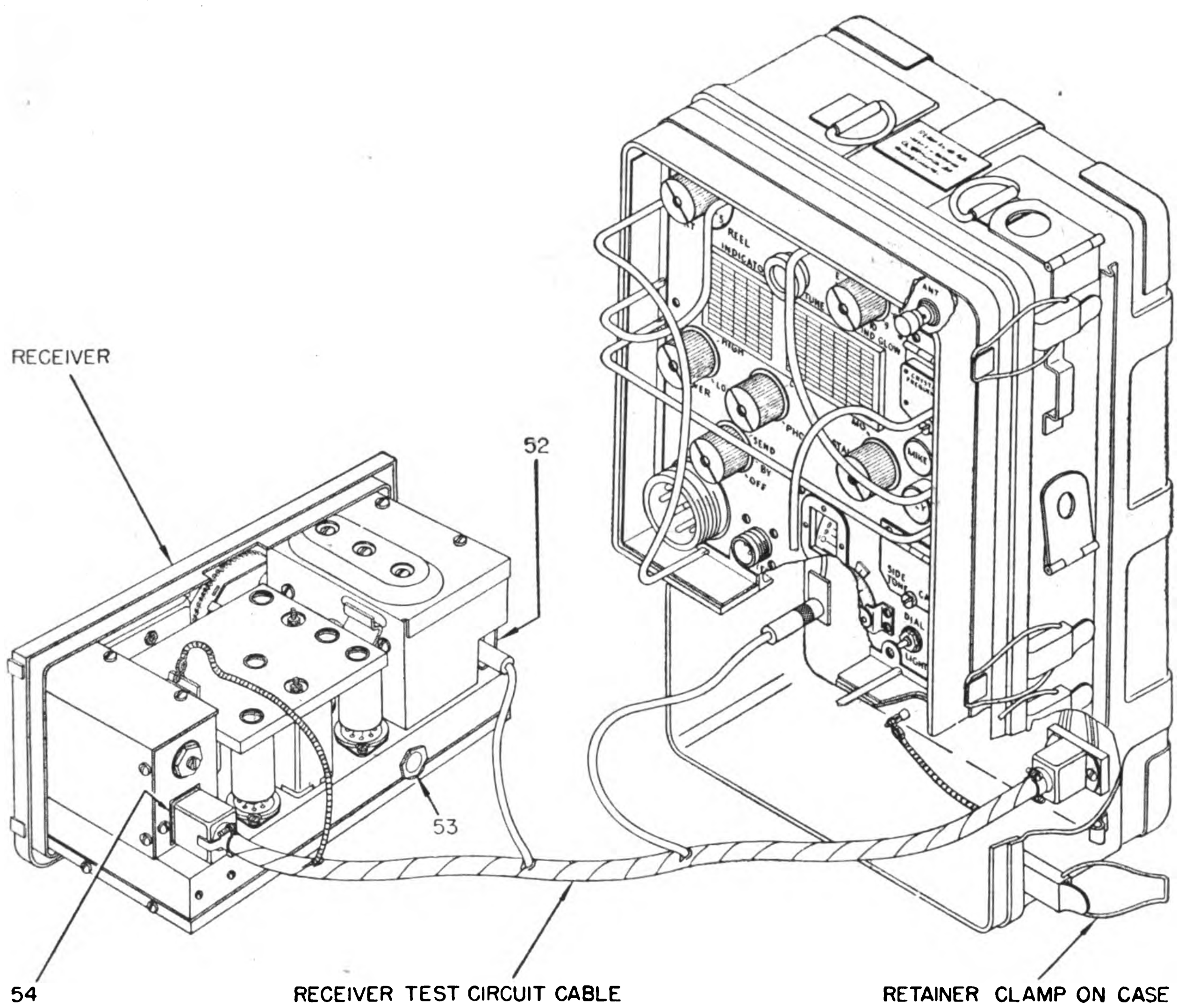


Figure 20. Receiver test set-up for Radio Receiver and Transmitter BC–1306.

(1) Plug the female connector of Cord CD–1086 into receptacle 144 on the transmitter making sure the retaining ring is screwed up tightly. Attach male connector at the other end of cord to a source of power.

(2) Plug a pair of earphones into one of the PHONE jacks of the receiver. (See fig. 21.) Turn switch 138 on the transmitter panel to STANDBY, thus applying power to the receiver.

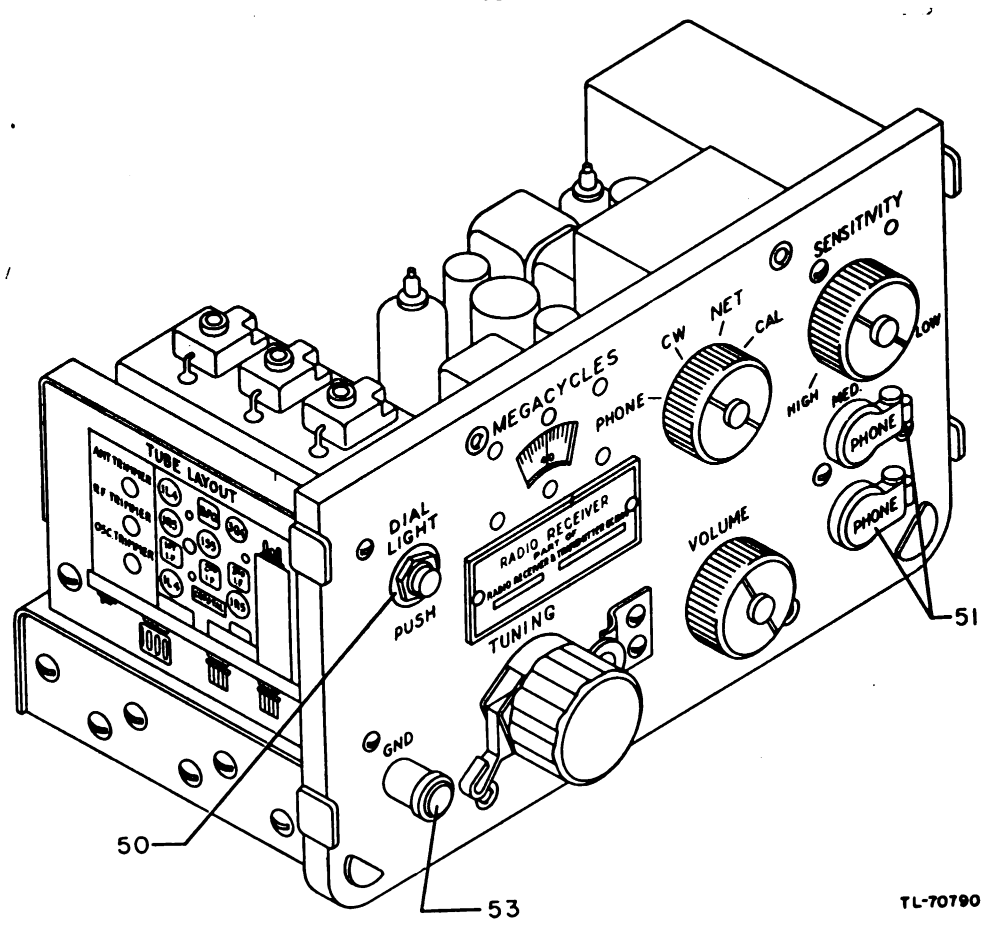


Figure 21. Parts identification of receiver, front panel, of Radio Receiver and Transmitter BC–1306.

(3) Make a rapid visual observation of the receiver for evidence of overheating or any other unusual conditions. Watch for smoke arising from resistors, burning insulation, arcing at switches, intermittent sparks, capacitors shorting or arcing over. Power should be turned OFF *immediately* if any abnormal conditions are indicated. Reference should be made to section VIII, and any abnormalities corrected before proceeding further. (See fig. 22.)

(4) If no abnormal conditions are indicated, push dial button and note whether power is being supplied to the filament circuit.

(5) Repeat the procedure outlined in step (4) above, for all positions of SENSITIVITY and PHONE-CW-NET-CAL switches.

(6) Turn switch 138 to OFF position.

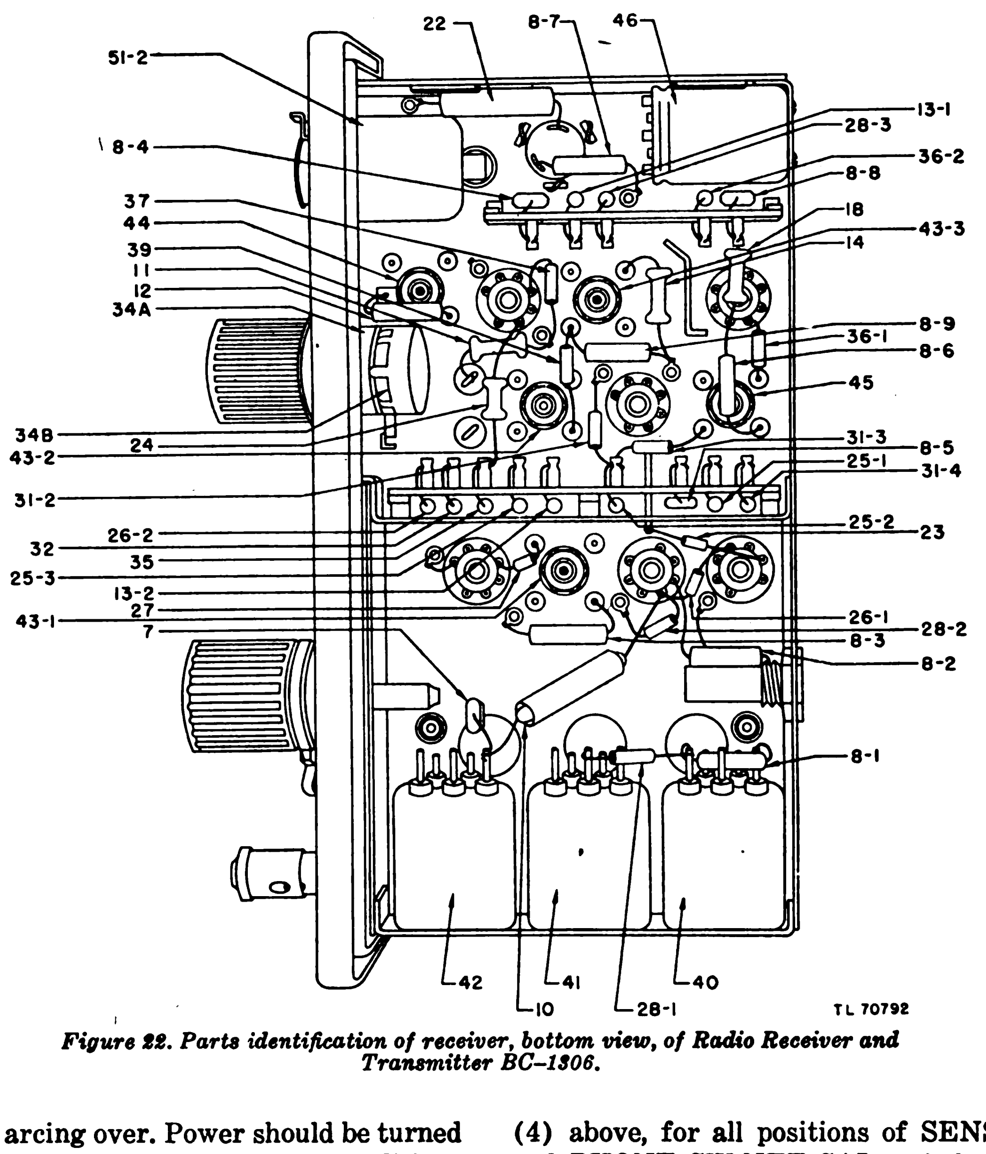


Figure 22. Parts identification of receiver, bottom view, of Radio Receiver and Transmitter BC-1306.

SECTION V

ALIGNMENT PROCEDURE

17. General

If, during the progress of alignment, a stage is reached where improper operation is indicated, the trouble should be located and the cause of faulty operation corrected before proceeding further. Refer to section VI for the procedure for localizing the trouble to a particular stage. After trouble has been localized to a particular stage, see the data given for that stage in section VIII.

18. Receiver

a. PREPARATION. (1) Connect receiver to power plug, antenna plug, and ground plug by means of circuit test cable. (See fig. 13.)

(2) Connect a 4,000-ohm output meter to a phone plug and insert it into one of the PHONE jacks; plug the headset into the other PHONE jack.

(3) Supply power to the set with Battery BA–48 by inserting the male plug of Cord CD–1119 into the receptacle on the battery and the female plug of Cord CD–1119 into the battery receptacle 145 on the transmitter, screwing the retaining ring up tight.

(4) Turn SEND-STANDBY-OFF switch 138 to STANDBY, PHONE-CW-NET-CAL switch 48 to PHONE, SENSITIVITY switch 47 to HIGH, the VOLUME control to maximum clockwise position, and the IMPEDANCE switch on the back of the receiver (fig. 12) to 4000.

(5) Set the receiver on one end so that aligning screws on both top and bottom of chassis can be easily reached. *Do not remove the tube shield.*

b. PROCEDURE. (1) Connect the r-f (hot) terminal of the signal generator to the grid (terminal 6) of the second i-f tube (point 9, fig. 23) in series with a .01 mf dummy antenna capacitor.

(2) Turn on the signal generator and set to exactly 456 kc, modulated 30 percent at 400 cycles per second.

(3) Adjust screws on top and bottom of third i-f transformer (point 7, fig. 23) for maximum indication on output meter.

Note. The tuning screws on all i-f transformers are provided with locknuts. Loosen the locknuts on each tuning screw before the screw is turned, and tighten after alignment is finished.

(4) Move the signal generator output lead to the grid of the first i-f tube. (See point 10, fig. 23.) Adjust the screws on the second i-f transformer (point 6, fig. 23) for maximum indication on the output meter.

Note. As alignment progresses, reduce the output from the signal generator to prevent overloading of the receiver and to obtain the most accurate alignment.

(5) Move the signal generator output connection to the grid of the mixer tube (point 11, fig. 23) and adjust the screws on the first i-f transformer (point 4, fig. 23), again reducing output from the signal generator.

(6) Set PHONE-CW-NET-CAL switch to CW. Turn the modulation OFF at the signal generator. Adjust the bfo (point 5, fig. 23) until a suitable beat note (between 400 and 1,000 cycles) is heard in the headset.

(7) Recheck all locknuts to be sure that none of the adjustments will shift after the set is restored to service. Disconnect the signal generator from the receiver.

(8) Set the PHONE-CW-NET-CAL switch to CAL. Adjust the receiver dial to 6.2 mc. (For examples of dial readings, see fig. 24.) If zero beat is not obtained with dial set at exactly 6.2 mc, vary its setting slightly above and below this point until zero beat is obtained with the crystal calibrator harmonic nearest the 6.2 mc dial markings.

(9) Leaving the position of the TUNING knob unchanged, set the PHONE-CW-NET-CAL switch to PHONE and connect the r-f lead of the signal generator to the antenna con-

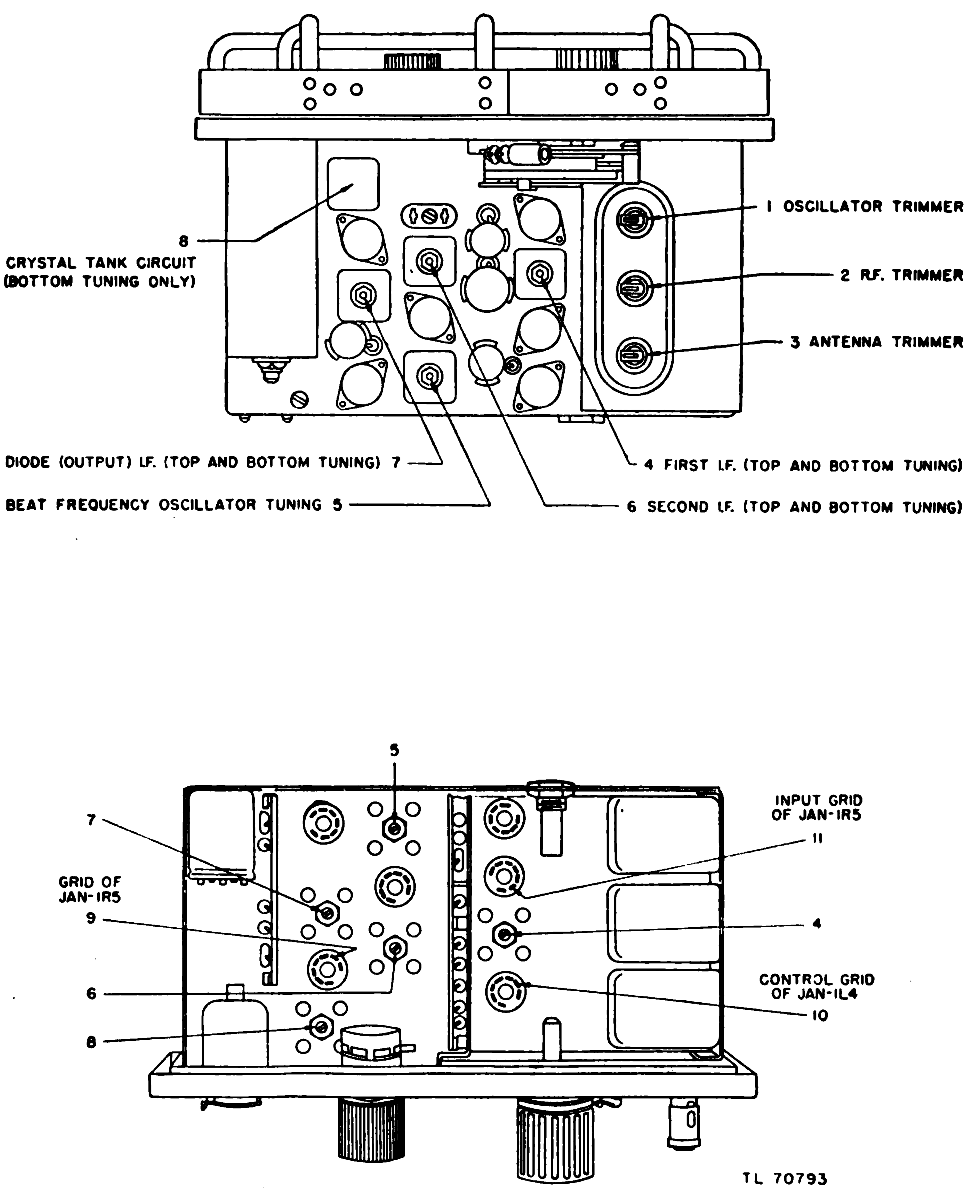


Figure 23. Alignment points for receiver of Radio Receiver and Transmitter BC–1306.

nection of the receiver in series with a 250 mmf dummy antenna capacitor.

(10) Set the signal generator dial to 6.2 mc with 30 percent, 400 cycles modulation. Vary the setting of the signal generator's dial slightly above and below this point until maximum indication of the receiver output meter is obtained. The signal generator's frequency is now exactly 6.2 mc and its dial setting should not be changed throughout the remainder of the receiver alignment.

(11) If the signal is received at the correct receiver dial reading, the oscillator is properly aligned. If the receiver dial does not indicate exactly 6.2 mc, the oscillator must be realigned. Set the receiver dial to exactly 6.2 mc and adjust the oscillator trimmer (point 1, fig. 23) for maximum indication on the output meter.

Note. Some receivers will give a response at two adjustments of this trimmer. When adjusting an oscillator whose trimmer gives two responses, it is always wise to shift the signal generator frequency to the image frequency, to assure that the image frequency is above the signal frequency. If the signal frequency is 6.2 mc, the image should be heard when the generator is tuned to 6.2 mc *plus twice the intermediate frequency* (6,200 kc plus 912 kc equals 7.112 mc). The output of the signal generator usually must be increased considerably to hear the response at the image frequency. If no signal is heard at the place where the image signal is supposed to be received, tune the generator to the low side of the signal frequency and search for a response at a frequency lower than the signal frequency by an amount equal to twice the intermediate frequency. In this case, 6,200 kc (6.2 mc) — 912 kc equals 5,288 kc or 5.288 mc. If the image frequency is below the signal frequency the oscillator trimmer has been adjusted to the wrong response. The simple rule for adjusting an oscillator trimmer which gives two responses is to set the trimmer to the response obtained with the lesser capacity in the trimmer. This puts the oscillator above the signal frequency. The response at the higher capacity puts the oscillator frequency below the signal frequency which is incorrect.

(12) With the hot lead of the signal generator still connected to the antenna input, adjust the remaining trimmers of the r-f and converter stages (points 2 and 3, fig. 23), for maximum reading of the output meter, being careful not to move the tuning control.

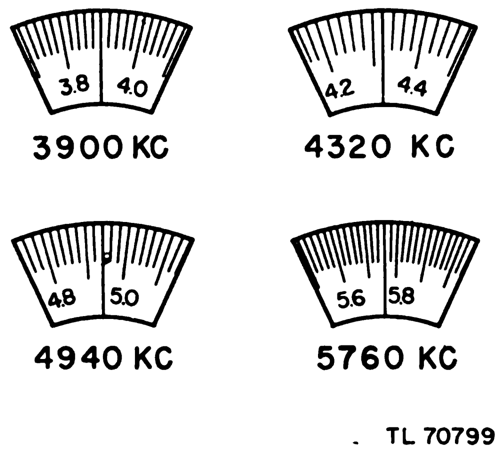


Figure 24. Dial settings for receiver of Radio Receiver and Transmitter BC–1306.

c. CALIBRATION. (1) Turn the PHONE-CW-NET-CAL switch to CAL. Disconnect the signal generator. Turn the receiver dial to the lowest frequency check point (3,800 kc), and adjust the receiver TUNING knob until zero beat is obtained on the strongest beat note in the vicinity of the crystal check point. Turn the SENSITIVITY switch to the lowest setting that will give satisfactory crystal check points. This avoids weak spurious signals that are not the correct calibration check points. The receiver is out of calibration by the amount that the index line on the dial window fails to coincide with the exact frequency. Note whether or not the deviation is less than plus or minus 30 kc.

(2) Having checked the calibration at 3,800 kc, proceed similarly through the entire tuning range checking the calibration at 4,000 kc, 4,200 kc, 4,400 kc, etc., up to 6,400 kc.

(3) If at any point on the dial the calibration of the receiver is off by more than plus or minus 30 kc, adjust the oscillator trimmer (point 1, fig. 23) a slight amount in the direction which improves calibration and recheck the calibration as described in steps (1) and (2) above. Continue making slight adjustments of the oscillator trimmer and rechecking the dial calibration until the deviation at each point is less than plus or minus 30 kc of the exact frequency.

(4) Turn the PHONE-CW-NET-CAL switch to PHONE. Reconnect the signal generator to the antenna input of the receiver. Set the signal generator dial to exactly 6.2 mc and tune the receiver for maximum reading of the output meter. Adjust the trimmers of the r-f and converter stages (points 2 and 3, fig. 23), for maximum reading of the output meter, being careful not to move the TUNING control.

(5) Turn SEND-STANDBY-OFF switch on the transmitter to OFF. Disconnect Cord CD–1119 and the circuit test cable. Turn off and disconnect the signal generator.

19. Transmitter

a. PREPARATION. (1) Warm up the Frequency Meter Set, SCR–211 or equivalent, and tune same to 6,300 kc.

(2) Remove the transmitter from the case carefully so as not to damage the p-a Tube JAN–2E22 on the chassis, left side rear.

(3) Set the panel controls as follows (fig. 25):

(*a*) MO-CRYSTAL switch 135 at MO.

(*b*) CW - MCW - PHONE switch 136 at PHONE.

(*c*) ANT. SELECTOR switch 139 at 1.

(*d*) ANT. TUNING knob 131 at any position above 5. Loose coupling is desired, therefore, do not use any position below 5 as improper alignment may result.

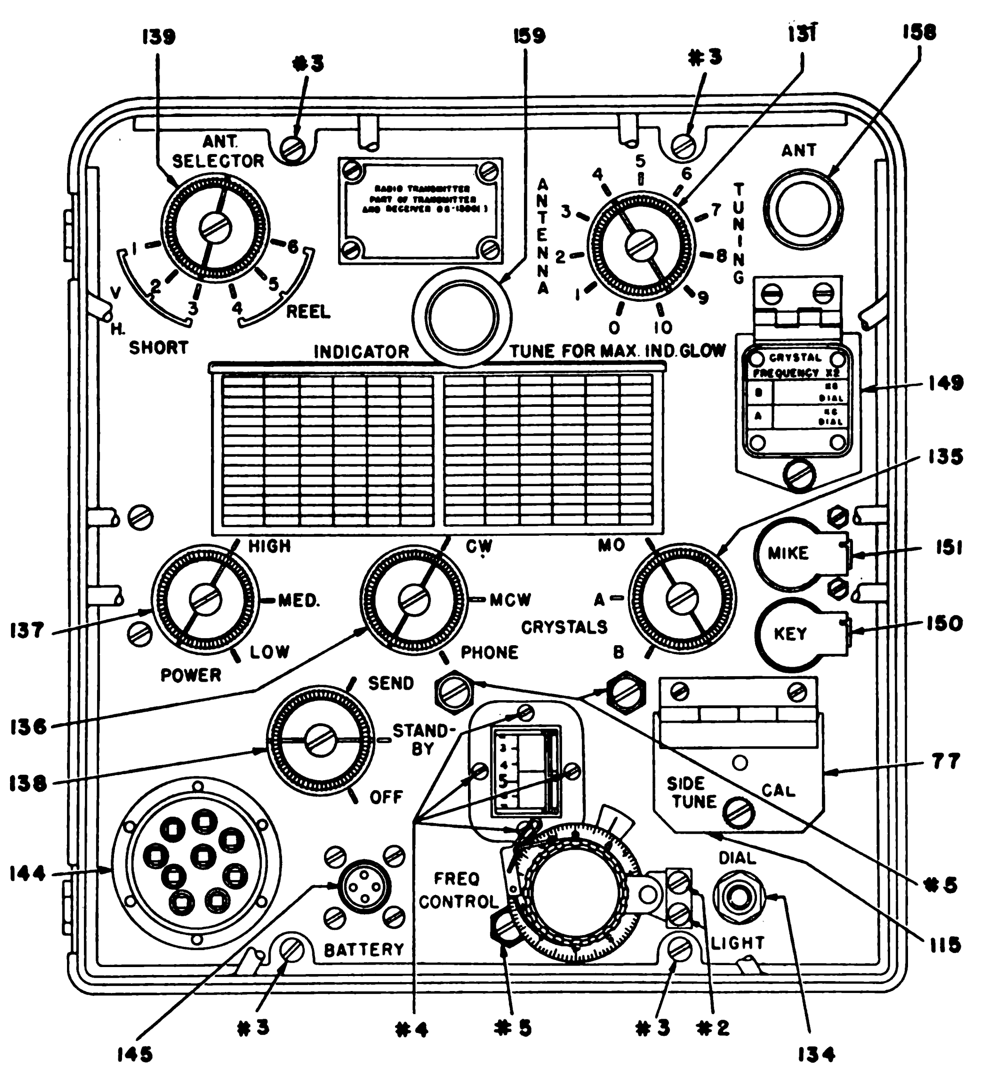
(*e*) Set FREQ. CONTROL knob to 6,300 kc. (See fig. 26 for method of reading dial.)

(4) The antenna circuit MUST be loaded with a dummy load during this test (fig. 19), consisting of a 10.5-ohm, 20-watt carbon or noninductive resistor in series with a 110-mmf capacitor and a 0–2. r-f ammeter.

(5) The Power Cable CD–1086 and Battery Cable CD–1119 should now be securely locked into power receptacle 144 and battery receptacle 145 respectively.

(6) Turn power on.

(7) Insert the KEY cord plug into jack 150. Close KEY circuit and listen in on headphones



(2) #2 FREQ. CONTROL DIAL CLAMPING RING SCREWS

(4) #3 PANEL GUARD MTG. SCREWS

(4) #4 DIAL WINDOW SCREWS

(3) #5 CAPACITOR MTG. SCREWS

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Figure 25. Component parts on front panel of transmitter of Radio Receiver and Transmitter BC–1306.

of the frequency meter for a signal from the transmitter.

b. PROCEDURE. (1) *Oscillator tuning.* Capacitor 76–A is a trimmer across capacitor 75–A, the oscillator section of ganged tuning capacitor assembly. Using an insulated screw driver, carefully adjust this MO trimmer (item 1, fig. 7) to exact zero beat of 6,300 kc. A beat note or signal will be heard before and after the zero beat, while rotating this trimmer capacitor. The spot of no signal or zero beat indicates the alignment of the oscillator tank circuit to the 6,300-kc frequency.

Note. Frequency Meter Set SCR–211 will produce beat notes between harmonics of the transmitter and the frequency meter. Care in the selection of the proper beat note frequency should be observed in order that improper alignment of the transmitter may be avoided.

(2) *P-a Tuning.* (*a*) Capacitor 81 is a trimmer across capacitor 75–B, the p-a grid circuit section of ganged tuning capacitor assembly.

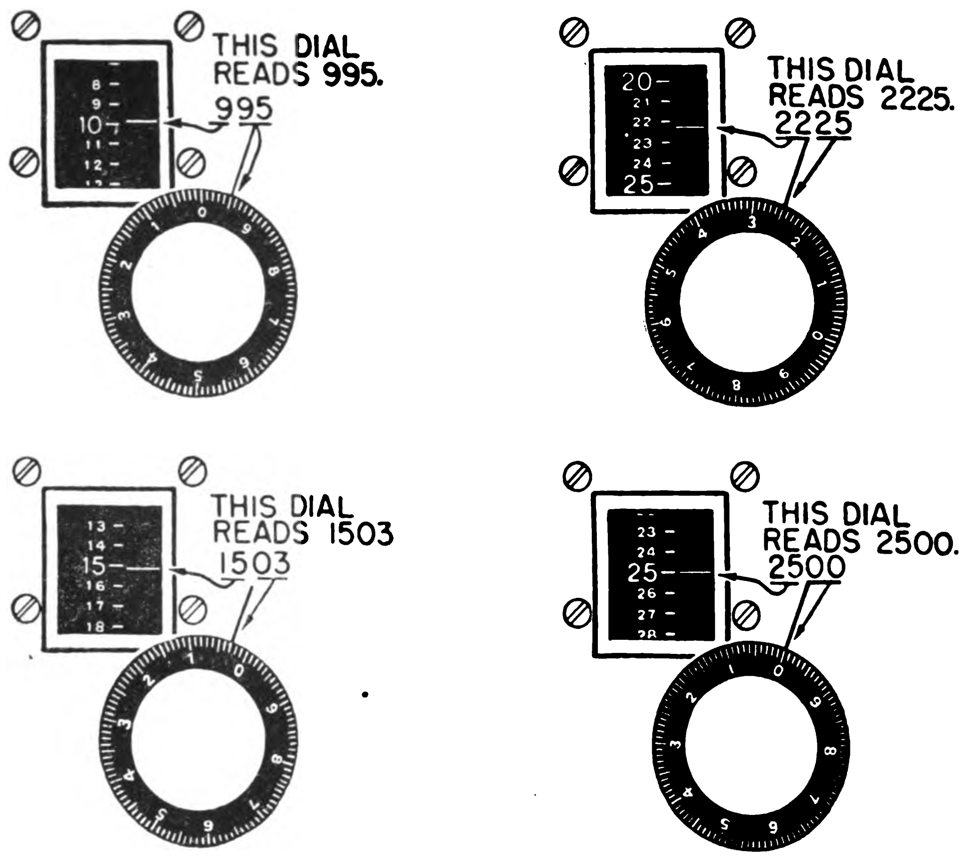

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Figure 26. Dial readings for transmitter of Radio Receiver and Transmitter BC–1306.

Using the 75-volt d-c (direct-current) range of voltmeter, insert the negative lead to prong 5 and the positive lead to prong 7 of metering socket 143. Reference should be made to table IV. Using an insulated screw driver, peak the doubler grid circuit by carefully adjusting this trimmer (item 2, fig. 7) for *maximum* voltage reading of the voltmeter. This negative grid bias voltage may vary from minus 47 to minus 68 volts depending upon operating conditions and vacuum-tube tolerances.

(*b*) Capacitor 86 is a trimmer across capacitor 75–C, the p-a plate section of ganged tuning capacitor assembly. Using the 3-volt d-c scale of the voltmeter, connect the positive lead to prong 2 and the negative lead to prong 8 of metering socket 143. (See table IV.)

Caution: High voltage — exercise extreme care to avoid bodily contact to ground.

Using an insulated screw driver, carefully adjust this p-a trimmer (item 3, fig. 7) for *minimum* reading of the voltmeter. Normal voltage readings are 0.05 volt on PHONE and 0.14 volt CW. This completes the alignment of the power amplifier. The transmitter is now fully aligned at 6,300 kc.

(3) *Operational test.* When these adjustments have been made, tune ANT. TUNING knob 131 for maximum brilliance as shown on indicator 159. Maximum light is visible when the two red spots on the barrel of the indicator cover are lined up. For minimum passage of light rotate the outer rim clockwise so the red spots are widely separated. This maximum brilliance should coincide with the maximum current reading on the thermocouple ammeter of the dummy load, r-f metering circuit. (See fig. 19.) The final frequency check should be made on each end of the frequency band. Retune the FREQ. CONTROL knob for each end frequency test, rotating knob 131 for maximum brilliance on each of these frequencies to make sure antenna resonance is secured at each end of the band. After the set has been properly aligned, turn off all power and disconnect all power cables.

SECTION VI

DETAILED TROUBLE-SHOOTING PROCEDURES

20. General

a. PURPOSE. The purpose of this section is to provide a systematic procedure for localizing trouble to a particular stage. When a faulty stage is found, see section VIII for the repair procedure.

b. RECEIVER. Since trouble in the first i-f amplifier stage, the calibrating oscillator stage, and the bfo stage is localized in aligning, no additional trouble-shooting procedure for these sections is given.

c. TRANSMITTER. Lack of audio-frequency power for modulating the transmitter may occur either in the modulator stage or in the suppressor grid of the p-a stage. Modulation faults are localized by resistance and voltage checks. (See sec. VIII.) Probing for r-f should be carried out in accordance with the procedure outlined in paragraph 23.

21. Receiver Second I-F Amplifier and Audio Stages

a. PREPARATION. (1) Use the hook-up and control settings described in paragraph 18.

(2) Set the signal generator to 456 kc with 30 percent, 400 cycles modulation and with maximum output voltage. Connect the ground of the signal generator to the GND. post of the receiver. Connect a clip lead in series with a .01-mf capacitor to the r-f post of the signal generator and clip it to terminal 6 of socket 61.

(3) Connect the ground of the a-c (alternating-current) vacuum-tube voltmeter to the GND. post of the receiver and the high post to an insulated test prod, in series with a .01-mf capacitor.

b. TEST AND INDICATION. If there is no indication on the output meter when alignment of the third i-f transformer is begun, apply the vacuum-tube voltmeter prod, successively, to the test points listed in table III, until a test point is found at which the voltmeter does not read. Check the stage or section in which faulty operation is indicated against the data in section VIII.

Table III. Receiver second i-f amplifier and audio stages.

Apply voltmeter test prod to—	If voltmeter does not read, faulty operation is indicated for—
Terminal 3 of coil assembly 43–3.	2d i-f amplifier stage.
Terminal 3 of socket 62.	Transformer 43–3 or diode detector section of Tube JAN–1S5 stage.
Terminal 6 of socket 62.	Grid coupling section of Tube JAN-1S5 stage.
Terminal 5 of socket 62.	Plate section of Tube JAN–1S5 stage.
Terminal 3 of socket 63.	Grid-coupling section of audio-output stage.
Terminal 2 of socket 63.	Plate circuit of audio-output stage.
Terminal 5 of transformer 46.	Transformer 46 or associated wiring.
Tip of phone jack.	Switch 49 or associated wiring.

22. Receiver Radio-frequency and Converter Stages

a. PRELIMINARY. If, in aligning the receiver, the output meter does not read when the signal generator is applied to the antenna input of the receiver after the audio system has been checked, either the r-f amplifier stage or the h-f oscillator portion of the converter stage may be at fault. The following procedure should be used in localizing trouble to the faulty stage.

b. PREPARATION. (1) Use the hook-up and control settings described in paragraph 18.

(2) Set the receiver dial to 6.2 mc.

(3) Set the signal generator to 6.2 mc with 30 percent, 400 cycles modulation.

(4) Connect the high r-f post of the signal generator to an insulated test prod in series with a 250-mmf capacitor. Connect the ground post of the signal generator to the ground post of the receiver.

c. TEST AND INDICATION. (1) Apply the signal generator output, with a voltage of 1,000 microvolts, to terminal 6 of socket 59. If the output meter does not read, the oscillator section of the converter stage is faulty.

(2) If the output meter indicates when signal is applied to the mixer tube, but does not when the signal generator output at a voltage of 50 μv (microvolts) is applied to antenna jack 52, the r-f amplifier stage is faulty.

23. Transmitter R-F Stages

a. PRELIMINARY. During all testing, it is imperative that the r-f output circuit be loaded. A dummy load r-f metering circuit (fig. 19) consisting of a 10.5-ohm, 20-watt carbon or noninductive resistor in series with a 110-mmf capacitor and a 0–2 r-f ammeter is connected across the r-f output in place of the usual antenna. Probing for r-f is done with the aid of a neon lamp to locate the last point of r-f voltage. Probing should begin at the oscillator stage, continuing through the p-a stage, through the keying relay 156 and the antenna tuning network to the antenna post 158.

b. PREPARATION. (1) Remove transmitter from the case.

(2) Install the dummy load.

(3) Connect Cable CD–1086 to power receptacle 144.

(4) Set the panel controls as follows:

(*a*) MO-CRYSTALS switch 135 at MO.

(*b*) CW-MCW-PHONE switch 136 at CW.

(*c*) HIGH-MED.-LOW POWER switch 137 at HIGH.

(*d*) ANT. SELECTOR switch 139 at 1.

(*e*) FREQ. CONTROL knob at 6,000 kc.

(5) Insert KEY cable plug into jack 150.

(6) Turn power ON and close key circuit.

(7) Rotate ANT. TUNING knob 131 to ascertain any resonance.

c. TESTS AND INDICATION. (1) *Oscillator stage.* If there is little or no r-f indication on indicator 159, or on the thermocouple ammeter of metering circuit, it should first be ascertained that this stage is operative as its r-f output furnishes excitation and d-c bias to the grid circuit of the p-a stage. The keying circuit should not remain closed for long periods until the trouble is localized, otherwise damage will result to the p-a tube and its component parts.

Probe with a neon lamp at the plate output circuit, working backward to the grid input circuit, to find where r-f is lost. Upon localizing any trouble, see paragraph 35, and correct the fault. Crystal operation should then be checked by selecting the crystal frequencies as noted on socket 149 cover, with switch 135, and setting the FREQ. CONTROL knob to the proper dial reading indicated on the calibration chart on the front panel and figure 27.

FREQ	-00KC	-20KC	-40KC	-60KC	-80KC
3800	168	208	247	284	321
3900	358	393	429	463	497
4000	532	564	596	629	660
4100	691	722	752	781	811
4200	840	869	897	925	954
4300	979	1005	1032	1058	1084
4400	1109	1134	1159	1183	1207
4500	1231	1254	1277	1300	1323
4600	1345	1367	1389	1411	1432
4700	1453	1474	1494	1515	1535
4800	1555	1575	1593	1613	1632
4900	1650	1668	1686	1705	1723
5000	1741	1759	1776	1794	1811
5100	1829	1846	1863	1879	1895

FREQ	-00KC	-20KC	-40KC	-60KC	-80KC
5200	1912	1929	1945	1962	1977
5300	1993	2009	2025	2041	2057
5400	2072	2088	2103	2119	2135
5500	2150	2165	2180	2195	2210
5600	2225	2240	2254	2269	2283
5700	2297	2312	2326	2340	2355
5800	2369	2383	2397	2411	2425
5900	2439	2453	2466	2480	2494
6000	2509	2522	2535	2549	2562
6100	2576	2589	2603	2617	2630
6200	2643	2656	2670	2684	2695
6300	2709	2723	2736	2750	2763
6400	2777	2790	2804	2820	2836
6500	2854				

TL 70752

Figure 27. Frequency calibration chart for transmitter of Radio Receiver and Transmitter BC–1306.

(2) *P-a stage.* R-f tracing with a neon lamp is first checked at the grid of Tube JAN–2E22. Continue tracing in turn at the plate cap of Tube JAN–2E22 (*danger, high voltage, exercise care to avoid bodily contact*), terminals Nos. 1 and 3 of coil 127 and capacitor 87. Lack of r-f voltage at any of these points should be localized (par. 36), and the fault corrected.

(3) *Antenna-tuning network.* R-f output of the p-a stage enters the antenna-tuning network via keying relay 156. Continue tracing for r-f with a neon lamp through relay 156, coil 131, coil 124, and switch 139 to antenna post 158. Where r-f is lost, see paragraph 37, and remedy the fault.

24. Moistureproofing, Fungiproofing, and Refinishing

After repairs have been completed on the receiver and transmitter, check the date of last moistureproofing, fungiproofing, and refinishing treatment. If a new treatment is required see TB SIG 13 and TM 11–230C, for methods of application. If the case has been chipped or scarred, remove all rough spots with fine sandpaper and apply paint to these spots with a small brush. If the case is sufficiently scarred or scratched to warrant complete refinishing, remove receiver and transmitter units from the case. Remove all rust and dirt accumulations with kerosene where necessary and spray the entire case with the proper paint authorized by existing regulations.

SECTION VII

FINAL TESTING

25. Alignment Check

Although the receiver and transmitter units were correctly aligned during the repair procedure, a recheck of the alignment of each unit is necessary after moistureproofing and fungiproofing have been completed. Check alignment as given in section V.

26. Final Testing (Transmitter)

a. TESTS. Upon completion of the alignment check, the following transmitter performance tests are to be made:

Metering socket 143 readings.
Filament voltage regulation.
Power output.
Modulation capability (MCW).
Modulation capability (PHONE).
Calibration accuracy test.
Sidetone frequency and output.
Transmitter operational test.

b. METERING SOCKET 143 READINGS. (1) *Preparation.* (*a*) Transmitter is removed from the case.

(*b*) Set MO-CRYSTALS switch 135 at MO.

(*c*) Set CW-MCW-PHONE switch 136 at PHONE.

(*d*) Set HIGH-MED.-LOW POWER switch 137 at HIGH.

(*e*) Set SEND-STANDBY-OFF switch 138 at SEND.

(*f*) Set FREQ. CONTROL at 6,000 kc.

(*g*) Insert KEY cord plug in jack 150.

(*h*) Install Cord CD–1086 in power receptacle 144 and connect to source of power, either PE–237 or PE–162.

(*i*) Turn power on.

(*j*) Close key circuit.

(2) *Test.* (*a*) Using a 1,000-ohm-per-volt voltmeter, readings must be shown as in table IV.

(*b*) Limits specified on p-a plate voltage, p-a plate current, and p-a grid voltage are to remain constant over the entire frequency range.

(*c*) Turn power OFF at source and open the key circuit at the end of test.

Table IV. Metering socket 143 readings.

Test	Voltmeter scale	Contacts	Voltmeter indication
p-a plate volts	750 v	8(+) 7(—)	500 v
p-a plate current	3 v	2(+) 8(—)	0.2 v (max)
p-a screen grid volts	500 v	3(+) 7(—)	150 to 220 v
p-a suppressor grid volts	75 v	4(—) 7(+)	34.5 to 44.5
p-a grid volts	75 v	5(—) 7(+)	47 to 68 v

c. FILAMENT VOLTAGE REGULATOR. (1) *Preparation.* (*a*) Set the 1,000-ohm-per-volt voltmeter to the 3-volt range. Connect the negative lead to the junction of 157 and 128 (fig. 9) and the positive lead to chassis.

(*b*) Turn power on and close the key circuit.

(2) *Test.* (*a*) The voltmeter must indicate not less than 1.2 nor more than 1.6 volts.

(*b*) Open key circuit and remove modulator tube shield and tube from socket 141. (See fig. 6.)

(*c*) Close key circuit. The new voltmeter indication must not exceed 2.2 volts.

(*d*) Open key circuit and turn power off. Remove Cord CD–1086 from power source. Replace modulator tube and shield in socket 141. Replace transmitter in case.

d. POWER OUTPUT. (1) *Preparation.* (*a*) Set ANT. SELECTOR switch 139 to position 1.

(*b*) Install dummy load r-f metering circuit consisting of a 10.5-ohm, 20-watt carbon or noninductive resistor in series with a 110-mmf capacitor and a 0–2 r-f ammeter across antenna post 158 and ground. (See fig. 19.)

(*c*) Set FREQ. CONTROL at 6,000 kc.

(*d*) Reconnect Cord CD–1086 to power

source, turn power ON, and close the key circuit.

(*e*) Rotate ANT. TUNING knob 131 for maximum indication on r-f ammeter.

(2) *Test.* (*a*) The r-f output as indicated by the ammeter must not be less than the values specified in table V.

Table V. R-f ammeter readings.

Switch 136	Switch 137	Minimum r-f current (amperes)
CW	HIGH	1.38
CW	MED.	Check for current reduction.
CW	LOW	Check for current reduction.
PHONE	HIGH	0.82

(*b*) Open key circuit and turn switch 138 to OFF.

e. MODULATION CAPABILITY (MCW). (1) *Preparation.* (*a*) With all other control settings unchanged, set switch 136 to MCW, switch 137 to HIGH, and rotate FREQ. CONTROL knob to 5,200 kc.

(*b*) Connect a lead to the "high" vertical plate of an oscilloscope and loosely couple its other end to the r-f output. Connect the other vertical plate to the chassis ground.

Note. The oscilloscope vertical amplifier is *not* used when r-f is being observed.

(*c*) Set switch 138 to SEND and close its key circuit.

(*d*) Tune ANT. TUNING knob 131 for maximum indication on the r-f ammeter.

(*e*) Vary coupling to the r-f output to obtain a satisfactory image on the oscilloscope and adjust the sweep frequency to obtain the modulation envelope pattern.

Note. If difficulty is encountered in obtaining a stable pattern on the oscilloscope screen, the following procedure should be followed: Connect the receiver to the transmitter by means of the circuit test cable. (See fig. 20.) Connect the tip of a phone Plug PL–55 to the external synchronizing binding post of the oscilloscope and the sleeve of the plug to the oscilloscope ground terminal. Insert the phone plug into one of the receiver PHONE jacks. Then adjust the oscilloscope synchronizing control until a stable pattern is obtained.

(2) *Test.* (*a*) The pattern must indicate between 70 and 110 percent sinusoidal modulation. Check against patterns of figure 28.

(*b*) Open key circuit and turn switch 138 to OFF.

f. MODULATION CAPABILITY (PHONE). (1) *Preparation.* (*a*) With all other control settings unchanged, set switch 136 to PHONE.

(*b*) The oscilloscope remains connected as in the previous test.

(*c*) Plug audio oscillator test circuit (fig. 29) into MIKE jack 151.

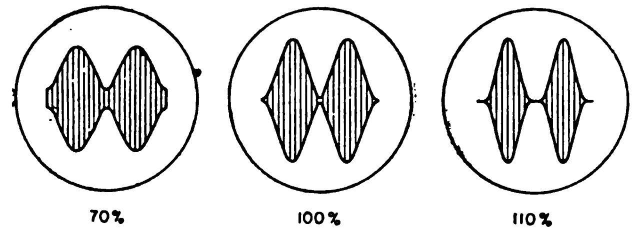


Figure 28. Modulation patterns of transmitter of Radio Receiver and Transmitter BC–1306.

(*d*) Set switch 138 to SEND and close KEY circuit.

(2) *Test.* (*a*) Set the audio frequency oscillator to 400 cycles and adjust its output until a 100 percent modulation pattern is obtained. The vacuum-tube voltmeter must not indicate more than 0.45 volt.

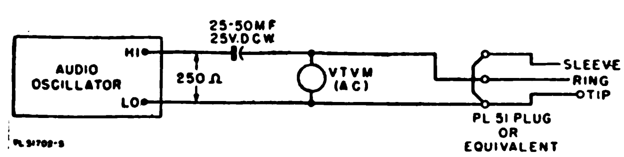


Figure 29. Audio oscillator test circuit for transmitter of Radio Receiver and Transmitter BC–1306.

(*b*) Repeat step (*a*) above, at audio frequencies of 1 kc, 2 kc and 3 kc. The audio-frequency oscillator output necessary for 100 percent modulation at each of these frequencies must not exceed 0.45 volt.

(*c*) Check oscilloscope pattern for sinusoidal modulation.

(*d*) Turn switch 138 to OFF and remove audio oscillator test circuit plug from MIKE jack 151. Turn OFF power source.

g. CALIBRATION ACCURACY. (1) *Preparation.* (*a*) Connect receiver to power plug, antenna plug, and ground plug by means of circuit test cable. (See fig. 13.)

(*b*) Insert headphone plug into one of receiver PHONE jacks.

(*c*) Turn power source ON and set switch 138 to STANDBY.

(*d*) Turn switch 136 to CW.

(2) *Test.* (*a*) Set the receiver PHONE-CW-NET-CAL switch to CAL.

(*b*) Tune the receiver dial to 6,400 kc as determined by the zero beat nearest the receiver 6,400 kc dial marking. Set the receiver sensitivity switch to the lowest value giving a clear beat so that spurious beats will not be heard.

(*c*) Leave the receiver dial at this setting and reset the receiver PHONE-CW-NET-CAL switch to NET.

(*d*) Turn the transmitter FREQ. CONTROL knob until the transmitter dial setting corresponds to 6,400 kc. (See transmitter frequency calibration chart, fig. 27.)

(*e*) Adjust CAL trimmer 77 until zero beat is obtained with the headset. (See fig. 25.)

(*f*) Reset the receiver PHONE-CW-NET-CAL switch to CAL and tune the receiver dial to 6,200 kc as determined by the zero beat nearest the receiver 6,200 kc dial marking.

(*g*) Leave the receiver dial at this setting and turn the receiver PHONE-CW-NET-CAL switch to NET.

(*h*) Rotate the transmitter FREQ. CONTROL knob until zero beat is obtained. The transmitter dial setting must now be within ±3.2 kc of the calibrated 6,200 kc point. (See transmitter frequency calibration chart, fig. 27.)

(*i*) Repeat steps (*a*) to (*e*) above, adjusting for exact tracking at 3,800 kc.

(*j*) Reset the receiver PHONE-CW-NET-CAL switch to CAL and tune the receiver dial to 4,000 kc as determined by the zero beat nearest the receiver 4,000 kc dial marking.

(*k*) Leave the receiver dial at this setting and turn the receiver PHONE-CW-NET-CAL switch to NET.

(*l*) Turn the transmitter FREQ. CONTROL knob until zero beat is obtained. The transmitter dial setting must now be within ±2 kc of the calibrated 4,000 kc point. (See transmitter frequency calibration chart, fig. 27.)

(*m*) Turn the power source OFF and turn switch 138 to OFF.

h. SIDETONE FREQUENCY AND OUTPUT. (1) *Preparation.* (*a*) Set receiver IMPEDANCE switch 49 to 4,000 ohms.

(*b*) Connect test apparatus as shown in figure 30.

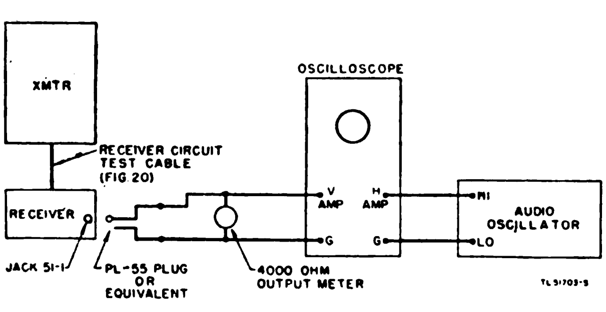


Figure 30. Sidetone test set-up for transmitter of Radio Receiver and Transmitter BC–1306.

(*c*) Set SIDETONE control 115 to its maximum clockwise position. (See fig. 25.)

(*d*) Rotate the FREQ. CONTROL knob to 5,200 kc.

(*e*) Turn ON the power source, set switch 138 to SEND and close the key circuit.

(*f*) Tune ANT. TUNING knob 131 for maximum indication on the r-f ammeter.

(2) *Test.* (*a*) The 4,000-ohm output meter must not read less than 4.2 volts with switch 136 in either the MCW or CW positions.

(*b*) Measure the sidetone frequency on the oscilloscope, varying the audio-oscillator frequency to obtain an elliptical pattern. The sidetone frequency must not be less than 600 cycles, nor more than 850 cycles.

(*c*) Open the key circuit, set switch 138 to OFF and turn off power source. Disconnect the output meter, oscilloscope, and audio oscillator from the receiver.

i. TRANSMITTER OPERATIONAL TEST. (1) *Preparation.* (*a*) With all other control settings unchanged, set switch 137 to LOW.

(*b*) Set up a short-wave receiver in the vicinity of the transmitter so that CW and PHONE signals from the transmitter of Radio Receiver and Transmitter BC–1306 may be monitored.

(*c*) Insert microphone in MIKE jack 151.

(*d*) Turn on power source and set switch 138 to SEND.

(2) *Test.* (*a*) With switch 136 set at MCW, close the key circuit. Tune the monitoring receiver to the transmitter frequency. Set switch 137 to MED. or HIGH if the received signal is too weak.

(*b*) Open key circuit. Set switch 136 to PHONE, press microphone switch and talk clearly into the microphone. An assistant at the monitoring receiver should check for clear undistorted reception.

(*c*) Set switch 136 to MCW. Key the transmitter at speeds up to 25 words per minute and check that there is no tendency towards chopping off of characters at this speed.

(*d*) Repeat (*c*) above, with switch 136 set to CW.

(*e*) Insert a crystal whose frequency lies in the range 3.8–6.5 mc in crystal socket A of the transmitter. Set switch 135 to position A and rotate FREQ. CONTROL knob until maximum indication on the r-f ammeter is obtained. Vary ANT. TUNING knob 131 to still further increase the r-f ammeter indication. Tune the monitoring receiver to the crystal frequency.

(*f*) Repeat steps (*c*) and (*d*) above, with crystal-controlled operation of the transmitter.

(*g*) Set switch 138 to OFF and turn off the power source.

(*h*) Disconnect Cord CD–1086 and dummy load from the transmitter. Remove key from jack 150 and microphone from jack 151. Turn off the monitoring receiver.

27. Final Testing (Receiver)

a. TESTS. Upon completion of the final testing of the transmitter, the following receiver performance tests are to be made:

Sensitivity and noise (PHONE).
Sensitivity and noise (CW).
Sensitivity switch ratio.
Selectivity.
I-f rejection ratio.
Image rejection ratio.
Microphonics.
Calibration oscillator output and dial calibration.
Receiver operational test.

b. PREPARATION. (1) Restore the bottom plate of receiver.

(2) Connect receiver to power plug, antenna plug, and ground plug by means of circuit test cable. (See fig. 20.)

(3) Connect a 4,000-ohm output meter to a phone plug and insert it into one of the PHONE jacks.

(4) Supply power to the set with Battery BA–48, connecting Cord CD–1119 to battery receptacle 145 on the transmitter panel.

(5) Connect the HI r-f output post of the signal generator, in series with a 110-mmf capacitor, to antenna post 158 on the transmitter panel.

(6) Receiver plate voltage is set at 105 volts d-c. Receiver filament voltage is set at 1.4 volts d-c.

c. CONTROL SETTING. Except where otherwise specified, the following control settings are to be maintained: SEND-STANDBY-OFF switch, of the transmitter, at STANDBY; receiver PHONE-CW-NET-CAL switch at PHONE; SENSITIVITY switch at HIGH; VOLUME control in maximum clockwise position; IMPEDANCE switch on the back of the receiver at 4000; ANT. SELECTOR switch on transmitter at position 1.

d. SENSITIVITY AND NOISE (PHONE). (1) Set the PHONE-CW-NET-CAL switch at PHONE.

(2) Set the signal generator output voltage to 5 μv at 6.2 mc with 30 percent, 400 cycles modulation, and tune the receiver to this input frequency.

(3) Set the VOLUME control so that the output meter indicates 6.3 volts.

(4) Turn off the modulation of the signal generator. The output meter reading must not be more than 2.0 volts.

(5) Repeat steps (2) through (4) above, at all check-point frequencies shown in table VI,

Table VI. Phone sensitivity and noise chart.

Frequency (mc)	Signal generator output voltage (mv)	Maximum allowable noise voltage (volts)
6.4	5	2.0
5.2	5	2.0
3.8	5	2.0

e. SENSITIVITY AND NOISE (CW). (1) Set the PHONE-CW-NET-CAL switch at PHONE.

(2) Set the signal generator output to 6.2 mc with 30 percent, 400 cycles modulation, and tune the receiver to this input frequency.

(3) Plug a pair of earphones into the receiver phone jack and become familiar with the sound of a 400-cycle note. If Headset HS–30 with Cord CD–933 is used, set the IMPEDANCE switch to 250 ohms for better audibility.

(4) Turn off the modulation of the signal generator. Set the PHONE-CW-NET-CAL switch at CW. Tune for a 400-cycle beat note.

(5) Increase the output voltage of the signal generator to 0.5 volts. The beat note must remain clear.

(6) Unplug the earphones and reset the IMPEDANCE switch to 4,000 ohms.

(7) Reduce the signal generator output voltage to 3 μv. Set the VOLUME control so that the output meter reads 6.3 volts.

(8) Turn off the output of the signal generator. The output meter reading must not be more than 2.0 volts.

(9) Repeat steps (2) through (8) above, at all check-point frequencies shown in Table VII.

Table VII. CW sensitivity and noise chart.

Frequency (mc)	Signal generator output voltage (mv)	Maximum allowable noise voltage (volts)
6.4	3	2
5.2	3	2
3.8	3	2

f. SENSITIVITY SWITCH RATIO. (1) Set the PHONE-CW-NET-CAL switch at PHONE.

(2) Set the signal generator output to 10 μv at 5.2 mc with 30 percent, 400 cycles modulation, and tune the receiver to this input frequency.

(3) Set the VOLUME control so that the output meter indicates 6.3 volts.

(4) Set the SENSITIVITY switch to MED. and increase the signal generator output until the output meter reading returns to 6.3 volts. The signal generator's output voltage must not be less than 50 μv.

(5) Set the SENSITIVITY switch to LOW and increase the signal generator output until the output meter reading returns to 6.3 volts. The signal generator's output voltage must not be less than 1,000 μv.

g. SELECTIVITY. (1) Set the PHONE-CW-NET-CAL switch at PHONE.

(2) Set the signal generator output voltage to 5 μv at 5.2 mc with 30 percent, 400 cycles modulation and tune the receiver to this input frequency.

(3) Set the VOLUME control so that the output meter indicates 6.3 volts.

(4) Increase the output voltage of the signal generator to 10 μv.

(5) Leaving the TUNING knob of the receiver unchanged, vary the frequency of the signal generator on either side of 5.2 mc until the output voltage returns to 6.3 volts. Note the two dial settings of the signal generator at which this occurs.

(6) Subtract the smaller dial setting from the larger. The difference (or selectance) must be between 3 and 6 kc.

(7) Repeat steps (4) through (6) above, increasing the output of the signal generator to each of the values listed in table VIII, and checking for the required selectances.

Table VIII. Selectivity.

Signal generator voltage (mv)	Selectance (kc)
10	3–6
50	7.5–11
500	12–20
5,000	15–30

h. INTERMEDIATE - FREQUENCY REJECTION RATIO. (1) Sets the PHONE-CW-NET-CAL switch at PHONE.

(2) Set the signal generator output voltage to 10 μv at 6.5 mc with 30 percent, 400 cycles modulation, and tune the receiver to this frequency.

(3) Set the VOLUME control so that the output meter indicates 6.3 volts.

(4) With the receiver settings unchanged, shift the frequency of the signal generator to 456 kc and increase its voltage output to 1 volt.

(5) Vary the frequency of the signal generator slightly above and below 456 kc until the output meter reads a maximum value. This reading must not be more than 6.3 volts.

(6) Repeat steps (2) through (5) above, with the receiver tuned to the frequencies shown in table IX.

Table IX. Intermediate-frequency rejection ratio.

Test frequency (mc)	Test frequency input (mv)	Intermediate-frequency input (volts)	Maximum output meter reading (volts)
6.5	10	1.0	6.3
5.2	10	1.0	6.3
3.8	10	1.0	6.3

i. IMAGE REJECTION RATIO. (1) Set the PHONE-CW-NET-CAL switch at PHONE.

(2) Adjust the signal generator's output voltage to 10 μv at 6.5 mc with 30 percent, 400 cycles modulation, and tune the receiver to this input frequency.

(3) Adjust the VOLUME control so that the output meter indicates 6.3 volts.

(4) Adjust the generator frequency to 7.412 mc, the image-frequency. (The image-frequency is the signal frequency plus twice the i-f frequency.)

(5) Increase the signal generator output to 6,000 μv. Vary the frequency of the signal generator slightly above and below 7.412 mc until the output meter reads maximum value.

(6) The output meter must not read more than 6.3 volts.

(7) Repeat steps (2) through (6) above, at each of the frequencies listed in table X.

Table X. Image rejection ratio.

Signal frequency (mc)	Image frequency (mc)	Signal frequency input (mv)	Image frequency input (mv)	Maximum output meter reading (volts)
6.500	7.412	10	5,000	6.3
5.200	6.112	10	5,000	6.3
3.800	4.712	10	5,000	6.3

j. MICROPHONICS. (1) Set PHONE-CW-NET-CAL switch at PHONE.

(2) Set the signal generator's output voltage to 10,000 μv at 5.2 mc with 30 percent, 400 cycles modulation, and tune the receiver to this frequency.

(3) Set the VOLUME control so that the output meter indicates 14.1 volts.

(4) Unplug the output meter and plug in a headset. Adjust the IMPEDANCE switch to match the proper impedance of the headset.

(5) Turn modulation off. Proceed to tap or slap side of receiver and note whether objectionable microphonic noises are heard in the headset.

(6) Microphonic tubes are distinguished by a sustained feedback and should be replaced.

k. Calibration Oscillator Output and Dial Calibration. (1) Disconnect the signal generator.

(2) Set the PHONE-CW-NET-CAL switch at CAL.

(3) Plug a set of earphones into one of the PHONE jacks.

(4) Turn the receiver's dial to 3.8 mc, and tune for zero beat. This should occur within ±30 kc of the 3.8 mc dial marking.

(5) Turn the receiver tuning knob slightly until a beat note of approximately 400 cycles is heard. Unplug the earphones.

(6) Set the IMPEDANCE switch at 4000. The output meter must not read less than 4,1 volts.

(7) Repeat steps (3) through (6) above, at each of the check-point frequencies of table XI.

Table XI. Calibration oscillator output and dial calibration.

Frequency (mc)	Maximum dial deviation (kc)	Minimum output meter reading (volts)
3.8	±30	4.1
5.2	±30	4.1
6.4	±30	4.1

(8) Disconnect the output meter and headset from the PHONE jacks. Turn the OFF-STANDBY-SEND switch of the transmitter to OFF. Disconnect the receiver test cable.

l. Receiver Operational Test. (1) With IMPEDANCE switch set at 250, replace receiver in case. Enter all plug-in connections properly without forcing. Secure the four retaining rings on case.

(2) Turn OFF-STANDBY-SEND switch on transmitter panel to STANDBY.

(3) Connect a suitable antenna to the antenna post 158 on the transmitter panel.

(4) Plug a headset into one of the PHONE jacks.

(5) With the PHONE-CW-NET-CAL switch in the PHONE position, rotate the TUNING knob until a station is tuned in.

(6) Check that the receiver output is not excessively distorted and is free of howls, squeals, and intermittent noises. Rotate the VOLUME control back and forth and check that there are no intermittent noises at any setting.

(7) Reset the PHONE-CW-NET-CAL switch to the CW position; tune in a c-w station and again check for normal operation.

(8) Push DIAL LIGHT switch 50 and check that pilot light goes on.

(9) Turn OFF-STANDBY-SEND switch on the transmitter panel to OFF. Disconnect the headset and Cord CD–1119.

SECTION VIII

INDIVIDUAL STAGE AND CIRCUIT REPAIR DATA

28. Receiver R-F Amplifier Stage

a. STAGE DATA. (1) R-f stage schematic, figure 31.

(2) Voltage and resistance values for socket 58, stage schematic.

(3) Parts data for r-f amplifier stage, table XII.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test it with the tube checker and replace with a new tube if necessary. In replacing the tube, see that it is seated firmly in its socket.

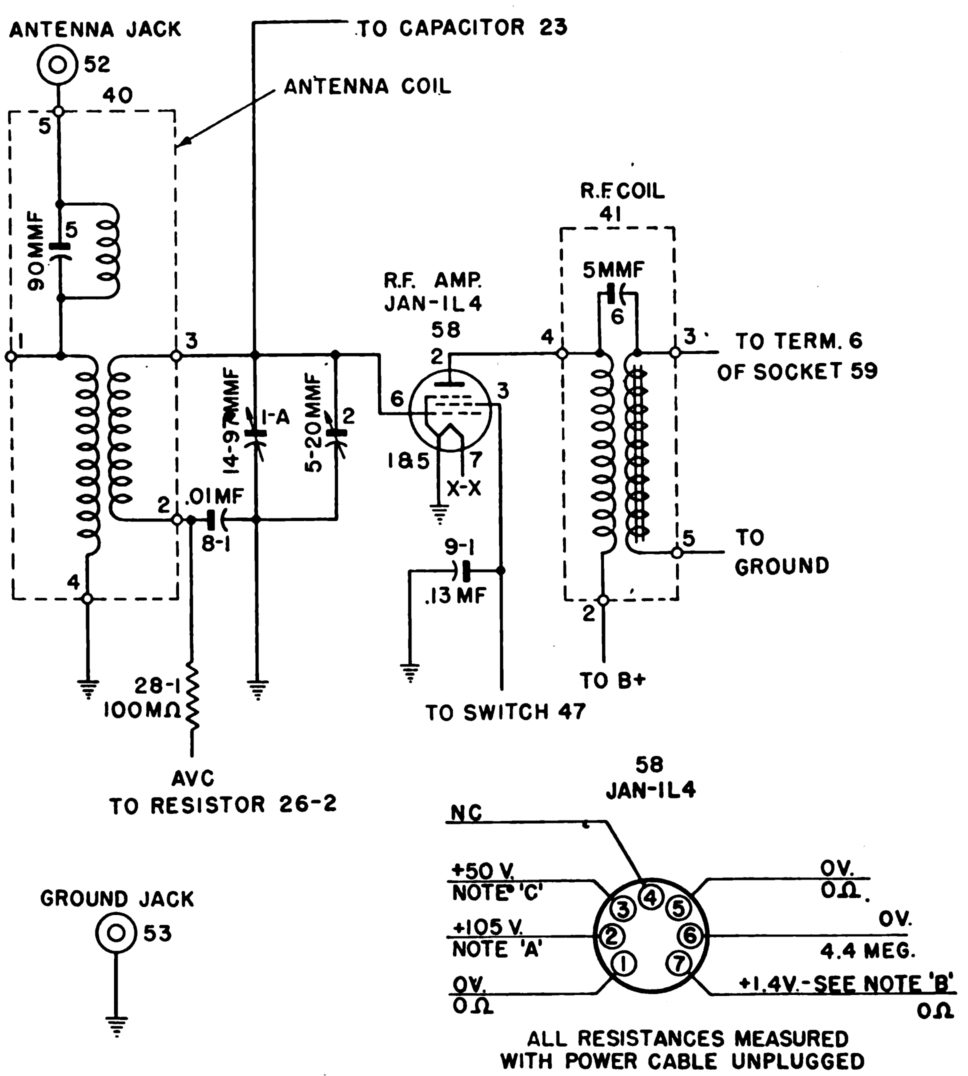
(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage. The voltage of terminal 6 of socket 58 may have an appreciable negative value when measured with a d-c vacuum-tube voltmeter. Check the resistance of terminal 6 of socket 58 to ground with the tuning capacitor in various positions, thus checking for shorts between rotor and stator plates.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the parts identification drawing, figure 22. Check for broken leads, faulty soldered joints and shorts. Capacitor 1–A is the rear section of the main tuning capacitor, and capacitor 2 is the trimmer mounted on the same section of the gang.

(4) *Low gain.* Use the test hook-up described in paragraph 18*a*. Connect the HI r-f output of the signal generator to the receiver antenna post in series with a 250-mmf dummy antenna. Set the signal generator to 5.2 mc with 30 percent, 400 cycles modulation, and tune the receiver to this frequency. Note whether the indication of the output meter increases sharply with any of the following steps, indicating an open bypass capacitor.

(*a*) Connect a 0.01-mf capacitor in parallel with capacitor 8–1.

(*b*) Connect a 0.01-mf capacitor in parallel with capacitor 9–1.



NOTE 'A' PHONE-CW-NET-CAL. SWITCH IN PHONE POS. ∞
" " " " " " CW " ∞
" " " " " " NET " 107 MΩ
" " " " " " CAL " 107 MΩ

NOTE 'B' WITH PHONE PLUG IN JACK

NOTE 'C' SENSITIVITY SWITCH IN LOW POS.-11 MEG PHONE-CW-NET-CAL SWITCH IN NET POS
" " " MED POS-1 MEG " " " " " " " "
" " " HIGH POS-47 M Ω " " " " " " " "

Figure 31. R-f amplifier stage schematic for receiver of Radio Receiver and Transmitter BC-1306. TL 70784

Table XII. Parts data, r-f amplifier stage (receiver) (fig. 31).

Reference symbol	Signal Corps stock No.	Name of part, description and function
1-A	3D9097V	CAPACITOR, variable: air; ganged; 14- to 97-mmf; 500-peak v; (tuning).
2	2D9020V-8	CAPACITOR, variable: ceramic; 5- to 20-mmf; 500 vdcw; (trimmer).
5	3D9090-10	CAPACITOR, fixed: ceramic; 90-mmf ±3%; 300 vdcw; (wave trap).
6		CAPACITOR, fixed: ceramic; 5-mmf; (r-f cplg).
8-1	3D810-160.1	CAPACITOR, fixed: paper; 10,000-mmf ±20%; 120 vdcw; (r-f bypass).
9-1	3DA130-5	CAPACITOR, fixed: paper; 130,000-mmf ±20%; 150 vdcw; (screen bypass).
28-1	3RC10AE104K	RESISTOR: carbon; 100,000-ohm ±10%; ¼-w; insulated; (a-v-c filter).
40	2C5395-1306/T2	TRANSFORMER: r-f; (ant. coil).
41	2C5395-1306/T1	TRANSFORMER: (r-f).
52	2Z5598-5	JACK: banana type; (ant. connector).
53	3Z635-12	BINDING POST: spring type; (jack, ground).
58	2Z8799-19	SOCKET: miniature tube; (r-f amplr).
	2J1L4	TUBE JAN-1L4: (r-f amplr).

29. Receiver Mixer, H-F Oscillator Stage

a. STAGE DATA. (1) Mixer-oscillator stage schematic, figure 32.

(2) Voltage and resistance values for socket 59, stage schematic.

(3) Parts data for mixer-oscillator stage, table XIII.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test it with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage. The voltage of terminal 4 of socket 59 will have an appreciable negative value, as measured on a d-c vacuum-tube voltmeter when the circuit is oscillating properly. Check the resistance of terminal 6 of socket 59 with the tuning capacitor in various positions, thus checking for shorts between rotor and stator plates.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the parts identification drawing, figure 22. Check for broken leads, faulty soldered joints, and shorts. Capacitor 1–B is the center section of the main tuning capacitor.

(4) *No oscillation.* Check capacitor 1–C for an accidental ground between rotor and stator. Check the wiring to terminals 5 and 2 of transformer 42 for accidental grounds. Check capacitor 8–2 by connecting a 0.01-mf capacitor in parallel with it.

(5) *Blocking and motorboating.* If the capacity of capacitor 10 is too large, or if resistor 28–2 is disconnected or makes only intermittent connection, blocking may occur.

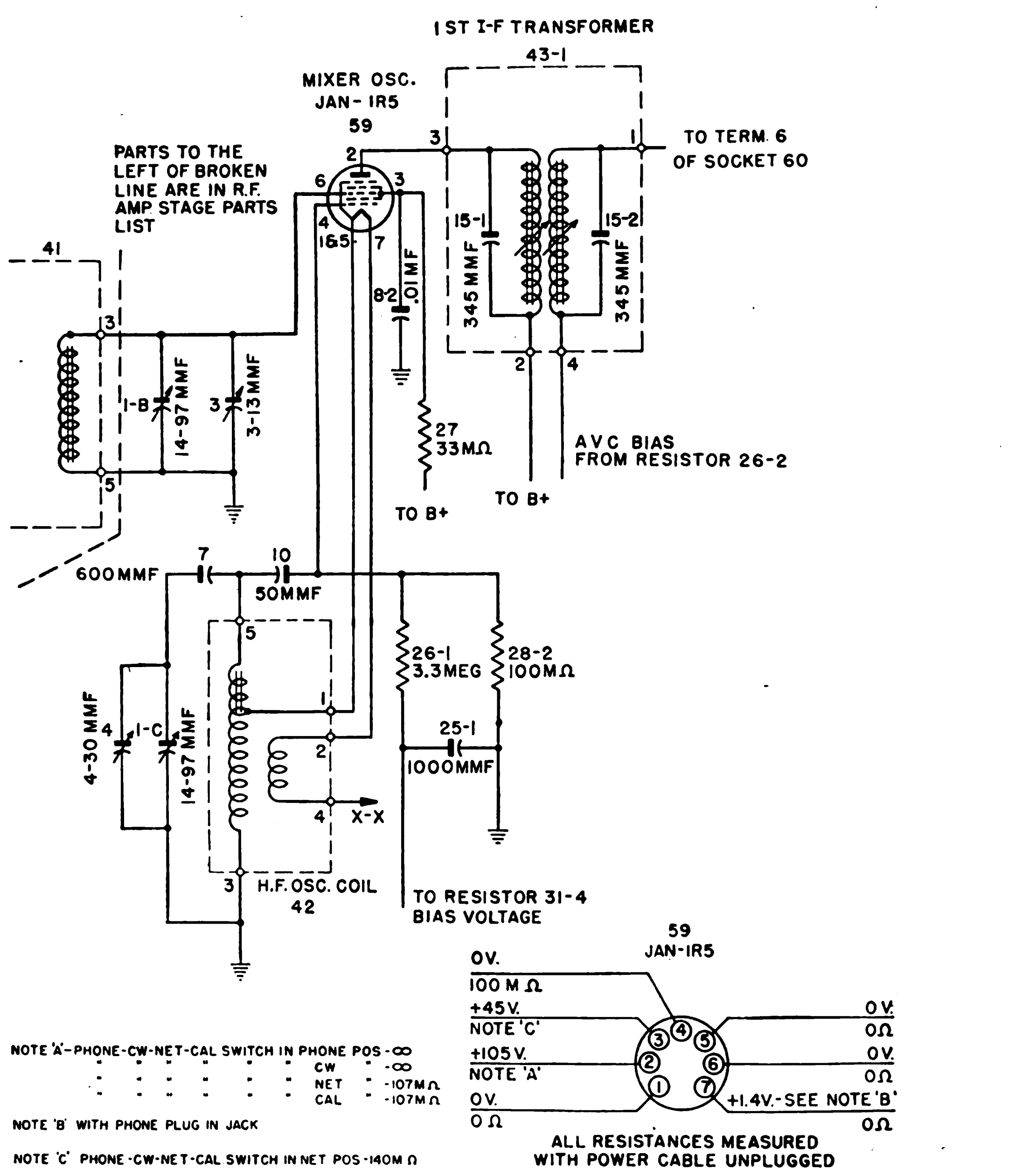


Figure 32. Mixer, h-f oscillator stage schematic for receiver of Radio Receiver and Transmitter BC–1306.

Table XIII. Parts data, mixer, h-f oscillator stage (receiver) (fig. 32).

Reference symbol	Signal Corps stock No.	Name of part, description and function
1–B	3D9097V	CAPACITOR, variable: air; 14- to 97-mmf; 500-peak v; (tuning).
1–C	3D9097V	CAPACITOR: same as 1–B; (tuning).
3	3DK9013V–3	CAPACITOR, variable: 3- to 13-mmf ±20%; (trimmer).
4	3D9030V–6	CAPACITOR, variable: 4- to 30-mmf; 500 vdcw; (trimmer).
7	3D9600–19	CAPACITOR, fixed: mica; 600-mmf ±10%; 300 vdcw; (padder).
8–2	3D810–160.1	CAPACITOR, fixed: paper; 10,000-mmf ±20%; 120 vdcw; (anode grid).
10	3D9050–49.4	CAPACITOR, fixed: ceramic; 50-mmf ±10%: 300 vdcw; (grid cplg).
15–1		CAPACITOR, fixed: mica; 345-mmf; (pri res).
15–2		CAPACITOR, fixed: mica; 345-mmf; (sec res).
25–1	3DA1–123	CAPACITOR, fixed: ceramic; 1,000-mmf ±10%; 500 vdcw; (bias filter).
26–1	3RC10AE335M	RESISTOR: carbon; 3.3-meg. ±20%; ⅓-w; insulated; (bias filter).
27	3RC10AE333K	RESISTOR: carbon; 33,000-ohm ±10%; ¼-w; insulated; (anode grid dropping).
28–2	3RC10AE104K	RESISTOR: carbon; 100,000-ohm ±10%; ¼-w; insulated; (grid leak).
42	2C5395–1306/T3	TRANSFORMER: r-f; (h-f osc coil).
43–1	2Z9641.80	TRANSFORMER: i-f; peaked at 456 kc; (1st i-f).
59		SOCKET: (mixer osc tube).
	2J1R5	TUBE JAN–1R5(VT–171): (mixer osc tube).

30. Receiver First I-F Amplifier Stage

a. STAGE DATA. (1) First i-f amplifier stage schematic, figure 33.

(2) Voltage and resistance values for socket 60, stage schematic.

(3) Parts data for first i-f amplifier stage, table XIV.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test it with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage. The voltage of terminal 6 of socket 60 may have an appreciable negative value when measured with a d-c vacuum-tube voltmeter.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the parts identification drawing, figure 22. Check for broken leads, faulty soldered joints and shorts.

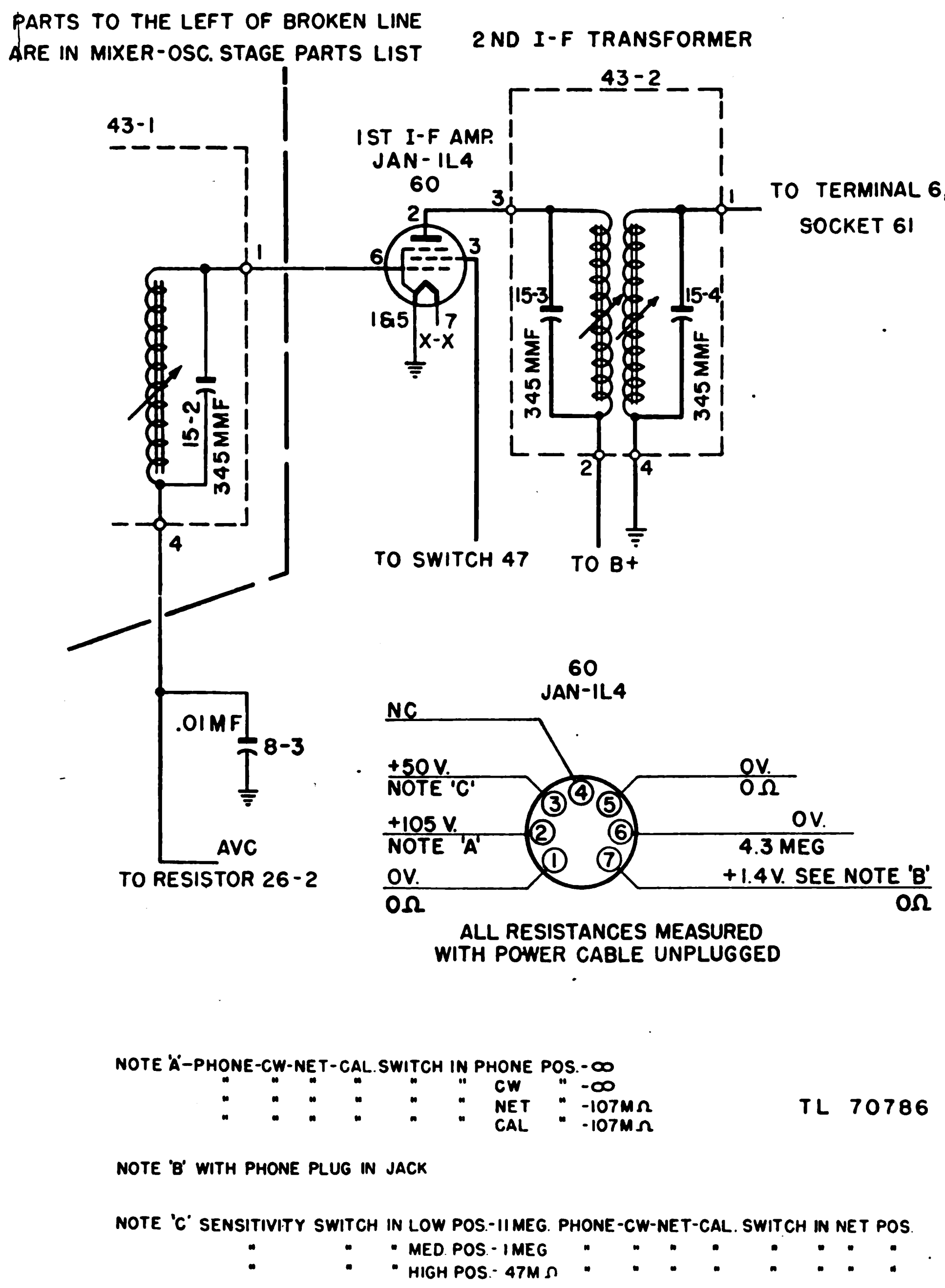


Figure 33. First i-f amplifier stage schematic for receiver of Radio Receiver and Transmitter BC-1306.

Table XIV. Parts data, first i-f amplifier stage (receiver) (fig. 33).

Reference symbol	Signal Corps stock No.	Name of part, description and function
8-3	3D810-160.1	CAPACITOR, fixed: paper; 10,000-mmf ±20%; 120 vdcw; (a-v-c bypass).
15-3		CAPACITOR, fixed: mica; 345-mmf; (pri res).
15-4		CAPACITOR, fixed: mica; 345-mmf; (sec res).
43-2	2Z9641.80	TRANSFORMER: i-f; peaked at 456 kc; (2d i-f).
60		SOCKET: (1st i-f amplr).
	2J1L4	TUBE JAN-1L4: (1st i-f amplr).

31. Receiver Second I-F Amplifier and Crystal Calibrator Stage

a. STAGE DATA. (1) Second i-f amplifier and crystal calibrator stage schematic, figure 34.

(2) Voltage and resistance values for socket 61, stage schematic.

(3) Parts data for second i-f amplifier and crystal calibrator stage, table XV.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test it with the tube checker and replace with a new tube if necessary. In replacing tube, see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage. The voltage of terminal 4 of socket 61 will have an appreciable negative value, as measured with a d-c vacuum-tube voltmeter, when the PHONE-CW-NET-CAL switch is set at CAL.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the parts identification drawing, figure 22. Check for broken leads, faulty soldered joints and shorts.

(4) *Low gain.* Check capacitor 8–9 for open circuit by connecting a 0.01-mf capacitor in parallel with it and noting the effect upon the output.

(5) *No oscillation.* If there is no crystal calibrator output, make the following checks:

(*a*) Check the resistance to ground from the end of capacitor 8–4 which is connected to the PHONE-CW-NET-CAL switch. This resistance should be zero except in the CAL position, when it should be infinite.

(*b*) Check capacitor 12 for open circuit by connecting a 300-mmf capacitor in parallel and noting the effect upon the output.

(*c*) Check capacitor 11 for open circuit by connecting a 30-mmf capacitor in parallel with it and noting the effect upon the output.

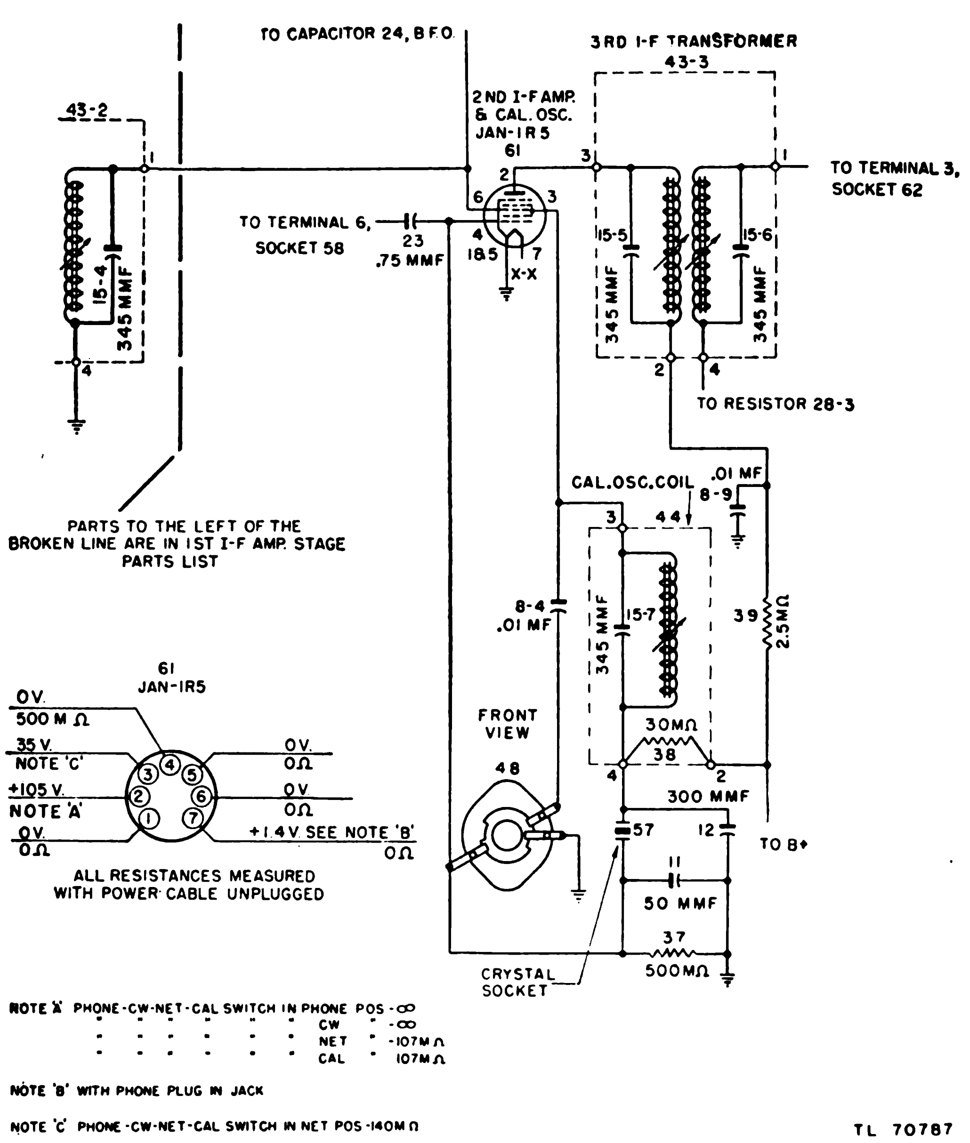


Figure 34. Second i-f amplifier and crystal calibrator stage schematic for receiver of Radio Receiver and Transmitter BC-1306.

Table XV. Second i-f amplifier and crystal calibrator stage (fig. 34).

Reference symbol	Signal Corps stock No.	Name of part, description and function
8-4	3D810-160.1	CAPACITOR, fixed: paper; 10,000-mmf ±20%; 120 vdcw; (tank ckt bypass).
8-9	3D810-160.1	CAPACITOR: same as 8-4; (plate dropping bypass).
11	3D9050-79.2	CAPACITOR, fixed: ceramic; 50-mmf ±5%; 300 vdcw; (grid leak bypass).
12	3D9300-8	CAPACITOR, fixed: mica; 300-mmf ±10%; 500 vdcw; (screen dropping bypass).
15-5		CAPACITOR, fixed: mica; 345-mmf; (pri res).
15-6		CAPACITOR, fixed: mica; 345-mmf; (sec res).
15-7		CAPACITOR, fixed: mica; 345-mmf; (tank res).
23	3D9000.75-1	CAPACITOR, fixed: bakelite; 0.75-mmf +66.6%, —0.0%; 300 vdcw; (r-f cplg).
37	3Z6750-56	RESISTOR: carbon; 500,000-ohm ±10%; ⅓-w; insulated; (grid leak).
38		RESISTOR: carbon; 30,000-ohm; (screen dropping).
39	3Z6250-74	RESISTOR: carbon; 2,500-ohm ±20%; ⅓-w; insulated; (plate dropping).
43-3	2Z9641.80	TRANSFORMER: i-f; peaked at 456 kc; (3d i-f).
44	2C5395-1306/C12	COIL: r-f; osc; (cal osc).
57	2Z8672.28	SOCKET: 2-contact; (crystal socket).
61		SOCKET: (2d i-f amplr cal osc tube).
	2J1R5	TUBE JAN-1R5(VT-171): (2d i-f amplr cal osc).

32. Receiver Detector, First A-F Amplifier, A-V-C, BFO Stage

a. STAGE DATA. (1) Detector, first a-f, a-v-c, bfo stage schematic, figure 35.

(2) Voltage and resistance values for socket 62, stage schematic.

(3) Parts data for detector, first a-f, a-v-c, and bfo stage, table XVI.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test it with the tube checker and replace with a new tube if necessary. In replacing tube, see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage. The voltage of terminal 3 of socket 62 may have an appreciable negative value when measured with a d-c vacuum-tube voltmeter.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the parts identification drawing, figure 22. Check for broken leads, faulty soldered joints, and shorts.

(4) *No beat-frequency oscillation or low-audio gain.* Check capacitor 8–6 for open circuit by paralleling with a 0.01-mf capacitor and noting the effect upon the output.

(5) *Coarse beat note.* Check to see that capacitor 13–2 is connected properly. Parallel it with a 100-mmf capacitor and note the effect upon the output.

(6) *Motorboating.* This trouble may be due to open or intermittent connections in the grid circuit. Check grid returns.

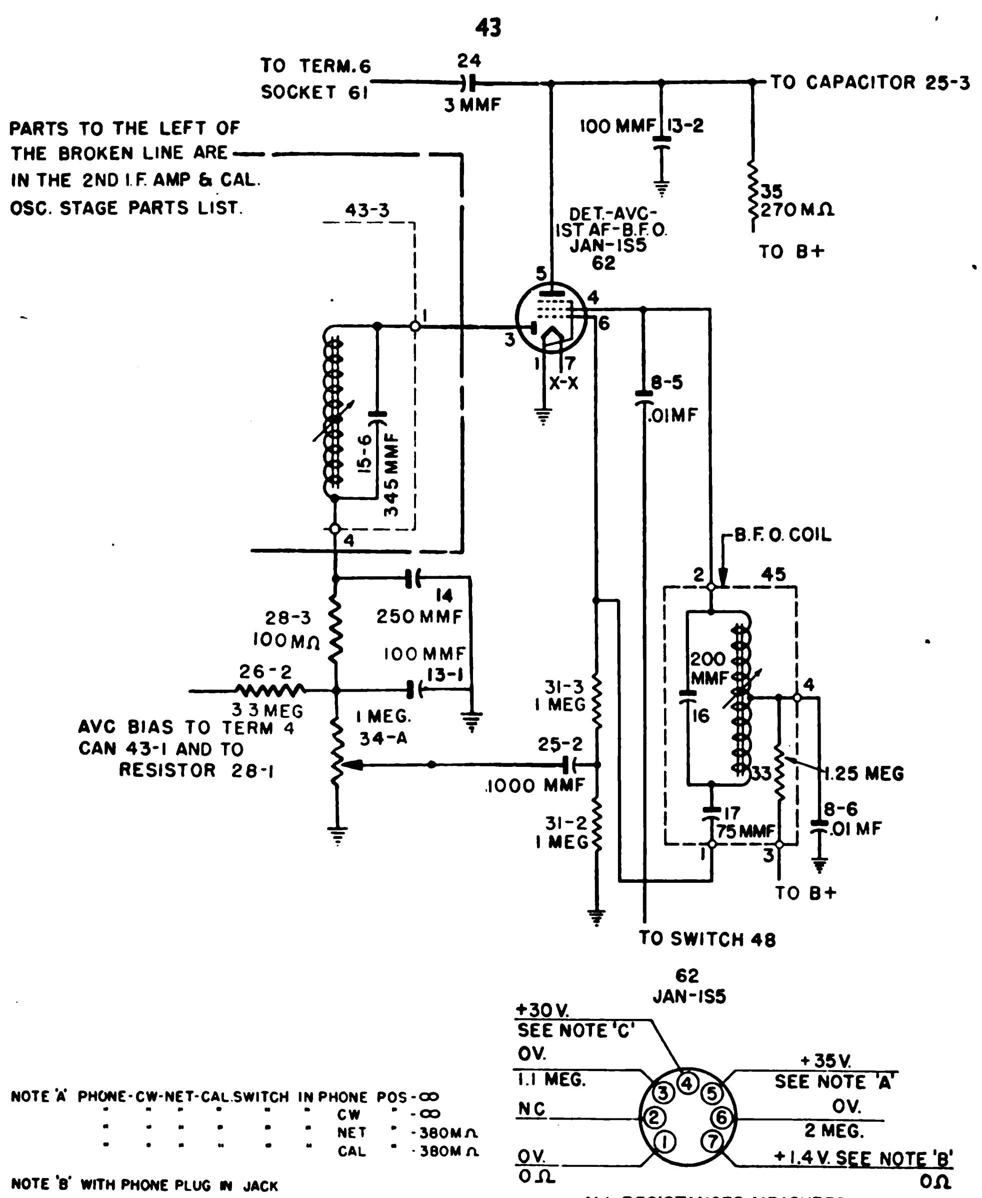


Figure 35. Detector, first a-f amplifier, a-v-c, bfo stage schematic, for receiver of Radio Receiver and Transmitter BC-1306. TL 70788

Table XVI. Parts data, det., first a-f, a-v-c, bfo stage (receiver) (fig. 35).

Reference symbol	Signal Corps stock No.	Name of part, description and function
8-5	3D810-160.1	CAPACITOR, fixed: paper; 10,000-mmf ±20%; 120 vdcw; (tank ckt bypass).
8-6	3D810-160.1	CAPACITOR: same as 8-5; (screen dropping bypass).
13-1	3D9100-126	CAPACITOR, fixed: ceramic; 100-mmf ±20%; 300 vdcw; (a-v-c filter bypass).
13-2	3D9100-126	CAPACITOR: same as 13-1; (r-f bypass).
14	3D9250-65	CAPACITOR, fixed: ceramic; 250-mmf ±20%; 500 vdcw; (diode load bypass).
16		CAPACITOR, fixed: mica; 200-mmf; (tank res).
17		CAPACITOR, fixed: ceramic; 75-mmf; (grid cplg).
24	3D9003-16.1	CAPACITOR, fixed: ceramic; 3-mmf ±10%; 500 vdcw; (bfo cplg).
25-2	3DA1-123	CAPACITOR, fixed: ceramic; 1,000-mmf ±10%; 500 vdcw; (a-f cplg).
26-2	3RC10AE335M	RESISTOR: carbon; 3.3-meg ±20%; ⅓-w; insulated; (a-v-c filter).
28-3	3RC10AE104K	RESISTOR: carbon; 100,000-ohm ±10%; ¼-w; insulated; (diode load).
31-2	3RC10AE105K	RESISTOR: carbon; 1-meg ±10%; ⅓-w; insulated; (grid return).
31-3	3RC10AE105K	RESISTOR: carbon; 1-meg ±10%; ⅓-w; insulated; (grid return).
33	3RC10AE125K	RESISTOR: carbon; 1.25-meg ±10%; ⅓-w; insulated; (screen dropping).
34-A	2Z7284-43	POTENTIOMETER: dual; 1-meg per sec; 0.03-w per 10% eff rotation; (volume control).
35	3RC10AE274K	RESISTOR: carbon; 270,000-ohm ±10%; ⅓-w; insulated; (plate load).
45	2C5395-1306/T4	TRANSFORMER: r-f; (bfo coil).
62		SOCKET: (diode audio-amplr tube).
	2J1S5	TUBE JAN-1S5(VT-172): (det 1st a-f a-v-c-bfo).

33. Receiver Audio-Output Amplifier Stage

a. STAGE DATA. (1) Audio-output amplifier stage schematic, figure 36.

(2) Voltage and resistance values for socket 63, stage schematic.

(3) Parts data for audio output amplifier stage, table XVII.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from socket. Test it with the tube checker and replace with a new tube if necessary. In replacing tube, see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the parts identification drawing, figure 22. Check for broken leads, faulty soldered joints, and shorts.

(4) *Low gain.* If low gain is suspected for this stage, check capacitors 9–2 and 9–3 for open circuits by connecting a 0.01-mf capacitor in parallel with each and noting the effect upon the output.

(5) *Motorboating.* This trouble may be due to open or intermittent connections in the grid circuit. Check grid returns.

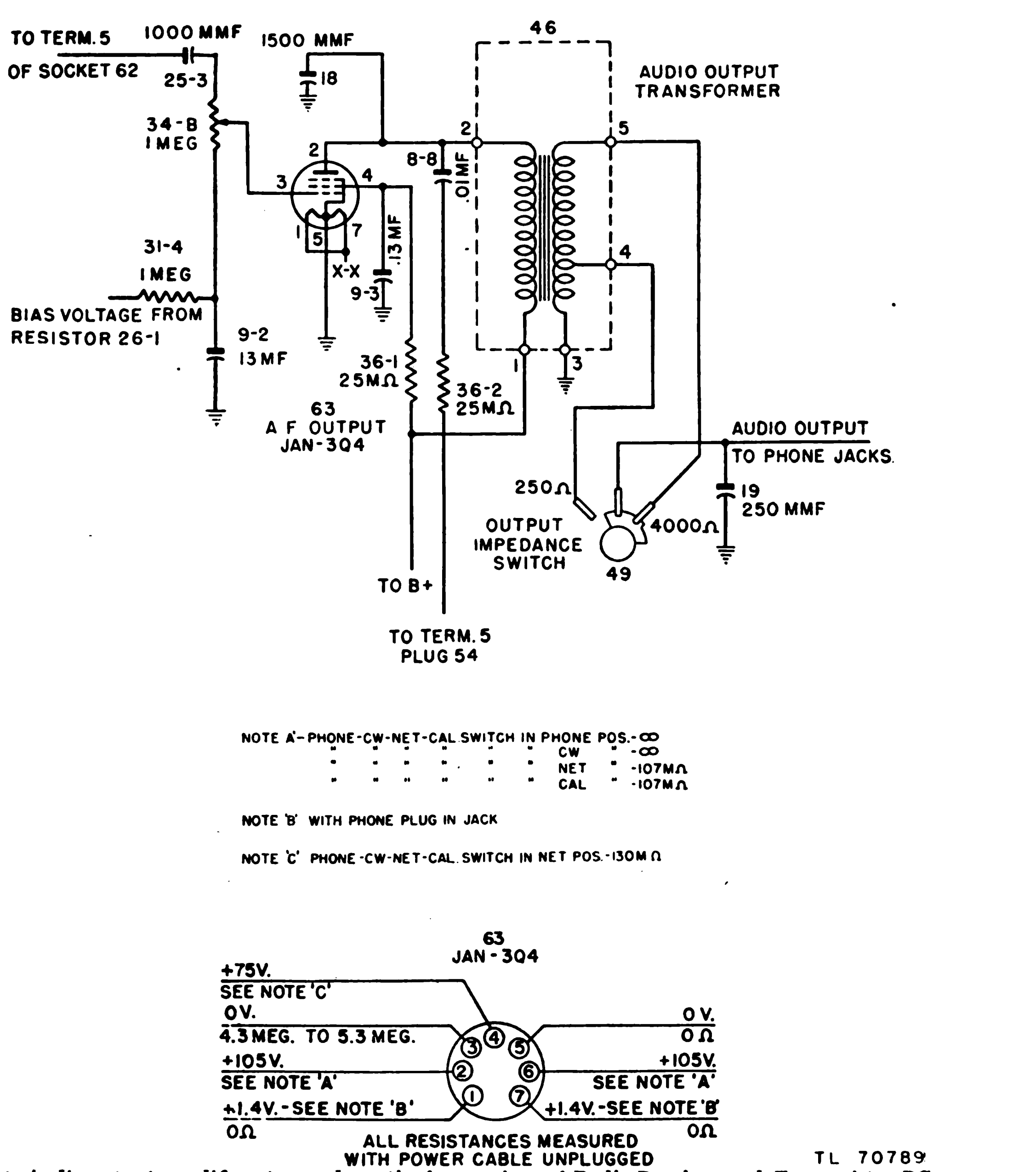


Figure 36. Audio-output amplifier stage schematic, for receiver of Radio Receiver and Transmitter BC–1306.

Table XVII. Parts data, a-f output stage (receiver) (fig. 36).

Reference symbol	Signal Corps stock No.	Name of part, description and function
8–8	3D810–160.1	CAPACITOR, fixed: paper; 10,000-mmf ±20%; 120 vdcw; (sidetone cplg).
9–2	3DA130–5	CAPACITOR, fixed: paper; 130,000-mmf ±20%; 150 vdcw; (a-f bypass).
9–3	3DA130–5	CAPACITOR: same as 9–2; (screen bypass).
18	3DA1.500–18	CAPACITOR, fixed: ceramic; 1,500-mmf ±20%; 300 vdcw; (plate load impedance).
19	3D9250–66	CAPACITOR, fixed: mica; 250-mmf ±10%; 300 vdcw; (plate load impedance).
25–3	3DA1–123	CAPACITOR, fixed: ceramic; 1,000-mmf ±10%; 500 vdcw; (grid cplg).
31–4	3RC10AE105K	RESISTOR: carbon; 1-meg. ±10%; ⅛-w; insulated; (bias filter).
34–B	2Z7284–43	POTENTIOMETER: dual; 1-meg per sec; 0.03-w per 10% eff rotation; (volume control).
36–1	3Z6625–102	RESISTOR: carbon; 25,000-ohm ±10%; ⅛-w; (screen dropping).
36–2	3Z6625–102	RESISTOR: same as 36–1; (sidetone cplg).
46	2Z9632.133	TRANSFORMER: (audio output).
49	3Z9825–62.92	SWITCH: rotary; (output impedance).
63	2Z8799–19	SOCKET: miniature tube; (audio output).
	2J3Q4	TUBE JAN–3Q4 (VT–264): (audio output).

34. Receiver Power and Switching Connections

a. Stage Data. (1) Power and switching connections schematic, figure 38.

(2) Details of switches 47 and 48, figure 37.

(3) Voltage and resistance values for plug 54, on stage schematic.

(4) Parts data for power and switching connections, table XVIII.

b. Trouble Location. (1) *Improper sensitivity switch ratio.* Perform a point-to-point continuity check of the wiring to switch 47.

(2) *Noise and regeneration.* If the receiver is noisy, or has regenerative squeals, a possible cause is capacitor 20 being open. Check by paralleling with a 1,000-mf capacitor and noting the effect upon the noise.

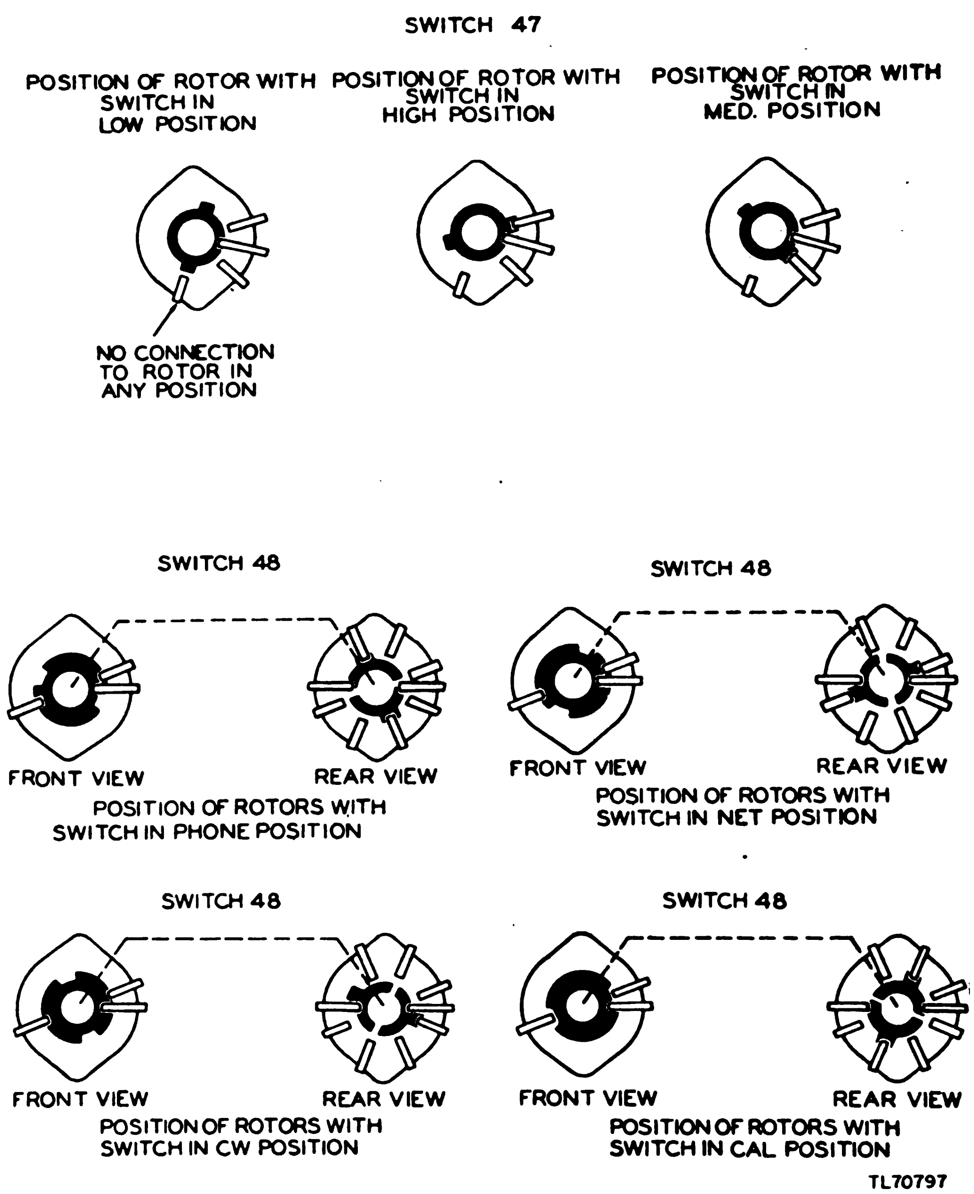


Figure 37. Details of switches 47 and 48 of receiver of Radio Receiver and Transmitter BC–1306.

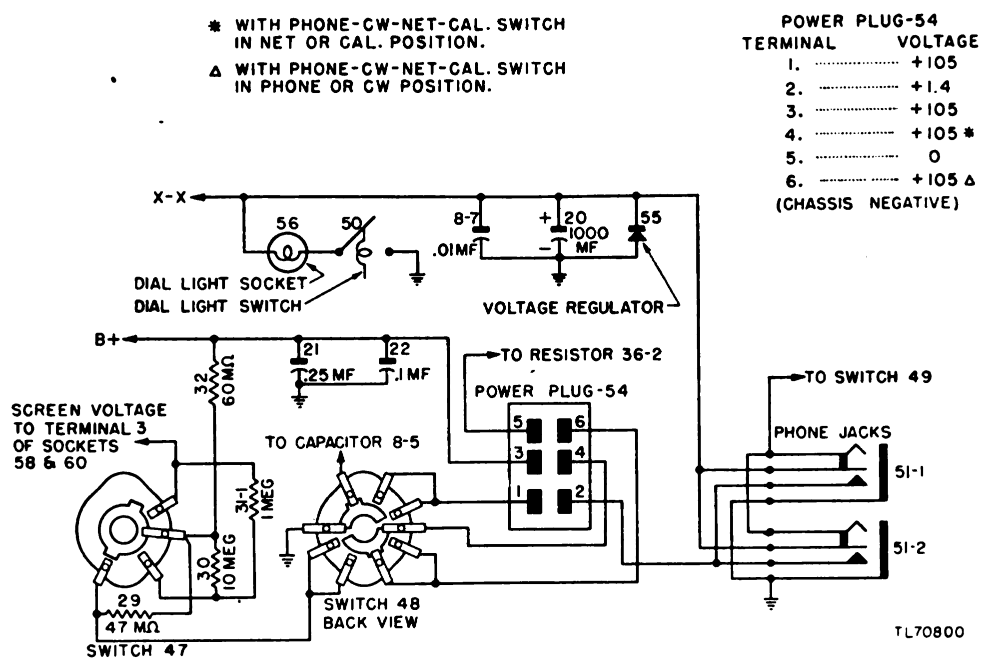


Figure 38. Power and switching connections schematic for receiver of Radio Receiver and Transmitter BC–1306.

Table XVIII. Parts data, power, and switching circuits (receiver) (fig. 38).

Reference symbol	Signal Corps stock No.	Name of part, description and function
8–7	3D810–160.1	CAPACITOR, fixed: paper; 10,000-mmf ±20%; 120 vdcw; (r-f bypass).
20	3DB1000–3	CAPACITOR, fixed: electrolytic; 1,000-mf +50%, —20%; 3 vdcw; (a-f bypass).
21	3DA250–88	CAPACITOR, fixed: paper; 250,000-mmf ±20%; 200 vdcw; (B+ bypass).
22	3DA100–209	CAPACITOR, fixed: paper; 100,000-mmf ±20%; 120 vdcw; (B+ bypass).
29*	3RC10AE473K	RESISTOR: carbon; 47,000-ohm ±10%; ⅛-w; insulated; (sensitivity).
30	3RC10AE106K	RESISTOR: carbon; 10-meg ±10%; ⅛-w; insulated; (sensitivity).
31–1	3RC10AE105K	RESISTOR: carbon; 1-meg ±10%; ⅛-w; insulated; (sensitivity).
32	3Z6660–24	RESISTOR: carbon; 60,000-ohm ±10%; ⅛-w; insulated; (sensitivity).
47	3Z9825–62.94	SWITCH: rotary; (sensitivity).
48	3Z9825–62.93	SWITCH: rotary; (PHONE-CW-NET-CAL).
50	3Z9824–42.1	SWITCH: pushbutton; (dial light).
51–1	2Z5598–7	JACK ASSEMBLY: (phone).
51–2	2Z5598–7	JACK ASSEMBLY: (phone).
54	2Z7227–2	PLUG: male; 6-pin; polarized; (power).
55	3H4858–6	RECTIFIER: selenium dry disk; 1.4 vdcw rating; (volt regulator).
56		SOCKET: (dial light).

*Resistor 29 in equipments Serial No. 1–211 was 20,000 ohms. Change to value in this table.

35. Transmitter Oscillator Stage

a. STAGE DATA. (1) Oscillator stage schematic, figure 40.

(2) Parts identification illustrations.

(*a*) Transmitter, top view, figure 6.

(*b*) Transmitter, bottom view, figure 55.

(*c*) Transmitter, rear view, figure 7.

(*d*) Transmitter, rear view, cover removed from ganged tuning capacitor, figure 8.

(3) Detail of switch 135, figure 39.

(4) Voltage and resistance values of socket 140, stage schematic.

(5) Parts data, table XIX.

b. TROUBLE LOCATION. (1) *Tube check.* Remove Tube JAN–3A4 from socket 140 by loosening its holder with a screw driver. (See fig. 6.) Test the tube with a tube checker and replace with a new tube if necessary. In replacing the tube be sure it is firmly seated in its socket and reinstall its holder properly to prevent the tube from loosening in its socket.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground. Never check for resistance with an ohmmeter with power on. Plate and grid elements are at r-f and d-c potentials and a vacuum-tube voltmeter should be used when measuring voltage at these elements. After trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage.

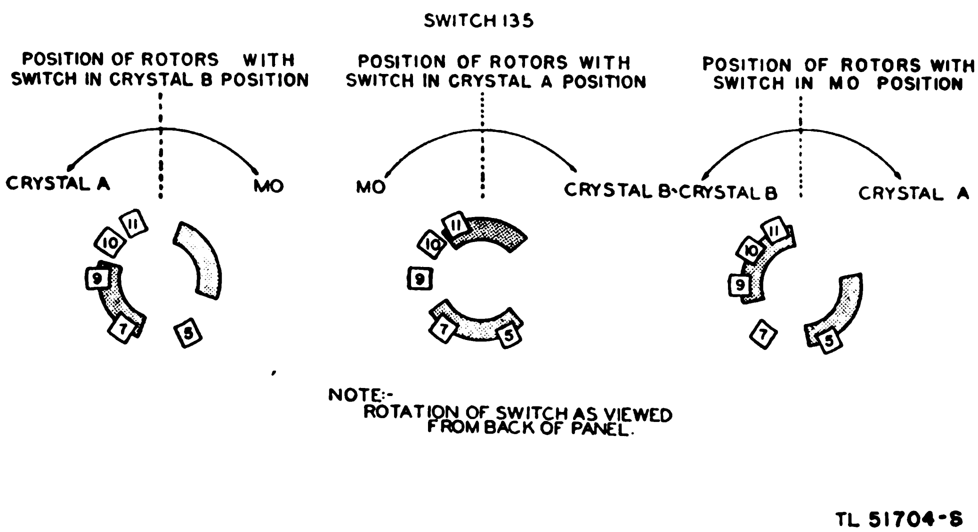


Figure 39. Detail of switch 135 for transmitter of Radio Receiver and Transmitter BC–1306.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic, figure 40, and to the parts identification illustrations, figures 6, 7, 8, and 55. Check for faulty soldered joints, broken leads, short circuits and grounds.

(4) *Over-all voltage checks.* Point-to-point voltage checks and voltages across component parts are performed referring to the normal voltage chart, figure 9. All voltages must conform with the values indicated. Data on the power supply voltages and associated switching connections is covered in figure 51.

(5) *Filament circuit.* (*a*) Excessive voltage across tube socket contacts 1 and 5 may be due to burned out tube in this stage or an open filament of the modulator tube in socket 141. Voltage regulator 157 may also be inoperative.

(*b*) Low voltage may be caused by run-down Battery BA–48, poor contacts at relay 156 (terminals 1 and 2), or defective contacts of switch 138.

(*c*) An open filament circuit may be due to an open resistor 122, an open r-f choke 128, one-half filament of Tube JAN–3A4 burned out, broken connections or faulty conditions as mentioned in (*b*) above.

(6) *Lack of oscillation.* (*a*) *MO operation.* If the oscillator does not oscillate in this position, the following conditions should be checked:

1. Low emission of Tube JAN–3A4.
2. Low-power supply source or run-down Battery BA–48.
3. Defective 105-volt circuit due to voltage regulator tube in socket 146, defective or out of socket.
4. Faulty contacts of switch 135 in MO position.
5. No plate voltage due to faulty power source, open resistor 106 or open r-f choke 130.
6. Defective grid leak resistor 105.
7. Shorted grid capacitor 79.
8. Shorted capacitors 75A, 76A, 76B, or 77 across coil 125.
9. Open circuit wiring or faulty soldered connections.

When a faulty connection has been localized, correct this condition to restore the oscillator to normal operation in MO position.

(*b*) *Crystal operation.* If the oscillator performs normally in the MO position, but abnormally in the CRYSTALS position of switch 135, the following conditions should be checked:

1. Defective contacts of switch 135 in crystal A or B position.
2. Crystals of incorrect frequency range.
3. Crystals damaged or poor oscillators.
4. Short in Capacitor 94.
5. Open r-f choke 129.

Substitute replacement crystals and correct the faulty condition to restore normal crystal operation.

(7) *R-f output.* If the r-f output is insufficient, the following conditions should be checked:

(*a*) Low emission of Tube JAN–3A4 or one-half of its filament open.

(*b*) Low power supply source voltage or run-down Battery BA–48.

(*c*) Incorrect grid bias due to defective resistor 105 and/or capacitor 79.

(*d*) Capacitor 94 leaking to ground.

(*e*) R-f being shorted to ground in the output circuit due to grounded wiring or short circuit in the p-a grid circuit. When a faulty condition has been localized, it should be remedied to permit full r-f output from the oscillator stage.

c. Removal and Replacement of Ganged Tuning Capacitor. Whenever it is necessary to remove this unit, see paragraph 40.

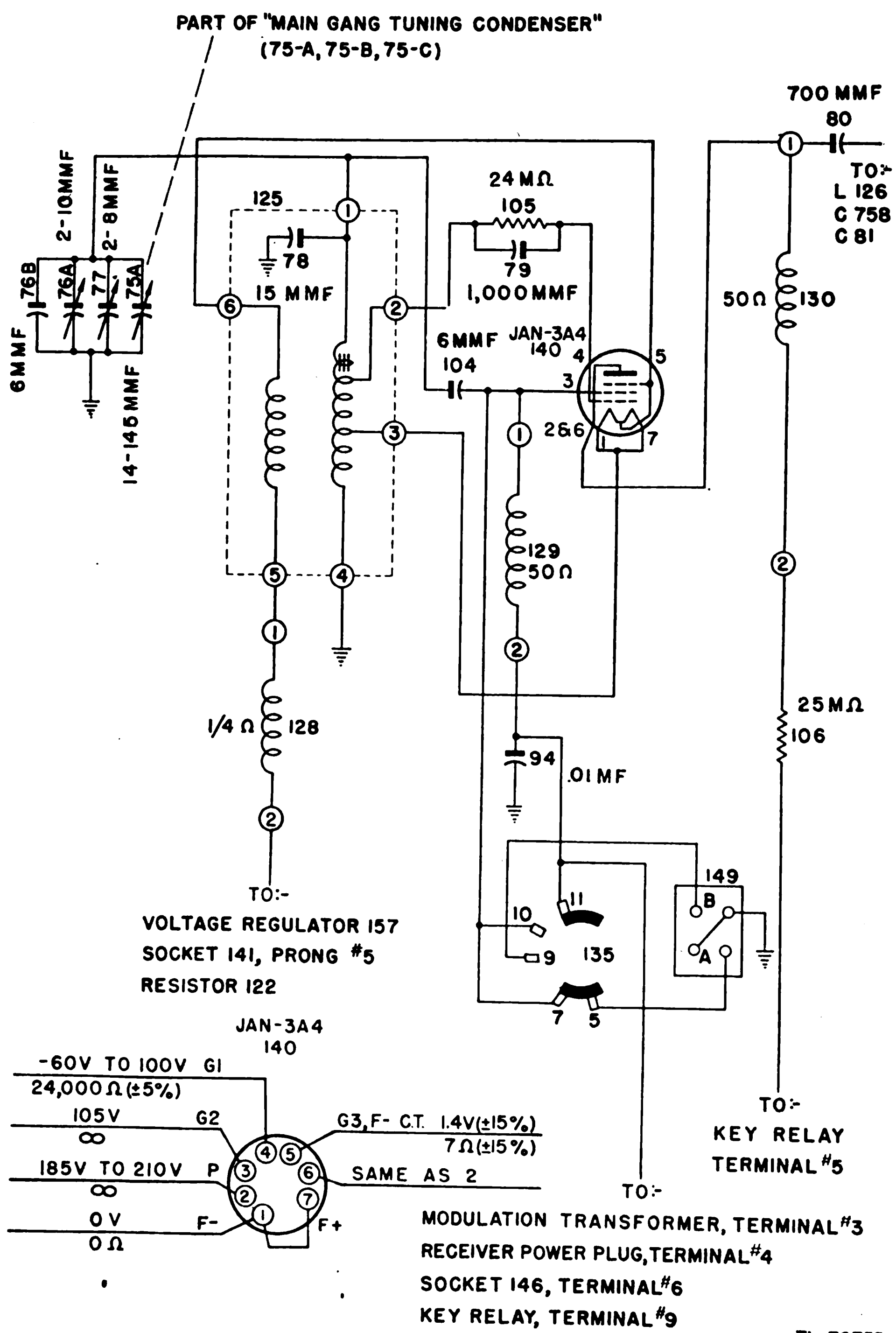


Figure 40. Oscillator stage schematic of transmitter of Radio Receiver and Transmitter BC-1306.

Table XIX. Parts data, transmitter oscillator stage (fig. 40).

Reference symbol	Signal Corps stock No.	Name of part, description and function
75–A	3D9145V–3	CAPACITOR, variable: air; 14-mmf min, 145-mmf max (section 1 of 3); (part ganged tuning capacitor resonates coil 125).
76–A	3D9010V–6	CAPACITOR, variable: air; 2-mmf min, 10-mmf max; (fine tuning of coil 125).
76–B		CAPACITOR, fixed: ceramic; 6-mmf ±10%; (temperature compensator across coil 125).
77	3D9008V–6	CAPACITOR, variable: air; 2-mmf min, 8-mmf max; (CAL tuning of coil 125).
78	3D9015–26	CAPACITOR, fixed: ceramic; 15-mmf ±5%; (neg coefficient compensator, coil 125).
79	3D9500–18	CAPACITOR, fixed: mica; 500-mmf ±10%; 500 vdcw; (grid-leak charge).
80		CAPACITOR, fixed: mica; 700-mmf ±10%; 500 vdcw; (r-f cplg to coil 126).
94	3DA10–160.1	CAPACITOR, fixed: paper; 10,000-mmf ±20%; 120 vdcw; (screen-grid r-f bypass to ground).
104	3D9006–10	CAPACITOR, fixed: ceramic; 6-mmf ±5%; 500 vdcw; (neutralizing; prevents self-oscillation).
125	2C5395–1306/C11	COIL ASSEMBLY: (osc grid coil, to resonant freq).
128	3C323–34B	COIL: r-f choke; 30-mh; (blocks r-f from fil circuit).
129	2C5395–1306/C5	COIL: r-f choke; 3-mh; (high impedance to r-f current using crystal operation).
130	2C5395–1306/C1	COIL: r-f choke; 3-mh; (blocks r-f from power supply).
105	3Z6624–3	RESISTOR: carbon; ½-w; 24,000-ohm ±5%; insulated; (grid-leak bias).
106	3Z6625–59	RESISTOR: fixed; wire-wound; 25,000-ohm ±10%; 10-w; (plate voltage dropping resistor).
140	2Z8677.36	SOCKET: tube; miniature; 7-prong; (Tube JAN–3A4).
149	2Z8678	SOCKET: 4-prong; (crystal holder).
135	3Z9825–62.81	SWITCH: rotary; selector; single-section; 3-position; (MO-CRYSTALS selector).
		TUBE JAN–3A4: (r-f generator).

36. Transmitter P-A Stage

a. STAGE DATA. (1) P-a stage schematic, figure 41.

(2) Parts identification illustrations.

(*a*) Transmitter, top view, figure 6.

(*b*) Transmitter, rear view, figure 7.

(*c*) Transmitter, bottom view, figure 55.

(*d*) Transmitter, rear view, cover removed from ganged tuning capacitor, figure 8.

(*e*) Transmitter, rear view, less ganged tuning capacitor and cover, figure 10.

(3) Voltage and resistance values of socket 142, stage schematic, figure 41.

(4) Parts data, table XX.

b. TROUBLE LOCATION. (1) *Tube check.* Remove Tube JAN–2E22, socket 142, by removing the plate cap lead and loosening the clamping ring at the tube base. (See fig. 7.) Test tube with a tube checker and replace with a new tube if necessary. When replacing a tube, make sure it is firmly seated in its socket, the clamping ring is securely locked, and the plate cap lead is restored.

Warning: When transmitter is in operation there are 500 volts d-c, plus high r-f voltage on the plate cap.

(2) *Tube socket voltage and resistance check.* Voltages and resistances are checked from the tube socket terminals to ground. Never check for resistance with the power on. Plate and grid elements are at high r-f and d-c potentials. Use a vacuum-tube voltmeter when measuring voltage at these elements, exercising extreme care to avoid bodily contact while the power is on. After trouble has been localized to a particular portion of the stage, make a check of each individual component associated with that portion of the stage and correct the fault.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic, figure 41, and to the parts identification illustrations, figures 6, 7, 8, and 55. Check also for faulty soldered joints and defective wiring.

(4) *Over-all voltage checks.* Point-to-point voltage checks across component parts are performed referring to the normal voltage chart, figure 9, and must conform to the values indicated. All voltages depend on the position of switches 136, 137, and 138. Refer to data on power supply voltages and associated switching connections as covered on figure 51.

(5) *Metering socket 143.* Test all voltages at this socket (fig. 7), referring to paragraph 39, table XXIII, for values and switching positions.

(6) *R-f checks.* Probe for r-f with a neon lamp, exercising care to avoid bodily contact with high potentials. An a-c vacuum-tube voltmeter may also be used for checking r-f potentials.

(7) *Lack of r-f at input circuit.* If there is no indication of r-f in the grid circuit, the following conditions should be checked:

(*a*) Test for r-f with a neon lamp or an a-c vacuum-tube voltmeter at contact 3 of tube socket 142. A weak glow, or no glow, indicates poor or no r-f excitation from the oscillator stage.

(*b*) Check for r-f at each side of capacitor 80, coil 126 (terminal 1), stator plates of capacitor 75B and trimmer 81.

(*c*) Failure to secure r-f at all of these points indicates the oscillator stage is inoperative and should be corrected accordingly.

(*d*) With normal oscillator r-f output, loss of r-f at contact 3 indicates an open capacitor 80, an open coil 126, or open circuit wiring. Localize where r-f is lost and correct the fault.

(*e*) Low oscillator r-f output will cause low d-c bias voltage due to lack of sufficient r-f excitation. The negative grid voltage must be between negative 47 and negative 68 volts for normal operation. If resistors 107 and 109 are open, or capacitors 82 or 83 are shorted, the grid circuit will be unbiased causing excessive plate current being drawn as indicated by a red hot plate of Tube JAN–2E22.

Warning: Failure to turn power off at once when plate of Tube JAN–2E22 is red, will cause damage to the tube and an overload on other circuit components.

(8) *Lack of r-f at output circuit.* If r-f output is low in the plate circuit, check for the following:

(*a*) Open-circuited capacitor 101.

(*b*) Open-circuited capacitor 87.

(*c*) Shorted capacitor 102.

(*d*) Shorted or grounded turns in coil 127.

(9) *Tank circuits.* Coils 126 and 127 should show continuity and freedom from grounds. Look for shorted turns. Tuning capacitors across each tank circuit must show infinity resistance checks. Rotate the frequency dial throughout its range during these checks. Look for bent plates and correct accordingly.

(10) *Lack of modulation or sidetone output.* These are generally covered under modulator

stage data, paragraph 38b(5). If difficulties are encountered in the p-a stage, check for the following:

(*a*) Improper values of negative voltage in the MCW-PHONE position of switch 136 may be caused by open resistor 108, shorted capacitor 83, or poor contact connections on switch 136.

(*b*) Defective or open resistor 110, will allow floating or unstabilized operation of the suppressor grid circuit.

(*c*) Open or defective resistor 118 will show up by unequalization of sidetone level between CW and MCW positions of switch 136.

(*d*) Open or defective resistor 119 will unload the suppressor grid in the MCW position.

(*e*) Open capacitor 84 will allow r-f leakage on to the audio-frequency modulation causing fuzziness of speech.

(*f*) Shorted capacitor 84 will short circuit the a-f to ground, resulting in no modulation in the MCW-PHONE position of switch 136. When the faulty condition has been localized, correct the condition to restore normal operation.

c. REMOVAL AND REPLACEMENT OF GANGED TUNING CAPACITOR. Whenever it is necessary to remove this unit, refer to detailed procedure as covered in paragraph 40.

d. REMOVAL AND REPLACEMENT OF TRANSMITTER DIAL LIGHT. (1) Remove receiver from case (release two retainer clamps on each side of the case, see fig. 1) and remove DIAL LIGHT EXTRACTOR mounted on the inside of the case. (See fig. 4.)

(2) Remove four screws, item 4, holding dial window frame and gasket to the panel. (See fig. 25.)

(3) Press the rubber end of the extractor over the dial light and unscrew defective bulb. Install new dial light in reverse procedure, securely screwing bulb into the socket.

(4) Replace gasket and window frame, securely making up all four screws so as to be waterproof.

(5) Restore extractor and receiver in case.

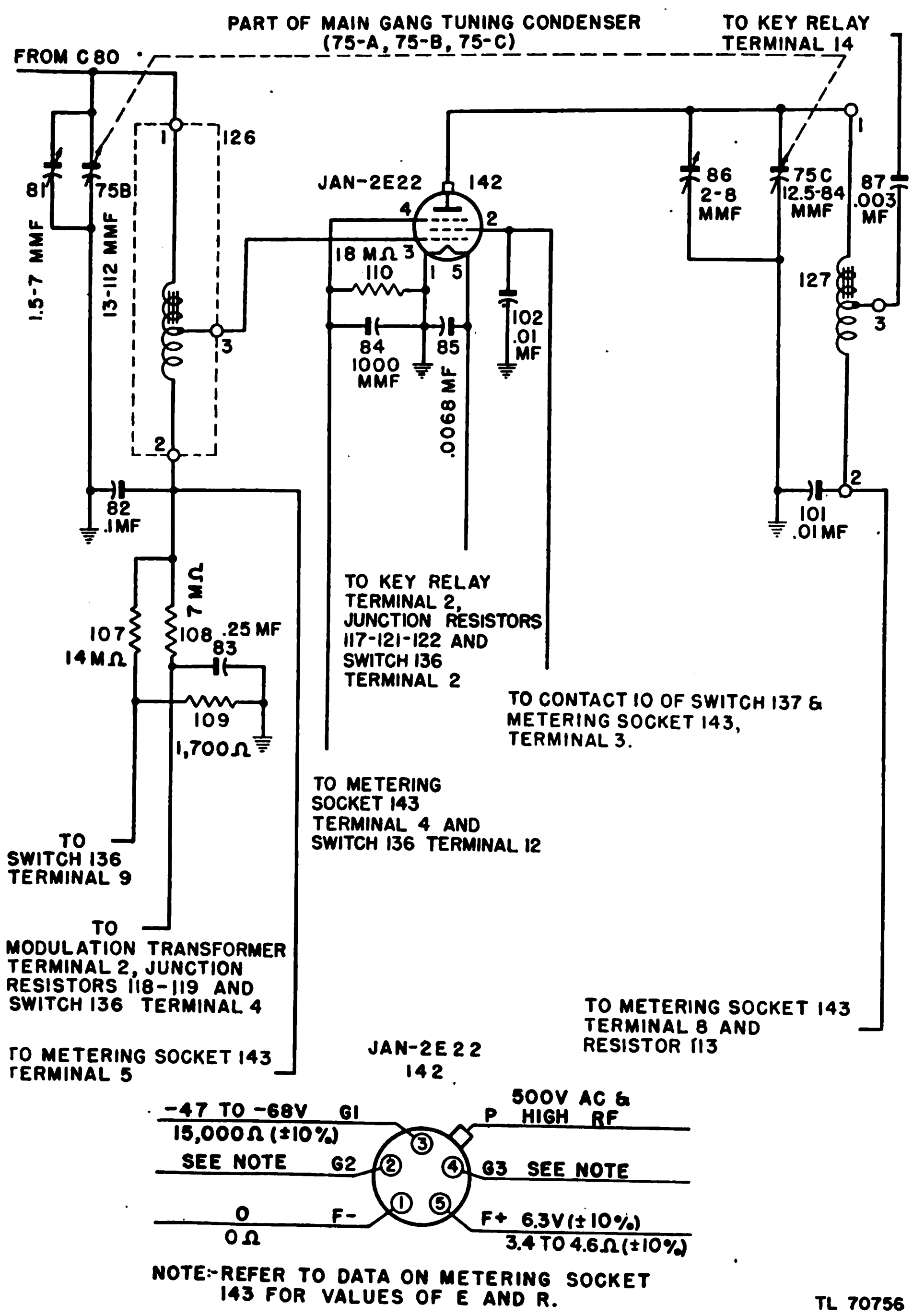


Figure 41. P-a stage schematic for transmitter of Radio Receiver and Transmitter BC-1306.

Table XX. Parts data, power amplifier (transmitter) (fig. 41).

Reference symbol	Signal Corps stock No.	Name of part, description and function
75–B	3D914V–3	CAPACITOR, variable: air; 13-mmf min, 112-mmf max (sec 2 of 3); (part of ganged tuning-to resonate coil 126).
75–C	3D9145V–3	CAPACITOR, variable: air; 12.5-mmf min, 84-mmf max (sec 3 of 3); (part of ganged tuning-to resonate coil 127).
81	3D9001VE5–1	CAPACITOR, variable: ceramic; 1.5-mmf min, 7-mmf max; (doubler trimmer; fine tuning of coil 126).
82	3DA100–209.1	CAPACITOR, fixed: paper; 100,000-mmf ±10%; 120 vdcw; (p-a grid return r-f bypass).
83	3DA250–88	CAPACITOR, oil: paper; 0.25-mf; (suppressor-grid audio bypass).
84	3DA1–123	CAPACITOR, fixed: ceramic; 1,000-mmf ±10%; 500 vdcw; (suppressor bypass).
85	3DA6.800–2	CAPACITOR, fixed: ceramic; 6,800-mmf +30%, —20%; 300 vdcw; (filament r-f bypass).
86	3DA9015V–19	CAPACITOR, variable: air; 2-mmf min, 7-mmf max; 4,000-v peak; (p-a trimmer-fine tuning of coil 127).
87	3DA3–5	CAPACITOR, fixed: mica; 3,000-mmf ±10%; 750 vdcw; (r-f cplg to antenna network via key relay).
101	3DA10–126.1	CAPACITOR, fixed: paper; 10,000-mmf ±10%; 1,000 vdcw; (plate supply r-f bypass).
102	3DA10–124.1	CAPACITOR, fixed: paper; 10,000-mmf ±20%; 600 vdcw; (screen-grid r-f bypass).
126	2C5395–1306/C8	COIL: r-f doubler grid; (resonated to twice oscillator frequency).
127	2C5395–1306/C10	COIL: r-f p-a plate; (resonated to output frequency).
107	3Z6614–5	RESISTOR: fixed; carbon; 14,000-ohm ±10%; 1-w; (grid-leak).
108	3Z6570–19	RESISTOR: fixed; carbon; 7,000-ohm ±10%; ½-w; (part of suppressor-grid bias voltage divider).
109	3Z6170–4	RESISTOR: fixed; carbon; 1,700-ohm ±10%; ½-w; (modulator bias).
110	3RC21BE183K	RESISTOR: fixed; carbon; 18,000-ohm ±10%; ½-w; (suppressor-grid return).
142	2Z8675.46	SOCKET: 5-prong; p-a tube; (Tube JAN–2E22).

37. Transmitter Antenna-tuning Network Stage

a. STAGE DATA. (1) Antenna-tuning network stage schematic, figure 42.

(2) Parts identification illustrations.

(*a*) Transmitter, top view, figure 6.

(*b*) Transmitter, rear view, figure 7.

(3) Parts data, table XXI.

b. TROUBLE LOCATION. (1) *Circuit theory.* The r-f output of the transmitter is designed to operate with either a short whip antenna or a one-half wavelength antenna, AN–160. Switch 139 selects the proper circuit constants for the type of antenna in use and connects the r-f output to antenna POST 158. Positions 1, 2, and 3 of switch 139, select the proper value of loading inductance, coil 124, for whip antenna operation, and positions 4, 5, and 6, of switch 139, select the proper value of loading capacitors 91, 92, and 93 when antenna AN–160 is used. Critical resonance of the transmitter frequency to the antenna in use is accomplished by varying the coupling of tuning coil 131 until maximum brilliance is indicated on the neon bulb in socket 152.

(2) *Point-to-point r-f check.* A neon bulb lamp is used for point-to-point r-f tracing, to find the place where r-f was last located. If r-f output is not secured at antenna post 158, when key relay 156 is in the SEND position, check the following items:

(*a*) Poor contacts on relay 156, springs 14 and 15.

(*b*) Defective neon lamp in socket 152.

(*c*) Shorted or grounded socket 152.

(*d*) Open antenna tuning coil 131.

(*e*) Open antenna loading coil 124.

(*f*) Defective capacitors 91, 92, and 93.

(*g*) Grounded antenna post 158.

Replace the defective part and repair unsoldered connections for broken leads, whenever necessary, to restore normal operation.

Table XXI. Parts data, antenna network (transmitter) (fig. 42).

Reference symbol	Signal Corps stock No.	Name of part, description and function
88		CAPACITANCE of socket 152; (neon lamp to ground).
91	3D9090–9	CAPACITOR, fixed: ceramic; 90-mmf ±5%; 3,800 v a-c test; (antenna loading).
92	3D9115	CAPACITOR, fixed: ceramic; 115-mmf ±5%; 3,800 v a-c test; (antenna loading).
93	3D9135–6	CAPACITOR, fixed: ceramic; 135-mmf ±5%; 3,800 v a-c test; (antenna loading).
124	2C5395–1306/C9	COIL: antenna; r-f loading; (to resonate antenna).
131	2C5395–1306/C4	COIL: r-f; antenna tuning; (resonate ant to transmitter operating frequency).
159		INDICATOR: polaroid; (shades brilliance of neon bulb socket 152).
158	3Z774–5.1	POST: antenna binding; (r-f output to antenna).
152	2Z5885–8	SOCKET: assembly; candelabra; bayonet; (for neon bulb).
139	3Z9825–62.85	SWITCH: rotary; single-section; 6-position; ceramic; insulation; (antenna selector of proper circuit constants).
		NEON BULB: bayonet base; ¼-w; (r-f output indicator).

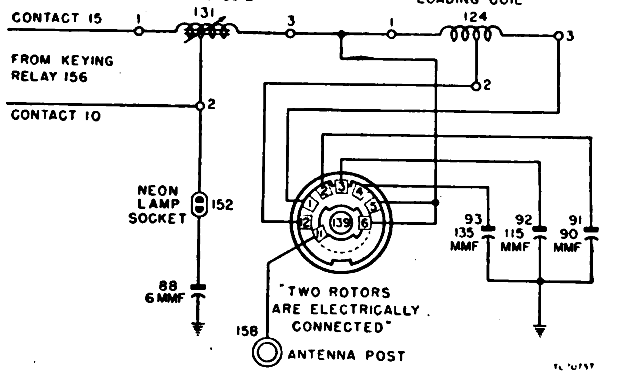


Figure 42. Antenna tuning network stage schematic of transmitter of Radio Receiver and Transmitter BC–1306.

38. Transmitter Modulator Stage

a. STAGE DATA. (1) The modulator stage schematic, figure 43.

(2) Parts identification illustrations.

(*a*) Transmitter, top view, figure 6.

(*b*) Transmitter, bottom view, figure 55.

(*c*) Transmitter, rear view, figure 7.

(*d*) Transmitter, rear view, cover removed from ganged tuning capacitor, figure 8.

(*e*) Transmitter, rear view, less ganged tuning capacitor and cover, figure 10.

(3) Voltage and resistance values of socket 141, stage schematic, figure 43.

(4) Parts data, table XXII.

b. TROUBLE LOCATION. (1) *Tube check.* Remove Tube JAN–3A4 from socket 141 after removing its tube shield by slight depression and short turn to the right. (See fig. 6.) Test the tube with a tube checker and replace with a new tube if necessary. In replacing the tube, make sure it is firmly seated in its socket and the tube shield is securely locked in place.

(2) *Tube socket voltage and resistance check.* Check the voltages and resistances from the socket terminals to ground. Never check for resistance with power on. All voltages and resistances must be normal as indicated on figure 43. Localize any trouble to a particular portion of the stage, making a check of each individual component associated with that portion of the stage.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic, figure 43, and to the parts identification illustrations, figures 6, 7, 8, and 55. Check the voltage drop across the resistors, transformers, and other components. Check for faulty soldered joints, broken connections, short circuits, and grounds.

(4) *Over-all voltage checks.* Point-to-point voltage checks and voltages across component parts are performed referring to the normal voltage chart, figure 9. All voltages must conform with the values indicated thereon. Data on the power supply voltages and associated switching connections is covered in figure 51.

(5) *Lack of modulation.* Conditions causing lack of modulation may be traced to the following items and should be checked accordingly.

(*a*) Tube JAN–3A4 in socket 141 may be low in emission, defective, one-half filament open, or burned out.

(*b*) Modulation transformer 133 may be defective, being open or having shorted turns, or grounded secondary winding. Replacement of this transformer should be made if any of these defects show up.

(*c*) Defective screen grid circuit caused by defective contacts of switch 138, open resistor 114, run-down Battery BA–48, defective voltage regulator tube in socket 146, shorted capacitor 95; or faulty connection between receiver control to plug 54 (on receiver), receptacles 175 and 66 (on case), and receiver power plug 148 (on transmitter). (See fig. 16.) Localize the trouble and correct the fault.

(*d*) Defective contacts or open circuit at switch 136 in PHONE position.

(*e*) Trouble may also be in the suppressor grid circuit of p-a Tube JAN–2E22 as covered in paragraph 36*b*(10).

(6) *Lack of a-f input.* The following conditions may cause no input signal and should be checked.

(*a*) Microphone plug not inserted in jack 151.

(*b*) Microphone or microphone switch of Cord CD–318–A, defective or broken connections to same.

(*c*) Defective input transformer 132 having open primary or secondary.

(*d*) No polarizing voltage available for microphone due to defective contacts at switch 138 in SEND position, or open resistor 117.

(*e*) Shorted capacitor 97.

(*f*) Open resistor 120.

(7) *Low a-f output.* Conditions causing low a-f output may be traced to the following items:

(*a*) Tube JAN–3A4, socket 141, low in emission or having one-half filament open.

(*b*) Defective resistor 120.

(*c*) Defective screen grid circuit as covered in (5) (*c*) above.

(8) *Lack of sidetone signal.* Failure to receive sidetone signal output may be traced to the following conditions:

(*a*) Potentiometer 115 (fig. 25) not set properly or may open.

(*b*) Capacitor 96 open or defective.

(*c*) Defective wiring and poor plug or receptacle contacts in plug 148 (on transmitter), receptacles 66 and 175 (in case), and plug 54 (on receiver). See case wiring diagram, figure 16.

(*d*) Defective switch 136, figure 49, or poor contacts in CW-MCW position.

(*e*) Poor contacts on keying relay 156.

(*f*) Switch 48 on receiver may be in NET or CAL position.

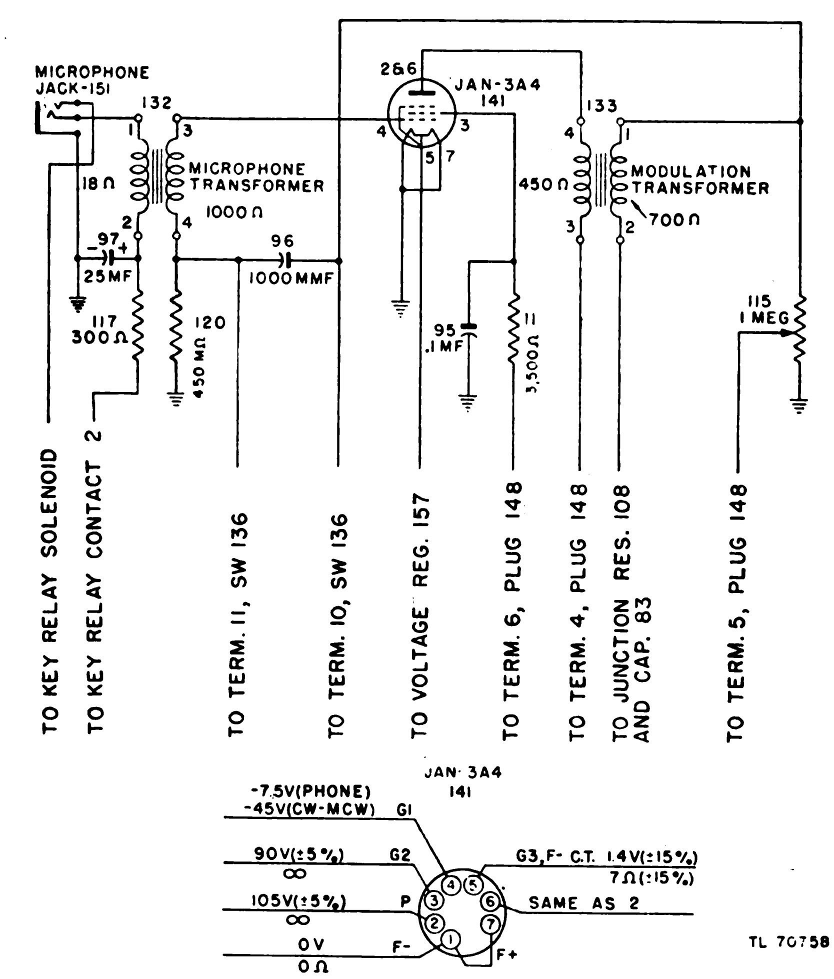


Figure 43. Modulator stage schematic of transmitter of Radio Receiver and Transmitter BC–1306.

Table XXII. Parts data, modulator stage (transmitter) **(fig. 43)**

Reference symbol	Signal Corps stock No.	Name of part, description and function
95	3DA100–209	CAPACITOR, fixed: paper; 100,000-mmf ±20%; 120 vdcw; (screen-grid by-pass).
96	3DA1–123	CAPACITOR, fixed: ceramic; 1,000-mmf ±20%; 500 vdcw; (feedback for side-tone circuit).
97	3DB25–34	CAPACITOR, fixed: electrolytic; 25-mf ±100%, —10%; 25 vdcw; (microphone filter bypass).
114	3Z6350–31	RESISTOR: fixed; carbon; 3,500-ohm ±10%; ½-w; (screen-grid dropping).
115	3Z6801–17	RESISTOR: potentiometer; 1-meg ±20%; (sidetone output to rcvr).
117	3Z6030–76	RESISTOR: fixed; carbon; 300-ohm ±20%; ½-w; (microphone decoupling filter).
120	2Z8677.37	RESISTOR: fixed; carbon; 450,000-ohm ±10%; ½-w; (grid-leak bias).
141	2Z9631.95	SOCKET: tube; miniature; 7-prong; (modulator, Tube JAN–3A4).
132	2Z9634.39	TRANSFORMER: input, a-f microphone; (steps up microphone volume).
133		TRANSFORMER: modulation; (a-f; modulates suppressor-grid of Tube JAN–2E22).
		TUBE JAN–3A4: (modulator).

39. Transmitter Power and Switching Circuits

a. Stage Data. (1) Metering socket 143, figure 44.

(2) Power receptacle 144, rear view, figure 45.

(3) Battery receptacle 145, rear view, figure 46.

(4) Voltage regulator tube, socket 146, figure 47.

(5) Receiver power plug, 148, figure 48.

(6) Detail of switch 136, figure 49.

(7) Detail of switches 137 and 138, figure 50.

(8) Power and switching connections schematic, figure 51.

b. Service Data. (1) *Metering socket 143.* All voltage and resistance readings obtained at this socket (fig. 44) pertain to normal operation of p-a stage and must conform to the values and conditions as stated under table XXIII.

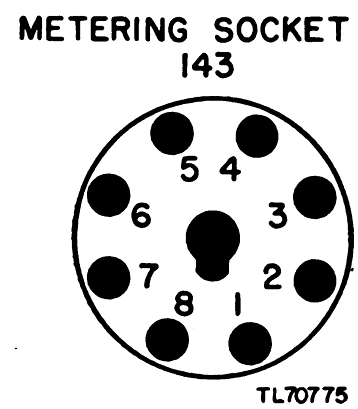


Figure 44. Metering socket 143 of transmitter of Radio Receiver and Transmitter BC-1306.

Table XXIII. Metering socket 143 measurements.

Prong	Prong	Voltage reading	Circuit measurement	Circuit resistor	Resistance measurement
2 (+)	8 (—)	.05 PHONE .14 CW	P-a plate circuit at no load (note 5).	#113	20 ohms ±5%.
3 (+)	7 (—)	180 phone	P-a screen grid (note 6).	#111 and 112.	See note 6.
4 (—)	7 (+)	+6 CW —45 PHONE	P-a suppressor bias (note 7).	#110 (note 7).	18,000 ohms ±10%.
5 (—)	7 (+)	—60	P-a grid bias.	#107 and 109.	15,700 ohms ±10%.
6 (+)	7 (—)	105	Receiver plate voltage.	Open circuit.	See warning.
8 (+)	7 (—)	500	P-a plate voltage.	Open circuit.	See warning.

Warning: Meter leads dangerous when power is on. Exercise all safety precautions while making voltage readings.

Notes 1. All readings with power switch 137 in HIGH.
2. All readings with reference to prong 7 (ground).
3. D-c voltmeter, 1,000-ohms per volt, used for all voltage measurements.
4. Ohmmeter set at scale nearest to the resistance reading. Do not use with power on.
5. Current in milliamperes equals voltage times 50.
6. Depends on position of switch 137, for example:

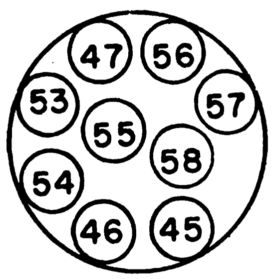
Position	*Voltage*	*Resistance measurement*
HIGH	180 v (±35 v)	#111 and 112 in parallel; 10,000 ohms ±5%.
MEDIUM	150 v (±25 v)	112 only in circuit; 20,000 ohms ±5%.
LOW	100 v (±15 v)	111 and 112 in series; 40,000 ohms ±10%.

7. Depends upon position of switch 136, for example:

Position	*Voltage*	*Resistance measurement*
CW	+6 v	10,000 ohms ±10%.
MCW-PHONE	—40 v	3 to 4 ohms.

(2) *Power receptacle 144, rear view.* All voltage readings obtained at this receptacle must conform to the values specified in table XXIV, for normal voltage supply sources.

POWER RECEPTACLE
144



(REAR VIEW)
TL70777

Figure 45. Power receptacle 144 of transmitter, rear view, of Radio Receiver and Transmitter BC–1306.

Table XXIV. Power receptacle 144 data.

Prong	Voltage reading	Circuit reference
45	6.0	To keying relay 156. Solenoid (resistance 13 ohms).
46	1.4	To receiver, switch 138 in SEND position.
47	500.	To plate of Tube JAN–2E22 via coil 127. To contacts 3 and 6 of key relay 156.
53	0	To chassis ground. (Negative lead of voltmeter.)
54	6.0	To p-a filament (Tube JAN–2E22), switch 138, SEND.
55	0	To terminal 3, switch 138, SEND.
56	1.4	To receiver power plug 148, terminal #2, switch 138, STANDBY.
57	105.0	To oscillator screen, modulator plate and receiver, switch 138, SEND.
58	105.0	To oscillator screen, modulator plate and receiver, switch 138, STANDBY.

Warning: All voltage readings taken with *power on.* Exercise *extreme care! High voltages are dangerous.*

Notes 1. Temporarily remove metering socket 143 and cover to take voltage checks; upon completion of all checks, remount socket 143 and cover in position.

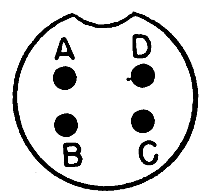
2. Above voltages taken with 1,000-ohm-per-volt voltmeter. Readings will be higher if more sensitive voltmeter is used.

(3) *Battery receptacle 145, rear view.* (*a*) *Voltage checks.* All voltages must conform with values as stated in table XXV for normal voltages of Battery BA–48, referring to figure 46.

Table XXV. Battery receptacle 145 data.

Prong	Voltage	Measurement
A	+1.4 v	To receiver with switch 138 at STANDBY.
B	+105 v	To receiver plates; to oscillator screen and modulator plate, when switch 138 is at STANDBY.
C	Neg	Common negative.
D	0	Chassis ground.

BATTERY RECEPTACLE
145



(REAR VIEW)
TL70779

Figure 46. Battery receptacle 145 of transmitter, rear view, of Radio Receiver and Transmitter BC–1306.

(*b*) *Tests and conditions.*

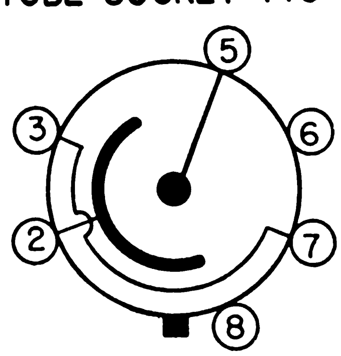
1. Set switch 138 at STANDBY.

2. Voltage checks taken at the female connector of Cord CD–1119 are of the same polarity but may be of a slightly higher voltage due to the unloaded condition.

3. Low voltages indicate Battery BA–48 is run-down and should be replaced.

(4) *Voltage regulator Tube JAN–OC–3/VR–105 in socket 146.* (*a*) *Voltage checks.* All voltages must conform with the values stated in table XXVI, referring to figure 47.

VOLTAGE REGULATOR
TUBE SOCKET 146



TL70781

Figure 47. Voltage regulator Tube JAN–OC–3/VR–105 in socket 146, BC–1306 Transmitter of Radio Receiver and Transmitter BC–1306.

Table XXVI. Voltage regulator tube data.

Prong	Voltage	Measurement
2	0 (—)	Cathode element of tube is grounded.
3	105 v	At all times when switch 138 is at STANDBY or SEND.
5 and 7	105 v	Plate element of tube. Voltage only if tube is in socket 146.
6	105 v	When KEY is closed.
8	6 v	When solenoid of key relay 156 is energized, KEY closed.

(*b*) *Tests and conditions.*

1. This tube regulates the B voltage to the receiver, modulator, and screen-grid of the oscillator.

2. A tube must be in socket 146 before tests can be made because a jumper within the base of the tube connects prongs 3 and 7.

3. Low voltage at prongs 5 or 7 indicates a faulty tube. Replace with new tube.

(5) *Receiver power plug 148.* (*a*) *Voltage checks.* All voltage and resistance readings obtained at this plug must conform with values shown in table XXVII, referring to figure 48.

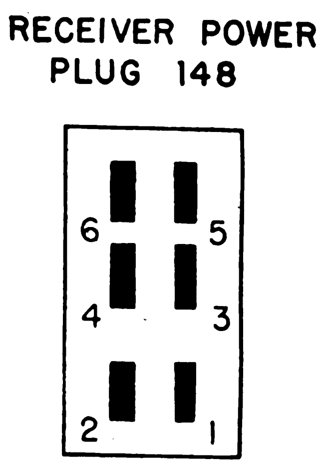


Figure 48. Receiver power plug 148, Radio Receiver and Transmitter BC-1306.

Table XXVII. Receiver power plug 148 data.

Prong	Voltage	Measurement and condition
1	105 v	At all times with switch 138 in STANDBY—B+ to receiver.
2	1.4 v	Filament voltage to receiver—switch 138 in STANDBY.
3	105 v	B+ to receiver, KEY open.
4	105 v	To oscillator screen-grid and modulator via switch 48 on receiver, KEY closed.
5	none	Sidetone to receiver (from 115). (Note 3.)
6	none	To modulator screen-grid. Voltage received via receiver switch 48 in CAL position.

(*b*) *Tests and conditions.*

1. Negative lead of voltmeter to chassis and positive lead to prong under test.

2. Do not check for resistance with the power on.

3. Resistance between prong 5 and ground will depend on the position of arm of potentiometer 115, figure 25. No reading on the ohmmeter indicates item 115 is open or open circuit wiring resulting in no sidetone signal being available.

(6) *Detail of switch 136.* (*a*) Switch 136 changes the p-a suppressor grid bias when switching from CW to MCW or PHONE. (See table XXIII, note 7.)

(*b*) The position of the rotors of this switch viewed from rear of panel at the CW-MCW-PHONE settings are shown on figure 49.

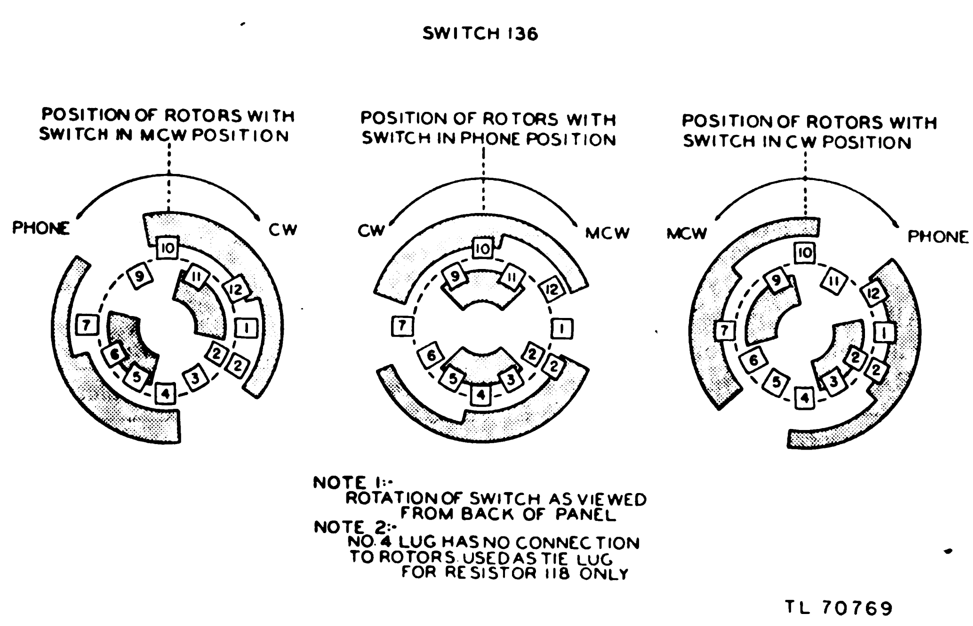


Figure 49. Detail of switch 136 of Transmitter of Radio Receiver and Transmitter BC-1306.

(*c*) Connections to other circuit components with this switch in the CW position are shown on figure 51.

(*d*) The over-all transmitter schematic (fig. 57), shows the connection of this switch in the PHONE position.

(7) *Detail of switches 137 and 138.* (*a*) Switch 137 controls the r-f power output by varying the p-a screen grid voltage. (See table XXIII, note 6.)

(*b*) The positions of the rotors of switch 137 (viewed from the rear) at the HIGH-MED.-LOW positions are shown on figure 50.

(*c*) Connections to other circuit components with switch 137 at HIGH are shown in figures 51 and 57.

(*d*) The position of the rotors of switch 138 (viewed from the rear) at the SEND-STAND-BY-OFF positions are shown in figure 50.

(*e*) Connection to other circuit components with switch 138 set at SEND are shown in figure 51.

(*f*) The over-all transmitter schematic (fig.

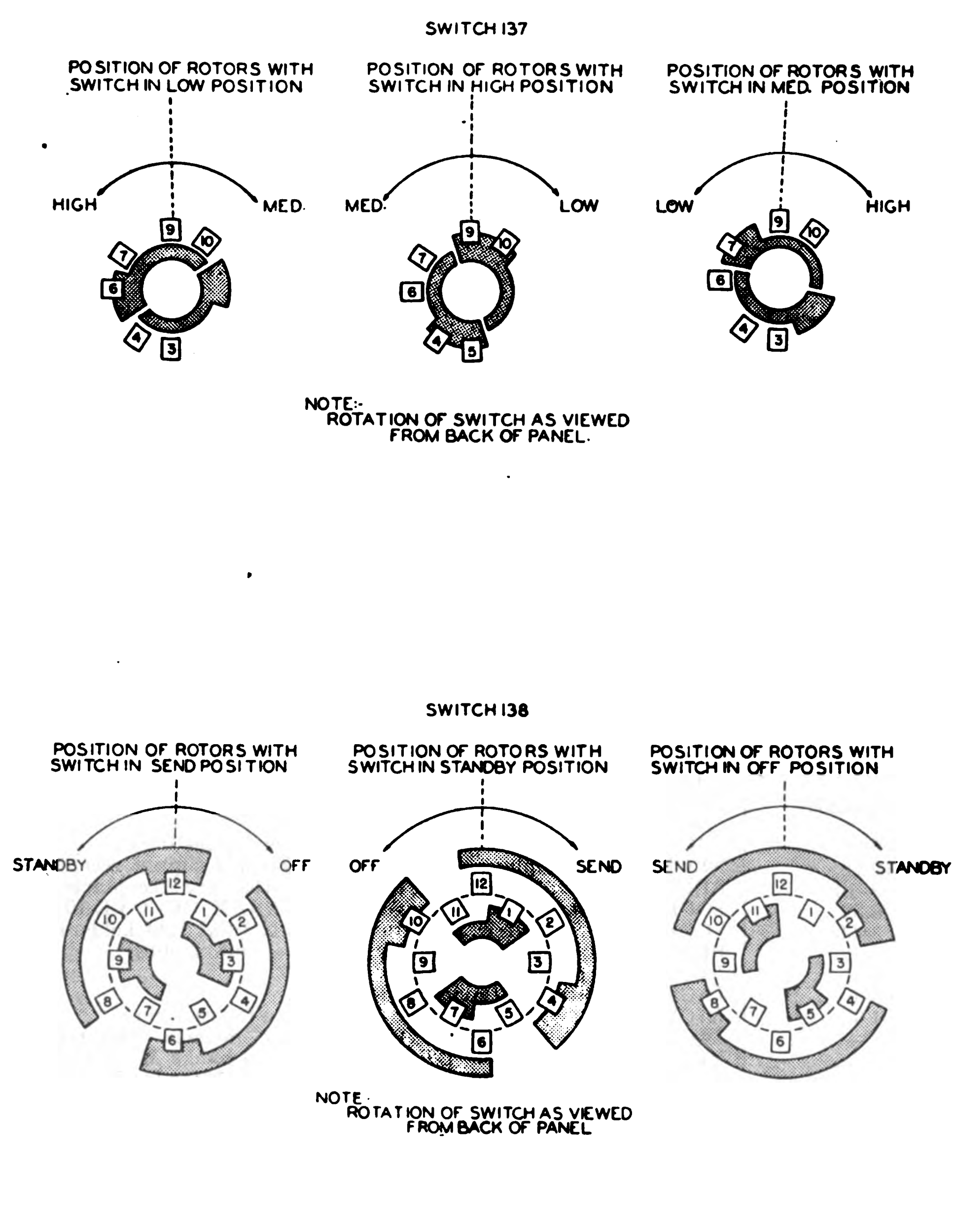


Figure 50. Detail of switches 137 and 138 of transmitter of Radio Receiver and Transmitter BC–1306.

57) shows connections of switch 138 in the STANDBY position.

(8) *Power and switching connections.* (*a*) Power and switching connections are shown in figure 51.

(*b*) Service data on metering socket 143 is covered in (1) above.

(*c*) Service data on power receptacle 144 is covered in (2) above.

(*d*) Service data on battery receptacle 145 is covered in (3) above.

(*e*) Service data on voltage regulator tube in socket 146 is covered in (4) above.

(*f*) Service data on receiver power plug 148 is covered in (5) above.

(*g*) Service data on switch 136 is covered in (6) above.

(*h*) Service data on switches 137 and 138 is covered in (7) above.

(*i*) Parts data for power and switching stage is covered in table XXVIII.

Table XXVIII. Parts data, power and switching schematic, transmitter (fig. 51.)

Reference symbol	Signal Corps stock No.	Name of part, description and function
74	3DA250–88	CAPACITOR, fixed: paper; 0.25-mf ±20%; 200 vdcw; (105 v supply filter-bypass, a-f, from receiver).
98	3DA20–85	CAPACITOR, fixed: paper; 0.02-mf ±20%; 300 vdcw; (audio-oscillator harmonic filter).
99	3DA100–209	CAPACITOR, fixed: paper; 0.1-mf ±20%; 120 vdcw; (power supply hash bypass).
100	3DA100–209	CAPACITOR: same as 99; (same as 99).
111	3Z6620–71	RESISTOR: fixed; wire-wound; 20,000-ohm ±5%; 10-w; (screen voltage dropping).
112	3Z6620–71	RESISTOR: fixed; wire-wound; 20,000-ohm ±5%; 10-w; (screen voltage dropping).
113	3RC31AE200J	RESISTOR: fixed; carbon; 20-ohm ±5%; 1-w; (measures plate current of p-a tube at metering socket 143).
118	3RC21BE183K	RESISTOR: fixed; carbon; 18,000-ohm ±10%; ½-w; (equalize sidetone level between CW and MCW positions).
119	3RC21BE183K	RESISTOR: same as 118; (loads suppressor grid of Tube JAN–2E22 in MCW position).
121	3Z6006–17	RESISTOR: fixed; carbon; 60-ohm ±10%; ½-w; (drops voltage to dial light).
122	3Z5999–3	RESISTOR: fixed; wire-wound on ceramic tube; 9.3-ohm ±2½%; 5-w; (drops filament voltage to oscillator and modulator tubes).
134	3Z9824–42.1	SWITCH: push button; (dial light, on-off).
136	3Z9825–62.84	SWITCH: rotary; single-section; 3-position; bakelite insulation; (CW-MCW-PHONE selection).
137	3Z9825–62.88	SWITCH: rotary; single-section; 3-position; bakelite insulation; (HIGH-MED-LOW power output, varies screen voltage).
138	3Z9825–62.87	SWITCH: rotary; single-section; 3-position; bakelite insulation; (SEND-STANDBY-OFF selection).
143	2Z8678.52	SOCKET: octal; 8-prong; (metering socket for testing).
144	2Z7119.12	RECEPTACLE: plug; male; 9-prong; (power supply receptacle).
145	2Z8799–134	RECEPTACLE: plug; male; 4-prong; (battery receptacle, Battery BA–48).
146	2Z8678.52	SOCKET: octal; 8-prong; (regulator Tube JAN–OC–3/VR 105).
147	2Z5883–69	SOCKET ASSEMBLY: miniature bayonet; (dial light holder).
148	2Z7227–2	PLUG: male; polarized; 6-prong; (receiver power plug).
150	2Z5598–6	JACK: key; (plug in Key J–45).
151	2Z5598–6	JACK: microphone; (microphone input).
154	2Z9401.35	JACK: banana type; (antenna jack on case for receiver).
155	2Z5598–4	JACK: large banana type; (ground jack on case. Neg return for receiver).
156	2Z7594	RELAY: keying; 3-pole DT, 2-pole ST; two banks of contacts; (keying relay).
157	3H4858–7	RECTIFIER: selenium; dry disk; 157-ma; 13% @ 76°F.; (filament voltage regulator).
	2Z5889–3	DIAL LIGHT: 2 v; 60-ma; (illuminates dial).

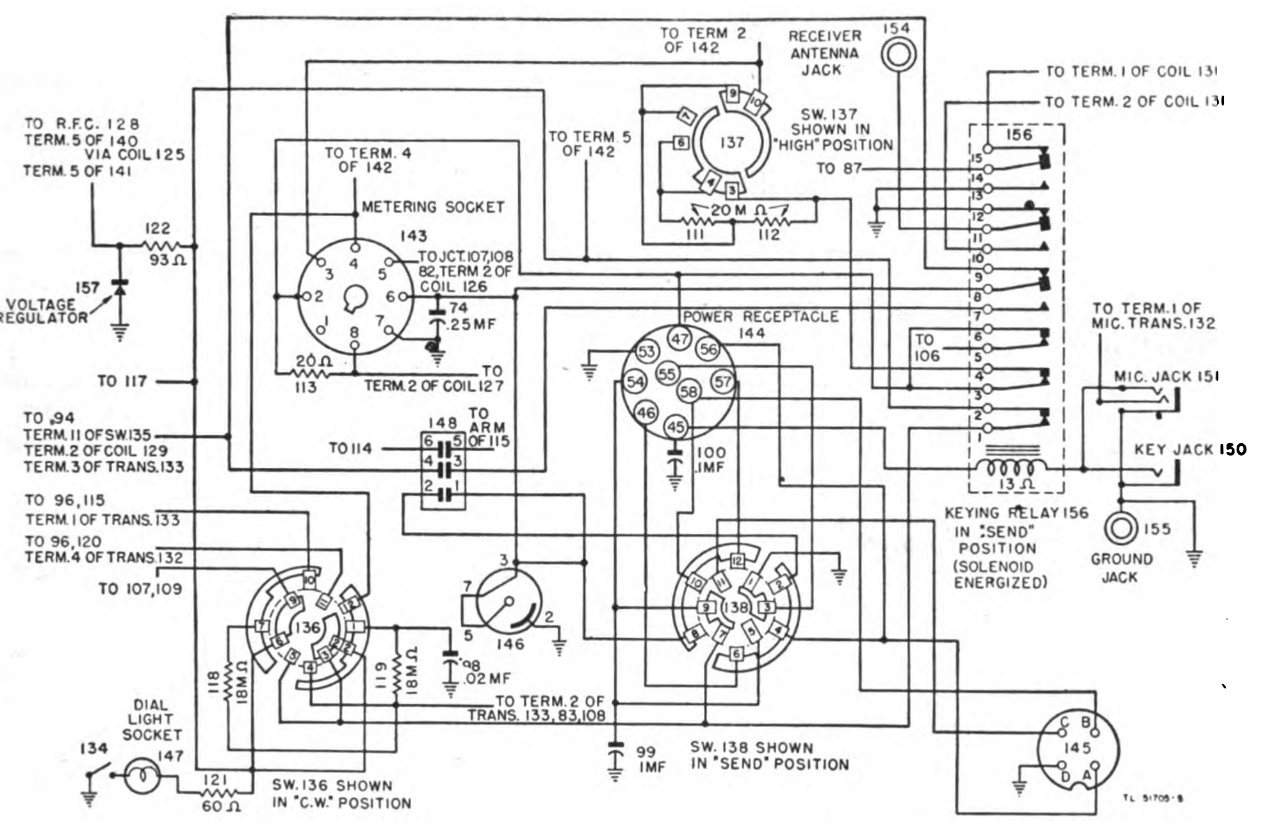


Figure 51. Power and switching connections schematic for transmitter of Radio Receiver and Transmitter BC–1306.

SECTION IX

SUPPLEMENTARY DATA

40. Removal and Replacement of Ganged Tuning Capacitor (Transmitter)

a. REMOVAL. This capacitor and its cover may be removed to facilitate trouble shooting of parts located above and behind it. Reference should be made to figure 7 for cover removal, and figure 25 for panel parts removal in employing the following procedure:

(1) Lay the transmitter, panel down, and remove 12 screws marked A, figure 7, which will remove the cover.

(2) Stand the transmitter on its left side.

(3) Unclamp the TUNING DIAL lock and remove two screws. (See item 2, fig. 25.)

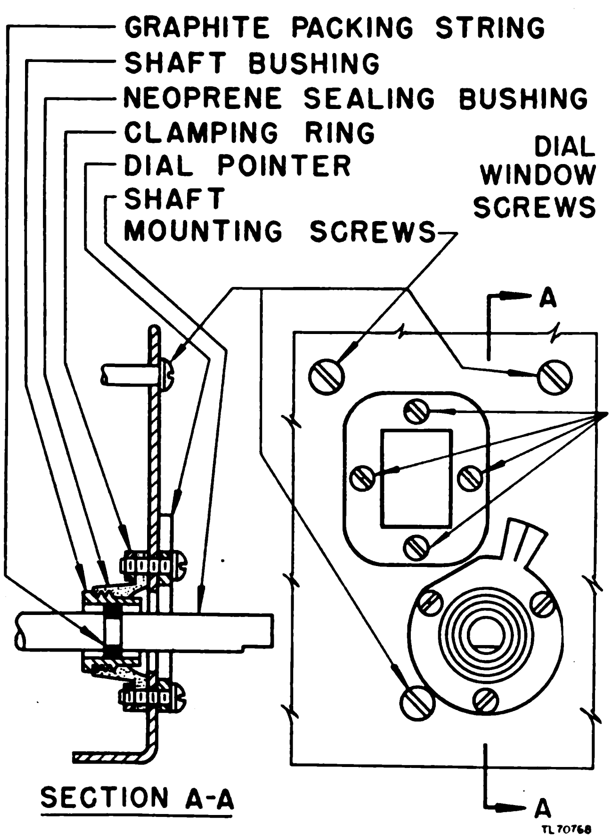


Figure 52. Detail of ganged tuning capacitor mounting in transmitter of Radio Receiver and Transmitter BC-1306.

(4) Remove the TUNING dial, by backing out its setscrew.

(5) Remove three screws (item 5, fig. 25), which mount the ganged tuning capacitor to the front panel. (Do not lose the rubber washers on these screws.)

(6) The ganged tuning capacitor, which is a plug-in type, may now be removed from the rear, making all parts accessible. No unsoldering is required.

(7) Examine the banana plugs and jacks for corrosion, and clean if necessary with an eraser. Check also for bent plates, shorted trimmers, and unsoldered connections in the assembly.

Note. These plugs and jacks are silver-plated. Do not remove the silver plating by excessive burnishing.

(8) For detail of transmitter ganged tuning capacitor mounting, see figure 52.

b. REPLACEMENT. Note that the capacitor shaft has a flat. This flat should be rotated to position for easy tightening up of the setscrew of the frequency control dial after the assembly is replaced. The setscrew of the frequency control dial *must* be seated on the flat of the capacitor shaft, otherwise calibration will be inaccurate.

(1) Insert the capacitor assembly from the rear, making sure the banana plugs are properly seated in their respective jacks.

(2) Replace loosely the three mounting screws (item 5, fig. 25), with the rubber washer on each screw.

(3) Replace loosely the frequency control dial and clamping ring screws (item 2, fig. 25).

(4) Do not make up any screws until all are properly entered.

(5) Tighten securely the three screws, item 5.

(6) Lock the dial setscrew.

(7) Close clamping ring and tighten the two setscrews, item 2.

(8) Replace the cover by reinstalling the previously removed 12 screws marked A. (See fig. 7.)

(9) If a replacement capacitor assembly has been installed, screw 2 (on coil 127) and screw 3 (on coil 126), shown on figure 6, may require readjustment for proper tracking. (See par. 19*b* if necessary, for alignment.)

41. Noise and Distortion in Receiver

a. NOISE. Noise due to some defective component of the receiver can be traced to its source by considering it as a signal and locating the first point at which it occurs by means of an a-c vacuum-tube voltmeter. The following are some possible causes of noise:

(1) Noise is frequently caused by worn or otherwise defective volume controls and is most noticeable when turning the control.

(2) Noise frequently results from poor contact between the wipers and rotor of the tuning capacitor gang, showing up especially when the set is being tuned.

(3) In a sensitive receiver, intermittent contact between any of the parts of the tuning dial drive may generate noise in much the same way as a screw driver point drawn lightly over the chassis of a sensitive receiver will generate noises that are reasonably loud if the set is operating at maximum sensitivity.

(4) If B+ or filament circuit bypass capacitors are open-circuited the set may be noisy when operated from a generator or vibrator power source.

(5) Sparking at nearby generator or motor brushes, or at vibrator contacts, may result in noise being picked up by the antenna.

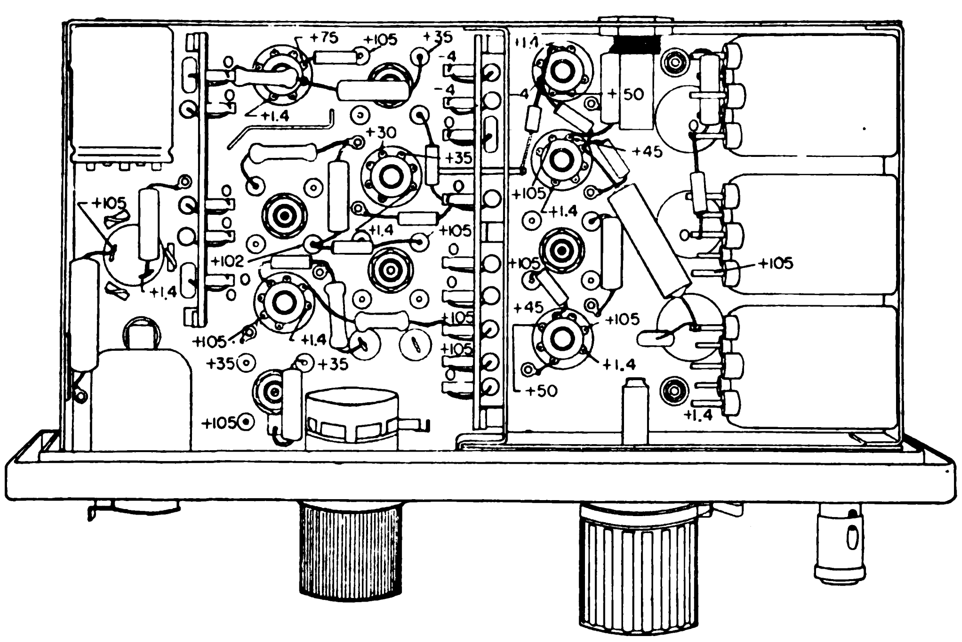
b. DISTORTION. The following are some possible causes of distortion:

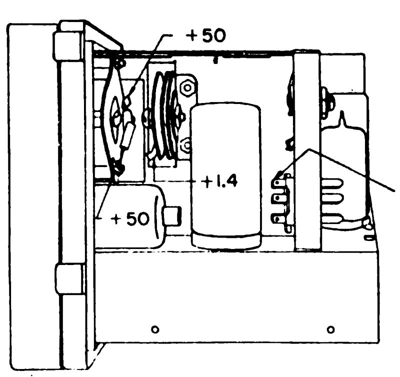
(1) Leaky coupling capacitors in the audio circuit decrease the normal bias of the tube whose grid is connected to the defective capacitor. In some cases the leakage is large enough to make the grid actually positive which will make the quality very bad and quickly ruin the tube, especially if the tube is an output tube. A short circuit to ground at the cathode side of a cathode biasing resistor, or in its bypass capacitor, will cause similar effects.

(2) An open, fixed, tone-control capacitor in the plate circuit of a pentode output tube (such as capacitor 18 in Radio Receiver and Transmitter BC–1306) will allow the harmonics generated in the tube to be reproduced in accentuated amount, causing a particularly objectionable type of distortion.

(3) Regeneration may be caused by coupling in a common B supply impedance, or by stray capacitive coupling, and may result in frequency distortion or oscillation.

(4) Occasionally, regeneration may result in a stage oscillating at a high inaudible frequency causing the grid to draw current with its attendant distortion and resulting in very short tube life.

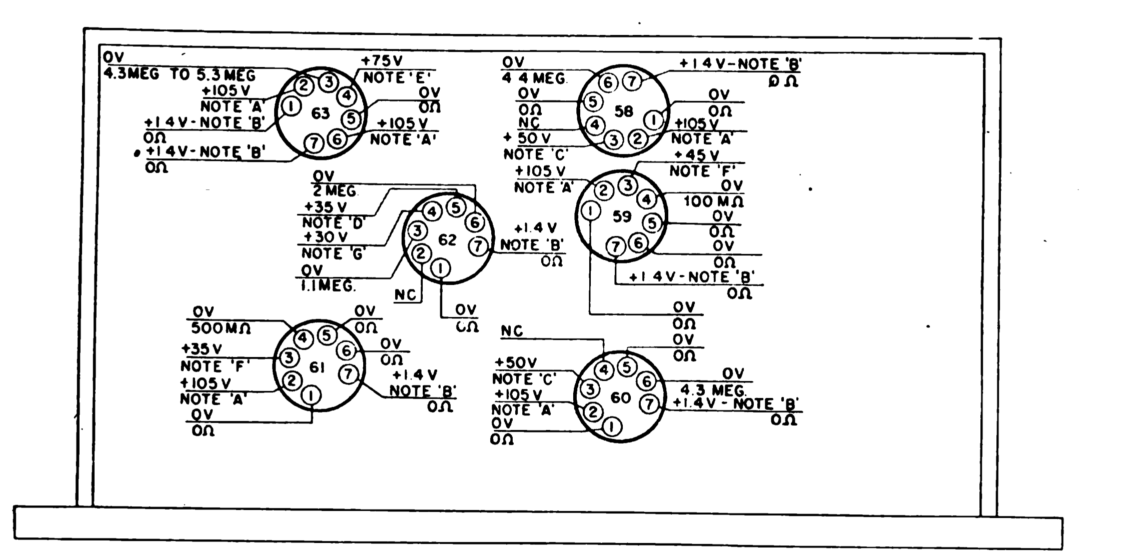




TERMINAL	VOLTAGE
1	+ 105
2	+ 1.4
3	+ 105
4	0
5	0
6	+ 105

TL 70798

Figure 53. Normal voltages for receiver of Radio Receiver and Transmitter BC–1306.



NOTE 'A' - PHONE-CW-NET-CAL SWITCH IN PHONE POSITION – ∞
PHONE-CW-NET-CAL. SWITCH IN CW POSITION – ∞
PHONE-CW-NET-CAL SWITCH IN NET POSITION – 107M Ω
PHONE-CW-NET-CAL. SWITCH IN CAL. POSITION – 107M Ω

NOTE 'B' - WITH PHONE PLUG IN JACK

NOTE 'C' - SENSITIVITY SWITCH IN LOW POSITION – 11 MEG
SENSITIVITY SWITCH IN MED POSITION – 1 MEG
SENSITIVITY SWITCH IN HI POSITION – 47M Ω
} PHONE-CW-NET-CAL. SWITCH IN NET POSITION

NOTE 'D' - PHONE-CW-NET-CAL. SWITCH IN PHONE POSITION – ∞
PHONE-CW-NET-CAL. SWITCH IN CW POSITION – ∞
PHONE-CW-NET-CAL. SWITCH IN NET POSITION – 380M Ω
PHONE-CW-NET-CAL SWITCH IN CAL POSITION – 380M Ω

NOTE 'E' - PHONE-CW-NET-CAL. SWITCH IN NET POSITION – 130M Ω

NOTE 'F' - PHONE-CW-NET-CAL SWITCH IN NET POSITION – 140M Ω

NOTE 'G' - PHONE-CW-NET-CAL SWITCH IN NET POSITION – 1.3 MEG

SOCKET	58	---	JAN-1L4	R.F. AMP
SOCKET	59	---	JAN-1R5	MIXER-H.F. OSC
SOCKET	60	---	JAN-1L4	1ST I.F. AMP
SOCKET	61	---	JAN-1R5	2ND I.F. AMP
SOCKET	62	---	JAN-1S5	DET-1ST A.F.-B.F.O.
SOCKET	63	---	JAN-3Q4	AUDIO OUTPUT

ALL RESISTANCE MEASUREMENTS ARE WITH POWER CABLE UNPLUGGED

Figure 54. Tube socket voltages and resistances for receiver of Radio Receiver and Transmitter BC–1306.

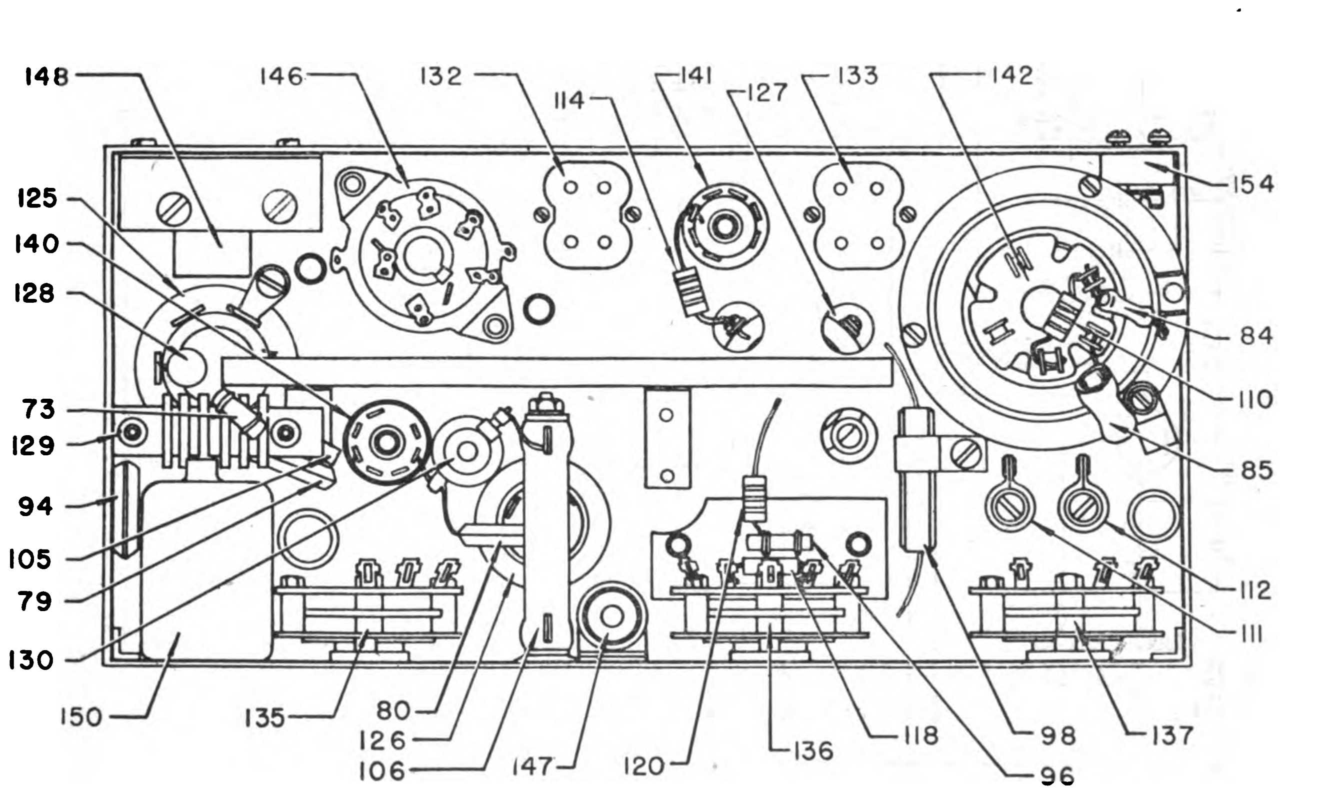
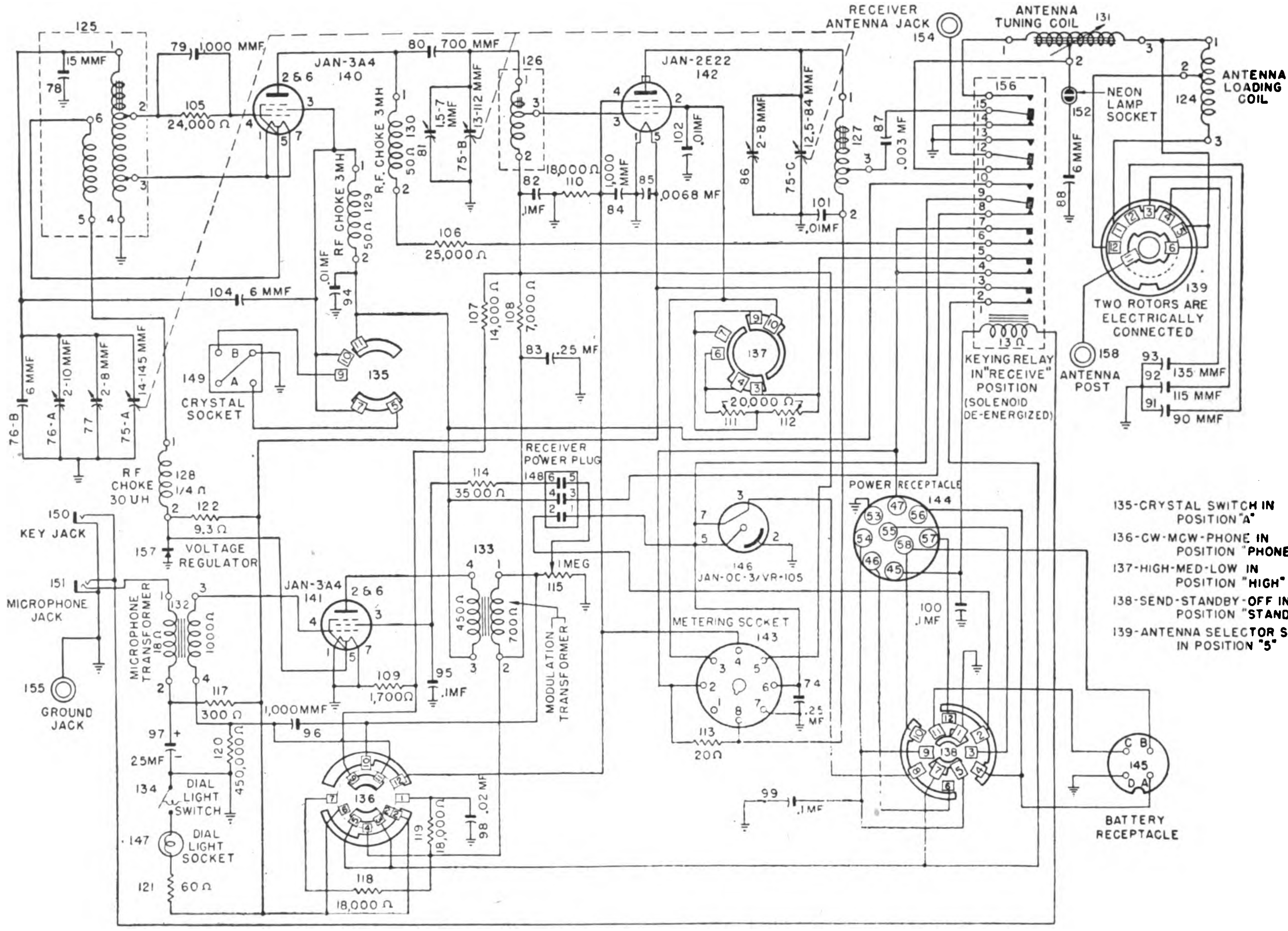


Figure 55. Parts identification for transmitter, bottom view, of Radio Receiver and Transmitter BC–1306.



135-CRYSTAL SWITCH IN POSITION "A"
136-CW-MCW-PHONE IN POSITION "PHONE"
137-HIGH-MED-LOW IN POSITION "HIGH"
138-SEND-STANDBY-OFF IN POSITION "STANDBY"
139-ANTENNA SELECTOR SWITCH IN POSITION "5"

Figure 56. Transmitter schematic diagram of Radio Receiver and Transmitter BC-1306.