TM 11-4047

WAR DEPARTMENT TECHNICAL MANUAL

RADIO RECEIVER BC-1005-A

REPAIR INSTRUCTIONS

WAR DEPARTMENT • NOVEMBER 1945

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

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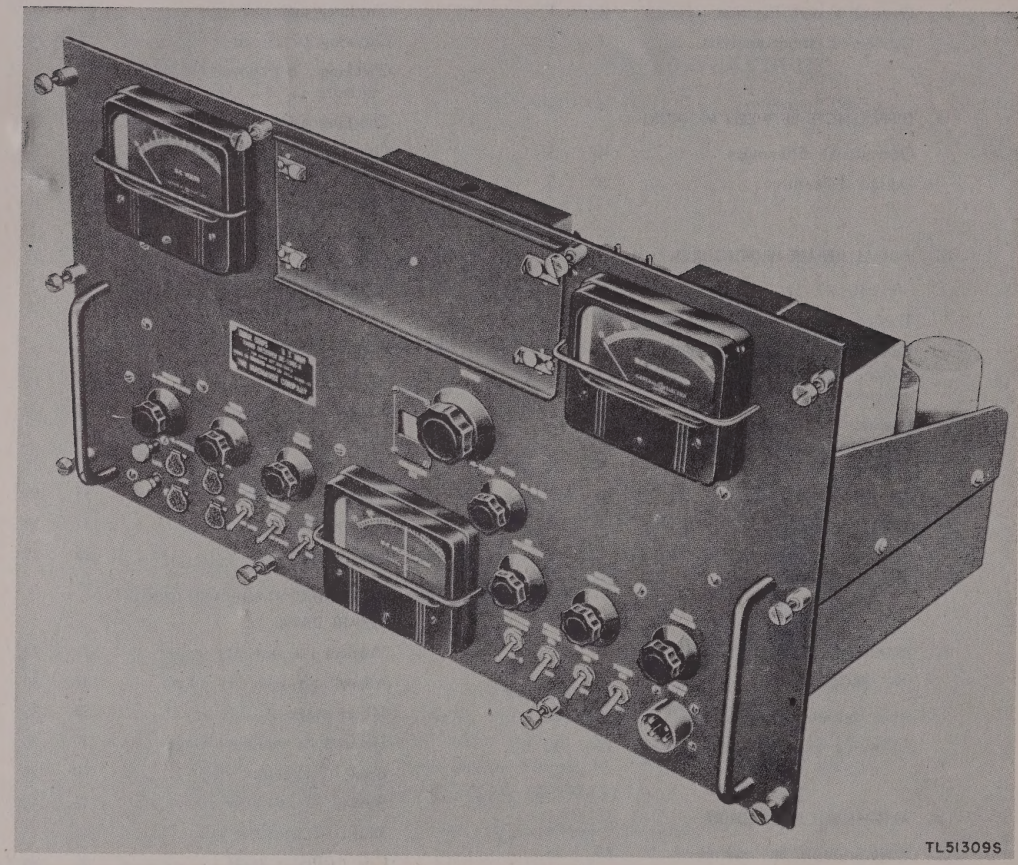


Figure 1. Radio Receiver BC-1005-A.

SECTION I

DESCRIPTION OF RADIO RECEIVER BC–1005–A[1]

1. Characteristics

a. GENERAL. Radio Receiver BC–1005–A is a high-frequency (h-f) superheterodyne receiver designed to receive continuous-wave (c-w) and amplitude-modulated (a-m) continuous-wave signals. It is one of several components which make up Radio Set SCR–555–A, a semiportable, ground, radio direction finder (RDF) station used to determine the direction of incoming signals.

b. FREQUENCY. The frequency of Radio Receiver BC–1005–A is continuously variable in two bands, 18 to 34 and 34 to 65 megacycles (mc).

c. RANGE. The exact range of the receiver cannot be given because no particular type of transmitter is used as complementary equipment. Between 18 and 30 mc, the range is about 50 to 150 miles; between 30 and 64 mc (line of sight operation), the maximum range is approximately 50 to 150 miles.

d. POWER SUPPLY. Power is supplied to the receiver from a separate source. The A supply is from a 12-volt storage battery; the B supply, from the 170-volt, 100-milliampere output of Power Unit PE–155–A.

e. POWER INPUT.

Application	Volts	Amperes
Dial lamp	12	0.24
Meter lamps	12	0.50
Heater lamps	12	0.75
Microphone	12	0.15
Vacuum-tube filaments	12	2.85
Vacuum-tube plates	170	.1

f. POWER OUTPUT. The maximum undistorted power output of the receiver measured at headphone jack 351–1, is about 35 volts across 4,000 ohms. The output impedance is normally 4,000 ohms, connected at the factory. It may be changed to the 250-ohm winding.

2. Over-all System Function (fig. 2)

a. Radio Receiver BC–1005–A is used in conjunction with a rotatable Adcock, or directional antenna and a fixed, vertical, nondirectional antenna. When the Adcock antenna is not oriented at right angles to an incoming signal (not in a null position), the signal is picked up by the antenna and amplified separately by each of the two tubes in the Adcock r-f amplifier stage. Controlled by the square wave oscillator and negative pulse rectifier stages, the Adcock amplifier tubes operate alternately in rapid succession (130 times per second). Because the Adcock amplifier tubes are connected 180° out of phase with each other, they alternately reinforce and oppose the amplified signal from the vertical antenna. Thus the resultant signal alternately increases and decreases in volume at a rate of 130 times per second. The amount of variation in volume is proportional to the degree which the Adcock antenna is off null. When the Adcock antenna is on null (at right angles to the incoming signal), there is no pulsating variation in the volume of the signal. The signal is amplified and detected by a fairly conventional superheterodyne radio circuit. The signal then goes to the synchronous voltmeter stage where the pulsating variation in signal volume is measured by a microammeter. This enables an operator to orient the Adcock antenna at right angles to an incoming signal and to determine from which side the signal is approaching the antenna. Hence the operator can determine the direction of the incoming signal. By cutting off the power supply to some of the stages, the receiver may also be used as a conventional figure-8 direction finder. A c–w oscillator and figure-8 operation is used chiefly for code reception.

b. Radio Receiver BC-1005-A has two separate radio-frequency (r-f) amplifier stages; a two-tube, series-connected, vertical r-f amplifier stage, which is fed by a vertical antennae; and two separate amplifier tubes connected out of phase in the Adcock r-f amplifier stage, which is fed by the Adcock antenna. The heterodyne oscillator, mixer, first, second, and third i-f amplifier, c-w oscillator, volume-control, and audio-output stages are conventional in design. In the second detector-bearing amplifier stage, the function of detection is conventional and the same tube also amplifies the detected signal, which is fed to the synchronous voltmeter stage. The square wave oscil-

[1]Refer to TM 11–251 for installation, operation, and other maintenance data on this equipment.

lator and negative pulse rectifier stages alternately synchronize one or the other of the two tubes in the Adcock amplifier stage with the synchronous voltmeter stage. The power supply stage distributes A− (−12 volts) and B+ (+170 volts) power to the other stages.

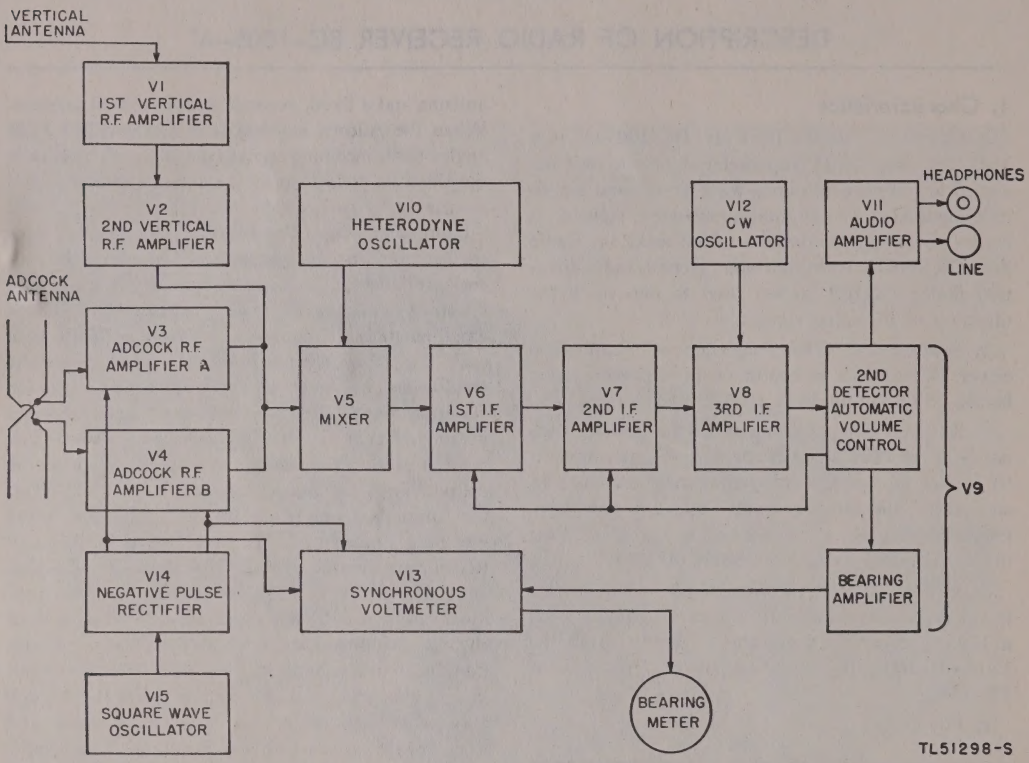


Figure 2. Radio Receiver BC-1005-A block diagram.

3. Condensed Circuit Analysis (fig. 3)

a. A very abbreviated circuit analysis is given here. For more details, see paragraphs 20 through 33, section III, TM 11–251, Radio Set SCR–555–A.

b. The following tubes are used in Radio Receiver BC–1005–A:

Reference No.	Stage	Commercial No.	VT No.	JAN No.	Signal Corps stock No.
V1	Vertical r-f amplifier	6AC7	VT-112	6AC7	2J6AC7
V2	Vertical r-f amplifier	6AC7	VT-112	6AC7	2J6AC7
V3	Adcock r-f amplifier	12SG7	VT-209	12SG7	2J12SG7
V4	Adcock r-f amplifier	12SG7	VT-209	12SG7	2J12SG7
V5	Mixer	12SA7	VT-161	12SA7	2J12SA7
V6	First i-f amplifier	12SK7	VT-131	12SK7	2J12SK7
V7	Second i-f amplifier	12SK7	VT-131	12SK7	2J12SK7
V8	Third i-f amplifier	12SK7	VT-131	12SK7	2J12SK7
V9	Second detector-bearing amplifier	12SR7	VT-133	12SR7	2J12SR7
V10	Heterodyne oscillator	12J5GT	VT-135	12J5GT	2J12J5GT
V11	Audio output	12A6	VT-134	12A6	2J12A6
V12	C-w oscillator	12SN7GT		12SN7GT	2J12SN7GT
V13	Synchronous voltmeter	12SN7GT		12SN7GT	2J12SN7GT
V14	Negative pulse rectifier	12H6	VT-214	12H6	2J12H6
V15	Square wave oscillator	12SN7GT		12SN7GT	2J12SN7GT

c. Each half of a 120-cycle-per-second signal generated by the two halves of a twin-triode square wave oscillator is rectified separately by each half of a twin-diode negative pulse rectifier. The negative pulses (a and b) of voltage are supplied alternately to the grids of the two Adcock r-f amplifiers. These negative pulses in rapid succession cut first the "B" Adcock amplifier, then the "A" Adcock amplifier, out of operation so that at any instant, only one Adcock amplifier tube is operating. The two Adcock amplifiers are connected with their grids in push-pull, or 180° out of phase, and with their plates in parallel. Because the "A" and "B" Adcock amplifier tubes are out of phase with each other, the signal from the "A" tube (1), for example, reinforces the amplified signal (2) from the series-connected, two-tube, vertical r-f amplifier stage. The signal from the "B" tube (3) would then oppose the signal (2) from the vertical amplifier. The resultant amplified r-f signal (4) alternately increases and decreases in volume at a rate of 130 times per second. In other words, when the "A" Adcock amplifier is operating, the resultant signal (4A) is louder than when the "B" Adcock amplifier is operating (4B). This r-f signal is combined in the mixer stage with a signal from the heterodyne oscillator to give an intermediate-frequency (i-f) signal of 4.2 mc which is similarly fluctuating in volume. The i-f signal is amplified by the first, second, and third i-f amplifier and is then detected. The detected signal (5) is filtered (6) and amplified (7). The detection and amplification is performed by the second detector-bearing amplifier. The signal is then fed (8) to one end of a Wheatstone bridge in the synchronous voltmeter stage. Each of the other two legs of the bridge are connected to one plate of a twin-triode amplifier, also in the synchronous voltmeter stage. The grids of the synchronous voltmeter amplifier are connected to the negative pulse rectifier so that current flows in the "A" plate of the synchronous voltmeter amplifier when the "A" Adcock amplifier tube is in operation, and in the "B" plate when the "B" Adcock amplifier is in operation. Because there is a higher signal voltage when the "A" Adcock amplifier is operating (8A) then when the "B" Adcock amplifier is operating (8B), more current flows through the "A" plate of the synchronous voltmeter amplifier than flows through the "B" plate. This difference causes a deflection of the microammeter, called the BEARING METER, in the Wheatstone bridge. If the directional Adcock antenna used in conjunction with the receiver is rotated 180°, the signal from the "A" Adcock amplifier tube will oppose instead of reinforce the signal from the vertical amplifier and the "B" Adcock amplifier tube will reinforce the vertical amplifier. This causes the BEARING METER to deflect in the opposite direction. In addition, an automatic-volume-control (a-v-c) circuit impresses the detected signal on the grids of the first and second i-f amplifiers. A manual volume control may be used to ground out the automatic volume control and vary the cathode-to-ground resistance of the first and second i-f amplifier stages. An audio-output stage amplifies the signal from the second detector and provides phone jacks as well as a microphone jack and terminals for an external telephone line. A power supply stage supplies power to individual stages or groups of stages to the other stages so that different combinations of stages may be made inoperative for test purposes and for figure-8 reception. By cutting off the B+ power supply to the vertical amplifiers, "B" Adcock amplifier, bearing amplifier, synchronous voltmeter amplifier, negative pulse rectifier, and square wave oscillator, the only signal fed to the receiver comes through the "A" Adcock amplifier, which is in continuous operation. This signal, which may be heard in the phones of the audio-output stage, is loud when the Adcock antenna is not on null and diminishes to zero as the Adcock antenna is rotated to a null position (at right angles to incoming signal). The output of a conventional c-w oscillator may be fed into the third i-f amplifier stage for code reception.

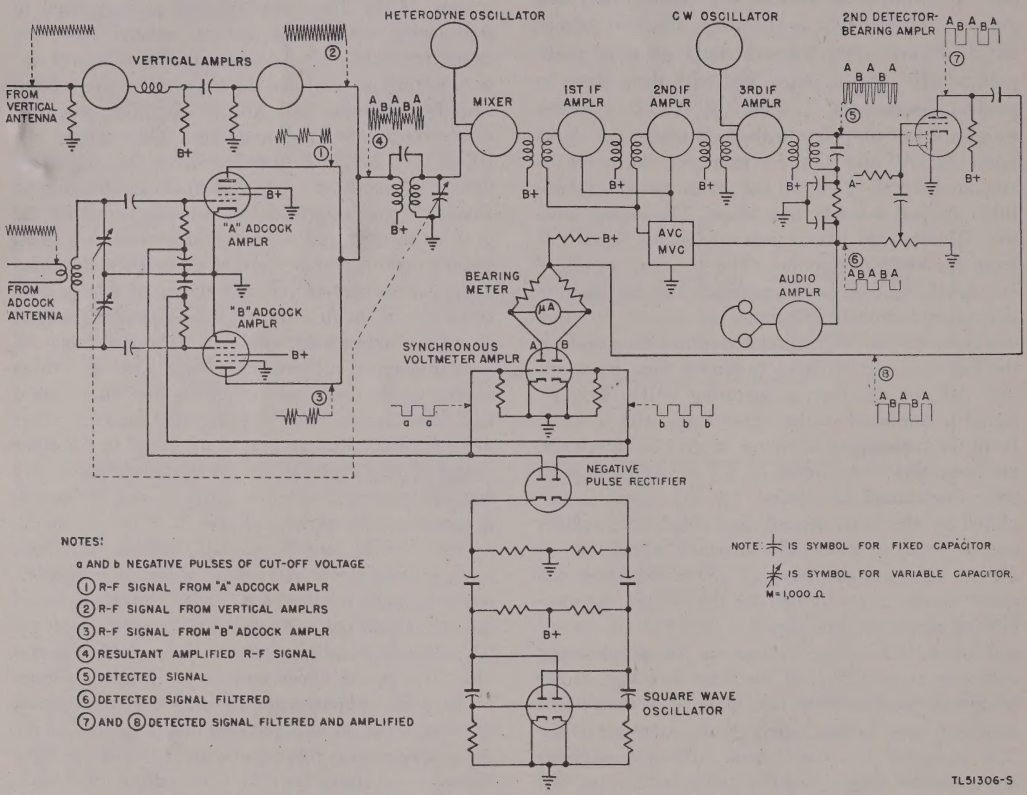


Figure 3. Radio Receiver BC-1005-A simplified circuit diagram.

SECTION II

DIFFERENCES BETWEEN MODELS

4. Operational Differences

There is only one model of Radio Receiver BC-1005–A and there are no operational variations in this model.

5. Design Differences

There is only one model of Radio Receiver BC–1005–A and there are no variations in this model which alter circuit characteristics. The only variations are purely mechanical. In later models the dial drive has been improved and mounted in a heavier cast frame. The shafts of tuning capacitors 120, 121A, and 121B have been mounted in ball bearings on cast supports, rather than in plain bearings in light metal stampings as in early units.

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SECTION III

INITIAL REPAIR PROCEDURES

Note. Before any repairs or adjustments are made, all authorized modification work orders must be applied. See FM 21-6 for list of applicable MWO's.

6. General

Maintenance personnel should follow the procedure outlined in this manual when repairing and overhauling Radio Receiver BC–1005–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 permits repair of the equipment in the shortest time possible, resulting in performance comparable to that of new equipment.

7. Tools, Test and Cleaning Equipment

a. TOOLS. No special tools are required. Standard tools needed are a No. 6 and No. 8 Allen wrench (provided with the receiver), a 6-inch straight edge, ¼-, 5/16-, ⅜-inch socket wrenches, and an assortment of standard radio repair and alignment hand tools.

b. TEST EQUIPMENT.

Item	Characteristics
Voltmeter	Vacuum-tube rectifier type, constant input resistance of 11 megohms or more, capable of measuring 1 to 200 volts dc (such as RCA Voltohmyst).
Ohmmeter	Capable of measuring resistance from 1 ohm to 1 megohm (such as ohmmeter which is part of Test Set I-56-(*)).
Tube tester	Standard emission type (such as tube tester which is part of Test Set I-56-(*)).
Signal generator	Capable of delivering audio-modulated signal over a continuous range of 18 to 65 mc and at a frequency of 4.2 mc, output calibrated or metered in microvolts.
Frequency meter	Capable of measuring frequencies over a continuous range of 18 to 65 mc and at 4.2 mc.
Capacity meter	Capable of measuring capacitances from 1 mmf to 100 mf.
Voltmeter	Sensitivity of 1000 ohms per volt.
Shielded test booth or screen room.	
D-c voltmeter	Range 0 to 15 volts or more—to be used as a voltmeter calibration standard.
D-c milliammeter	Range 0 to 50 milliamperes or more—to be used as a milliammeter calibration standard.
D-c microammeter	Range 0 to 75 microamperes or more—to be used as a microammeter calibration standard.
Battery	Capable of delivering 6 and 12 volts.
Power unit PE-135-A	Any steady source of 170-volt direct-current (d-c) power may be substituted.

Item	Characteristics
Capacitor	Capacitance 0.01 mf ±10% (for use in dummy antenna).
Capacitor	Capacitance 5,000 mmf ±10% (for use in dummy antenna).
Resistors (2)	Resistance 75 ohms ±20% (for use in dummy antenna).
Tube adapter	Universal, single-pin, clip type or eight-pin socket type to provide pin contacts for measuring tube voltages (convenient but not essential).

c. CLEANING EQUIPMENT.

Item	Characteristics
Source of compressed air	Must be clean and free of all traces of moisture.
Wiping cloth	Must be clean and free of lint.
Solvent, dry-cleaning	
Crocus cloth	
#0000 sandpaper	
Pipe cleaners	
Assortment of stiff, small paint brushes.	
Small flashlight or probing light.	
Small knife blade or scraper.	

8. Removal of Tubes, Coil Shields, Dial and Heater Lamps, and Meters

a. TUBES. Remove all the tubes from the top and bottom of the chassis. No tubes are secured by clamps or inclosed in any way. They all may be pulled straight out. DO NOT USE TOOLS. DO NOT TWIST OR TURN TUBES.

b. COIL SHIELDS. From the underside of the chassis, remove the nuts and lockwashers which secure the four coil shields to the top of the chassis. Remove the coil shields. Remove the four heater lamps 385–1, –2, –3, and –4.

c. DIAL AND HEATER LAMPS. Remove the socket of dial lamp 386 by pressing the two clips which snap the socket fast to its bracket and firmly pulling the base of the socket upward. Remove dial lamp 386 and the four heater lamps 385–1, –2, –3, and –4 by pressing each lamp slightly into its socket and rotating it ⅛ turn counterclockwise.

d. METERS. (1) From the back of the front panel, remove the two nuts and lockwashers which secure each of the three bars protecting meters 375, 376, and 377. Remove the bars.

(2) Remove the four leads from the terminals of each of meters 375, 376, and 377, and replace the flat washer, lockwasher, and nut, in that order, on each terminal.

(3) From the back of the front panel, remove the four nuts, lockwashers, and flat washers which secure each of the three meters 375, 376, and 377. Remove the meters.

9. Preliminary Cleaning of Receivers Exposed to Sand, Silt, or Salt Water

When a receiver has been submerged or subjected to salt spray, it is very important to remove all traces of salt and corrosion from the equipment. Silt or beach sand will often deposit crystals of salt between the prongs of tube sockets and in small crevices. If, after a careful visual inspection, the receiver is found to be free of all traces of sand, silt, or salt crystals, proceed with paragraph 10. If the transmitter contains sand or silt, or if salt crystal formation is visible around insulation or in cracks, flush the receiver thoroughly with clear, fresh water. Wipe insulation, tube sockets, and exposed surfaces carefully with a clean rag soaked in fresh water. After the receiver has been thoroughly washed, dry it in a drying oven.

Caution: The tuning capacitors 120 and 121A and B are required to track with extreme accuracy. Do not attempt to wipe the plates of these capacitors. Do not use an air jet or any cleaning tool on these plates.

10. Chassis Cleaning

Thorough cleaning of the receiver is necessary to insure optimum performance and to prevent corrosion, grease, and dirt from damaging parts or causing low-resistance leakage, especially under humid operating conditions. In addition to the general cleaning procedure, observe the following specific cautions and procedures.

Caution: Do not apply high voltages between the plates of capacitors 120 and 121A and B to burn off dust or metallic chips. The plates are silver-plated and their surfaces may be pitted or marred by this treatment. Damage to the surfaces of these capacitors will destroy their ability to track with the required precision.

a. TUNING CAPACITORS 120 AND 121A AND B. Be careful not to bend the plates of the tuning capacitors. Do not use an air jet or cleaning tool on these plates. Flush the plates with dry-cleaning solvent or, if very dirty, disassemble the capacitors and soak them in dry-cleaning solvent. If disassembly is necessary observe the following precautions:

(1) Turn the TUNING knob until capacitors 120 and 121A and B are fully meshed. Lay a straight edge across the stator plates and carefully adjust the TUNING knob until the stator and rotor plates of all four tuning capacitor sections are touching the straight edge.

(2) Note the exact dial setting or mark the dial so that it may be moved and returned to the same position.

(3) If possible, remove only one two-gang tuning capacitor and replace that capacitor before removing the other tuning capacitor. The capacitor being replaced may then be oriented with the capacitor already in place by means of a straight edge, as in (1) above.

(4) If capacitors are damaged in the slightest, replace them with new capacitors.

Note. Tuning capacitor design has been changed during the production of Radio Receiver BC-1005-A. Therefore, if the capacitor being replaced is not mounted in ball bearings, replace both two-gang tuning capacitors. When replacing old capacitors with new ones, it may be necessary to drill new mounting holes in the chassis. The capacitors should be fitted in place with their shafts in line and new holes marked and drilled where necessary.

(5) If both two-gang tuning capacitors are removed at the same time, set the plates of the capacitors as in (1) above and the dial as in (2) above

before tightening the Allen setscrews which couple the capacitors to the dial drive.

b. General Cleaning Procedure. (1) Use an air jet and a stiff brush to remove loose solder, dirt, and metallic chips. Drops of solder adhering to sturdy parts of the receiver may be scraped off with a knife or screw driver blade.

(2) Use a clean, lint-free rag and dry-cleaning solvent to wipe the receiver clean of oil or grease. Pipe cleaners, a thin-handled brush, or a pencil wrapped with a strip of cloth will aid in cleaning hard-to-reach parts. Pay special attention to insulation, tube sockets, jacks, resistor and capacitor panels, and other points where shorts or opens might occur.

(3) Remove all traces of corrosion from switch contacts and other metal parts. Wipe wafer switch contacts very lightly with crocus cloth or erase any signs of corrosion with a lead pencil eraser. If necessary, tube socket contacts, jacks, the power input socket, and other sturdy electrical contacts may be scraped with a knife blade.

(4) Remove all traces of fungus by scraping or sanding. After scraping, wipe off the affected parts carefully with a rag soaked in dry-cleaning solvent (SD). Materials containing cellulose, such as insulation, adhesive cement, wood, and certain plastics are especially vulnerable to fungus growth.

11. Chassis Inspection and Lubrication

a. Inspection Procedure. After the receiver has been thoroughly and carefully cleaned, make a general visual inspection of the chassis and all parts on the chassis. Inspect all wiring for breaks and burned, rotted, or cracked insulation. If any defects are noticed, replace the faulty lead. Leads must be dressed away from all jacks, tube socket terminals, sharp corners on chassis, and other points where shorts might occur. There should be a wide clearance around the heavy lead connecting pin 8 of V2, V3, and V4 with wafer switch 332c. Where groups of leads run parallel, they should be neatly tied with cord to form cables. Check all resistors and capacitors to be sure their leads do not short to tube sockets or ground. Especially check resistor 214–2 and capacitors 106–1, 101–8, and 122. The leads from resistors 212–1 and 212–2 (at Adcock antenna input socket 350) must be symmetrical. The lead from the pin of the vertical antenna input socket 349 should be as short as possible. All leads should be securely held either by terminal nuts or by solder. Inspect all soldered joints. If solder is cracked, the lead is insecurely held, or two or more strands of a flexible lead are broken, resolder the joint. If terminal lugs are bent or leads protrude from the soldered joint, straighten the lugs and resolder the joint to avoid possibilities of a short.

Note. Use only resin core or special radio solder. DO NOT USE PASTE OR ACID FLUX.

(1) Inspect all nuts, bolts, and screws to be sure they are tight and secured with glyptal. Use a small wrench and screw driver. Do not use pliers.

Caution: Do not touch any screws used to adjust variable capacitors or coils. The adjusting screws on the four i-f transformers 317–1, –2, –3, and –4 should not be loose. The clips which help to prevent these screws from turning should be tight.

(2) Inspect the contacts of wafer switches 331A, B, C, and D, and 332A, B, and C for proper contact pressure. Check the alignment of the wafer switches and the linkage connecting the switches to the BAND switch knob to be sure they are in the proper position for both settings of the BAND switch knob. The lock nuts at the joints of the linkage must be tight. The wafer switches, linkage, and BAND switch knob must operate freely without binding. The setscrews on the BAND switch knob must be tight.

(3) Inspect the contacts of wafer switch 330 for proper contact pressure. Check the alignment of the wafer to be sure it is in the proper position for all four settings of the TEST SWITCH knob. The knob and wafer must operate freely without binding.

(4) Inspect the plates of tuning capacitors 120 and 121A and B for cleanliness. The capacitor rotors, dial drive, and TUNING knob must turn freely without binding. Setscrews on the dial, couplings, and TUNING knob must be tight. When the tuning dial is set at its bottom reference line, the four tuning capacitors must be fully meshed. Check with a straight edge. Leave the plates of the tuning capacitors *fully meshed.*

(5) Inspect all other controls on the front panel for loose setscrews or improper setting. These controls and their associated switches and potentiometers should be cleaned, mounted securely, and turn freely without binding.

(6) Check electrolytic capacitors 116A and B and 117 for leaks.

(7) Check capacitors 106–1 through 106–13, and 111–1 through 111–5, transformers 301 and 302, and choke coil 303 for oil leaks.

b. Lubrication Procedure (figs. 31 and 32). (1) The dial drive worm and worm-wheel bearing surfaces should be covered with a light coating of

Grease, Lubricating, Special. The dial drive ball bearings should be lubricated with Oil, Lubricating, Preservative, Special. These lubricants are suitable for all temperatures at which this equipment was designed to operate.

(2) The ball bearings or plain bearings at the ends of the rotor shafts of tuning capacitors 120 and 121A and B should be lubricated with special preservative lubricating oil (PS). This lubricant is suitable for all temperatures at which this equipment was designed to operate.

12. Cleaning, Inspecting, and Testing Removed Parts

a. Tubes. (1) *Cleaning.* Use a clean rag and dry-cleaning solvent (SD) to wipe the tubes, bases, and prongs clean of dirt, oil, and grease. Use crocus cloth to remove any signs of corrosion on the tube prongs. Remove all traces of fungus by scraping and sanding. Wipe the affected areas with a clean rag soaked in dry-cleaning solvent (SD).

(2) *Inspecting.* There must be no traces of fungus or corrosion on any parts of tubes. Inspect the tube envelopes and bases to be sure there are no cracks. Tube prongs must not be loose, bent, or broken.

(3) *Testing.* Test the tubes in a tube tester according to instructions accompanying the tester or test doubtful tubes in a receiver known to be operating normally. Replace any tubes which fail tests for low emission, leakage, and short or open circuits.

(*a*) To test tubes V1, V5, V6, V10, and V11, connect the output lead of a signal generator in series with a 75-ohm resistor, a 0.005-microfarad (mf) capacitor, and the pin of the VERTICAL INPUT socket 349 of a receiver known to be operating normally. Connect the ground lead of the signal generator to the chassis of the receiver. Connect an output indicator (rectifier-type voltmeter) between LINE terminals 334 of the receiver. Set TEST switch 330 at CARDIOID A, POWER switch 334–2 at ON, SWITCHED CARDIOID switch 333–2 at FIG–8, and RADIO switch 335 at ON LINE. Turn the signal generator on to give an audio-modulated signal, tune the generator and receiver to the same frequency (about 20 mc), and adjust the signal generator output to give a reading of 5 to 10 volts on the output meter. Substitute doubtful tubes in place of tubes known to be good. The output meter reading with a doubtful tube in place should be within 5 percent of the reading with normal tubes in place.

(*b*) To test tube V3, connect each lead of a signal generator in series with a 75-ohm resistor and a pin of ADCOCK INPUT socket 350 of a receiver known to be operating normally. Proceed as in (*a*) above.

(*c*) To test tubes V13 and V14, connect each lead of a signal generator in series with a 75-ohm resistor and a pin of ADCOCK INPUT socket 350 of a receiver known to be operating normally. Connect an output indicator (rectifier type voltmeter) between LINE terminals 334 of the receiver. Set TEST SWITCH 330 at NORMAL, POWER switch 334–2 at ON. SWITCHED CARDIOID switch 333–2 at SWITCHED CARDIOID, and RF SENSITIVITY control 228 at AVC. Turn the signal generator on to give an audio-modulated signal and tune the generator and receiver to the same frequency (about 20 mc). Set METER SENSITIVITY control 229–2 fully clockwise and METER BALANCE control 228 in such a position that BEARING METER 377 pointer deflects approximately three-quarters scale. Substitute a doubtful tube in place of a tube known to be good. The BEARING METER reading with a doubtful tube in place should be within 5 percent of the reading with normal tubes in place. Turn METER SENSITIVITY control 228 fully counterclockwise. Turn METER BALANCE control 228 fully counterclockwise, then fully clockwise. The BEARING METER 377 pointer should deflect first to the left and then to the right for a minimum reading of 20 microamperes on each side of the zero.

(*d*) To test tube V9, follow the procedure in (*a*) and (*c*) above.

(*e*) Tubes not covered by the (*a*) through (*d*) above may be tested by substituting them for tubes which are mentioned as follows:

Tubes	Test in socket of
V2	V1
V4	V3
V7, V8	V6
V12, V15	V13

b. Coil Shields. (1) *Cleaning.* Remove any traces of fungus or corrosion by scraping or sanding. Wipe the affected areas with a clean rag soaked in dry-cleaning solvent (SD).

(2) *Inspecting.* There must be no traces of fungus or corrosion. Inspect to be sure there are no bent or broken lugs which are used to secure the shields to the chassis.

c. Dial and Heater Lamps. (1) *Cleaning.* Wipe off the lamps with a clean rag. Remove any

traces of fungus or corrosion on the lamp bases by scraping and sanding.

(2) *Inspecting.* There must be no traces of fungus or corrosion. Inspect the lamps to be sure the envelopes are not cracked and the bases are not loose.

(3) *Testing.* Test the lamps with a 6-volt battery. Replace any lamps which are dim or do not light.

d. Meters 375, 376, and 377 (fig. 4). (1) *Disassembly.* Remove the screw on each side of the front panels of the three meters and carefully lift the front panel straight out from the face of each meter. Lay the meters on the bench in such a position that there is no danger of a meter tipping over, face down, on the bench. Remove the six meter lamps 366 by pressing each lamp slightly into its socket and rotating it ⅛ turn counterclockwise.

(2) *Interior cleaning.* Use a clean rag and dry-cleaning solvent (SD) to wipe off the lamps and front panels of the meters. Remove any traces of fungus or corrosion on the lamps, front panels, or lamp contacts by scraping and sanding. Wipe off the meter dials with a clean rag dampened in dry-cleaning solvent, being *VERY CAREFUL* not to exert any pressure on the meter hands or the exposed mechanism at the base of the meter.

(3) *Interior inspection.* There must be no traces of fungus or corrosion on the front panel, lamps, lamp sockets, or meter dial. If there are any signs of fungus or corrosion in the meter mechanism, or if the meter appears damaged in any way, replace the entire meter. If the glass in the front panel is cracked or scratched, replace it. Inspect the lamps to be sure the envelopes are not cracked and the bases are not loose.

(4) *Testing lamps.* Test the lamps with a 6-volt battery. Replace any lamps which are dim or do not light.

(5) *Reassembly.* Insert the six lamps firmly in their sockets. Gently fit the front panel over the dial of each lamp and secure each front panel in place with two screws.

Caution: When fitting the front panel into place, be VERY CAREFUL that the pin on the end of the adjusting screw in the lower center of the front panel slides *FREELY WITHOUT FORCING* into the slot in the adjusting lever of the meter mechanism. Pressure on this lever, the hand of the meter, or the meter mechanism will *DAMAGE THE METER.*

(6) *Exterior cleaning.* Remove any traces of fungus or corrosion on the meter cases or terminals by scraping and sanding. Use a clean rag and dry-cleaning solvent (SD) to wipe off the cases and terminals.

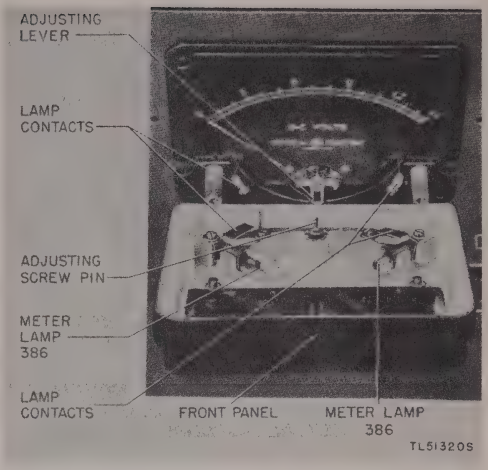


Figure 4. Meter, front panel removed.

(7) *Exterior inspection.* The four terminals on each meter must not be loose or bent. There must be no traces of fungus or corrosion. Slightly rotate the adjusting screw in the lower center of the front panel of each meter. The position of the hand should change if the pin on the adjusting screw has been properly engaged. When the meters are right side up with their dial in a vertical plane, the hand of each meter must be on 0.

(8) *Meter testing.* While each meter is being tested, it should be right side up with its dial in a vertical plane. Make test connections to the two large terminals at the back of the meter. Connect meter 375 in series with a standard milliammeter having a range of 0 to 50 milliamperes (ma) or more. Check the calibrations of the meter. At full scale deflection, meter 373 should agree with the standard within ± 2 percent. Connect meter 376 in parallel with a standard voltmeter having a range of 0 to 15 volts or more. Check the calibrations of the meter. At full scale deflection, meter 376 should agree with the standard within ± 2 percent. Connect meter 377 in series with a standard microammeter having a range of 0 to 75 microamperes or more. Check the calibrations of half the meter dial. Reverse the connections to the meter terminals and check the calibrations of the other half of the dial. At full scale deflection, meter 377 should agree with the standard within ± 2 percent.

SECTION IV

PRELIMINARY TROUBLE-SHOOTING PROCEDURES

13. Input Resistance Measurements

Troubles within the receiver can sometimes be detected by checking the filament and plate supply circuits at the terminals of POWER INPUT plug 355 before applying power to the receiver, thereby preventing damage to the equipment. Make the following checks before attempting to place the receiver in operation. The POWER INPUT plug must not be connected to the power cable socket. Dial lamp 386, the 4 heater lamps 385–1, –2, –3, and –4, and the 15 tubes V1 through V15 must be removed. Short the terminals of the 3 meters 375, 376, and 377 for this test.

a. With an ohmmeter, check the resistance between pin 3 of POWER INPUT plug 355 and ground (chassis). There should be a dead short, or zero ohmmage. If there is any resistance, look for a broken lead between pin 3 and ground.

b. POWER switch 354–2 must be OFF and HEATERS switch 333–3 must be ON. With an ohmmeter, check the resistance between pins 1 and 3 of POWER INPUT plug 355. There should be an open, or infinite ohmmage. If there is less than infinite ohmmage, look for a short to ground on the pin 1 and heater lamp circuits.

c. Turn POWER switch 334–2 ON. With an ohmmeter, check the resistance between pins 1 and 2 of POWER INPUT plug 355. There should be a dead short, or zero ohmmage. If there is any resistance, look for a faulty POWER switch 334–2 or broken leads between pins 1 and 2 and the switch.

d. Turn PANEL LIGHTS switch 333–1 ON. Use an ohmmeter with the positive test prod on pin 3, check the resistance between pins 2 and 3 of POWER INPUT plug 355. There should be a "kick," or swing of the pointer to a low ohmmage reading, to indicate charging of capacitors. Then 25,000 to 100,000 ohms should be indicated. If these results are not obtained, see figures 39 and 40 and look for a short or open in the A-circuit.

Note. Theoretical resistance is 188,000 ohms ± 20 percent, but leakage across capacitor 117 reduces this value considerably.

e. Set the knob of TEST SWITCH 330 on the top of the chassis to the CARDIOID A position. With an ohmmeter, take a reading of the resistance between terminal A on TEST SWITCH 330 and ground. (See fig. 5.) Adjust ADCOCK BALANCE control 227 on the top of the chassis until the reading obtained at terminal A equals 43,000 ohms. If unable to obtain this reading, look for a short or open in the circuit between terminal A and Adcock r-f amplifier tube V4.

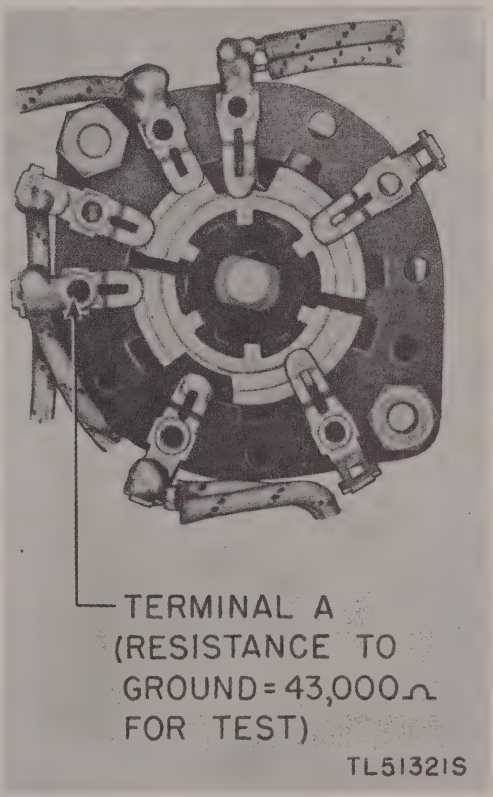


Figure 5. Reading on TEST SWITCH 330 for preliminary Adcock balance adjustment.

f. Set the knob of TEST SWITCH 330 in the extreme counterclockwise, or NORMAL, position. SWITCHED CARDIOID switch 333–2 must be set

at SWITCHED CARDIOID and CW switch 333–4 must be ON. With an ohmmeter, check the resistance between pins 4 and 3 of POWER INPUT plug 355. There should be a resistance of 17,200 to 25,800 ohms. If these results are not obtained, look for a short or an open in the B + circuit.

14. Operating Test

a. PREPARATION. (1) Dial lamp 386, the 4 heater lamps 385–1, –2, –3, and –4, and the 15 tubes V1 through V15 must be inserted in their sockets. Be sure all lamps and tubes are fully seated.

(2) Replace the three meters 375, 376, and 377. Each is secured by four flat washers, lockwashers, and nuts. Replace the three bars which protect the faces of the three meters. Each bar is secured to the front panel by two nuts and lockwashers. Connect the four leads to each of the meters as shown in figure 6. Each lead is secured by a flat washer, lockwasher, and nut in that order.

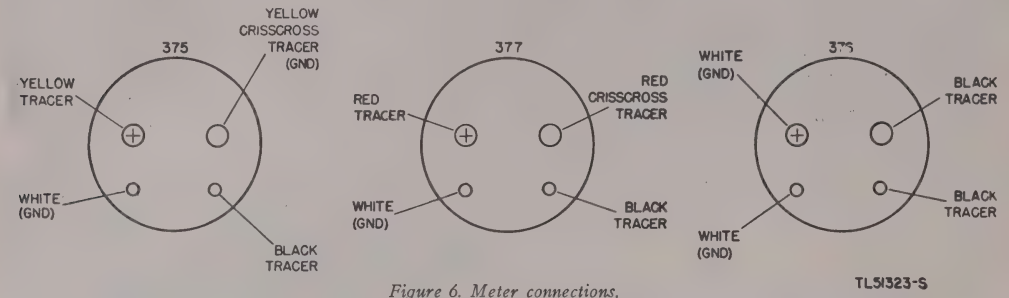


Figure 6. Meter connections.

(3) If Power Unit PE–155–A, battery cable (Signal Corps stock No. 3E7182–1), power cable (Signal Corps stock No. 3E7182–3), and a 12-volt storage battery are all available and known to be in good operating condition, connect these units as indicated in figure 7. POWER switch 334–2 and HEATERS switch 333–3 must be OFF. Firmly plug the power cable socket into POWER INPUT plug 355.

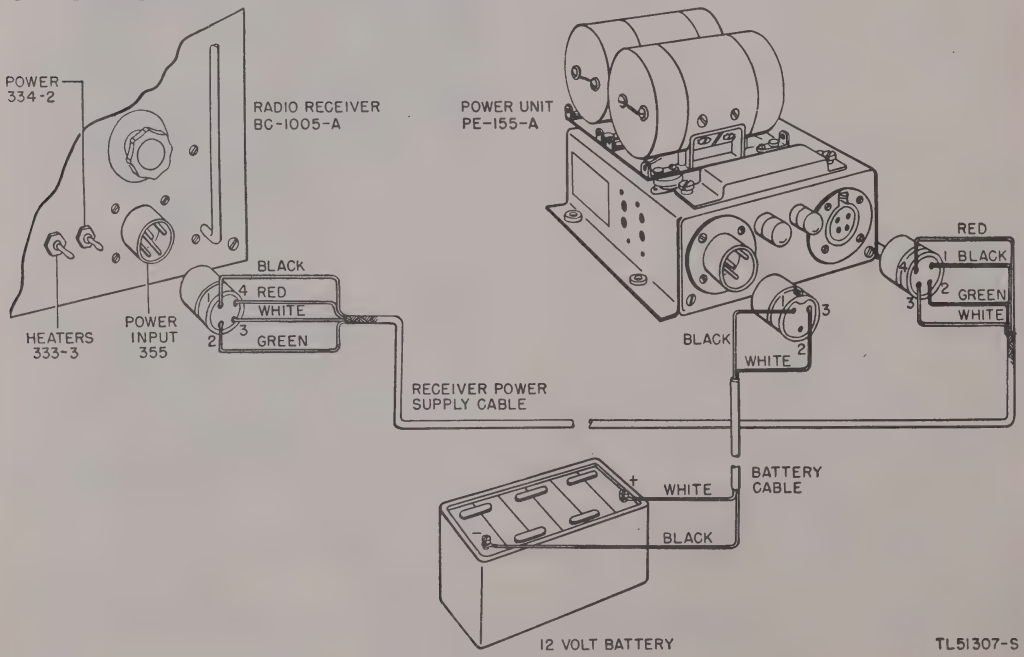


Figure 7. Standard power supply.

Note. If Power Unit PE-155-A is unavailable, a switch and steady source of d-c power capable of delivering 170 volts at 0.1 ampere may be substituted. When this substitution is made, wire a 12-volt storage battery, the 170-volt power source, and the power source switch as indicated in figure 8. POWER switch 334-2 and HEATERS switch 333-3 on the receiver must be OFF. With the power source switch open, connect the ground terminal to pin 3 of POWER INPUT plug 355; connect the −12 volts terminal to pin 1; and connect the +170 volts terminal to pin 4.

Caution: When a 170-volt power source is used instead of Power Unit PE–155–A, the power source switch must *always* be *open* when POWER switch 334–2 is OFF. The power source switch should be *closed* when POWER switch 334–2 is ON. This procedure *must* be observed during *all* operations when a B+ power source other than Power Unit PE–155–A is used.

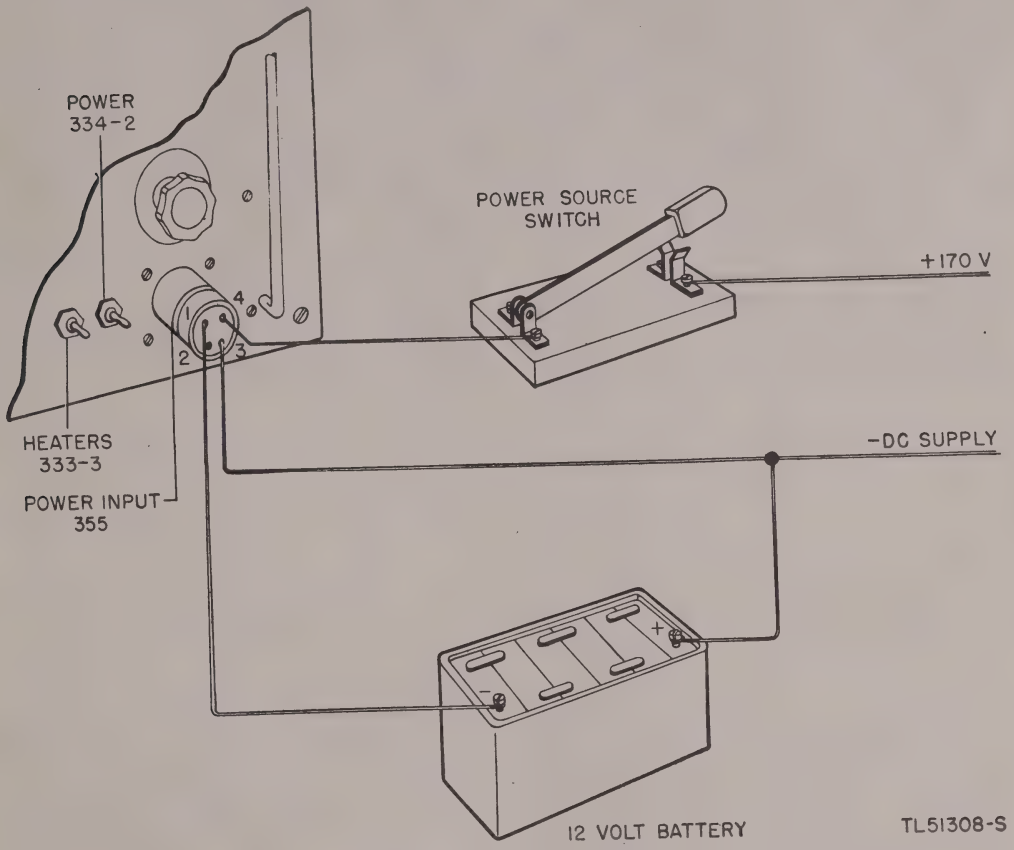


Figure 8. Substitute power supply.

b. Turning on Set. During the following operations, listen closely to the receiver for any crackling or buzzing noises which indicate arcing, watch carefully to see if there is any smoking, and smell the receiver to detect an odor of burning insulation. Watch the three meters 375, 376, and 377 to be sure they do not swing off scale. If any ob normalities are noticed, cut off the power *immediately,* attempt quickly to find the source of trouble, and see section VIII.

(1) Check to be sure the following switches on the front panel of the receiver are set as indicated:

Ref. symbol	Nomenclature	Set at
334-2	POWER switch	OFF
333-3	HEATERS switch	OFF
333-1	PANEL LIGHTS switch	OFF
333-2	SWITCHED CARDIOID switch	FIG-8
333-4	CW switch	OFF

(2) Turn the HEATERS switch ON. If the four heater lamps 385–1, –2, –3, and –4 do not light, see section VIII.

Note. The heater lamps are under three of the coil shields on the top of the chassis. Lamps 385-1 and 385-2 produce a glow which may be observed through the holes marked ANT 18-34 MC and BAL. The glow from lamp 385-3 may be observed through the hole marked RF 18-34 MC. The glow from lamp 385-4 may be observed through the hole marked OSC 18-34 MC.

(3) Turn POWER switch 334–2 ON while observing BAT. VOLTAGE meter 376. The meter should give a reading of the available battery voltage (approximately 12 volts). If these results are not obtained, look for a short or open in the A-circuit or improper connections to BAT. VOLTAGE meter 376. If Power Unit PE–155–A is used to supply B+ power, the unit should begin to operate when POWER switch 334–2 is turned ON.

(4) Turn PANEL LIGHTS switch 333–1 ON. If dial lamp 386 and the lamps in the three meters on the front panel of the receiver do not light, see section VIII.

(5) Rotate METER SENSITIVITY 229–2 and METER BALANCE 230 controls counterclockwise until they reach the stop. Turn SWITCHED CARDIOID switch 333–2 to SWITCHED CARDIOID. The pointer of BEARING METER 377 should deflect slightly. As METER SENSITIVITY control 229–2 is rotated clockwise, the pointer should deflect further in the same direction. As METER BALANCE control 230 is rotated clockwise, the pointer should swing back across zero and deflect in the opposite direction. If these results are not obtained, see section VI.

(6) Slowly rotate RF SENSITIVITY control 228 from full clockwise to a full counterclockwise position. During this operation the pointer of TUNE FOR DIP meter 375 should recede toward zero; then, as the control snaps into the SWITCH TO AVC position, the pointer should jump to a higher reading. If these results are not obtained, see section VI.

(7) Operate the remaining controls and switches on the front panel of the receiver to be sure they work freely over their full range.

(8) Replace the four coil shields on the top of the chassis and secure each of their mounting lugs with a nut and lockwasher.

SECTION V

ALIGNMENT PROCEDURE

15. Calibration of Test Equipment

The entire alignment procedure should be performed in a shielded test booth or screen room. To insure accuracy of alignment, use the frequency meter as a standard when setting the signal generator to a certain frequency. Check each signal-generator setting against the frequency meter as follows: Place the signal generator and the frequency meter near each other. Turn both units on and allow them 15 minutes to warm up. The frequency meter should be calibrated according to instructions furnished with the meter. Attach a lead to the signal generator output and run the lead near the antenna of the frequency meter. However, do not connect the lead to the antenna of the frequency meter. Set the frequency meter to the exact frequency at which the signal generator is to be used. While listening to the headset attached to the frequency meter, tune the signal generator by zero-beating it against the frequency meter. When the signal generator has been tuned, turn off the frequency meter and remove the lead from the signal generator output.

16. Alignment of I-F Amplifier Stages

(figs. 9 and 29)

a. PREPARATION. Check the receiver according to paragraph 14*a*, section IV to be sure all removed parts have been replaced and the power supply is connected correctly. Turn POWER switch 334–2 ON and allow the radio about 15 minutes to warm up. Adjust the signal generator for a 4.2-mc modulated signal, as described in paragraph 15. Set the controls and switches as follows:

Ref. symbol	Nomenclature	Set at
231	TONE CONTROL	Maximum clockwise position.
229-1	AUDIO VOLUME control	Maximum clockwise position.
228	RF SENSITIVITY control	Maximum clockwise position.
355	RADIO switch	
334-1	A-PHONES switch	OFF LINE.
333-4	CW switch	ON LINE.
333-2	SWITCHED CARDIOID switch	OFF.
331 and 332	BAND switch	FIG-8.
120 and 121	TUNING control	18-34 MC.
330	TEST SWITCH	18 mc.
		CARIOID A.

b. PROCEDURE. (1) Attach the ground lead of the signal generator to the receiver chassis. Connect the dummy antenna (a 5,000-micromicrofarad (mmf) capacitor and a 75-ohm resistor in series) between the signal generator output and pin 4 (control grid) of the third i-f amplifier tube V8.

(2) Connect an output meter (rectifier type voltmeter) across B-PHONES jack 351–1, and adjust the signal generator output to give a reading of about 12 volts on the output indicator.

Note. The output meter should not read more than 15 volts at any time during the alignment procedure. Therefore the output of the signal generator may have to be reduced several times during the alignment procedure.

(3) Adjust the alignment screws on fourth i-f transformer 317–4 to give a maximum reading on the output indicator.

(4) Move the dummy antenna to pin 4 (control grid) of second i-f amplifier tube V7.

(5) Adjust the alignment screws on third i-f transformer 317–3 to give a maximum reading on the output indicator.

(6) Move the dummy antenna to pin 4 (control grid) of first i-f amplifier tube V6.

(7) Adjust the alignment screws on second i-f transformer 317–2 to give a maximum reading on the output indicator.

(8) Move the dummy antenna to pin 5 (control grid) of mixer tube V5.

Note. If an adapter is not available, the removal of the shield covering the bottom of the socket of mixer tube V5 may be avoided as follows. Strip the insulation from the end of a short piece of insulated wire. Remove mixer tube V5 from its socket, wrap two or three turns of the bare end of the wire tightly around pin 5 of the tube, and reinsert the tube firmly in its socket. Make sure the wire is not shorted to the chassis. Connect the free end of the wire to the dummy antenna.

(9) Adjust the alignment screws on first i-f transformer 317–1 to give a maximum reading on the output indicator.

(10) Leaving the dummy antenna connected to pin 5 of mixer tube V5 socket (or pin 5 of the tube), carefully readjust the fourth, third, second, and first i-f transformers 317–4, –3, –2, and –1, in the order named, for maximum reading on the output indicator.

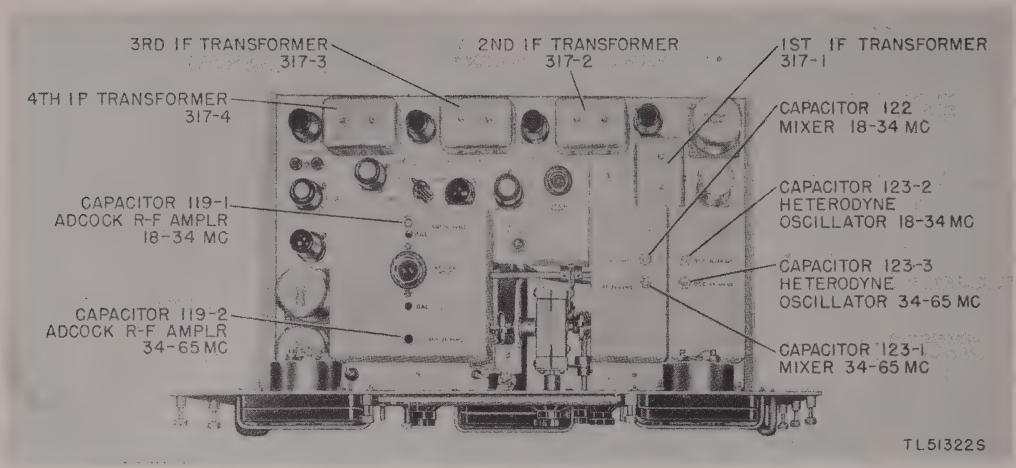


Figure 9. Alignment adjustments.

17. Alignment of 18- to 34-MC Band of Heterodyne Oscillator and Mixer Stages (fig. 9)

a. Preparation. After aligning the i-f amplifier stages, as described in paragraph 16, adjust the signal generator for a 34-mc signal, described in paragraph 15, and audio-modulate the signal. Tune the receiver to 34 mc on the 18- to 34-mc band. Make no changes in any other control or switch settings.

Note. The output meter should not read more than 15 volts at any time during the alignment procedure. Therefore the output of the signal generator may have to be reduced several times during the alignment procedure.

b. Procedure. (1) Connect the dummy antenna to the pin in VERTICAL INPUT socket 349.

(2) Adjust capacitor 123–2 to give a maximum reading on the output indicator.

(3) Adjust capacitor 122 to give a maximum reading on the output indicator.

(4) Carefully readjust capacitor 123–2, then capacitor 122, for maximum reading on the output indicator.

18. Alignment of 34- to 65-MC Band of Heterodyne Oscillator and Mixer Stages (fig. 9)

a. Preparation. After aligning the 18-to 34-mc band of the heterodyne oscillator and mixer stages, as described in paragraph 17, adjust the signal generator for a suitable 65-mc modulated signal, described in paragraph 15. Tune the receiver to 65 megacycles. Make no changes in any other control or switch settings.

Note. The output meter should not read more than 15 volts at any time during the alignment procedure. Therefore the output of the signal generator may have to be reduced several times during the alignment procedure.

b. Procedure. (1) Adjust capacitor 123–3 to give a maximum reading on the output indicator.

(2) Adjust capacitor 123–1 to give a maximum reading on the output indicator.

(3) Carefully readjust capacitor 123–3, then capacitor 123–1, for maximum reading on the output indicator.

19. Alignment of 18- to 34-MC Band of Adcock R-F Amplifier Stage (fig. 9)

a. Preparation. After aligning the 34- to 65-mc band of the heterodyne oscillator and mixer stages, as described in paragraph 16, adjust the signal generator for a 34-mc modulated signal, described in paragraph 15. Tune the receiver to 54 mc on the 18- to 34-mc band. Make no changes in any other control or switch settings.

b. Procedure. (1) Connect a 75-ohm resistor between the signal generator output and pin A of ADCOCK INPUT socket 350. Connect a 75-ohm resistor between the ground lead of the signal generator and pin B of ADCOCK INPUT socket 350.

(2) Adjust the signal generator output to give a reading of about 12 volts on the output indicator.

Note. The output meter should not read more than 15 volts at any time during the alignment procedure. Therefore, the output of the signal generator may have to be reduced several times during the alignment procedure.

(3) Carefully adjust TUNING control 120 and 121 to give a maximum reading on the output indicator.

(4) Adjust capacitor 119–1 to give a maximum reading on the output indicator.

(5) Carefully readjust TUNING control 120 and 121, then capacitor 119–1, for maximum reading on the output indicator.

20. Alignment of 34- to 65-MC Band of Adcock R-F Amplifier Stage (fig. 9)

a. Preparation. After aligning the 18- to 34-mc band of the Adcock r-f amplifier stage, as described in paragraph 19, adjust the signal generator for a 65-mc modulated signal, described in paragraph 15. Tune the receiver to 65 megacycles. Make no changes in any other control or switch settings.

b. Procedure. (1) Connect a 75-ohm resistor between the signal generator output and pin A of ADCOCK INPUT socket 350. Connect a 75-ohm resistor between the ground lead of the signal generator and pin B of ADCOCK INPUT socket 350.

(2) Adjust the signal generator output to give a reading of about 12 volts on the output meter.

Note. The output meter should not read more than 15 volts at any time during the alignment procedure. Therefore the output of the signal generator may have to be reduced several times during the alignment procedure.

(3) Carefully adjust TUNING control 120 and 121 to give a maximum reading of the output indicator.

(4) Adjust capacitor 119–2 to give a maximum reading on the output indicator.

(5) Carefully readjust TUNING control 120 and 121, then capacitor 119–2, for maximum reading on the output indicator.

SECTION VI

DETAILED TROUBLE-SHOOTING PROCEDURES

21. Localizing Trouble to a Stage

a. GENERAL. The alignment procedure (pars. 15 through 20, sec. V) generally localizes any troubles to one of the stages. If still in doubt, see paragraph 28 on resistance and voltage measurements and the over-all connection and schematic diagrams. (See figs. 39, 40, and 41.) Repeat the preliminary trouble location checks. (See pars. 13 and 14, sec. IV.) When the defective stage has been located, see the applicable paragraph in section VIII.

b. GRID PIN CHECK. If the receiver has a weak output, or if some of the stages are operative while others are inoperative, the faulty stage may often be located by turning on the radio and setting the controls and switches as described in paragraph 16*a*, section V. When the receiver has warmed up for about 15 minutes, successively touch the control grid of each tube with a metallic object, such as a key or screw driver blade, while listening to an earphone plugged into B-PHONES jack 351–1. If a click or hum is heard when the grid of a tube is touched, that stage is generally operative. If no response is heard, the trouble generally lies between that point and the point of the last response. Check the tubes in the following order:

Tube symbol	Nomenclature	Grid pin No.
V11	Audio-output amplifier	5
V8	Third i-f amplifier (amplr)	4
V7	Second i-f amplr	4
V6	First i-f amplr	4
V5	Mixer	5
V10	Heterodyne oscillator	5
V2	Second vertical r-f amplr	4
V1	First vertical r-f amplr	4
V3	Adcock r-f amplr	4
*V4	Adcock r-f amplr	4

*Before checking V4, change TEST SWITCH 330 setting to CARDIOID B.

c. SWITCH AND CONTROL CHECK. Troubles may sometimes be located by cutting off the B+ voltage supply to certain stages or circuits and then determining if the remaining stages become operative. There is no B+ voltage supplied to the negative pulse rectifier stage. Certain switch and control settings, together with the elements which are cut off from the B+ supply, are tabulated below.

Note. The B+ voltage to the plates (pin 8) of tubes V2, V3, and V4 cannot be cut off except by breaking a lead or turning the power supply off. However, B+ voltage to tube screens, resistors, and capacitors in these stages is cut off as indicated below.

Nomenclature	Set at	Nomenclature	Set at	Elements isolated
TEST SWITCH 330.	NORMAL	SWITCHED CARDIOID switch 333-2.	FIG-8	Vertical amplr stage.
				V4 section of Adcock amplr stage.
				Amplr section of 2d detector-bearing amplr stage.
				Synchronous voltmeter stage.
				Square wave oscillator stage.
TEST SWITCH 330.	CARDIOID A	SWITCHED CARDIOID switch 333-2.	FIG-8	V4 section of Adcock amplr stage.
				Amplr section 2d detector-bearing amplr stage.
				Synchronous voltmeter stage.
				Square wave oscillator stage.
TEST SWITCH 330.	CARDIOID B	SWITCHED CARDIOID switch 333-2.	FIG-8	V3 section of Adcock amplr stage.
				Amplr section of 2d detector-bearing amplr stage.
				Synchronous voltmeter stage.
				Square wave oscillator stage.

Nomenclature	Set at	Nomenclature	Set at	Elements isolated
TEST SWITCH 330.	BALANCE	SWITCHED CARDIOID switch 333-2.	FIG-8	Vertical amplr stage. Amplr section of 2d detector-bearing amplr stage. Synchronous voltmeter stage. Square wave oscillator stage.
TEST SWITCH 330.	NORMAL	SWITCHED CARDIOID switch 333-2.	SWITCHED CARDIOID	No elements inoperative.
TEST SWITCH 330.	CARDIOID A	SWITCHED CARDIOID switch 333-2.	SWITCHED CARDIOID	V4 section of Adcock amplr stage.
TEST SWITCH 330.	CARDIOID B	SWITCHED CARDIOID switch 333-2.	SWITCHED CARDIOID	V3 section of Adcock amplr stage.
TEST SWITCH 330.	BALANCE	SWITCHED CARDIOID switch 333-2.	SWITCHED CARDIOID	Vertical amplr stage.
.....	.....	CW switch 333-4.	OFF	C-w oscillator stage.

22. Checking Audio Circuits

a. Test and Indication. (1) Set up the receiver and a power supply as outlined in paragraph 14*a*(3), section IV. Turn POWER switch 334–2 ON and allow the radio about 15 minutes to warm up. Set the controls and switches as follows:

Ref. symbol	Nomenclature	Set at
334-2	POWER switch	ON.
333-2	SWITCHED CARDIOID switch	FIG-8.
333-4	CW switch	OFF.
334-1	A-PHONES switch	ON LINE.
335	RADIO switch	ON LINE.
232	VOLUME A-PHONES ON LINE control	Maximum clockwise position.
231	TONE CONTROL	Maximum clockwise position.
229-1	AUDIO VOLUME control	Maximum clockwise position.
228	RF SENSITIVITY control	SWITCH TO AVC.

(2) Attach the ground lead of an audio signal generator to the receiver chassis. Connect a 0.01-mf capacitor between the signal generator output and pin 4 or 5 (detector plate) of the second detector-bearing amplifier tube V9. Turn on the signal generator. If the audio-output stage is functioning correctly, a loud, clear signal should be heard in headphones plugged into any of the following jacks:

Ref. symbol	Nomenclature
351-2	A-PHONES jack
351-3	LINE jack
351-1	B-PHONES jack

(3) If a weak signal or no signal is heard in all of the jacks, feed the signal from the audio signal generator through the 0.01-mmf capacitor to pin 5 (control grid) of audio-output amplifier V11. A loud, clear signal should be heard in headphones plugged into any of the jacks mentioned in (2) above.

(4) If a weak signal or no signal is heard in all of the jacks, feed the signal from the audio signal generator through the 0.01-mmf capacitor to pin 3 (plate) of audio-output amplifier V11.

b. Localization. (1) If a signal is heard by the procedure outlined in *a*(3) above but is not heard by the procedure of *a*(2) above the trouble is probably in the detector section components of the second detector-bearing amplifier stage. See section VIII and trace the trouble to its origin.

(2) If a signal is heard in one or two jacks but not in all, or if a signal is heard by the procedure of *a*(4) above but is not heard by the procedure of *a*(3) above, the trouble is probably in the audio-output stage. See section VIII and trace the trouble to its origin.

23. Checking I-F Circuits

a. Test and Indication. (1) Set up the receiver, a power supply, and a signal generator with

an output calibrated or metered in microvolts as outlined in paragraph 16*a*, section V. Remove heterodyne oscillator tube V10.

(2) Attach the ground lead of the signal generator to the receiver chassis. Connect the dummy antenna (a 5,000-mmf capacitor and a 75-ohm resistor in series) between the signal generator output and pin 4 or 5 (detector plate) of the second detector-bearing amplifier tube V9.

(3) Connect an output meter (rectifier type voltmeter) across B-PHONES jack 351–1, and adjust the signal generator output to give a reading of 12 volts on the output indicator. Record the signal generator output in microvolts.

Note. The output meter should not read more than 15 volts at any time during this test.

(4) Move the dummy antenna to the following pins and tubes. At each pin, reduce the signal generator output to give a reading of 12 volts on the output meter. Record each signal generator output in microvolts. Insert the heterodyne oscillator tube in its socket.

Ref. symbol	Nomenclature	Pin No. (control grid)
V8	Third i-f amplifier	4
V7	Second i-f amplifier	4
V6	First i-f amplifier	4
V5	Mixer	5

b. Localization. If the signal generator output does not have to be definitely reduced at each successive reading, a lack of gain is indicated. The trouble probably lies in the stage of the tube which has no gain. The ratio between any two successive signal generator output readings should be approximately the same. If a stage is defective, see the applicable paragraph in section VIII and trace the trouble to its origin.

24. Checking Heterodyne Oscillator Circuits

a. Test and Indication. (1) After checking the i-f circuits, as described in paragraph 23, adjust the signal generator for an 18-mc modulated signal as outlined in paragraph 15, section V. Make no changes in the hook-up or any of the control or switch settings.

(2) Connect the dummy antenna to pin 8 (screen grid) of mixer tube V5 and adjust the output of the signal generator to give a reading of about 12 volts on the output meter.

(3) While observing the output meter, slowly tune the signal generator 0.2 mc above and below the 18-mc setting; the output should give a lower reading on either side of 18 mc.

(4) Adjust the signal generator for a 35-mc modulator signal as outlined in paragraph 15, section V. Carefully tune the receiver to 35 mc and repeat (2) and (3) above.

b. Localization. If the output meter reading does not drop almost to zero when the signal generator is tuned off 18 mc, or if the 18-mc signal required is many times stronger than the signal required at pin 5 of V5 to produce the same output (par. 23*a*(4)), the trouble probably lies in the heterodyne oscillator stage. If the stage is defective, see section VIII and trace the trouble to its origin.

25. Checking R-F Circuits

a. Test and Indication. (1) After checking the heterodyne oscillator circuit, as described in paragraph 24, adjust a signal generator with an output calibrated or metered in microvolts for an 18-mc modulated signal as outlined in paragraph 15, section V. Carefully tune the receiver to 18 mc. Make no changes in the hook-up or in any of the control or switch settings.

(2) Connect the dummy antenna to pin 8 (screen grid) of mixer tube V5 and adjust the output of the signal generator to give a reading of 12 volts on the output meter. Record the signal generator output in microvolts.

Note. The output meter should not read more than 15 volts at any time during this test.

(3) Move the dummy antenna to the following pins and tubes. At each pin, adjust the signal generator output to give a reading of 12 volts on the output indicator. Record each signal generator output in microvolts.

Ref. symbol	Nomenclature	Pin No. (control grid)
V2	Second vertical amplr	4
V1	First vertical amplr	4

(4) Set TEST SWITCH 330 at CARDIOID A. Connect a 75-ohm resistor between the signal generator output and pin A of ADCOCK INPUT socket 330. Adjust the signal generator output to give a reading of 12 volts on the output indicator. Record the signal generator output in microvolts.

(5) Set TEST SWITCH 330 at CARDIOID B. Adjust the signal generator output to give a reading

of 12 volts on the output indicator. Record the signal generator output in microvolts.

(6) Adjust the signal generator for a 35-mc modulated signal as outlined in paragraph 15, section V. Carefully tune the receiver to 35 mc. Repeat (4) and (5) above.

b. Localization. (1) If the signal generator output does not have to be definitely reduced at the successive readings taken in *a*(2) and *a*(3) above, the trouble probably lies in the vertical amplifier stage. If the stage is defective, see section VIII and trace the trouble to its origin.

(2) The readings taken in *a*(4) and *a*(5) above should be approximately equal and be definitely less than the reading taken in *a*(2) above. The readings taken in *a*(6) above should be two or three times the readings taken in *a*(4) and *a*(5) above. If these results are not obtained, the trouble probably lies in the Adcock amplifier stage. If the stage is defective, see section VIII and trace the trouble to its origin.

26. Checking Electronic Switching Circuits

a. Test and Indication. (1) Set the switches and controls as follows:

Ref. symbol	Nomenclature	Set at
334-2	POWER switch	ON.
229-2	METER SENSITIVITY control.	Maximum counterclockwise position.

(2) Rotate METER BALANCE control 230 from a maximum counterclockwise to a maximum clockwise position.

(3) The pointer of BEARING METER 377 should indicate 20 microamperes or more to the left of zero and should then swing to a reading of 20 microamperes or more to the right of zero.

b. Localization. If BEARING METER 377 operates abnormally, replace in succession the three tubes V15, V14, and V13, repeating the test after each replacement. Check the voltage and resistance at the sockets of these tubes in the same order. When the defective stage has been located, see the proper paragraph in section VIII and trace the trouble to its origin.

27. Checking C-W Oscillator Circuits

a. Test and Indication. Set up the signal generator and receiver and make the tests as outlined in paragraph 34, section VII.

b. Localization. If these results are not obtained, the trouble probably lies in the c-w oscillator stage. If the stage is defective, see section VIII and trace the trouble to its origin.

28. Voltage and Resistance Measurements

a. General. The voltage and resistance values indicated in figures 10, 11, 12, and 13 are average values and have a tolerance of approximately 20 percent. Because certain terminals must be disconnected to make the resistance tests, it is advisable to make the voltage measurements on Radio Receiver BC–1005–A before making the resistance measurements.

b. Voltage Measurements (figs. 10 and 11). Use a vacuum-tube rectifier type voltmeter with a constant input resistance of 11 megohms or more, capable of measuring from 1 to 200 volts direct current, for best results. Under these conditions, the highest reading indicated at each pin should be obtained. If only a 1,000-ohm-per-volt voltmeter is available, voltage measurements may be expected to vary as indicated. The sockets of tubes V1, V2, V3, V4, V5, and V10 are inclosed by the coil shields on the top of the chassis. To measure voltages at the pins of these tubes, the coil shields may be removed, an adaptor may be inserted between tube and socket, or the insulation may be stripped from the end of a short piece of insulated wire and two or three turns of the bare end of the wire wrapped tightly around the pin to be measured to provide a terminal for attaching the voltmeter. (Make sure the wire is not shorted to the chassis.) Conditions for making voltage measurements are as follows:

(1) All tubes and meters must be in place and rated power must be supplied (B+ equals 145 to 180 volts). For details, see paragraph 14*a*, section IV.

(2) Switches and controls should be set as follows:

Ref. symbol	Nomenclature	Set at
334-2	POWER switch	ON.
333-2	SWITCHED CARDIOID switch	SWITCHED CARDIOID.
333-4	CW switch	ON.
231	TONE CONTROL	Maximum clockwise position.
229-1	AUDIO VOLUME control	Maximum clockwise position.
331 and 332	BAND switch	18-34 MC.
228	RF SENSITIVITY control	SWITCH TO AVC.

Ref. symbol	Nomenclature	Set at
229-2	METER SENSITIVITY control	Maximum clockwise position.
227	ADCOCK BALANCE adjustment	Adjust according to paragraph 13*e*, section IV.
330	TEST SWITCH	After adjusting 227, set 330 at NORMAL.
230	METER BALANCE control	After setting 227 and 330, adjust 230 until BEARING METER 377 reads 0.

(3) All readings are taken between tube pin and ground (chassis).

c. Resistance Measurements (figs. 12 and 13). Use an ohmmeter capable of measuring from 1 ohm to 1 megohm, for best results. As all tubes must be removed, all readings may be taken from the bottom of the chassis. This avoids any need for removing the coil shields. Conditions for making resistance measurements are as follows:

(1) All tubes V1 through V15 must be removed and POWER INPUT plug 355 must be disconnected.

(2) Disconnect the lead from either of the large terminals on the rear of BAT. VOLTAGE meter 376 and secure the lead so that it cannot short to any other parts.

(3) Capacitors 116A, 116B, and 117 are electrolytic. To secure stable readings, unsolder the leads from all the terminals of these three capacitors except the ground terminals. Where two leads are soldered to the same terminal, remove the two leads and solder them together. Secure these leads so they cannot short to any other parts.

(4) Switches and controls should be set as follows:

Ref. symbol	Nomenclature	Set at
334-2	POWER switch	OFF.
333-3	HEATERS switch	OFF.
333-1	PANEL LIGHTS switch	OFF.
333-2	SWITCHED CARDIOID switch	SWITCHED CARDIOID.
333-4	CW switch	ON.
331 and 332	BAND switch	18-34 MC.
228	RF SENSITIVITY control	SWITCH TO AVC.
230	METER BALANCE control	Set halfway between maximum clockwise and maximum counterclockwise positions.
227	ADCOCK BALANCE adjustment	Adjust according to paragraph 13*e*, section IV.
330	TEST SWITCH	After adjusting 227, set 330 at NORMAL.

29. Moistureproofing, Fungiproofing, and Refinishing

a. Thorough moistureproofing and fungiproofing of the receiver is necessary to insure optimum performance in spite of operation under conditions of excessive heat or humidity. Both conditions promote corrosion of metal parts and fungus growth, which attacks materials containing cellulose, such as insulation, adhesive cement, wood, and certain plastics. Secretions of fungus also have a corrosive effect on certain materials, such as wire, switch contacts, and other metal parts. After the transmitter has been repaired and is functioning correctly, for general instructions on moistureproofing and fungiproofing see TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment. Follow the specific procedure for moistureproofing and fungiproofing this equipment as outlined in paragraph 54*b*, section IV, TM 11–251.

b. If the front panel of the receiver is scarred or chipped, remove any rough spots with #00 or #000 sandpaper. If the panel is very dirty or badly rusted, kerosene may be used as an aid to cleaning. After the panel is thoroughly dry, use a small brush to apply the proper paint authorized by existing regulations.

Note. Do not paint out parts identification numbers on the back of the front panel. Make sure all nomenclature in white letters on the front of the panel is clearly legible.

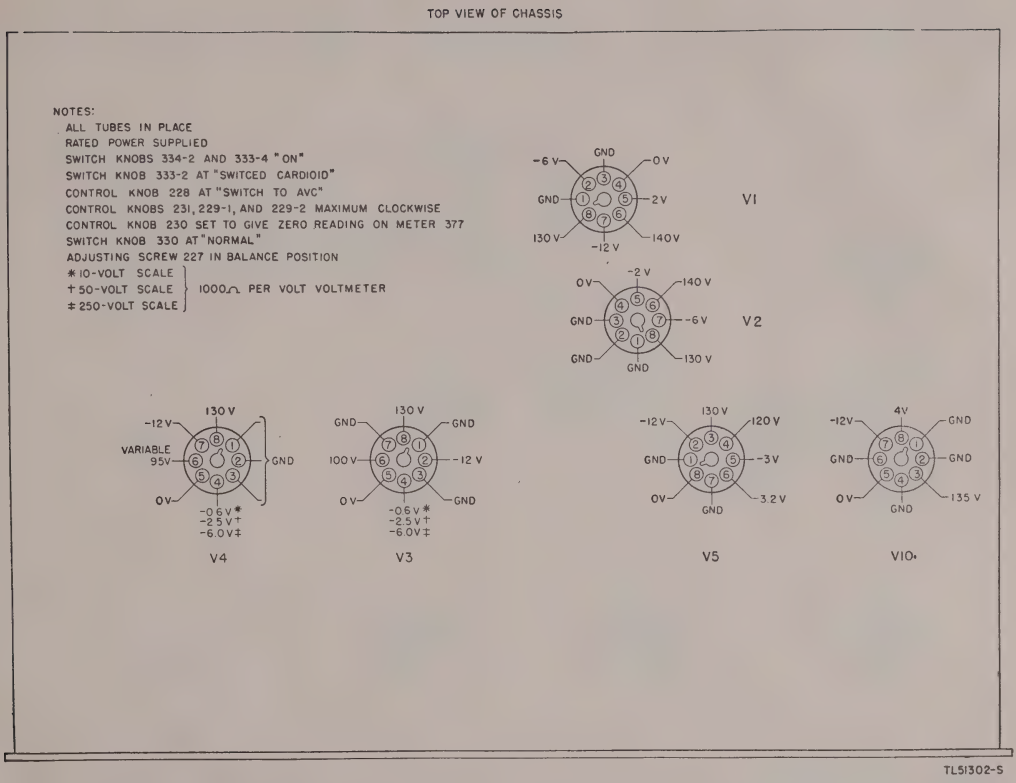
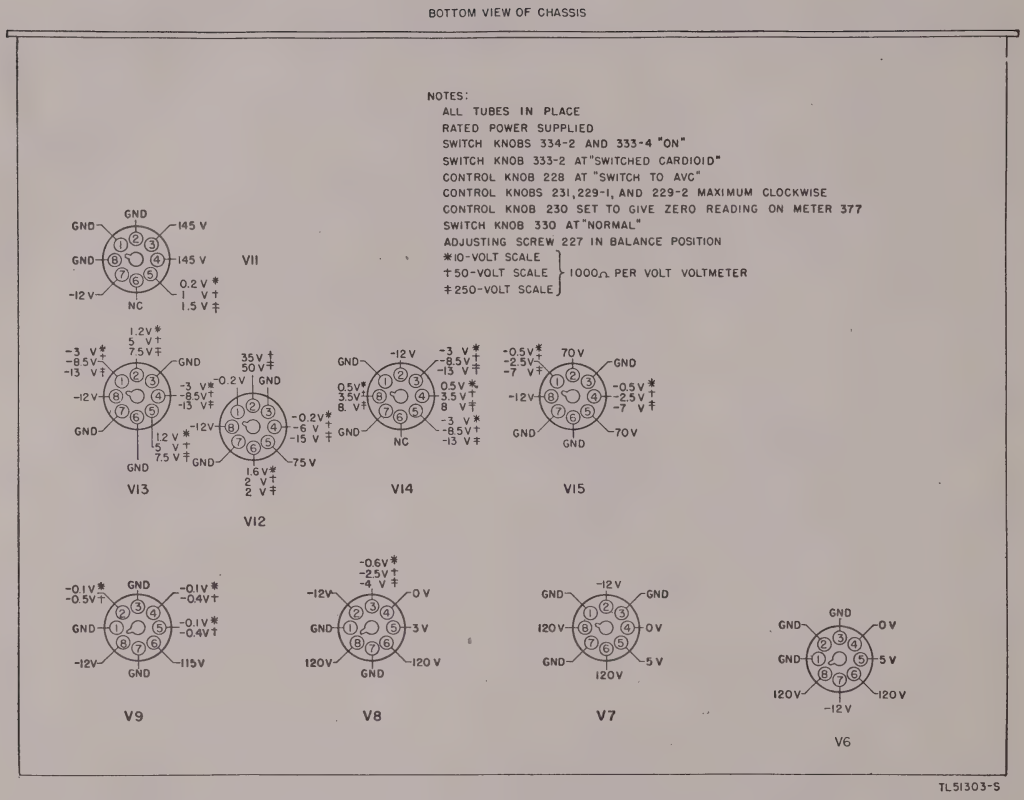


Figure 10. Radio Receiver BC-1005-A, tube socket layout and voltage measurements, top view of chassis.



Figur· 11. Radio Receiver BC-1005-A, tube socket layout and voltage measurements, bottom view of chassis.

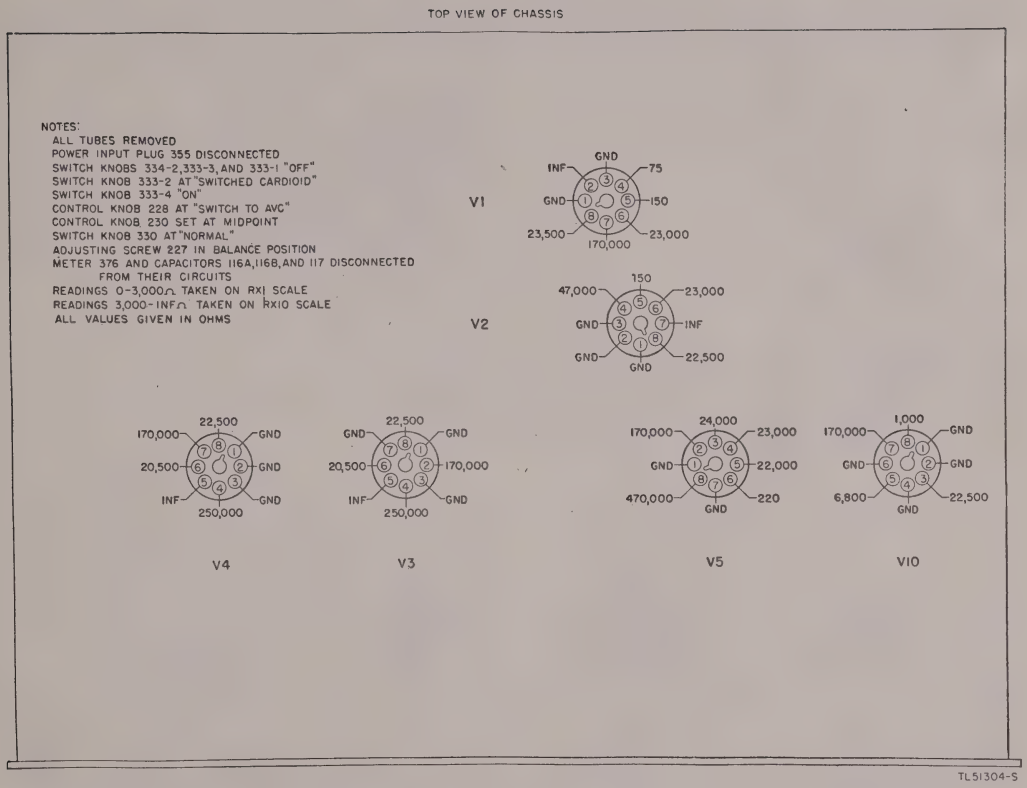


Figure 12. Radio Receiver BC-1005-A, tube socket layout and resistance measurements, top view of chassis.

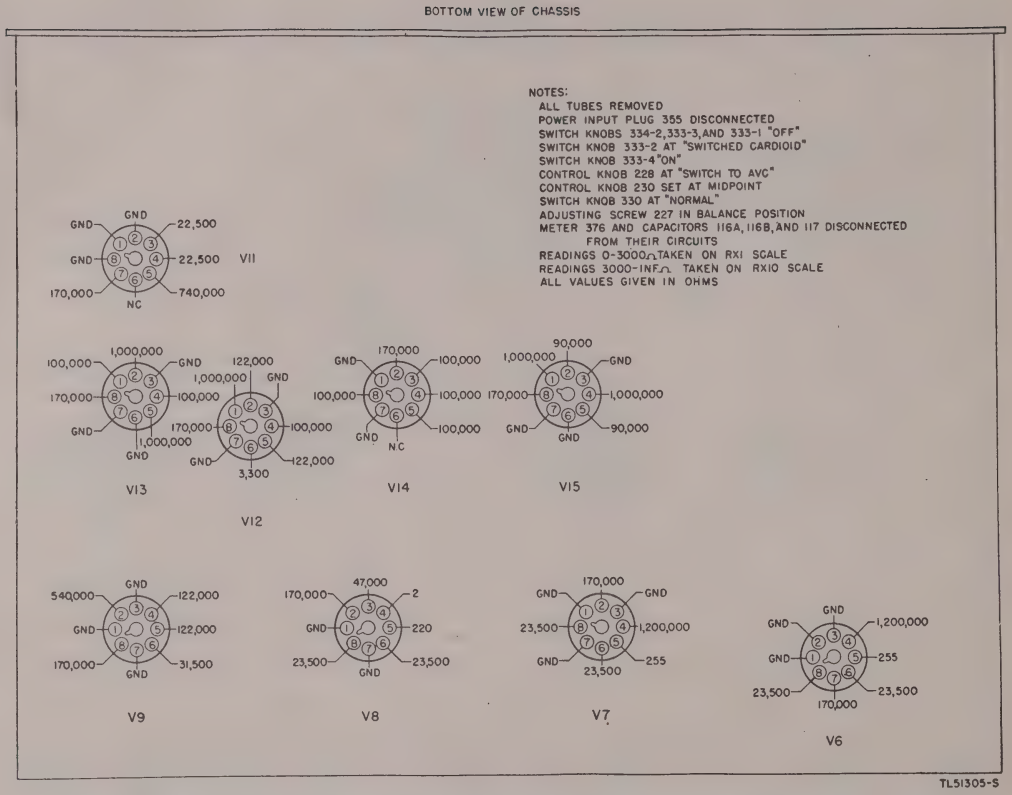


Figure 13. Radio Receiver BC-1005-A, tube socket layout and resistance measurements, bottom view of chassis.

SECTION VII

FINAL TESTING

30. Alignment Check

After repairs have been completed on the receiver and the unit has been moistureproofed, fungiproofed, and refinished, a series of final tests are necessary to ascertain that the unit is in proper condition for tactical use. All final tests except the operational test must be performed in a shielded test booth or screen room. Although the unit has been correctly aligned during the repair procedure, recheck the alignment, paragraphs 15 to 20, section V, after moistureproofing, fungiproofing, and refinishing have been completed. After the alignment check, make the following over-all performance tests in the order named.

Adcock balance test.
Mcw sensitivity and dial deviation.
I-f selectivity test.
C-w oscillator test.
Operational test.

31. Adcock Balance Test

a. PREPARATION. Set up the receiver and a power supply as outlined in paragraph 14*a*(3), section IV. Turn POWER switch 334–2 ON and allow the radio about 15 minutes to warm up. Adjust the signal generator for a 34-mc modulated signal, as described in paragraph 15, section V. Set the controls and switches as follows:

Ref. symbol	Nomenclature	Set at
334–2	POWER switch	ON.
333–2	SWITCHED CARDIOID switch	FIG–8.
333–4	CW switch	OFF.
334–1	A-PHONES switch	ON LINE.
335	RADIO switch	OFF LINE.
231	TONE control	Maximum clockwise position.
229–1	AUDIO VOLUME control	Maximum clockwise position.
228	RF SENSITIVITY control	Maximum clockwise position.
229–2	METER SENSITIVITY control	Maximum clockwise position.
230	METER BALANCE control	Set halfway between maximum clockwise and maximum counterclockwise.
331 and 332	BAND switch	34–65 MC.
120 and 121	TUNING control	34 mc.
330	TEST SWITCH	NORMAL.

b. TEST. (1) Connect a 75-ohm resistor between the signal generator output and pin A on ADCOCK INPUT socket 350. Connect a 75-ohm resistor between the ground lead of the signal generator and pin B of ADCOCK INPUT socket 330.

(2) Connect an output meter (rectifier type voltmeter) across B-PHONES jack 351–1, and adjust the signal generator output to give a reading of about 12 volts on the output meter.

(3) Change the settings of the switches and controls in the following order:

Ref. symbol	Nomenclature	Set at
228	RF SENSITIVITY control	Turn counterclockwise until pressure is felt (do not switch on AVC).
333–2	SWITCHED CARDIOID switch	SWITCHED CARDIOID.
230	METER BALANCE control	Adjust until BEARING METER 377 reads 0.
229–2	METER SENSITIVITY control	Maximum clockwise position.
230	TEST SWITCH	BALANCE.
227	ADCOCK BALANCE adjustment	Rotate in either direction until stop is hit.
228	RF SENSITIVITY control	Turn slowly clockwise until pointer of BEARING METER 377 reaches maximum deflection and starts to reverse. Set control 228 slightly counterclockwise from position of maximum pointer deflection.
227	ADCOCK BALANCE adjustment	Rotate slowly until BEARING METER 377 reads 0.

(4) If unable to obtain the described results, reverse the positions of tubes V3 and V4 or replace one of these tubes. Repeat the Adcock balance test. If still unable to obtain the described results, see section VI.

32. M-C-W Sensitivity and Dial Deviation Tests

a. GENERAL. The test for sensitivity to audio-modulated signals and the test for dial deviation require the same test set-up and readings are taken at the same frequencies. It is therefore more efficient to perform these two tests simultaneously. For these tests a signal generator with an output calibrated or metered in microvolts will be required.

b. PREPARATION. Set up the receiver and a power supply as outlined in paragraph 14*a*(3), section IV. Turn POWER switch 334–2 ON and allow the radio about 15 minutes to warm up. Adjust the signal generator for a 64-mc signal, as described in paragraph 15, section V, and set the signal generator for 30-percent modulation at 400 cycles per second. Set the controls and switches as follows:

Ref. symbol	Nomenclature	Set at
334–2	POWER switch	ON.
333–2	SWITCHED CARDIOID switch	FIG–8.
333–4	CW, switch	OFF.
228	RF SENSITIVITY control	Maximum clockwise position.
330	TEST SWITCH	CARDIOID A.

c. TEST. (1) Connect a 75-ohm resistor between the signal generator output and pin A on ADCOCK INPUT socket 350. Connect a 75-ohm resistor between the ground lead of the signal generator and pin B of ADCOCK INPUT socket 350.

(2) Connect tip plugs to the terminals of a d-c microammeter with a range of 75 microamperes or more. Insert the plugs into DETECTOR OUTPUT jack 353. Keep the output of the signal generator regulated so that the meter *does not read off scale.*

Note. If a microammeter is not available, connect the leads from the tip plugs to the two large terminals of BEARING METER 377 and use this meter as an output meter.

(3) Carefully tune the radio to give a maximum reading on the microammeter output meter.

(4) Adjust the output of the signal generator to give a reading of *exactly* 60 microamperes.

(5) Record the exact dial setting and the signal generator output.

(6) Adjust the signal generator as described in paragraph 15, section V, and repeat (3), (4), and (5) above at the following signal generator frequencies. Allowable tolerances of dial readings and signal generator outputs are tabulated below.

Signal generator frequency (mc)	Dial readings (mc)	Maximum allowable signal generator output (microvolts)
64	63.8 to 64.2	35
59	58.8 to 59.2	35
54	53.8 to 54.2	35
49	48.8 to 49.2	35
44	43.8 to 44.2	35
39	38.8 to 39.2	35
34	33.8 to 34.2	35
33	32.8 to 33.2	15
28	27.8 to 28.2	12
23	22.8 to 23.2	12
18	17.8 to 18.2	15

(7) Attach the ground lead of the signal generator to the receiver chassis. Connect the dummy antenna (a 5,000-mmf capacitor and a 75-ohm resistor in series) between the signal generator output and the pin in VERTICAL INPUT socket 349.

(8) Adjust the signal generator as described in paragraph 15, section V, and repeat (3), (4), and (5) above at the following signal generator frequencies. Allowable tolerances of dial readings and signal generator outputs are tabulated below.

Signal generator frequency (mc)	Dial readings (mc)	Maximum allowable signal generator output (microvolts)
64	63.8 to 64.2	55
49	48.8 to 49.2	50
34	33.8 to 34.2	50
33	32.8 to 33.2	20
23	22.8 to 23.2	20
18	17.8 to 18.2	15

33. I-F Selectivity Test

a. PREPARATION. Set up the receiver and a power supply as outlined in paragraph 14*a*(3), section IV. Turn POWER switch 334–2 ON and allow the radio about 15 minutes to warm up. For these tests a signal generator with an output calibrated or metered in microvolts will be required. Adjust the signal generator for a 4.2-mc signal, as described in paragraph 15, section V, and set the signal generator for 30-percent modulation at 400 cycles per second. Set the controls and switches as follows:

Ref. symbol	Nomenclature	Set at
334–2	POWER switch	ON.
333–2	SWITCHED CARDIOID switch	FIG–8.
333–4	CW switch	OFF.
228	RF SENSITIVITY control	Maximum clockwise position.
120 and 121	TUNING control	18 mc.
331 and 332	BAND switch	18–34 MC.
330	TEST SWITCH	NORMAL.

b. TEST. (1) Attach the ground lead of the signal generator to the receiver chassis. Connect the dummy antenna (a 5,000-mmf capacitor and a 75-ohm resistor in series) between the signal generator output and pin 5 (control grid) of mixer tube V5.

Note. If an adapter is not available, avoid removing the shield covering the bottom of the socket of mixer tube V5 as follows: Strip the insulation from the end of a short piece of insulated wire. Remove mixer tube V5 from its socket, wrap two or three turns of the bare end of the wire tightly around pin 5 of the tube, and reinsert the tube firmly in its socket. Make sure the wire is not shorted to the chassis. Connect the free end of the wire to the dummy antenna.

(2) Connect tip plugs to the terminals of a d-c microammeter with a range of 75 microamperes or more. Insert the plugs into DETECTOR OUTPUT jack 353. Carefully adjust the output of the signal generator so that the microammeter output meter reads exactly 60 microamperes.

Note. If a microammeter is not available, connect the leads from the tip plugs to the two large terminals of BEARING METER 577 and use this meter as an output indicator.

(3) Record the *exact* signal generator output (normal i-f sensitivity).

(4) Tune the signal generator to 4,050 kilocycles (kc), increase the output of the signal generator to twice the normal i-f sensitivity, and slowly tune the signal generator toward 4,200 kc until the output microammeter reads 60 microamperes. Record the *exact* signal generator frequency. Reduce the output of the signal generator to an approximately normal i-f sensitivity value.

(5) Tune the signal generator to 4,550 kc, increase the output of the signal generator to twice the normal i-f sensitivity, and slowly tune the signal generator toward 4,200 kc until the output microammeter reads 60 microamperes. Record the *exact* signal generator frequency. Reduce the output of the signal generator to an approximately normal i-f sensitivity value.

(6) Repeat (4) and (5) above except that instead of setting the signal generator output at twice normal i-f sensitivity, set the output successively at 10 times, 100 times, and 1,000 times normal i-f sensitivity. Allowable tolerances of signal generator frequency at different signal generator outputs are tabulated below.

Signal generator output (number of times normal i-f sensitivity)	Minimum allowable signal generator frequency (kc)	Maximum allowable signal generator frequency (kc)
2	4,165	4,235
10	4,135	4,265
100	4,100	4,300
1,000	4,075	4,325

34. C-W Oscillator Test

a. PROCEDURE. Set up the receiver and a power supply as outlined in paragraph 14*a*(3), section IV. Turn POWER switch 334–2 ON and allow the radio about 15 minutes to warm up. Set the signal generator for an 18-mc audio-modulated signal. Set the controls and switches as follows:

Ref. symbol	Nomenclature	Set at
334–2	POWER switch	ON.
333–2	SWITCHED CARDIOID switch	FIG–8.
335–4	CW switch	OFF.
231	TONE CONTROL	Midpoint.
229–1	AUDIO VOLUME control	Maximum clockwise position.
120 and 121	TUNING control	18 mc.
131 and 132	BAND switch	18–34 MC.
228	RF SENSITIVITY control	Maximum clockwise position.
330	TEST SWITCH	CARDIOID A.

b. TEST. (1) Attach the ground lead of the signal generator to the receiver chassis. Connect the dummy antenna (a 5,000-mmf capacitor and a 75-ohm resistor in series) between the signal generator output and the pin in VERTICAL INPUT socket 549.

(2) Plug a headphone into B-PHONES jack 551–1 and adjust the signal generator out until a clear tone is heard. Adjust TUNING control 120 and 121 if necessary.

(3) Turn off the audio modulation of the signal generator. The tone should stop.

(4) Change the setting of CW switch 335–4 to ON. A harmonious tone should be heard.

35. Operational Test

a. GENERAL. The operational test is not performed on Radio Receiver BC–1005–A as a unit, but is a field test of Radio Set SCR–555–A, of which the receiver is a component. Because of slight variations between similar components, it is preferable to test the receiver with the other components which will actually be used tactically with the receiver under test.

b. PROCEDURE. Set up and operate the complete RDF station as described in paragraphs 9 through 19, section II, TM 11–251.

c. TEST. Take direct and reciprocal bearings, as instructed in TM 11–251, at the following frequencies. The equipment should be tested both as a figure–8 and a switched-cardioid direction finder.

Allowable tolerances between direct and reciprocal bearings are tabulated below.

Frequency (mc)	Allowable difference in degrees between direct and reciprocal bearings	
	Figure–8 reception	Switched-cardioid reception
64	178.3 to 161.5	177.8 to 182.2
59	178.5 to 181.5	177.8 to 182.2
54	178.5 to 181.5	177.8 to 182.2
49	178.5 to 181.5	177.8 to 182.2
44	178.5 to 181.5	177.8 to 182.2
39	178.5 to 181.5	177.8 to 182.2
34	178.5 to 181.5	177.8 to 182.2
33	178.5 to 181.5	177.8 to 182.2
28	178.5 to 181.5	177.8 to 182.2
23	178.5 to 181.5	177.8 to 182.2
18	178.5 to 181.5	177.8 to 182.2

Note. If these readings are not obtained see TM 11–251 for information on installation, operation and maintenance of this equipment.

SECTION VIII

INDIVIDUAL STAGE AND CIRCUIT REPAIR DATA

36. Vertical R-F Amplifier Stage (fig. 14)

a. Circuit Repair Features. The vertical amplifiers increase the amplitude of the vertical antenna signals before they are combined with the Adcock r-f amplifier output. The vertical antenna is terminated by resistor 218 which serves as the grid load of the first r-f amplifier tube V1. Resistor 202–1, bypassed by capacitor 101–1, provides self-bias. Resistor 203–1 drops the B+ voltage to the proper screen potential, and decoupling is provided by capacitor 101–2. The output of amplifier tube V1 is coupled to amplifier tube V2 by coil 316 and coupling capacitor 102–1. Resistor 204 helps to supply the plate load, and resistor 203–2 and capacitor 101–3 form a decoupling network for tube V1. Resistor 205–1 forms the grid load for tube V2, which is self-biased by resistor 202–3 and bypassed by capacitor 101–4. Proper screen potential is provided by dropping resistor 203–3 bypassed by capacitor 101–5. The output of the vertical amplifiers is combined with the Adcock r-f amplifier output and applied to the mixer stage input.

b. Voltage and Resistance Measurements. The voltage and resistance measurements shown in figure 14 were made at the pin connections to the tube sockets on the top of the chassis. Connect the meter between the pins to be checked and the chassis to obtain these readings. For further details of conditions under which the tests were made, see paragraph 28, section VI.

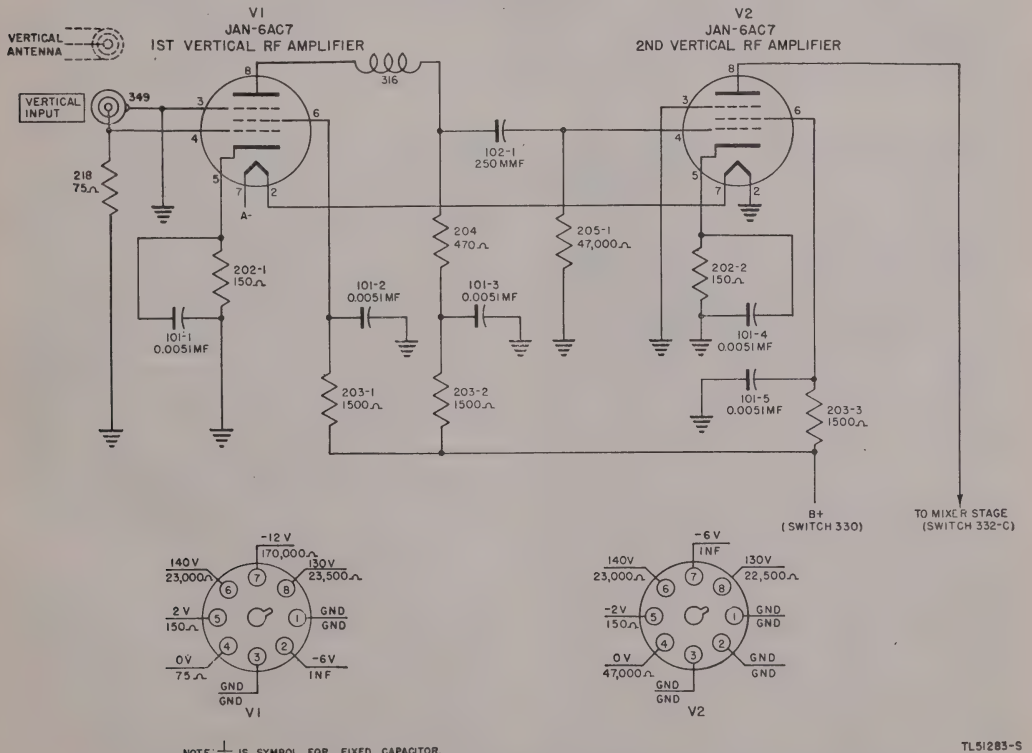


Figure 14. Vertical r-f amplifier stage schematic diagram and voltage and resistance measurements.

c. Parts Data.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
101–1	3D3551212	CAPACITOR: mica; moulded, 5,100 mmf ± 5%; 500 vdcw.	Cathode bypass, VI.
101–2	3D3551212	CAPACITOR: mica; moulded, 5,100 mmf ± 5%; 500 vdcw.	Screen bypass, VI.
101–3	3D3551212	CAPACITOR: mica; moulded, 5,100 mmf ± 5%; 500 vdcw.	Plate filter bypass, VI.
101–4	3D3551212	CAPACITOR: mica; moulded, 5,100 mmf ± 5%; 500 vdcw.	Cathode resistor bypass, V2.
101–5	3D3551212	CAPACITOR: mica; moulded, 5,100 mmf ± 5%; 500 vdcw.	Screen resistor bypass, V2.
102–1	3D9250–46.2	CAPACITOR: fixed; ceramic; 250 mmf ± 5%; 500 vdcw.	Grid coupling, V2.
202–1	3RC20BE151M	RESISTOR: carbon; insulated; 150 ohms ± 20%; ½ w.	Cathode bias, V1.
202–2	3RC20BE151M	RESISTOR: carbon; insulated; 150 ohms ± 20%; ½ w.	Cathode bias, V2.
203–1	3RC21BE152M	RESISTOR: carbon; insulated; 1,500 ohms ± 20%; ½ w.	Screen voltage dropping, V1.
203–2	3RC21BE152M	RESISTOR: carbon; insulated; 1,500 ohms ± 20%; ½ w.	Plate filter resistor, V1.
203–3	3RC21BE152M	RESISTOR: carbon; insulated; 1,500 ohms ± 20%; ½ w.	Screen voltage dropping, V2.
204		RESISTOR: carbon; 470 ohms ± 20%; ½ w.	Plate load, V1.
205–1		RESISTOR: carbon; 47,000 ohms ± 20%; ½ w.	Grid load, V2.
218	3ZK600755–12	RESISTOR: carbon; insulated; 75 ohms ± 20%; ½ w.	Grid load, V1.
316	2C5005A/C1	COIL: reactor; air core.	Inductive reactor phase shifter.
349	2ZK8671.12	SOCKET: connector; single-prong.	Vertical antenna input connection.
V1	2J6AC7	TUBE: JAN–6AC7 (VT–112).	R-f amplifier.
V2	2J6AC7	TUBE: JAN–6AC7 (VT–112).	R-f amplifier.

37. Adcock R-F Amplifier Stage (fig. 15)

a. Circuit Repair Features. The Adcock antenna signal is fed through series resistors 212–1 and 212–2 to antenna transformer 311 or 310, depending on the band being used. Each transformer is cut in or out of the circuit by means of band switches 331A, 331B, 331C, and 331D. Split stator capacitors 126–1 and 126–2 are adjustable and each provides the means for accurately balancing one of the transformer primaries to ground. Capacitors 120 are ganged with the tuning control and, together with aligning capacitor 119–1 or 119–2, resonate the secondary to transformer 311 or 310. The signal is applied in push-pull to the grids of tubes V3 and V4 through capacitors 103–1 and 103–2. The grids of tubes V3 and V4 are alternately driven to cut-off by applying negative pulses 130 times per second from the negative pulse rectifier stage. Since the grids are connected in push-pull and the plates in parallel, the Adcock antenna signal voltage appearing across the plate load is reversed in phase at a 130-cycle rate. The pulsed bias voltages from the negative pulse rectifier stage are applied through an r-f decoupling network (consisting of resistors 208–1, 208–2 and capacitors 104–1, 104–2), and alternately drive the grids to cut-off. Capacitors 103–1 and 103–2 have a value of 100 mmf and therefore present a low-impedance path to the Adcock antenna r-f signals; however, their reactance at 130 cycles is very high and they effectively isolate the switching pulses from the tuned grid circuit. The screen voltage for tube V3 is supplied through a voltage-dividing network consisting of resistors 209–1 and 210–1. Capacitor 101–8 acts as a screen r-f bypass. Tube V4 screen potential is supplied by a voltage-dividing network consisting of variable resistor 227 and resistor 209–2. The variable resistor provides means for regulating the screen potential of tube V4 so that the cathode currents of both tubes can be balanced. Capacitor 101–9 acts as a screen r-f bypass for tube V4.

b. Voltage and Resistance Measurements. The voltage and resistance measurements shown in figure 15 were made at the pin connections to the tube sockets on the top of the chassis. Connect the meter between the pins to be checked and the chassis to obtain these readings. For further details of conditions under which the tests were made, see paragraph 28, section VI.

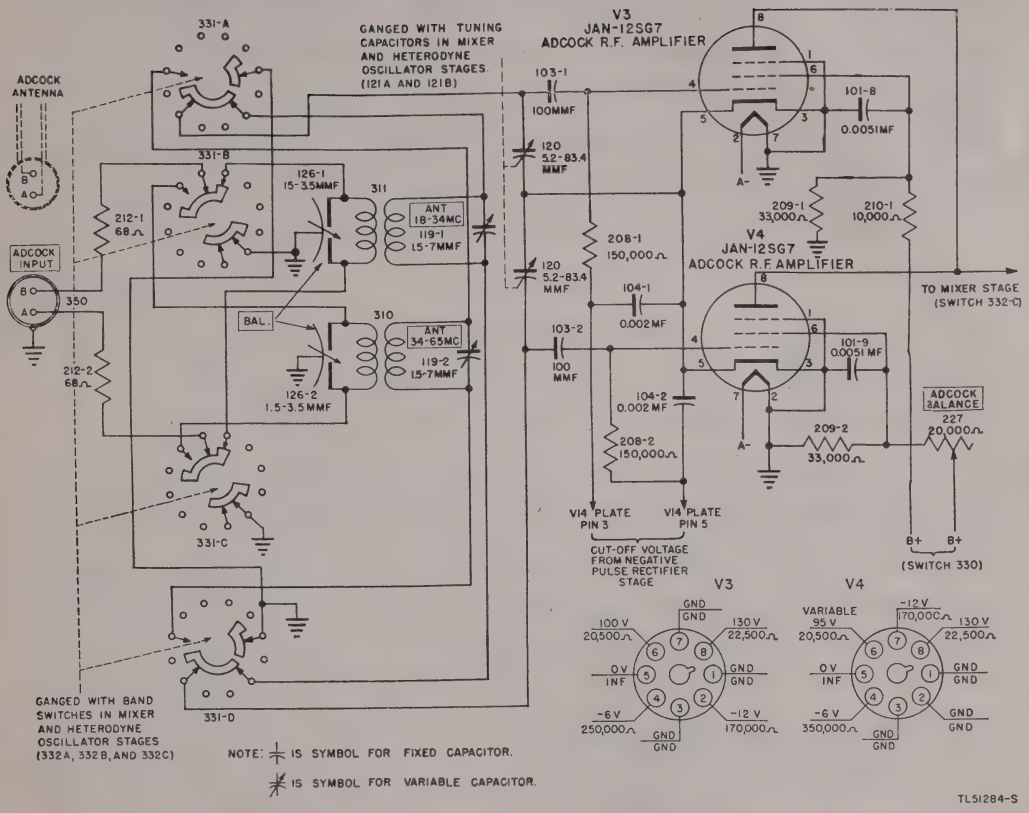


Figure 15. Adcock r-f amplifier stage schematic diagram and voltage and resistance measurements.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
101–8	3D3551212	CAPACITOR: mica; moulded; 5,100 mmf ± 5%; 500 vdcw.	Screen bypass, V3.
101–9	3D3551212	CAPACITOR: mica; moulded; 5,100 mmf ± 5%; 500 vdcw.	Screen bypass, V4.
103–1	3D9100–57.2	CAPACITOR: fixed; ceramic; 100 mmf ± 5%; 500 vdcw.	Grid coupling, V5.
103–2	3D9100–57.2	CAPACITOR: fixed; ceramic; 100 mmf ± 5%; 500 vdcw.	Grid coupling, V4.
104–1	3K3020212	CAPACITOR: mica; moulded; 2,000 mmf ± 5%; 500 vdcw.	Grid filter, V3.
104–2	3K3020212	CAPACITOR: mica; moulded; 2,000 mmf ± 5%; 500 vdcw.	Grid filter, V4.
119–1	3D9001VE5–1	CAPACITOR: variable; ceramic; 1.5 to 7 mmf.	Low waveband antenna transformer secondary tuning.
119–2	3D9001VE5–1	CAPACITOR: variable; ceramic; 1.5 to 7 mmf.	High waveband antenna transformer secondary tuning.
120	3D9089VA1	CAPACITOR: variable; air; 2-gang; each section 5.2–83.4 mmf.	Grid circuit tuning, V3, V4.
126–1		CAPACITOR: differential; variable; 1.5–3.5 mmf.	Low waveband, Adcock antenna capacitance balancing.
126–2		CAPACITOR: differential; variable; 1.5–3.5 mmf.	High waveband, Adcock antenna capacitance balancing.
208–1	3RC21BE154M	RESISTOR: carbon; insulated; 150,000 ohms ± 20%; ½ w.	Grid filter, V3.
208–2	3RC21BE154M	RESISTOR: carbon; insulated; 150,000 ohms ± 20%; ½ w.	Grid filter, V4.
209–1	3RC21BE333M	RESISTOR: carbon; insulated; 33,000 ohms ± 20%; ½ w.	Screen voltage divider, V3.
209–2	3RC21BE333M	RESISTOR: carbon; insulated; 33,000 ohms ± 20%; ½ w.	Screen voltage divider, V4.
210–1	3RC21BE103M	RESISTOR: carbon; insulated; 10,000 ohms ± 20%; ½ w.	Screen voltage dropping, V3.
212–1	3Z6006H8–11	RESISTOR: carbon; noninsulated; 68 ohms; ¼ w.	Adcock line load.
212–2	3Z6006H8–11	RESISTOR: carbon; noninsulated; 68 ohms; ¼ w.	Adcock line load.
227	2Z7281.7	POTENTIOMETER: wire-wound; 20,000 ohms.	Variable screen voltage dropping to adjust Adcock amplifier V4 gain.
310	2C5005A/T1	TRANSFORMER: r-f; antenna; 34–65 mc; primary, 2 turns; secondary, 10⅞ turns.	Adcock high waveband coupling.
311	2C5005A/T4	TRANSFORMER: r-f; antenna; 18–34 mc; primary, 2 turns; secondary, 3.68 turns.	Adcock low waveband coupling.
331A	3Z9826-12.1	SWITCH: rotary; 2-position; wafer type; one of four decks.	Adcock antenna transformer secondary band selection.
331B	3Z9826-12.1	SWITCH: rotary; 2-position; wafer type; one of four decks.	Adcock antenna transformer primary band selection.
331C	3Z9826-12.1	SWITCH: rotary; 2-position; wafer type; one of four decks.	Adcock antenna transformer primary band selection.
331D	3Z9826-12.1	SWITCH: rotary; 2-position; wafer type; one of four decks.	Adcock antenna transformer secondary band selection.
350	2Z8799–207	SOCKET: connector; 2-prong.	Adcock antenna input connection.
V3	2J12SG7	TUBE: JAN–12SG7 (VT–209).	R-f amplifier.
V4	2J12SG7	TUBE: JAN–12SG7 (VT–209).	R-f amplifier.

38. Mixer Stage (fig. 16)

a. Circuit Repair Features. The combined signal from the vertical and Adcock r-f amplifier stages is fed to the primary of transformer 313 or 312, depending on the band being used. Each transformer is cut in or out of the circuit by means of band switch 3320. Padding capacitor 114–1 helps to tune the primary of transformer 312. Variable capacitor 123–1 performs the same function on the higher frequency band as capacitor 122 on the lower frequency band. Additional r-f coupling is provided between the primaries and secondaries of transformers 313 and 312 by capacitor 114–2. The signal induced in the secondary of transformer 313 is resonated by tracking capacitor 122 and ganged tuning capacitor 121A. The signal is then applied to mixer tube V5 through blocking capacitor 105–1 and appears across signal control grid load resistor 211–1. Tube V5 is self-biased by resistor 214–1 which is bypassed by capacitor 101–11. The heterodyne oscillator frequency, 4.2 mc above the incoming signal, is fed from the heterodyne oscillator stage through coupling capacitor 114–3, and appears across injector control grid load resistor 213 of tube V5. The 4.2 mc i-f output is fed to the primary of transformer 317–1 (of the first i-f amplifier stage) which is tuned by capacitor 125. Resistor 203–4, capacitors 101–12 and 106–2, and resistor 215–1 form decoupling networks.

b. Voltage and Resistance Measurements. The voltage and resistance measurements shown in figure 16 were made at the pin connections to the tube socket on the top of the chassis. Connect the meter between the pins to be checked and the chassis to obtain these readings. For further details of conditions under which the tests were made, see paragraph 28, section VI.

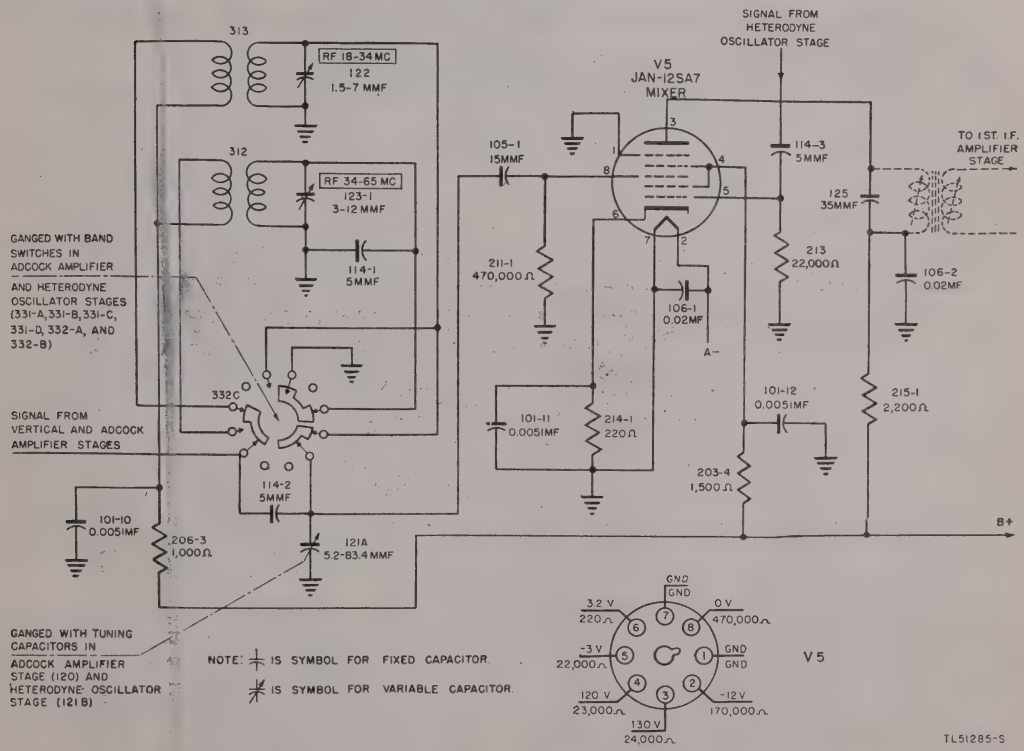


Figure 16. Mixer stage schematic diagram and voltage and resistance measurements.

c. Parts Data.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
101–10	3D3551212	CAPACITOR: mica; moulded; 5,100 mmf ± 5%; 500 vdcw.	B+ filter, V3 and V4.
101–11	3D3551212	CAPACITOR: mica; moulded; 5,100 mmf ± 5%; 500 vdcw.	Cathode resistor bypass, V5.
101–12	3D3551212	CAPACITOR: mica; moulded; 5,100 mmf ± 5%; 500 vdcw.	Screen filter bypass, V5.
105–1	3A9005–23	CAPACITOR: fixed; ceramic; 15 mmf ± 5%; 500 vdcw.	Grid coupling, V5.
106–1	3DA20–81	CAPACITOR: paper; oil filled; 20,000 mmf ± 20%; 600 vdcw.	Heater r-f bypass, V5.
106–2	3DA20–81	CAPACITOR: paper; oil filled; 20,000 mmf ± 20%; 600 vdcw.	B+ filter bypass, V5.
114–1	3D9005–25	CAPACITOR: fixed; ceramic; 5 mmf ± 1 mmf; 500 vdcw.	Secondary of high waveband r-f transformer tuning.
114–2	3D9005–25	CAPACITOR: fixed; ceramic; 5 mmf ± 1 mmf; 500 vdcw.	R-f coupling.
114–3	3D9005–25	CAPACITOR: fixed; ceramic; 5 mmf ± 1 mmf; 500 vdcw.	Injector control grid coupling, V5.
121A	(Part of 3D9089VA1)	CAPACITOR: variable; air; one section of 2-gang capacitor; each section 5.2–83.4 mmf.	Signal control grid circuit tuning, V5.
122	3D9001VE5	CAPACITOR: variable; ceramic; 1.5 to 7 mmf.	R-f trimmer, low waveband.
123–1	3D9012V–2	CAPACITOR: variable; ceramic; 3 to 12 mmf.	R-f trimmer, high waveband.
125	3D9035–10	CAPACITOR: fixed; ceramic; 35 mmf ± 3%; 500 vdcw.	First i-f transformer, primary tuning.
203–4	3RC21BE152M	RESISTOR: carbon; insulated; 1,500 ohms ± 20%; ½ w.	Screen filter, V5.
206–3	3RC21BE102M	RESISTOR: carbon; insulated; 1,000 ohms ± 20%; ½ w.	B+ filter resistor, V2, V3, and V4.
211–1	3RC21BE474M	RESISTOR: carbon; insulated; 470,000 ohms ± 20%; ½ w.	Signal control grid load, V5.
213	3RC21BE223K	RESISTOR: carbon; insulated; 22,000 ohms ± 10%; ½ w.	Injector control grid load, V5.
214–1	3RC21BE221M	RESISTOR: carbon; insulated; 220 ohms ± 20%; ½ w.	Cathode bias, V5.
215–1	3RC21BE222M	RESISTOR: carbon; insulated; 2,200 ohms ± 20%; ½ w.	Plate filter, V5.
312	2C5005A/T3	TRANSFORMER: r-f mixer; 34–65; primary, 1⅞ turns; secondary, 6½ turns.	R-f high waveband coupling.
313	2C5005A/T2	TRANSFORMER: r-f mixer; 18–34 mc; primary, 6$\frac{1}{16}$ turns; secondary, 15½ turns.	R-f low waveband coupling.
332C	3Z9826–123	SWITCH: rotary; 2 position; wafer type; one of three decks.	Band selection, r-f transformer primaries and secondaries.
V5	2J125A7	TUBE: JAN–12SA7 (VT–161).	Mixer.

39. Heterodyne Oscillator Stage (fig. 17)

a. Circuit Repair Features. The heterodyne oscillator operates at a frequency 4.2 mc higher than the r-f signal from the vertical and Adcock r-f amplifier stages. The heterodyne oscillator output is fed to the mixer stage. This signal, combined with the r-f signal from the vertical and Adcock r-f amplifier stages, results in a 4.2 mc i-f signal at the mixer output. The signal from the plate of oscillator tube V10 is fed to transformer 315 or 314, depending on the band being used. Each transformer is cut in or out of the circuit by means of band switches 332A and 332B. Padding capacitor 105–2 helps to tune the primary of transformer 314. Variable capacitor 123–3 performs the same function on the higher frequency band as capacitor 123–2 on the lower frequency band. Transformer 315 is resonated by tracking capacitor 123–2, series padding capacitor 118, and ganged tuning capacitor 121B. Capacitor 101–6 and resistor 206–2 form the plate feedback coil decoupling network. Resistor 206–1 and capacitor 102–2 serve to equalize the amplitude of oscillations on the low-frequency band. When plate voltage is applied, the grid and cathode are at the same potential and plate current increases, resulting in a feedback voltage through transformer 315. As oscillations build up, the grid is driven positive, charging grid capacitor 108–1. During negative half-cycles, the capacitor tends to discharge through parallel resistor 207. Capacitor 108–1 acquires an average negative charge on the grid side, providing bias. As V10 is alternately driven to saturation and cut-off, oscillations are produced in the parallel resonant circuit at a frequency determined by the circuit components. The heterodyne output is applied to the mixer stage through coupling capacitor 114–3 (of the mixer stage).

b. Voltage and Resistance Measurements. The voltage and resistance measurements shown in figure 17 were made at the pin connections to the tube socket on the top of the chassis. Connect the meter between the pins to be checked and the chassis to obtain these readings. For details of further conditions under which the tests were made, see paragraph 28, section VI.

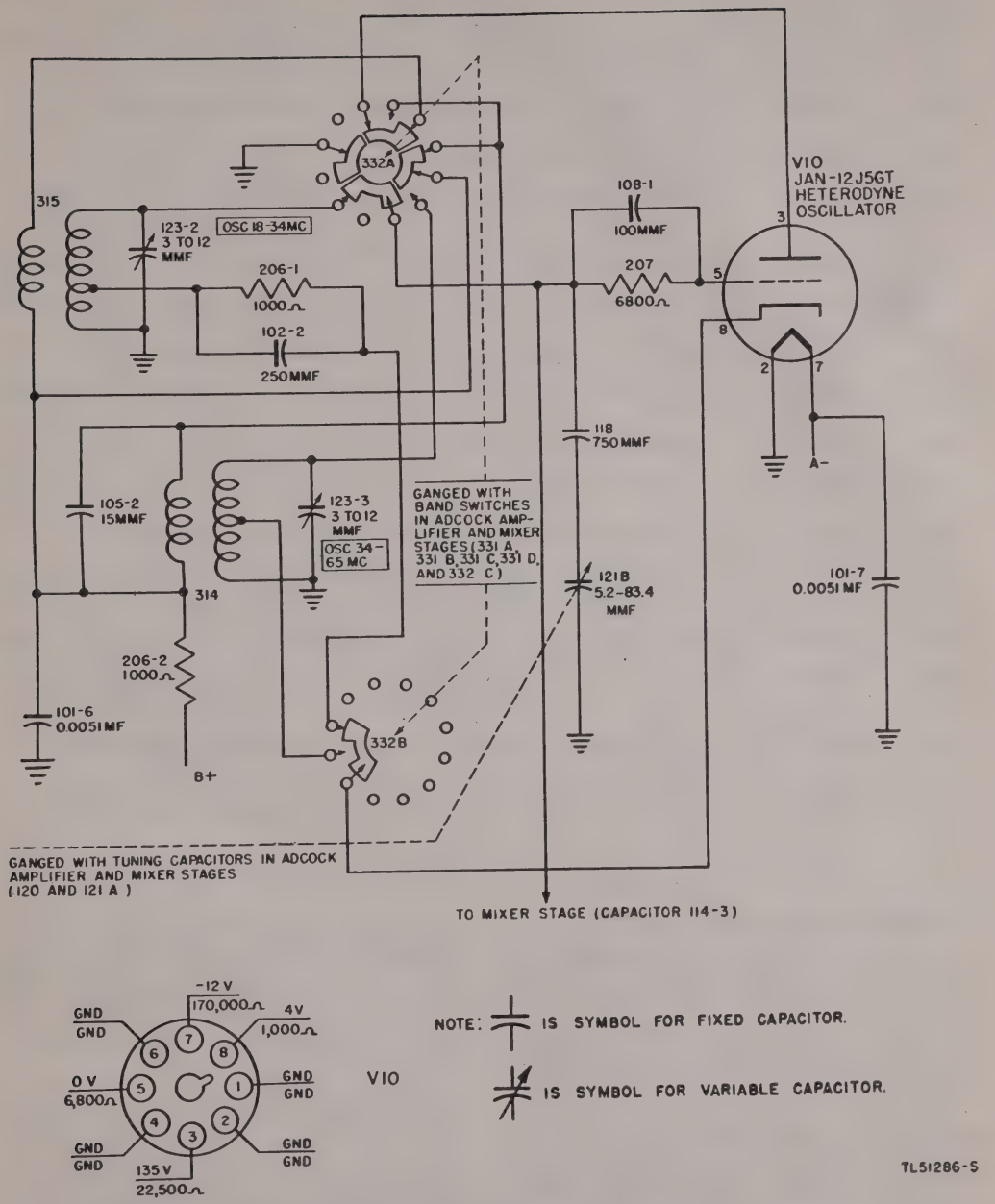


Figure 17. Heterodyne oscillator stage schematic diagram and voltage and resistance measurements.

c. Parts Data.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
101–6	3D3551212	CAPACITOR: mica; moulded; 5,100 mmf ± 5%; 500 vdcw.	B+ filter bypass, V10.
101–7	3D3551212	CAPACITOR: mica; moulded; 5,100 mmf ± 5%; 500 vdcw.	Heater r-f bypass, V10.
102–2	3D9250–46.2	CAPACITOR: fixed; ceramic; 250 mmf ± 5%; 500 vdcw.	Low waveband cathode resistor bypass, V10.
105–2	3D9005–23	CAPACITOR: fixed; ceramic; 15 mmf ± 5%; 500 vdcw.	Primary tuning capacitor on high waveband oscillator transformer 314.
108–1	3D9100–119	CAPACITOR: fixed; ceramic; 100 mmf ± 5%; 500 vdcw.	Grid tank coupling, V10.
118	3DK9750–13	CAPACITOR: mica; moulded; 750 mmf ± 2%; 500 vdcw.	Oscillator padder, V10.
121B	(Part of 3D9089VA1)	CAPACITOR: variable; air; one section of 2-gang capacitor; each section 5.2–83.4 mmf.	Oscillator tuning, V10.
123–2	3D9012V–2	CAPACITOR: variable; ceramic; 3 to 12 mmf.	Oscillator trimmer, low waveband.
123–3	3D9012V–2	CAPACITOR: variable; ceramic; 3 to 12 mmf.	Oscillator trimmer, high waveband.
206–1	3RC21BE102M	RESISTOR: carbon; insulated; 1,000 ohms ± 20%; ½ w.	Low waveband cathode bias, V10.
206–2	3RC21BE102M	RESISTOR: carbon; insulated; 1,000 ohms ± 20%; ½ w.	B+ filter, V10.
207	3RC21BE682M	RESISTOR: carbon; insulated; 6,800 ohms ± 20%; ½w.	Grid leak, V10.
314	2C5005A/T5	TRANSFORMER: r-f oscillator; 34–65 mc; tapped secondary; primary, 4½ turns, secondary, 2 turns.	Oscillator high waveband feedback and tank coil.
315	2C5005A/T6	TRANSFORMER: r-f oscillator; 18–34 mc; tapped secondary; primary, 14½ turns; secondary, 6 turns.	Oscillator low waveband feedback and tank coil.
332A	3Z9826–123	SWITCH: rotary; 2 position; wafer type; one of three decks.	Band selection, oscillator transformer primaries and secondaries.
332B	3Z9826–123	SWITCH: rotary; 2 position; wafer type; one of three decks.	Band selection, oscillator cathode taps.
V10	2J12J5GT	TUBE: JAN–12J5GT (VT–135).	Heterodyne oscillator.

40. First I-F Amplifier Stage (fig. 18)

a. Circuit Repair Features. The signal from the mixer stage is fed to the primary of coupling transformer 317–1. The variable inductance of the transformer coils, with the secondary bridged by capacitor 107–1, tunes the transformer to select the 4.2 mc i-f component of the signal. This signal component is fed to the grid of tube V8. Resistor 205–2 damps the tuned input circuit. Resistor 216–1 (of the volume-control stage) and capacitors 106–3 and 106–5 form the grid circuit decoupling network. When in a-v-c operation, grid bias voltage is supplied by the volume-control stage through resistor 216–1. Self-bias is provided by resistor 214–2. Degeneration is introduced because this resistor is not bypassed by a capacitor. Capacitor 106–4 and resistor 215–2 form the plate load decoupling network. The output of the first i-f amplifier is fed to the primary of coupling transformer 317–2 (of the second i-f amplifier stage), which is tuned by capacitor 107–2.

b. Voltage and Resistance Measurements. The voltage and resistance measurements shown in figure 18 were made at the pin connections to the tube socket on the bottom of the chassis. Connect the meter between the pins to be checked and the chassis to obtain these readings. For further details of conditions under which the tests were made, see paragraph 28, section VI.

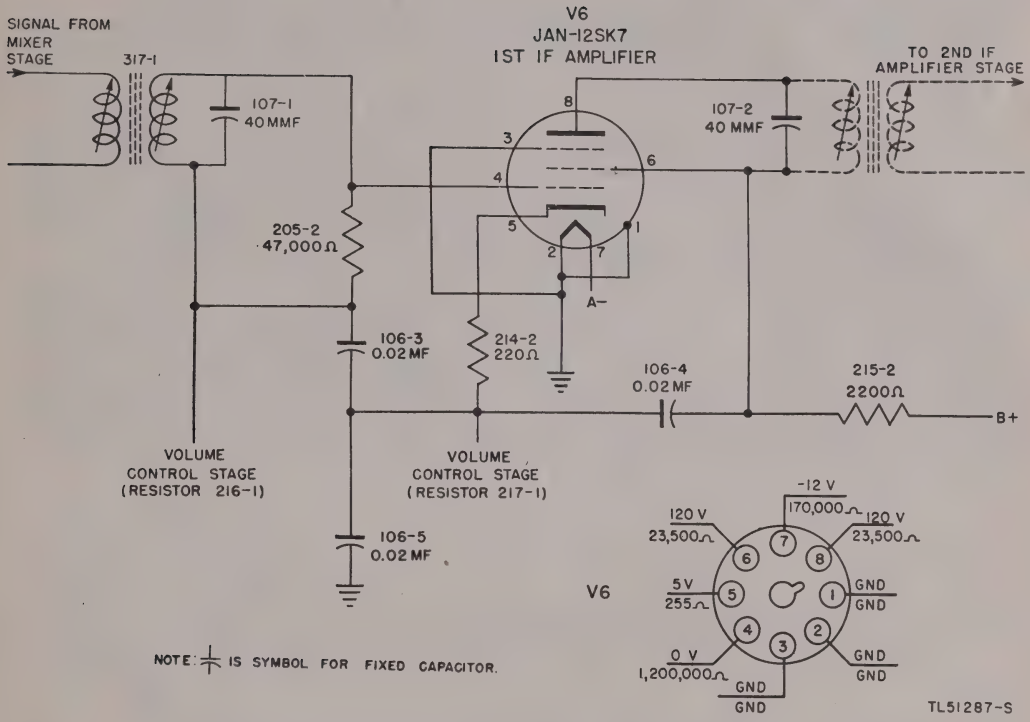


Figure 18. First i-f amplifier stage schematic diagram and voltage and resistance measurements.

c. Parts Data.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
106–3	3DA20–81	CAPACITOR: paper; oil filled; 20,000 mmf ± 20%; 600 vdcw.	Grid filter, V6.
106–4	3DA20–81	CAPACITOR: paper; oil filled; 20,000 mmf ± 20%; 600 vdcw.	B+ filter bypass, V6.
106–5	3DA20–81	CAPACITOR: paper; oil filled; 20,000 mmf ± 20%; 600 vdcw.	Cathode filter, V6.
107–1	3D9040–18.1	CAPACITOR: fixed; ceramic; 40 mmf; 500 vdcw.	First i-f transformer secondary tuning.
107–2	3D9040–18.1	CAPACITOR: fixed; ceramic; 40 mmf; 500 vdcw.	Second i-f transformer primary tuning.
205–2		RESISTOR: fixed; carbon; 47,000 ohms ± 20%; ½ w.	Tank circuit oscillation damping, V6.
214–2	3RC21BE221M	RESISTOR: carbon; insulated; 220 ohms ± 20%; ½ w.	Cathode bias, V6.
215–2	3RC21BE222M	RESISTOR: carbon; insulated; 2,200 ohms ± 20%; ½ w.	B+ filter, V6.
317–1	2Z9643.105	TRANSFORMER: i-f coils 52 turns at 94 turns per inch.	I-f stage coupling.
V6	2J12SK7	TUBE: JAN–12SK7 (VT–131).	I-f amplifier.

41. Second I-F Amplifier Stage (fig. 19)

a. Circuit Repair Features. The 4.2-mc signal from the first i-f amplifier stage is fed to the primary of coupling transformer 317–2. The variable inductance of the transformer coils, with the secondary bridged by capacitor 107–3, tunes the transformer to pass only the 4.2-mc i-f signal. This signal is fed to the grid of tube V7. Resistor 203–3 damps the tuned input circuit. Resistor 216–2 (of the volume-control stage) and capacitors 106–7 and 106–9 from the grid circuit decoupling network. When in a-v-c operation, grid bias voltage is supplied by the volume-control stage through resistor 216–1. Self-bias is provided by resistor 214-3. Degeneration is introduced because this resistor is not bypassed by a capacitor. Capacitor 106–8 and resistor 215–3 form the plate load decoupling network. The output of the second i-f amplifier is fed to the primary of coupling transformer 317–3 (of the third i-f amplifier stage), which is tuned by capacitor 107–4.

b. Voltage and Resistance Measurements. The voltage and resistance measurements shown in figure 19 were made at the pin connections to the tube socket on the bottom of the chassis. Connect the meter between the pins to be checked and the chassis to obtain these readings. For further details of conditions under which the tests were made, see paragraph 28, section VI.

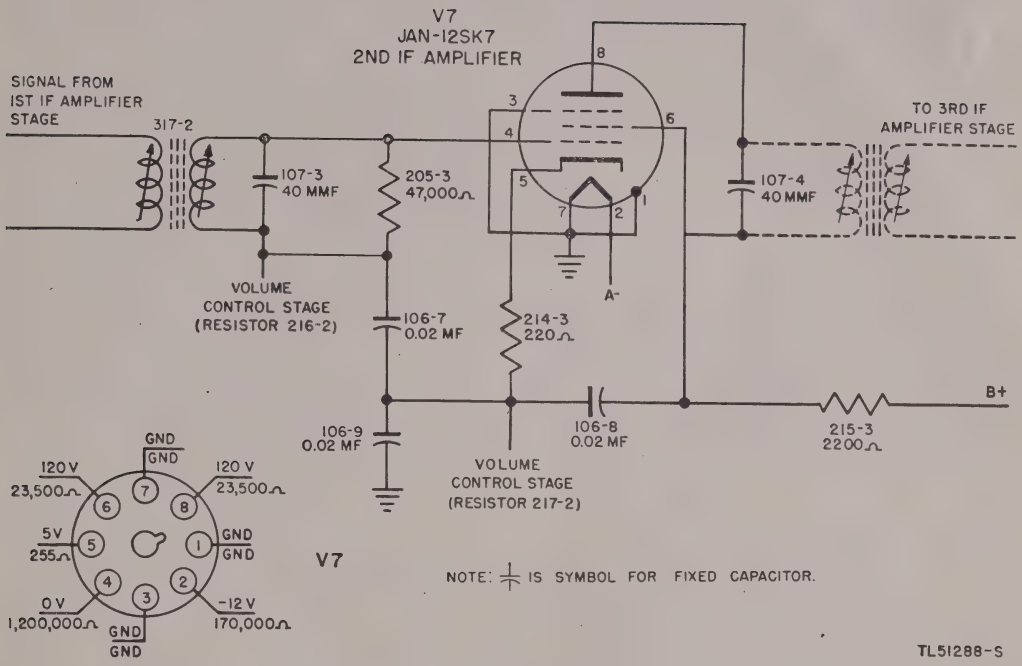


Figure 19. Second i-f amplifier stage schematic diagram and voltage and resistance measurements.

c. Parts Data.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
106–7	3DA20–81	CAPACITOR: paper; oil filled; 20,000 mmf ± 20%; 600 vdcw.	Grid filter, V7.
106–8	3DA20–81	CAPACITOR: paper; oil filled; 20,000 mmf ± 20%; 600 vdcw.	B+ filter bypass, V7.
106–9	3DA20–81	CAPACITOR: paper; oil filled; 20,000 mmf ± 20%; 600 vdcw.	Cathode filter, V7.
107–3	3D9040–18.1	CAPACITOR: fixed; ceramic; 40 mmf; 500 vdcw.	Second i-f transformer secondary tuning.
107–4	3D9040–16.1	CAPACITOR: fixed; ceramic; 40 mmf; 500 vdcw.	Third i-f transformer primary tuning.
205–3		RESISTOR: fixed; carbon; 47,000 ohms ± 20%; ½ w.	Tank circuit oscillation damping, V7.
214–3	3RC21BE221M	RESISTOR: carbon; insulated; 220 ohms ± 20%; ½ w.	Cathode bias, V7.
215–3	3RC21BE222M	RESISTOR: carbon; insulated; 2,200 ohms ± 20%; ½ w.	B+ filter, V7.
317–2	2Z9643.105	TRANSFORMER: i-f; coils 52 turns at 94 turns per inch.	I-f stage coupling.
V7	2J12SK7	TUBE: JAN–12SK7 (VT–131).	I-f amplifier.

42. Third I-F Amplifier Stage (fig. 20)

a. Circuit Repair Features. The 4.2-mc signal from the second i-f amplifier stage is fed to the primary of coupling transformer 317–3. The variable inductance of the transformer coils, with the secondary bridged by capacitor 107–5, tunes the transformer to pass only the 4.2-mc i-f signal. This signal is fed to the grid of tube V8. The selectivity of the tuned input circuit is broadened by resistor 205–4 to give the required over-all band width. Self-bias is provided by resistor 214–4, bypassed by capacitor 106–11. Capacitor 106–10 and resistor 215–4 form the plate load decoupling network. The c-w oscillator 1,500-cycle audio-frequency (a-f) signal is fed from the c-w oscillator stage through coupling capacitor 111–3. Signal voltage appears across grid load resistor 205–3 and i-f decoupling capacitor 124. The c-w oscillator signal voltage is fed to the suppressor grid of tube V8 and audio-modulates the i-f signal output. The output is fed to the primary of coupling transformer 317–4 (of the second detector bearing amplifier stage), which is tuned by capacitor 107–6.

b. Voltage and Resistance Measurements. The voltage and resistance measurements shown in figure 20 were made at the pin connections to the tube socket on the bottom of the chassis. Connect the meter between the pins to be checked and the chassis to obtain these readings. For further details of conditions under which the tests were made, see paragraph 28, section VI.

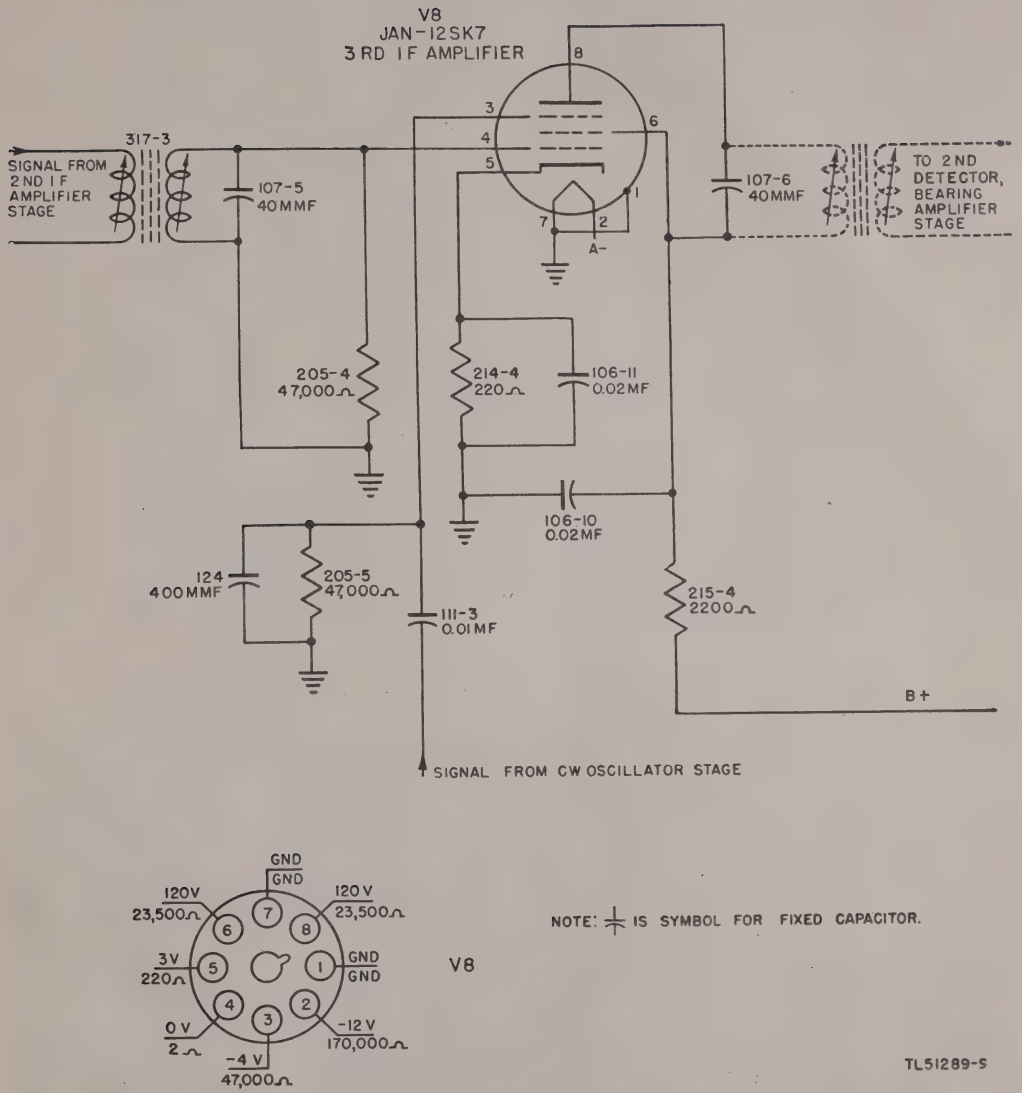


Figure 20. Third i-f amplifier stage schematic diagram and voltage and resistance measurements.

c. Parts Data.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
106–10	3DA20–81	CAPACITOR: paper; oil filled; 20,000 mmf ± 20%; 600 vdcw.	B+ filter bypass, V8.
106–11	3DA20–81	CAPACITOR: paper; oil filled; 20,000 mmf ± 20%; 600 vdcw.	Cathode resistor bypass, V8.
107–5	3D9040–18.1	CAPACITOR: fixed; ceramic; 40 mmf; 300 vdcw.	Third i-f transformer secondary tuning.
107–6	3D9040–18.1	CAPACITOR: fixed; ceramic; 40 mmf; 500 vdcw.	Fourth i-f transformer primary tuning.
111–3	3DA10–189.1	CAPACITOR: paper; oil filled; 10,000 mmf ± 20%; 600 vdcw.	Coupling capacitor, V8.
124	3D9400–29	CAPACITOR: fixed; ceramic; 400 mmf ± 5%; 500 vdcw.	I-f bypass, V8.
205–4		RESISTOR: fixed; carbon; 47,000 ohms ± 20%; ½ w.	Tank circuit selectivity broadening, V8.
205–5		RESISTOR: fixed; carbon; 47,000 ohms ± 20%; ½ w.	Suppressor grid load, V8.
214–4	3RC21BE221M	RESISTOR: carbon; insulated; 220 ohms ± 20%; ½ w.	Cathode bias, V8.
215–4	3RC21BE222M	RESISTOR: carbon; insulated; 2,200 ohms ± 20%; ½ w.	B+ filter, V8.
317–3	2Z9643.105	TRANSFORMER: i-f; coils 52 turns at 94 turns per inch.	I-f stage coupling.
V8	2J12SK7	TUBE: JAN–12SK7 (VT–131).	I-f amplifier.

43. C-W Oscillator Stage (fig. 21)

a. Circuit Repair Features. The c-w oscillator generates a 1,500-cycle audio signal which, when applied to the third i-f amplifier tube V8 suppressor grid, modulates the i-f component at a 1,500-cycle audio rate. One section of tube V12 is used in a phase-shifting oscillator circuit and the second section acts as a buffer amplifier. A three-mesh, resistance-capacitance, phase-shifting network is connected between the output and the input of the oscillator section. This network comprises capacitors 112–1, 112–2, and 101–13, resistors 209–3, 208–3, 221–3, and the resistance-capacitance network 104–3 and 208–4. The network is proportioned to give a 180° phase shift between the plate and grid at the desired frequency of 1,500 cycles, since each resistor-capacitor combination is designed to shift the applied voltage approximately 60°. The oscillator output is applied to the second half-section of tube V12 through coupling capacitor 101–14 and resistor 221–4 to the buffer-amplifier input. Resistor 220–8 forms the grid load, the tube is self-biased by cathode resistor 233, and degeneration is introduced since resistor 233 is not bypassed. The 1,500-cycle output appearing across load resistor 220–7 is applied to the third i-f suppressor grid through coupling capacitor 111–3 (of the third i-f amplifier stage). A small portion of the output is fed through stabilizing capacitor 108–4 to the oscillator input.

b. Voltage and Resistance Measurements. The voltage and resistance measurements shown in figure 21 were made at the pin connections to the tube socket on the bottom of the chassis. Connect the meter between the pins to be checked and the chassis to obtain these readings. For further details of conditions under which the tests were made, see paragraph 28, section VI.

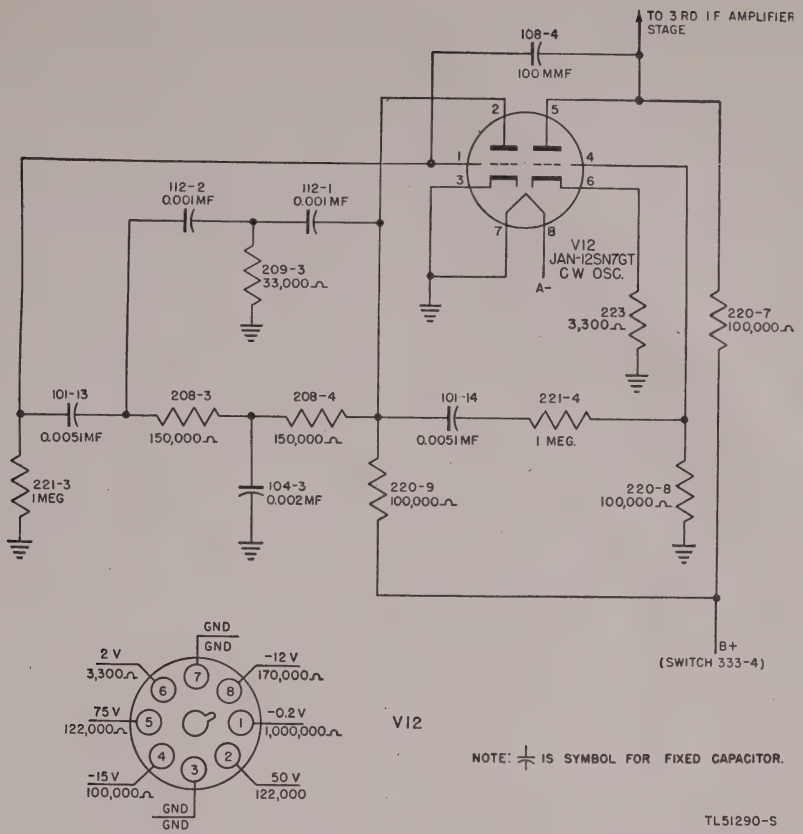


Figure 21. C-w oscillator stage schematic diagram and voltage and resistance measurements.

c. PARTS DATA.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
101–13	3D3551212	CAPACITOR: mica; moulded; 5,100 mmf ± 5%; 500 vdcw.	Grid-plate blocking, V12.
101–14	3D3551212	CAPACITOR: mica; moulded; 5,100 mmf ± 5%; 500 vdcw.	Grid coupling, V12.
104–3	3K3020212	CAPACITOR: mica; moulded; 2,000 mmf ± 5%; 300 vdcw.	Phase shifting, V12.
108–4	3D9100–119	CAPACITOR: fixed; ceramic; 100 mmf ± 5%; 500 vdcw.	Feedback, V12.
112–1	3K3010212	CAPACITOR: mica; moulded; 1,000 mmf ± 5%; 500 vdcw.	Phase shifting, V12.
112–2	3K3010212	CAPACITOR: mica; moulded; 1,000 mmf ± 5%; 500 vdcw.	Phase shifting, V12.
208–3	3RC21BE154M	RESISTOR: carbon; insulated; 150,000 ohms ± 20%; ½ w.	Phase shifting, V12.
208–4	3RC21BE154M	RESISTOR: carbon; insulated; 150,000 ohms ± 20%; ½ w.	Phase shifting, V12.
209–3	3RC21BE333M	RESISTOR: carbon; insulated; 33,000 ohms ± 20%; ½ w.	Phase shifting, V12.
220–7	3RC21BE104M	RESISTOR: carbon; insulated; 100,000 ohms ± 20%; ½ w.	Plate load, V12.
220–8	3RC21BE104M	RESISTOR: carbon; insulated; 100,000 ohms ± 20%; ½ w.	Grid load, V12.
220–9	3RC21BE104M	RESISTOR: carbon; insulated; 100,000 ohms ± 20%; ½ w.	Plate load, V12.
221–3	3RC21BE105M	RESISTOR: carbon; insulated; 1 meg; ½ w.	Grid leak, V12.
221–4	3RC21BE105M	RESISTOR: carbon; insulated; 1 meg; ½ w.	Grid coupling, V12.
222	3RC21BE332M	RESISTOR: carbon; insulated; 3,300 ohms ± 20%; ½ w.	Cathode bias, V12.
V12	2J12SN7GT	TUBE: JAN–12SN7GT.	C-w oscillator.

44. Second Detector Bearing Amplifier Stage
(fig. 22)

a. Circuit Repair Features. The 4.2-mc signal from the third i-f amplifier stage is fed to the primary of coupling transformer 317–4. The variable inductance of the transformer coils, with the secondary bridged by capacitor 107–7, tunes the transformer to pass only the 4.2-mc i-f signal. This signal is fed to the plates of the detector diode section of tube V9. Resistor 219–1 and capacitors 108–2 and 108–3 form an i-f decoupling network which removes the i-f carrier signal and leaves an audio signal voltage proportional to the audio-modulation of the i-f carrier. This signal voltage is applied across voltage-dividing resistor 221–5 (of the volume-control stage) and shunt-connected audio volume and meter sensitivity potentiometers 229–1 and 229–2. Capacitor 111–2 bypasses detector output jack 353, which is used to measure detected signal output. The signal voltage fed to the volume-control stage is used in a-v-c operation to regulate the gain of the first and second i-f amplifier stages. Audio volume potentiometer 229–1 regulates the amplitude of the audio signal fed to the audio-output stage through coupling capacitor 111–4 (of the audio-output stage). Meter sensitivity potentiometer 229–2 regulates the amplitude of the signal fed through coupling capacitor 111–1 to the grid of the amplifier triode section of tube V9. Resistor 211–2 is the triode grid load resistor and resistors 220–6 and 222–5, bypassed by capacitor 110–1, form a voltage-dividing network which supplies a fixed bias to the triode grid from the A-voltage source. Resistor 210–2, bypassed by capacitor 102–1, supplies the plate load for the triode. The output of the bearing amplifier section of tube V9 is fed to the synchronous voltmeter stage through coupling capacitor 110–2 (of the synchronous voltmeter stage).

b. Voltage and Resistance Measurements. The voltage and resistance measurements shown in figure 22 were made at the pin connections to the tube sockets on the bottom of the chassis. Connect the meter between the pins to be checked and the chassis to obtain these readings. For further details of conditions under which the tests were made, see paragraph 28, section VI.

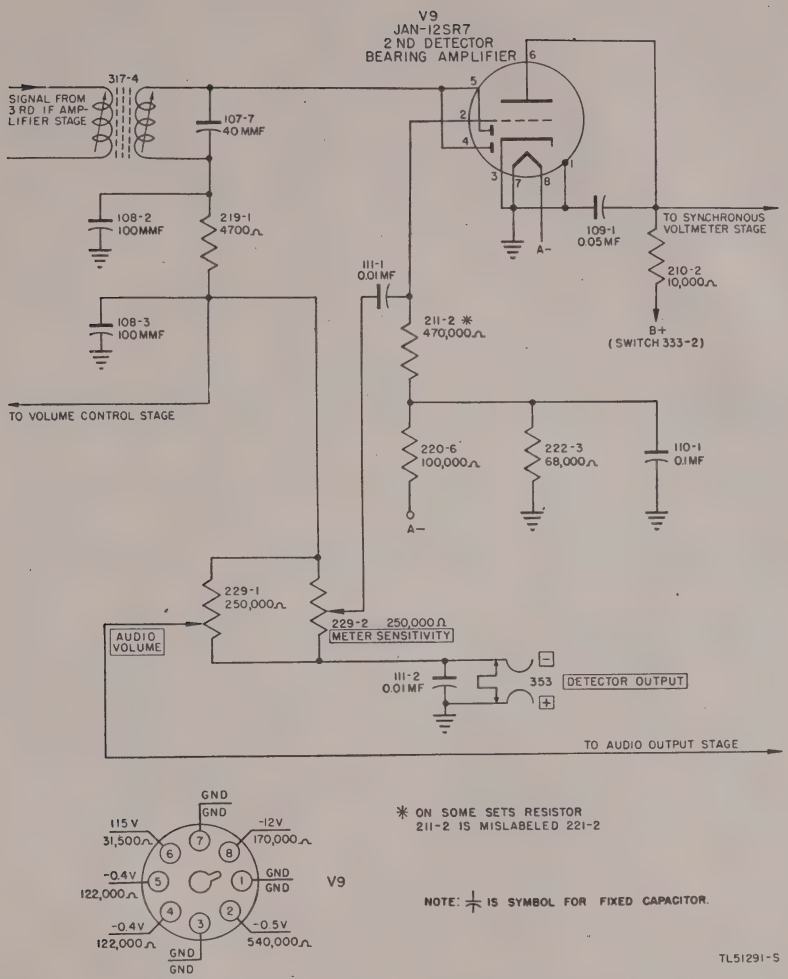


Figure 22. Second detector bearing amplifier stage schematic diagram and voltage and resistance measurements.

c. Parts Data.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
107–7	3D9040–18.1	CAPACITOR: fixed; ceramic; 40 mmf; 500 vdcw.	Fourth i-f transformer secondary tuning.
108–2	3D9100–119	CAPACITOR: fixed; ceramic; 100 mmf ± 5%; 500 vdcw.	Triode load filter bypass, V9.
108–3	3D9100–119	CAPACITOR: fixed; ceramic; 100 mmf ± 5%; 500 vdcw.	Diode load filter bypass, V9.
109–1	3DA50–120	CAPACITOR: paper; tubular; 50,000 mmf ± 20%; 600 vdcw.	Plate resistor bypass, V9.
110–1	3DA100–255	CAPACITOR: paper; tubular; 100,000 mmf ± 20%; 600 vdcw.	Grid filter bypass, V9.
111–1	3DA10–189.1	CAPACITOR: paper; oil filled; 10,000 mmf ± 20%; 600 vdcw.	Coupling capacitor, V9.
111–2	3DA10–189.1	CAPACITOR: paper; oil filled; 10,000 mmf ± 20%; 600 vdcw.	Diode output metering jack bypass.
210–2	3RC21BE103M	RESISTOR: carbon; insulated; 10,000 ohms ± 20%; ½ w.	Plate load, V9.
211–2	3RC21BE474M	RESISTOR: carbon; insulated; 470,000 ohms ± 20%; ½ w.	Grid load, V9.
219–1	3RC21BE472M	RESISTOR: carbon; insulated; 4,700 ohms ± 20%; ½ w.	Diode load filter, V9.
220–6	3RC21BE104M	RESISTOR: carbon; insulated; 100,000 ohms ± 20%; ½ w.	Grid filter, V9.
222–3	3RC21BE683M	RESISTOR: carbon; insulated; 68,000 ohms ± 20%; ½ w.	Grid filter, V9.
229–1	2Z7272–18	POTENTIOMETER: carbon; 250,000 ohms.	Audio volume control.
229–2	2Z7272–18	POTENTIOMETER: carbon; 250,000 ohms.	Bearing meter sensitivity control.
317–4	2Z9643.105	TRANSFORMER: i-f; coils 52 turns at 94 turns per inch.	I-f stage coupling.
353	2Z55763–3	JACK: phone tip.	Detector output metering connection.
V9	2J12SR7	TUBE: JAN–12SR7 (VT–133).	Second detector bearing amplifier.

45. Volume-Control Stage (fig. 23)

a. Circuit Repair Features. Part of the detected signal voltage from the second detector, bearing amplifier stage is fed to the volume-control stage through voltage-dividing resistor 221–5. When in a-v-c operation, an a-v-c voltage is developed across voltage-dividing resistor 221–6 and is filtered by capacitor 109–3. This voltage is applied through resistors 216–1 and 216–2 to bias the grids of the amplifier tubes in the first and second i-f amplifier stages. Additional cathode bias is provided the first and second i-f amplifiers by resistors 217–1 and 217–2. When in manual-volume-control (m-v-c) operation, this cathode bias resistance, hence the gain of the first and second i-f amplifier stages, may be varied by potentiometer 228. The switch on potentiometer 228 either grounds out the a-v-c or grounds out potentiometer 228. Tuning meter 375 indicates the combined cathode current of the tubes in the first and second i-f amplifier stages. Because the cathode current varies inversely with the amplitude of the received signal, a minimum reading on tuning meter 375 indicates a maximum signal.

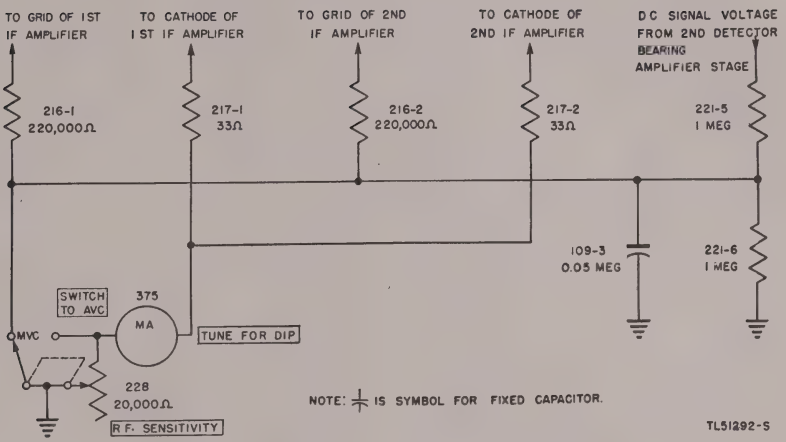


Figure 23. Volume-control stage schematic diagram.

b. Parts Data.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
109–3	3DA50–120	CAPACITOR: paper: tubular; 50,000 mmf ± 20%; 600 vdcw.	A-v-c voltage filter bypass.
216–1	3RC21BE224M	RESISTOR: carbon; insulated; 220,000 ohms ± 20%; ½ w.	Grid filter, V6.
216–2	3RC21BE224M	RESISTOR: carbon; insulated; 220,000 ohms ± 20%; ½ w.	Grid filter, V7.
217–1	3RC21BE330M	RESISTOR: carbon; insulated; 33 ohms ± 20%; ½ w.	Cathode bias, V6.
217–2	3RC21BE330M	RESISTOR: carbon; insulated; 33 ohms ± 20%; ½ w.	Cathode bias, V7.
221–5	3RC21BE105M	RESISTOR: carbon; insulated; 1 megohm; ½ w.	A-v-c voltage divider.
221–6	3RC21BE105M	RESISTOR: carbon; insulated; 1 megohm; ½ w.	A-v-c voltage divider.
228	2Z270.94	POTENTIOMETER: carbon; 20,000 ohms ± 10%; single-pole; single-throw; snap switch.	I-f sensitivity control.
375	3F905–13	AMMETER: d-c; 0–50 μa.	Tuning indicator.

46. Audio-Output Stage (fig. 24)

a. Circuit Repair Features. The second detector output is applied to the control grid of tube V11 through coupling capacitor 111–4 and appears across grid load resistor 211–3. Bypass capacitor 110–3 places the lower end of grid load resistor 211–3 at ground potential, and fixed bias is applied through resistor 220–1 from the A-voltage source. Capacitor 111–5 bypasses some of the higher audio frequencies; tone control 231 and capacitor 109–2 vary the audio response curve. The tone control, when set to the desired position, is useful for improving the signal-to-noise ratio since bypassing some of the higher audio frequencies minimizes static and interference. Resistor 224 and capacitor 116A form a decoupling network for the plate load. Terminals 3 and 5 of output transformer 302 provide an output impedance of 4,000 ohms, and tap 4 is available for a 250-ohm output to match low-impedance phones. Switch 335 provides means for disconnecting the radio equipment from the telephone line, and phone jack 551–2 may be switched from radio output to line by switch 334–1. When jack 351–2 is operated in line position, phone volume may be controlled by potentiometer 232. Transformer 301 output impedance matches 600-ohm telephone line whose connections are made to terminal strip 354. A connection from microphone jack 352 to the line is provided by a third winding on transformer 301, resistor 225–1 provides microphone current from the A-voltage source, and capacitor 117 bypasses the lower end of the microphone winding.

b. Voltage and Resistance Measurements. The voltage and resistance measurements shown in figure 24 were made at the pin connections to the tube socket on the bottom of the chassis. Connect the meter between the pins to be checked and the chassis to obtain these readings. For further details of conditions under which the tests were made, see paragraph 28, section VI.

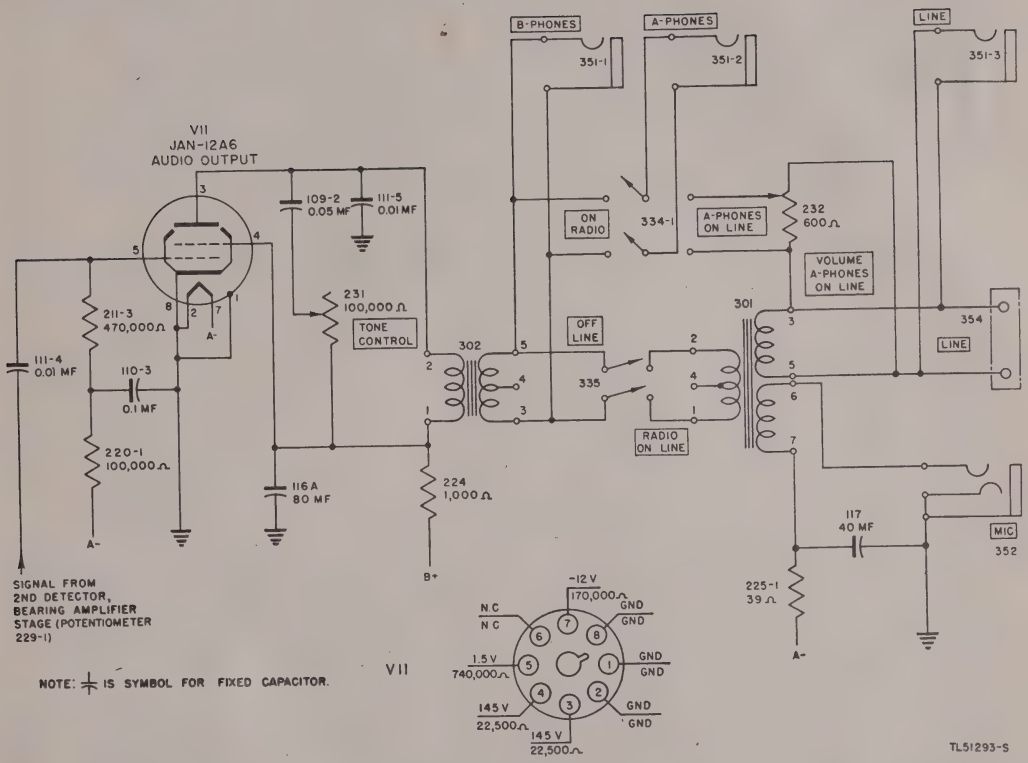


Figure 24. Audio-output stage schematic diagram and voltage and resistance measurements.

c. PARTS DATA.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
109–2	3DA50–120	CAPACITOR: paper; tubular; 50,000 mmf ± 20%; 600 vdcw.	Tone filter.
110–3	3DA100–255	CAPACITOR: paper; tubular; 100,000 mmf ± 20%; 600 vdcw.	Grid filter, bypass, V11.
111–4	3DA10–189.1	CAPACITOR: paper; oil filled; 10,000 mmf ± 20%; 600 vdcw.	Coupling capacitor, V11.
111–5	3DA10–189.1	CAPACITOR: paper; oil filled; 10,000 mmf ± 20%; 600 vdcw.	Plate bypass, V11.
116A	3DB80–4	CAPACITOR: electrolytic; metal cased; 80–80 mf; +100% −10%; 300 vdcw.	B+ filter bypass.
117	3DB40–33	CAPACITOR: electrolytic; metal cased; 40 mf; 40 vdcw.	Microphone filter bypass.
211–3	3RC	RESISTOR: carbon; insulated; 470,000 ohms ± 20%; ½ w.	Grid load, V11.
220–1	3RC21BE104M	RESISTOR: carbon; insulated; 100,000 ohms ± 20%; ½ w.	Grid filter, V11.
224	3RC31BE102K	RESISTOR: carbon; insulated; 1,000 ohms ± 10%; 1 w.	B+ filter, V11.
225–1	3RC41BE390K	RESISTOR: carbon; insulated; 39 ohms; ± 10%; 2 w.	Microphone filter.
231	2Z7271.1	POTENTIOMETER: carbon; 100,000 ohms.	Tone control.
232	2Z7279–56	POTENTIOMETER: wire-wound; 600 ohms ± 10%.	Volume control for "A" phones.
301	2Z9632.171	TRANSFORMER: tapped primary split secondary windings; primary, 2,120 turns (tapped 580 turns) 239 ohms ± 15%; secondary #1, 825 turns, 116.7 ohms ± 15%; secondary #2, 184 turns, 55 ohms + 8%; hermetically sealed.	Couples radio output and microphone to line.
302	2Z9632.172	TRANSFORMER: audio; tapped secondary winding; primary, 3,000 turns 550 ohms ± 1%; secondary, 2,120 turns (tapped at 580 turns) 252 ohms ± 15%; hermetically sealed.	Couples radio output to either A or B phones, or to the primary of transformer 301.
334–1	3Z9849.60	SWITCH: toggle; double-pole; double-throw.	Switches "A" phones to radio output or line.
335	3Z9845–11.1	SWITCH: toggle; double-pole; double-throw.	Connects radio output to line through transformer 301.
351–1	2Z5534A	JACK: telephone; single-circuit.	"B" headphone connection.
351–2	2Z5534A	JACK: telephone; single-circuit.	"A" headphone connection.
351–3	2Z5534A	JACK: telephone; single-circuit.	Line connection.
352	2Z55342	JACK: microphone; two-circuit.	Microphone input connection.
354–1		POST: binding.	Line output connection on receiver panel.
354–2		POST: binding.	Line output connection on receiver panel.
V11	2J12A6	TUBE: JAN–12A6 (VT–134).	Audio amplifier.

47. Square Wave Oscillator Stage (fig. 25)

a. CIRCUIT REPAIR FEATURES. Square wave oscillator tube V15 is used as a two-stage resistance-coupled amplifier in which the output of one section is coupled to the input of the other section. Each section of the tube gives a phase inversion which is equivalent to a 180° phase shift. A total phase shift of 360° is obtained. This phase shift puts the output of one section in phase with the input of the other section and thus satisfies the conditions for an oscillatory circuit. Although the circuit is balanced externally, there will be enough unbalance between the two sections of the tube to start its operation. Assume a point in one cycle of operation at which the voltage at plate 5 is increasing and has reached a value just above that for plate 2. The instant the voltage at plate 5 exceeds that at plate 2, capacitor 104–4 charges and causes the voltage on grid 1 to become positive. This voltage rise on grid 1 causes an increase in current through plate resistor 222–1 and causes the voltage at plate 2 to decrease. The decreasing voltage at plate 2 causes capacitor 104–5 to discharge through grid resistor 221–2, causing the voltage at grid 4 to become negative. The current through plate resistor 222–2 now decreases and the voltage at plate 5 increases, charging capacitor 104–4 still further. The action described continues until grid 4 is well beyond cut-off and there is no further change in voltage at plate 5. The instant the voltage at plate 5 reaches maximum value, capacitor 104–4 starts to discharge through resistor 221–1, causing the voltage at grid 1 to become negative. The current through plate resistor 222–1 now decreases, and the voltage at plate 2 increases, charging capacitor 104–5 and causing grid 4 to become positive. When this happens the current through plate resistor 222–2 increases causing the voltage to decrease at plate 5, thereby causing a further discharge of capacitor 104–4 through grid resistor 221–1, driving grid 1 more negative. The negative voltage on grid 1 causes less current through plate resistor 222–1 and an increase in voltage at plate 2, charging capacitor

104–5 still further. The action just described continues until there is no further change in voltage at plate 2. The instant the voltage at plate 2 reaches maximum value, capacitor 104–5 starts to discharge through grid resistor 221–2 making grid 4 negative, less current flows through plate resistor 222–2, the voltage at plate 5 increases, the capacitor 104-4 starts to charge. This completes one cycle of operation. The frequency of the square wave oscillator is determined by the values of the grid and plate resistors and the feedback capacitors. A negative pulse is produced at each plate during the time it is conducting. Capacitors 113–1 and 113–2 couple the oscillator output to the negative pulse rectifier stage.

b. Voltage and Resistance Measurements. The voltage and resistance measurements shown in figure 25 were made at the pin connections to the tube socket of the bottom of the chassis. Connect the meter between the pins to be checked and the chassis to obtain these readings. For further details of conditions under which the tests were made, see paragraph 28, section VI.

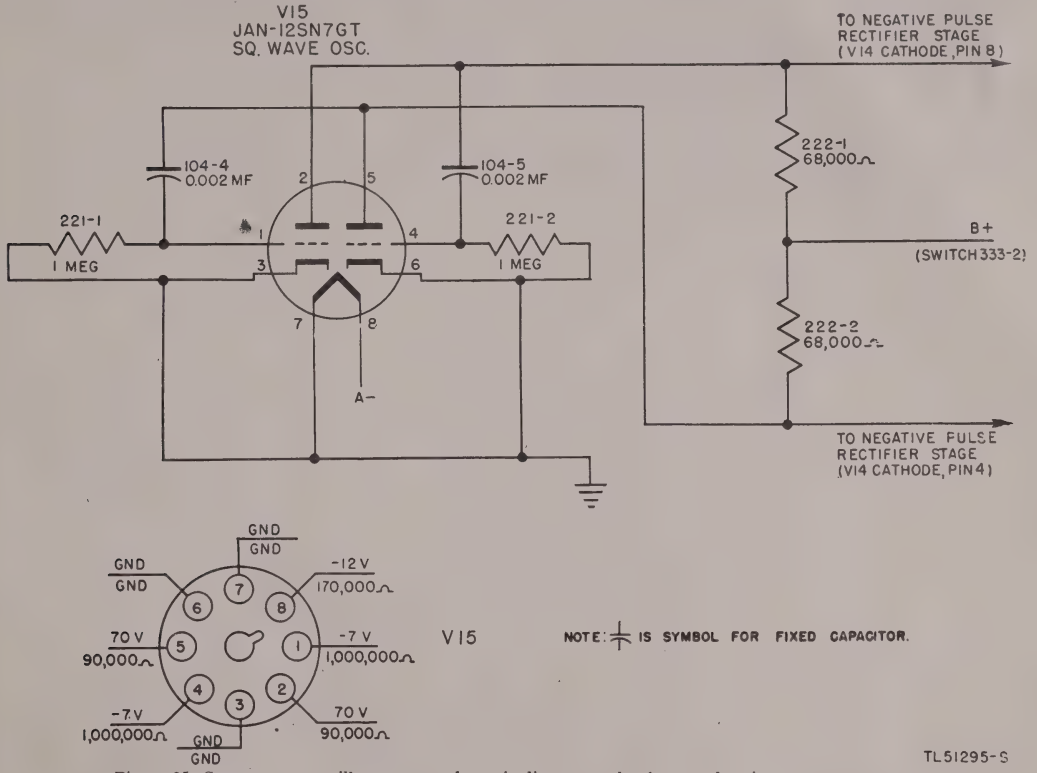


Figure 25. Square wave oscillator stage schematic diagram and voltage and resistance measurements.

c. Parts Data.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
104–4	3K3020212	CAPACITOR: mica; moulded; 2,000 mmf ± 5%; 500 vdcw.	Feedback, V15.
104–5	3K3020212	CAPACITOR: mica; moulded; 2,000 mmf ± 5%; 500 vdcw.	Feedback, V15.
221–1	3RC21BE105M	RESISTOR: carbon; insulated; 1 meg; ½ w.	Grid leak, V15.
221–2	3RC21BE105M	RESISTOR: carbon; insulated; 1 meg; ½ w.	Grid leak, V15.
222–1	3RC21BE683M	RESISTOR: carbon; insulated; 68,000 ohms ± 20%; ½ w.	Plate load, V15.
222–2	3RC21BE683M	RESISTOR: carbon; insulated; 68,000 ohms ± 20%; ½ w.	Plate load, V15.
V15	2J12SN7GT	TUBE: JAN–12SN7GT.	Square wave oscillator.

48. Negative Pulse Rectifier Stage (fig. 26)

a. Circuit Repair Features. The two sections of negative pulse rectifier tube V14 are driven by negative pulses from the square wave oscillator stage. The two sections alternately generate d-c voltages in synchronism with the negative portion of the applied pulses. The bias voltages thus developed are utilized alternately to switch the grid bias of the Adcock r-f amplifier tubes and the two sections of the synchronous voltmeter tube. The two sections of the negative pulse rectifier are contained in one envelope, tube V14. The output from the square wave oscillator stage is applied to the cathodes of tube V14 through coupling capacitors 113–1, 113–2, and series cathode resistors 220–2 and 220–3. When a negative pulse is applied to cathode 4 of tube V14, the diode will conduct (as its cathode is driven negative with respect to the anode) and a voltage will be developed across resistor 220–4 (of the synchronous voltmeter stage). At the same instant, a positive pulse is applied to cathode 8 of tube V14, but this diode will not conduct as its cathode is being driven positive. When the applied pulse polarity is reversed, the action of the two diodes will be reversed, developing a negative voltage across resistor 220–5 (of the synchronous voltmeter stage). The negative voltages which are alternately developed at the two plates of tube V14 are applied to the control grids of the tubes in the synchronous voltmeter and Adcock r-f amplifier stages.

b. Voltage and Resistance Measurements. The voltage and resistance measurements shown in figure 26 were made at the pin connections to the tube socket on the bottom of the chassis. Connect the meter between the pins to be checked and the chassis to obtain these readings. For further details of conditions under which the tests were made, see paragraph 28, section VI.

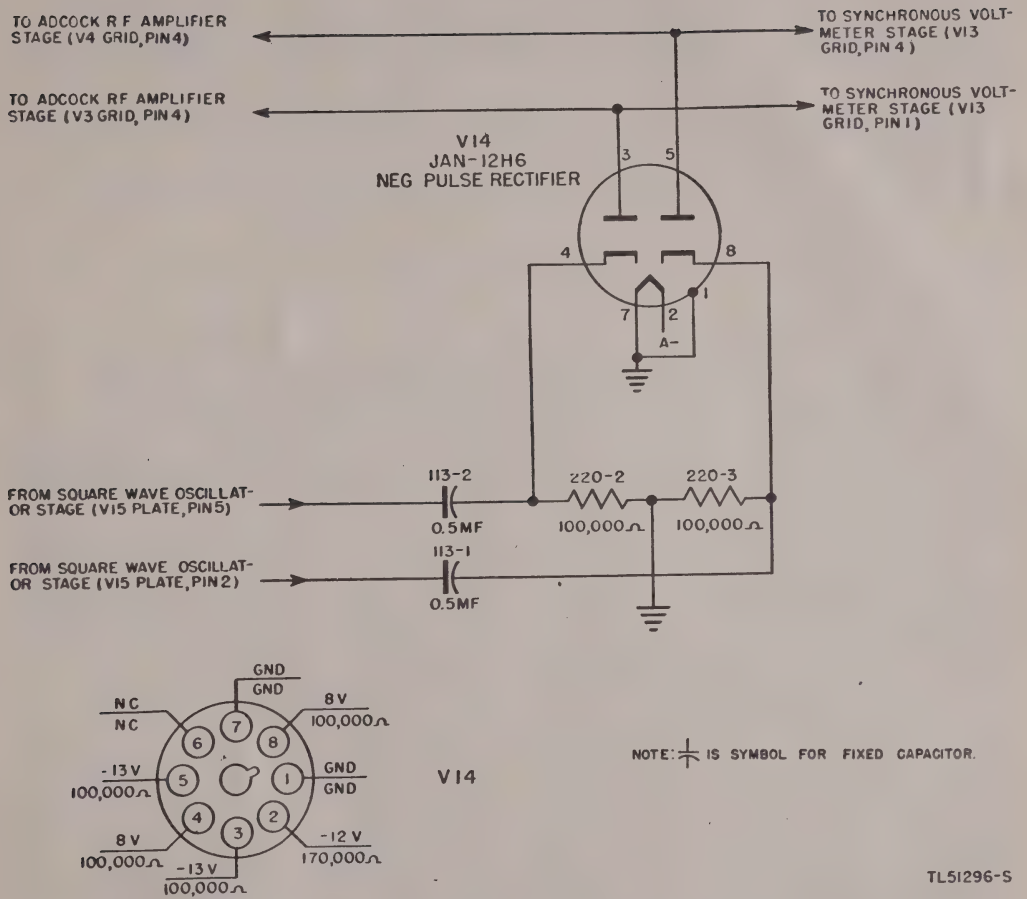


Figure 26. Negative pulse rectifier stage schematic diagram and voltage and resistance measurements.

c. Parts Data.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
113–1	3DA500–95	CAPACITOR: paper; metal cased; 500,000 mmf ± 10%; 400 vdcw.	Coupling, V14.
113–2	3DA500–95	CAPACITOR: paper; metal cased; 500,000 mmf + 10%; 400 vdcw.	Coupling, V14.
220–2	3RC21BE104M	RESISTOR: carbon; insulated; 100,000 ohms ± 20%; ½ w.	Cathode load, V14.
220–3	3RC21BE104M	RESISTOR: carbon; insulated; 100,000 ohms ± 20%; ½ w.	Cathode load, V14.
V14	2J12H6	TUBE: JAN–12H6 (VT–214).	Negative pulse rectifier.

49. Synchronous Voltmeter Stage (fig. 27)

a. Circuit Repair Features. The synchronous voltmeter stage provides visual indication of the Adcock antenna null position and may be used to determine the direction of incoming signals. A zero-center, 75–0–75 microammeter 377, and tube V13 form the main circuit components. The two triode sections of the tube are connected in push-pull and the output from the negative pulse rectifier stage is applied to the grids across grid load resistors 220–4 and 220–5. Resistors 219–2 and 219–3, and potentiometer 230 form a balanced plate load circuit. Bearing meter 377, in conjunction with the balanced plate load, indicates the potential difference between plates. In the absence of a signal from the bearing amplifier, the pulsed voltage from the negative pulse rectifier stage alternately drives the grids to cut-off and a balanced condition exists. When the Adcock antenna is off null the square wave output of the bearing amplifier is fed through coupling capacitor 110–2. This output appears across resistor 221–7, and will be applied to the plates of tube V13. For purposes of analysis, assume plate 2 is conducting and the grid of plate 5 is driven to cut-off by a negative pulse from the negative pulse rectifier stage. At the same instant that the above action is occurring, assume a positive pulse from the bearing amplifier appears at the plates of tube V13 through coupling capacitor 110–2. Since plate 2 is conducting, the positive pulse from the bearing amplifier will instantaneously increase that plate voltage and an unbalanced condition will exist. Meter 377 will then deflect off center in proportion to the pulse amplitude from the bearing amplifier. Next consider the grid of plate 2 biased to cut-off by a negative pulse from the pulse rectifier and plate 5 conducting. At this instant plate 5 will not receive a positive pulse from the bearing amplifier and the plate current will not increase. When the Adcock antenna is rotated to a null position the pulsed voltage input to tube V13 plates is effectively removed, as the 130-cycle r-f envelope is no longer present across the Adcock and vertical amplifier plate loads. Assume that the above events, occurring at a rate of 130 cycles per second, occurred when the received signals arrived from the right side of the Adcock antenna null. If a station is now received to the left side of null, the above cycle of events will be repeated but in opposite sequence. Since the square wave i-f envelope at the mixer stage has been reversed or shifted in effect 180°, the waveform of the bearing amplifier output has also reversed and an unbalanced condition which will deflect meter 377 in the opposite direction exists. The above cycle of events, occurring 130 times per second, causes meter 377 to deflect left or right until the Adcock antenna is rotated to a null position.

b. Voltage and Resistance Measurements. The voltage and resistance measurements shown in figure 27 were made at the pin connections to the tube socket on the bottom of the chassis. Connect the meter between the pins to be checked and the chassis to obtain these readings. For further details of conditions under which tests were made, see paragraph 28, section VI.

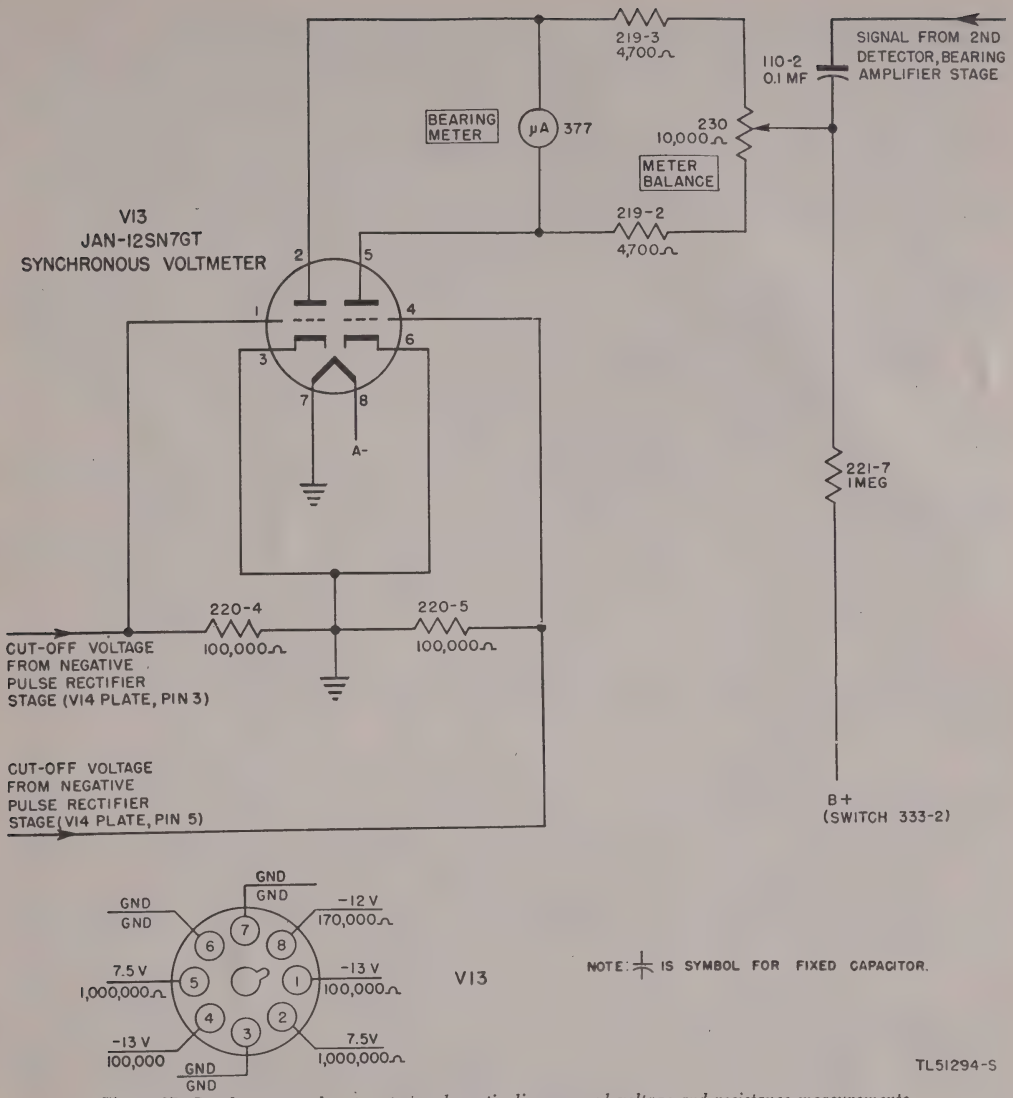


Figure 27. Synchronous voltmeter stage schematic diagram and voltage and resistance measurements.

c. PARTS DATA.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
110–2	3DA100–255	CAPACITOR: paper; tubular; 100,000 mmf ± 20%; 600 vdcw.	Coupling.
219–2	3RC21BE472M	RESISTOR: carbon; insulated; 4,700 ohms ± 20%; ½ w.	Plate bridging resistor, V13.
219–3	3RC21BE472M	RESISTOR: carbon; insulated; 4,700 ohms ± 20%; ½ w.	Plate bridging resistor, V13.
220–4	3RC21BE104M	RESISTOR: carbon; insulated; 100,000 ohms ± 20%; ½ w.	Grid load, V13.
220–5	3RC21BE104M	RESISTOR: carbon; insulated; 100,000 ohms ± 20%; ½ w.	Grid load, V13.
221–7	3RC21BE105M	RESISTOR: carbon; insulated; 1 meg; ½ w.	Output load resistor.
230	2Z7278.1	POTENTIOMETER: wire-wound; 10,000 ohms.	Meter balancing control.
377	3F2822	AMMETER: d-c; 75 microamps each side of center.	Bearing indicator.
V13	2J12SN7GT	TUBE: JAN-12SN7GT.	Amplifier.

50. Power Input Stage (fig. 28)

a. Circuit Repair Features. Power from a 12-volt storage battery is impressed between pins 1 (−12 volts) and 3 (ground) of power input socket 355. When power switch 334–2 is turned ON, −12 volts is impressed on pin 2. The motor of Power Unit PE–135–A (a separate meter-generator unit which supplies 170-volt B+ power to the receiver) is connected between pins 2 and 3 of socket 355. Hence, when switch 334–2 is turned on and −12 volts is impressed on pin 2, the power unit begins to operate and supplies 170 volts to pin 4 of socket 355. The B+ voltage is constantly distributed to all stages except as outlined in paragraph 21*c*, section VI. Pin 2 of socket 355 also supplies A-voltage to the dial and meter lamps, to the filaments of all tubes, to bias the grids of tubes V9 and V11 in the

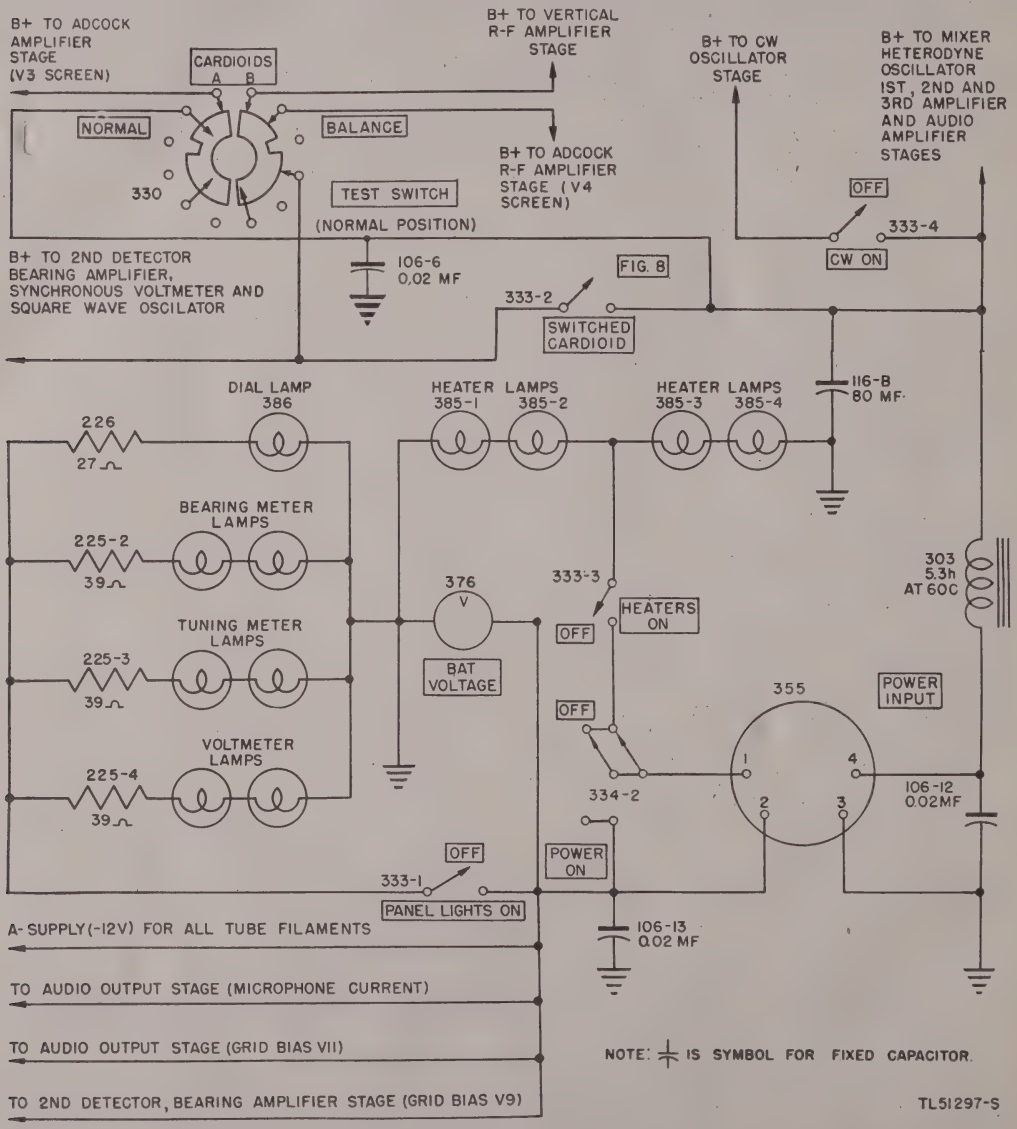


Figure 28. Power input stage schematic diagram.

second detector bearing amplifier stage and the audio-output stage, and to provide a d-c supply for the microphone which may be used in the audio-output stage. The functions of other parts in the power input stage need no more explanation than is contained in *b* below.

b. Parts Data.

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
106–6		CAPACITOR: paper; oil filled; 20,000 mmf ± 20%; 600 vdcw.	B+ r-f bypass.
106–12	3DA20–81	CAPACITOR: paper; oil filled; 20,000 mmf ± 20%; 600 vdcw.	B+ r-f bypass.
106–13	3DA20–81	CAPACITOR: paper; oil filled; 20,000 mmf ± 20%; 600 vdcw.	A− r-f bypass.
116B	3DB80–4	CAPACITOR: electrolytic; metal cased; 80–80 mf; +100% −10%; 300 vdcw.	B+ filter bypass.
225–2	3RC41BE390K	RESISTOR: carbon; insulated; 39 ohms ± 10%; 2 w.	Lamp voltage dropping resistor.
225–3	3RC41BE390K	RESISTOR: carbon; insulated; 39 ohms ± 10%; 2 w.	Lamp voltage dropping resistor.
225–4	3RC41BE390K	RESISTOR: carbon; insulated; 39 ohms ± 10%; 2 w.	Lamp voltage dropping resistor.
226	3RC41BE270K	RESISTOR: carbon; insulated; 27 ohms ± 10%; 2 w.	Lamp voltage dropping resistor.
303	3C323–54B	COIL: choke; iron core; 3,3h at 60 cycles.	B+ supply ripple filter.
330	3Z9826–122	SWITCH: rotary; 4-position; single-deck; wafer type.	Test switch for checking cardioid pattern symmetry, for operating as switched-cardioid, or as figure–8 direction finder.
333–1	3ZK9845–19	SWITCH: toggle; single-pole; single-throw.	Panel lamp switch.
333–2	3ZK9845–19	SWITCH: toggle; single-pole; single-throw.	Disconnects electronic switching circuit for figure–8 reception.
333–3	3ZK9845–19	SWITCH: toggle; single-pole; single-throw.	Heater lamp switch.
333–4	3ZK9845–19	SWITCH: toggle; single-pole; single-throw.	C-w oscillator switch.
334–2	3Z9849.60	SWITCH: toggle; double-pole; double-throw.	Power switch.
355	2Z3024–4	PLUG: connector; four-prong; male.	Power input connection.
376	3F8015–15	VOLTMETER: d-c; 0–15 volts.	A− supply voltmeter.
385–1	2Z5929	LAMP: clear; 6–8 volt; miniature bayonet base.	Heater lamp for Adcock r-f coil.
385–2	2Z5929	LAMP: clear; 6–8 volt; miniature bayonet base.	Heater lamp for Adcock r-f coil.
385–3	2Z5929	LAMP: clear; 6–8 volt; miniature bayonet base.	Heater lamp for mixer coil.
385–4	2Z5929	LAMP: clear; 6–8 volt; miniature bayonet base.	Heater lamp for heterodyne oscillator coil.
386	2Z5927	LAMP: clear; 6–8 volt; miniature bayonet base.	Dial and meter lamps.

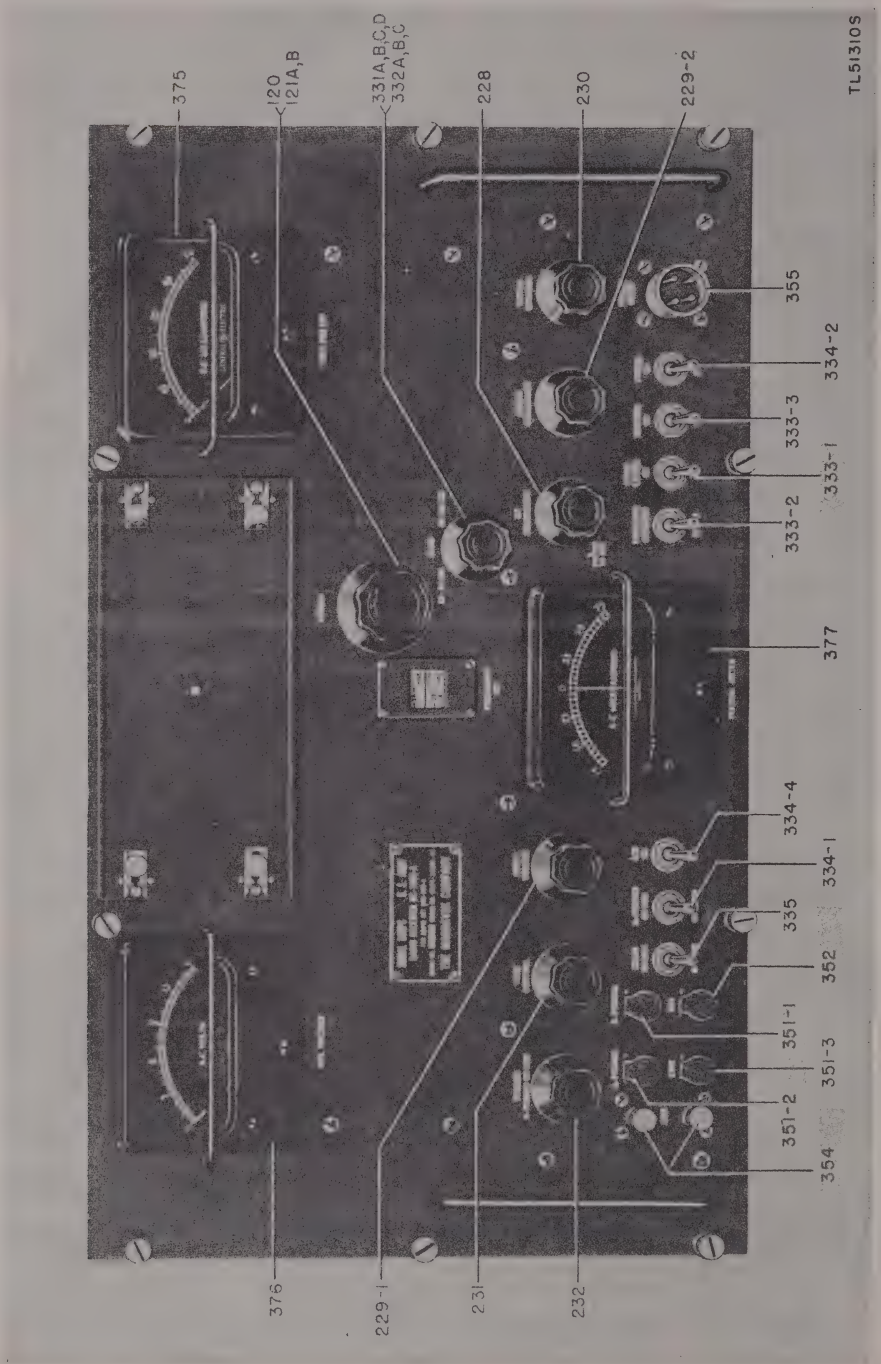


Figure 29. Radio Receiver BC-1005-A, front view.

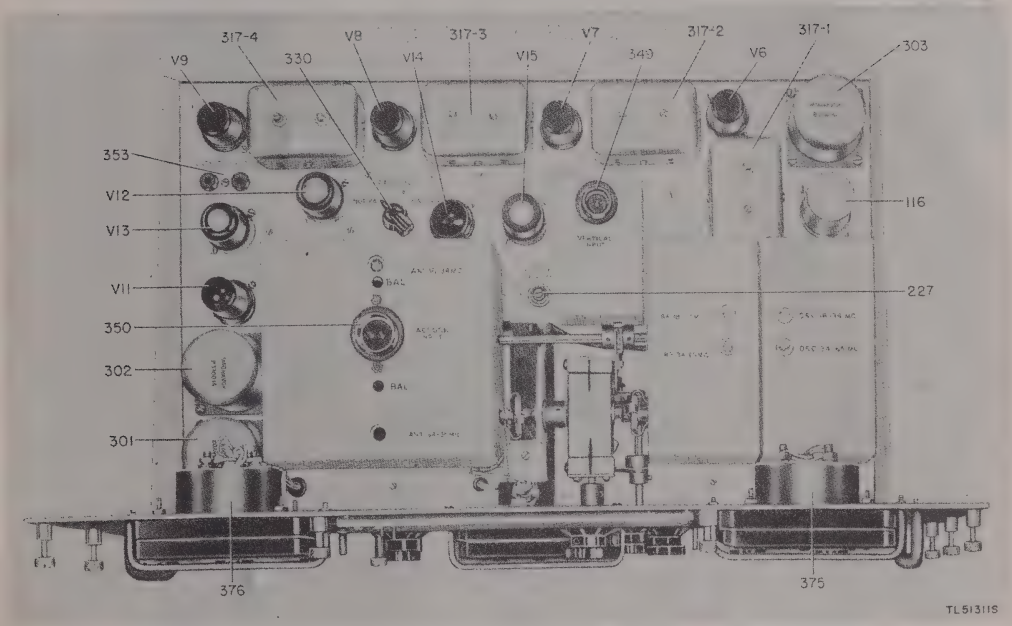


Figure 30. Radio Receiver BC-1005-A, top view, coil shields in place.

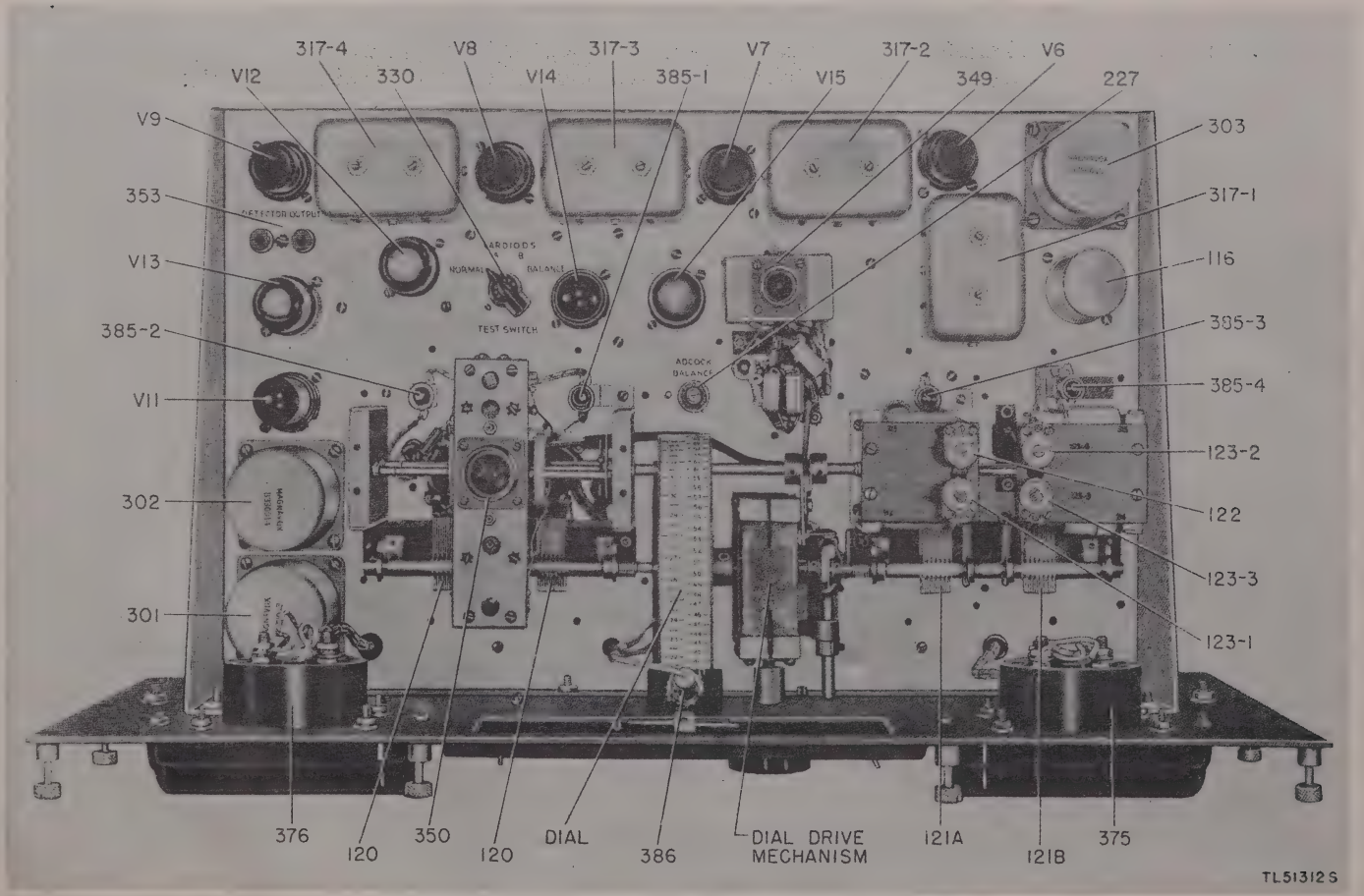


Figure 31. Radio Receiver BC-1005-A, top view, coil shields removed.

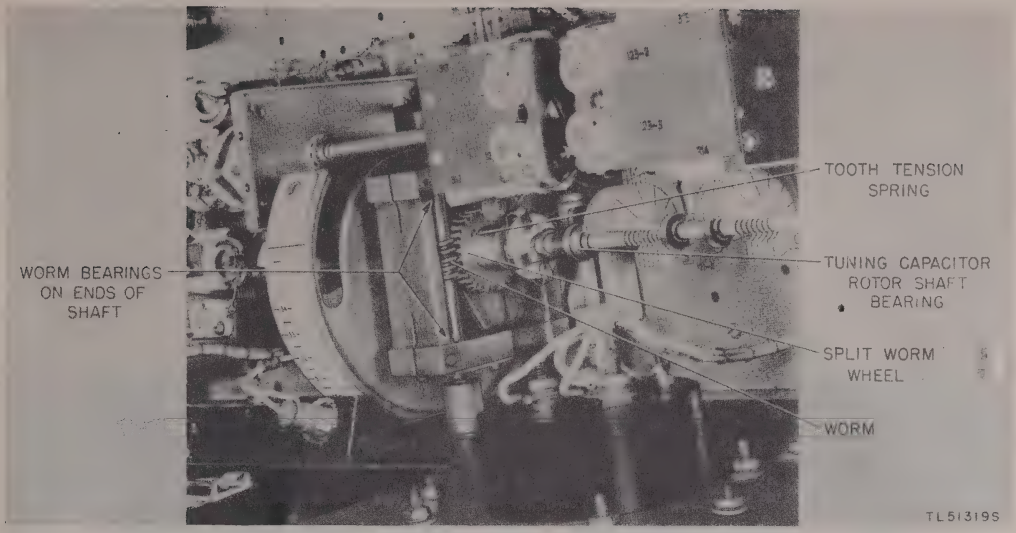


Figure 32. Dial drive mechanism.

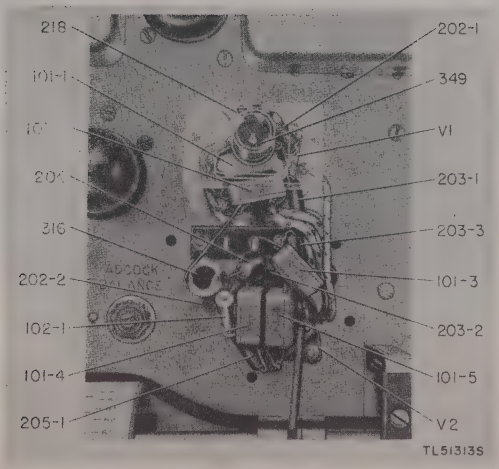


Figure 33. Parts under coil shield surrounding vertical r-f amplifier circuits.

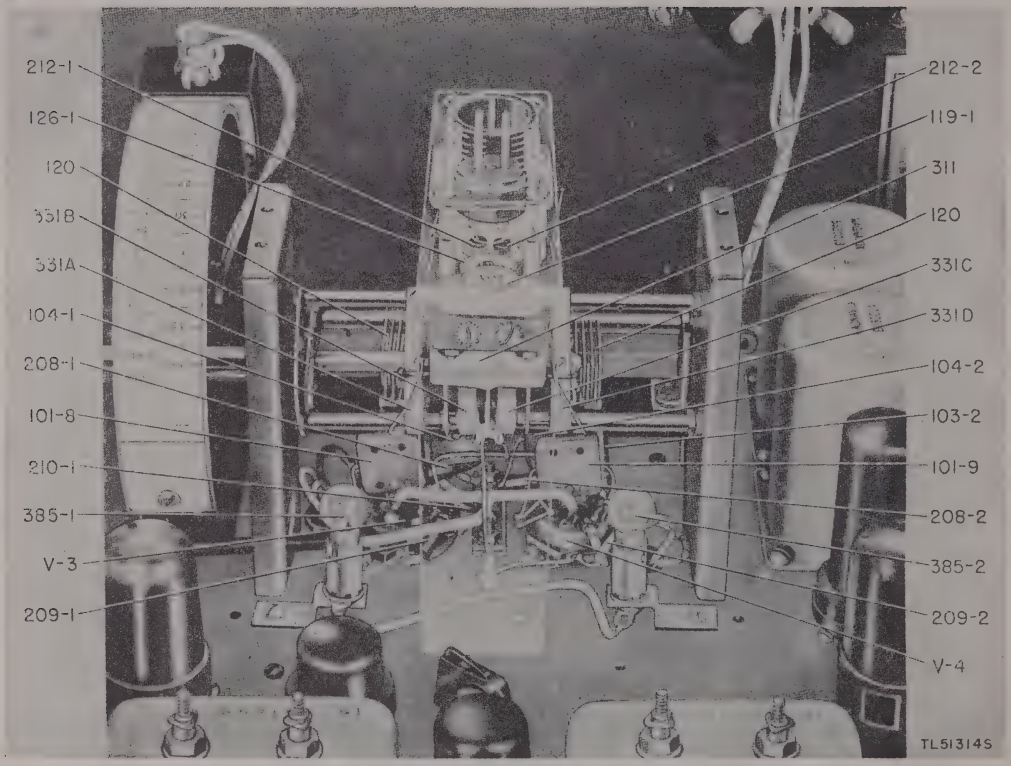


Figure 34. Parts under coil shield surrounding Adcock r-f amplifier circuits, rear view.

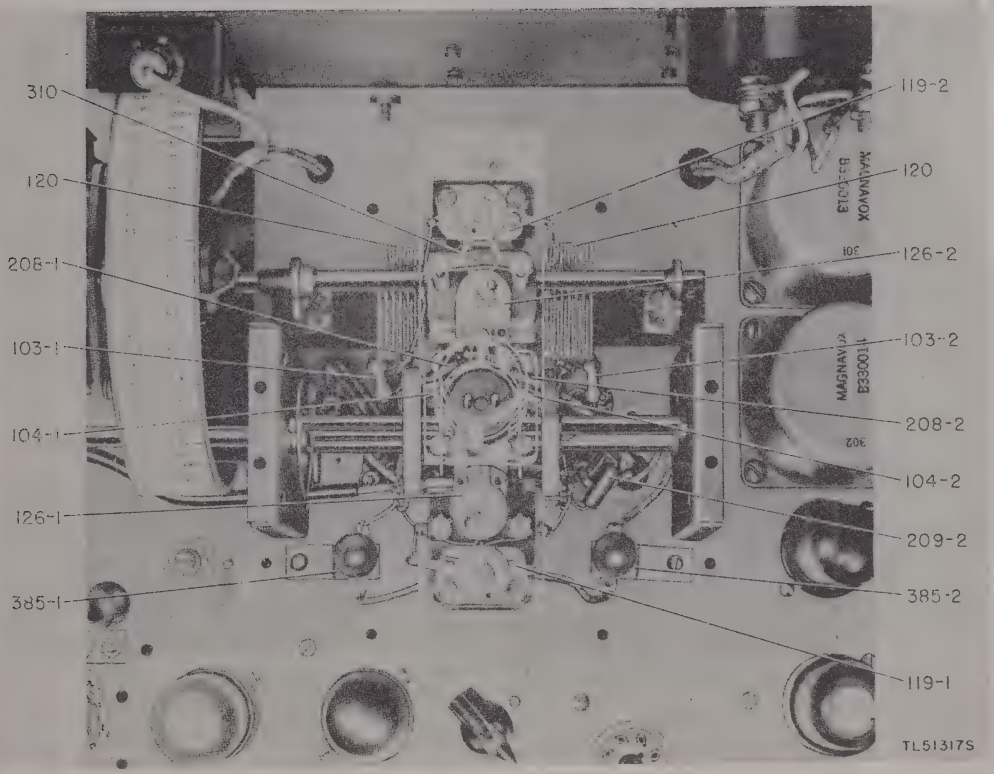


Figure 35. Parts under coil shield surrounding Adcock r-f amplifier circuits, top view.

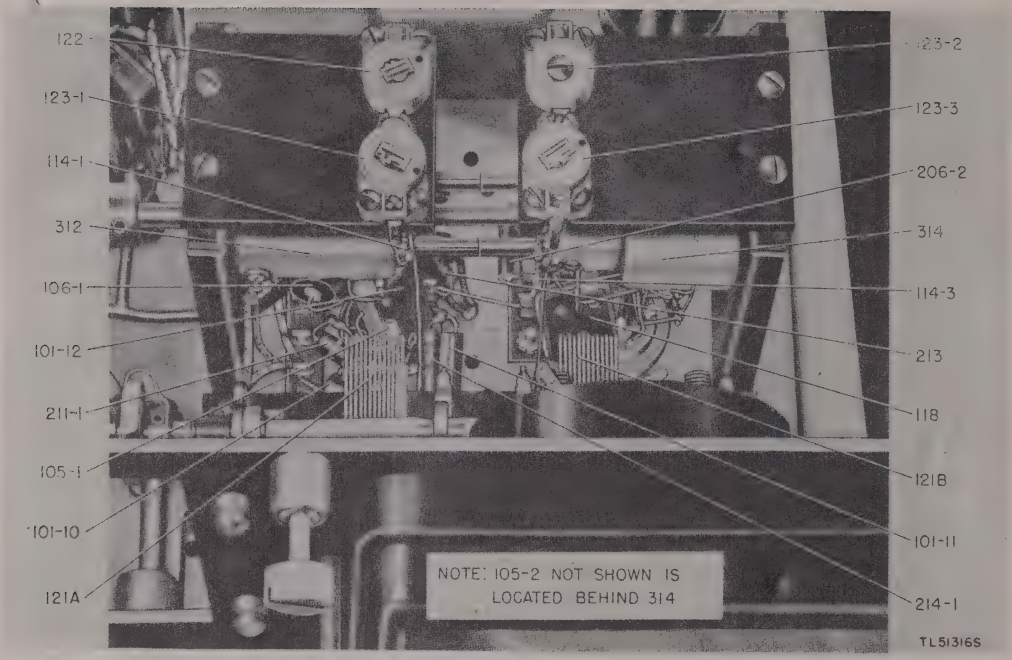


Figure 36. Parts under coil shields surrounding mixer and heterodyne oscillator circuits, top front view.

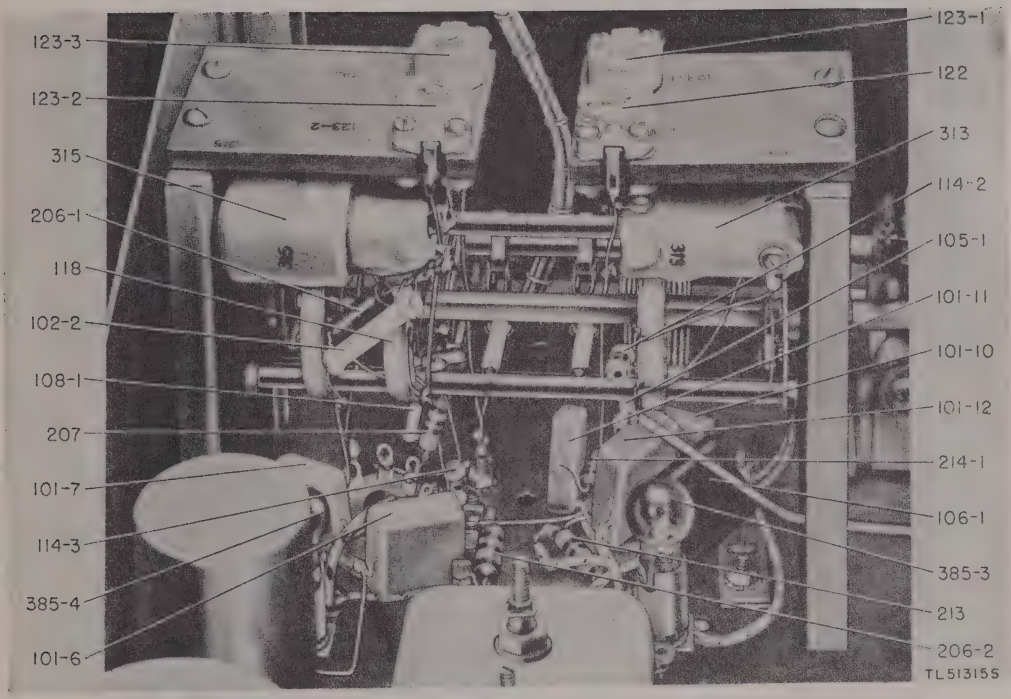


Figure 37. Parts under coil shields surrounding mixer and heterodyne oscillator circuits, rear view.

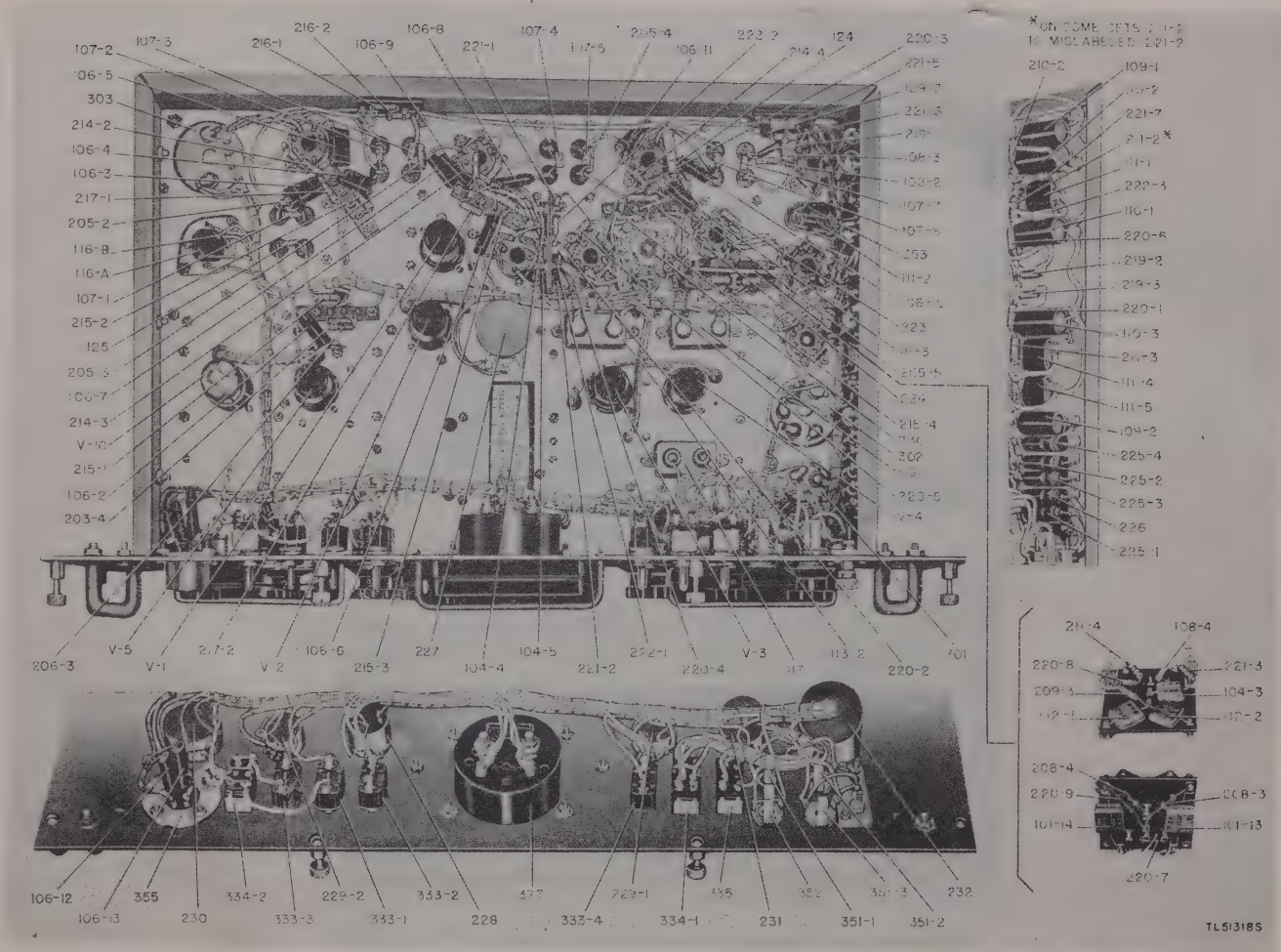


Figure 38. Radio Receiver BC-1005-A, bottom view.

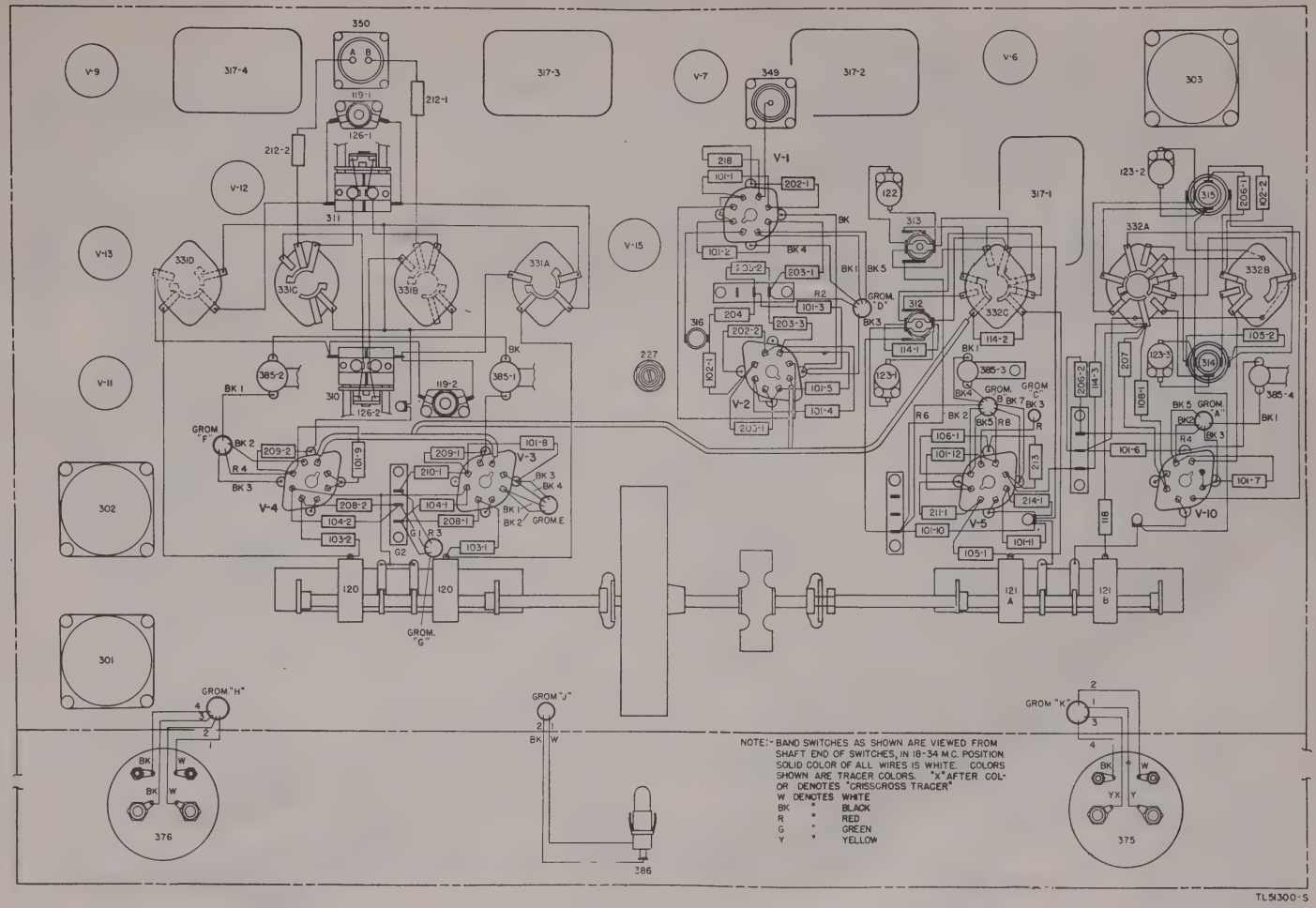


Figure 39. Radio Receiver BC-1005-A, connection diagram, top view.

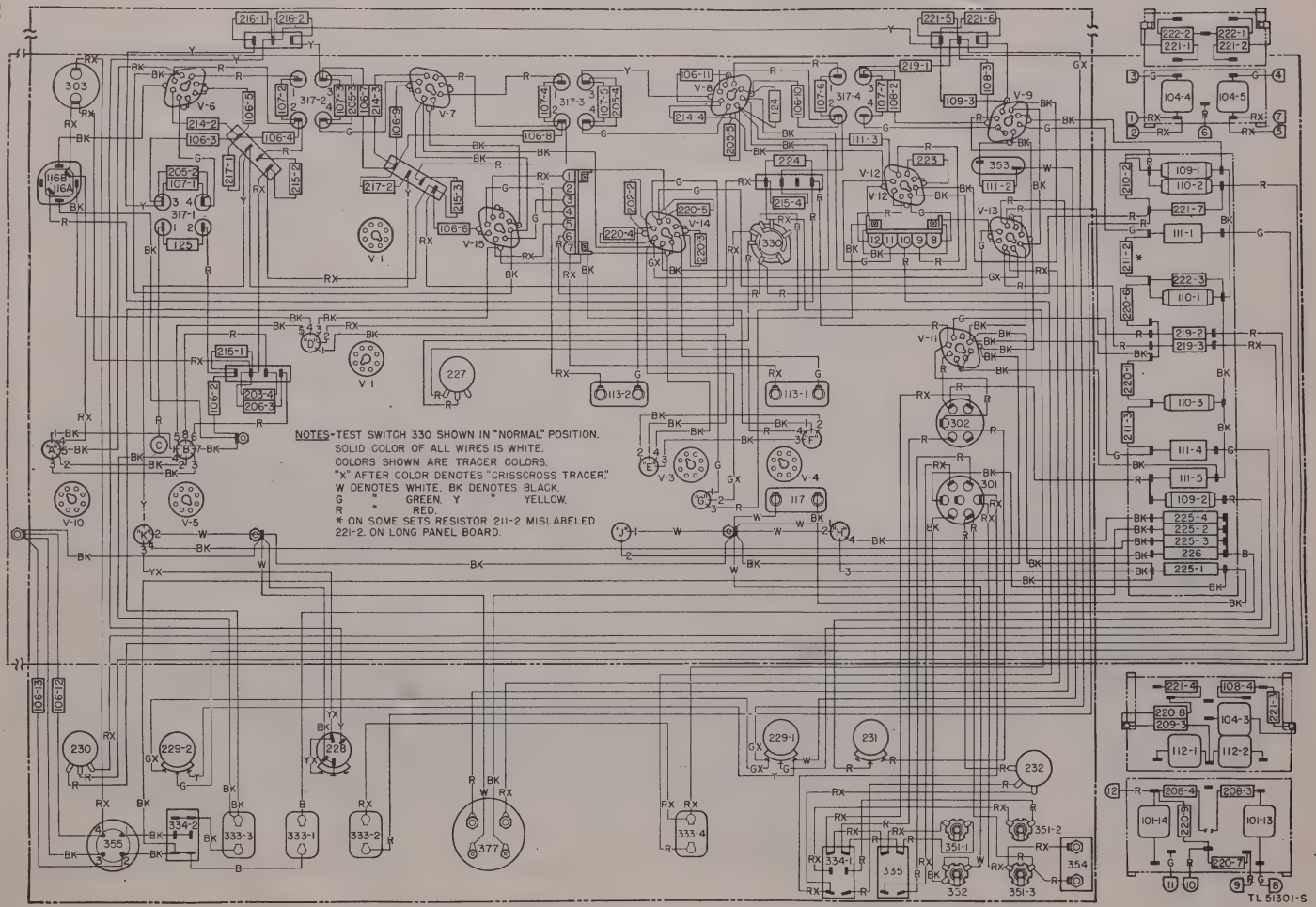
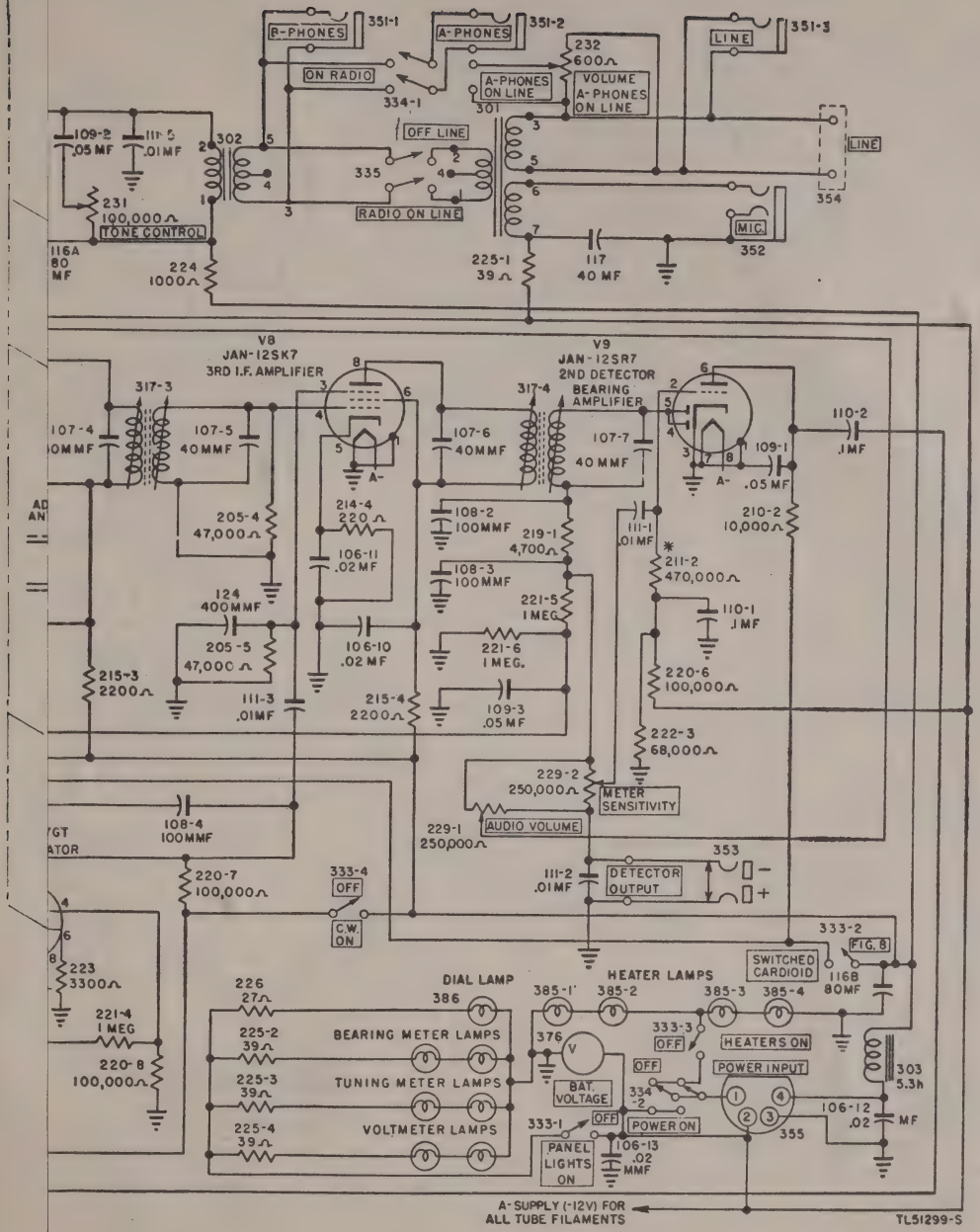


Figure 40. Radio Receiver BC-1005-A, connection diagram, bottom view.

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P-PHONES
351-1
A-PHONES
351-2
232
600Ω
LINE
351-3
ON RADIO
334-1
A-PHONES ON LINE
VOLUME A-PHONES ON LINE
301
109-2 .05 MF
111-5 .01MF
302
OFF LINE
335
RADIO ON LINE
LINE
354
231
100,000Ω
TONE CONTROL
MIC.
352
224
1000Ω
225-1
39Ω
117
40 MF
V8
JAN-12SK7
3RD I.F. AMPLIFIER
V9
JAN-12SR7
2ND DETECTOR
BEARING AMPLIFIER
317-3
317-4
107-4
107-5
40MMF
107-6
40MMF
107-7
40 MMF
110-2
.1MF
109-1
.05 MF
205-4
47,000Ω
214-4
220Ω
106-11
.02 MF
108-2
100MMF
219-1
4,700Ω
111-1
.01MF
210-2
10,000Ω
211-2
470,000Ω
108-3
100MMF
221-5
1 MEG.
110-1
.1MF
124
400MMF
205-5
47,000Ω
106-10
.02 MF
221-6
1 MEG.
220-6
100,000Ω
215-3
2200Ω
111-3
.01MF
215-4
2200Ω
109-3
.05 MF
222-3
68,000Ω
229-2
250,000Ω
METER SENSITIVITY
108-4
100MMF
229-1
250,000Ω
AUDIO VOLUME
220-7
100,000Ω
333-4
OFF
C.W. ON
111-2
.01MF
DETECTOR OUTPUT
353
333-2
FIG. 8
SWITCHED CARDIOID
1168
80MF
223
3300Ω
221-4
1 MEG
220-8
100,000Ω
226
27Ω
DIAL LAMP
386
HEATER LAMPS
385-1
385-2
385-3
385-4
225-2
39Ω
BEARING METER LAMPS
225-3
39Ω
TUNING METER LAMPS
225-4
39Ω
VOLTMETER LAMPS
376
BAT. VOLTAGE
333-3
OFF
HEATERS ON
POWER INPUT
303
5.3h
334-2
OFF
POWER ON
333-1
OFF
PANEL LIGHTS ON
106-13
.02 MMF
106-12
.02 MF
355
A- SUPPLY (-12V) FOR ALL TUBE FILAMENTS
TL51299-S

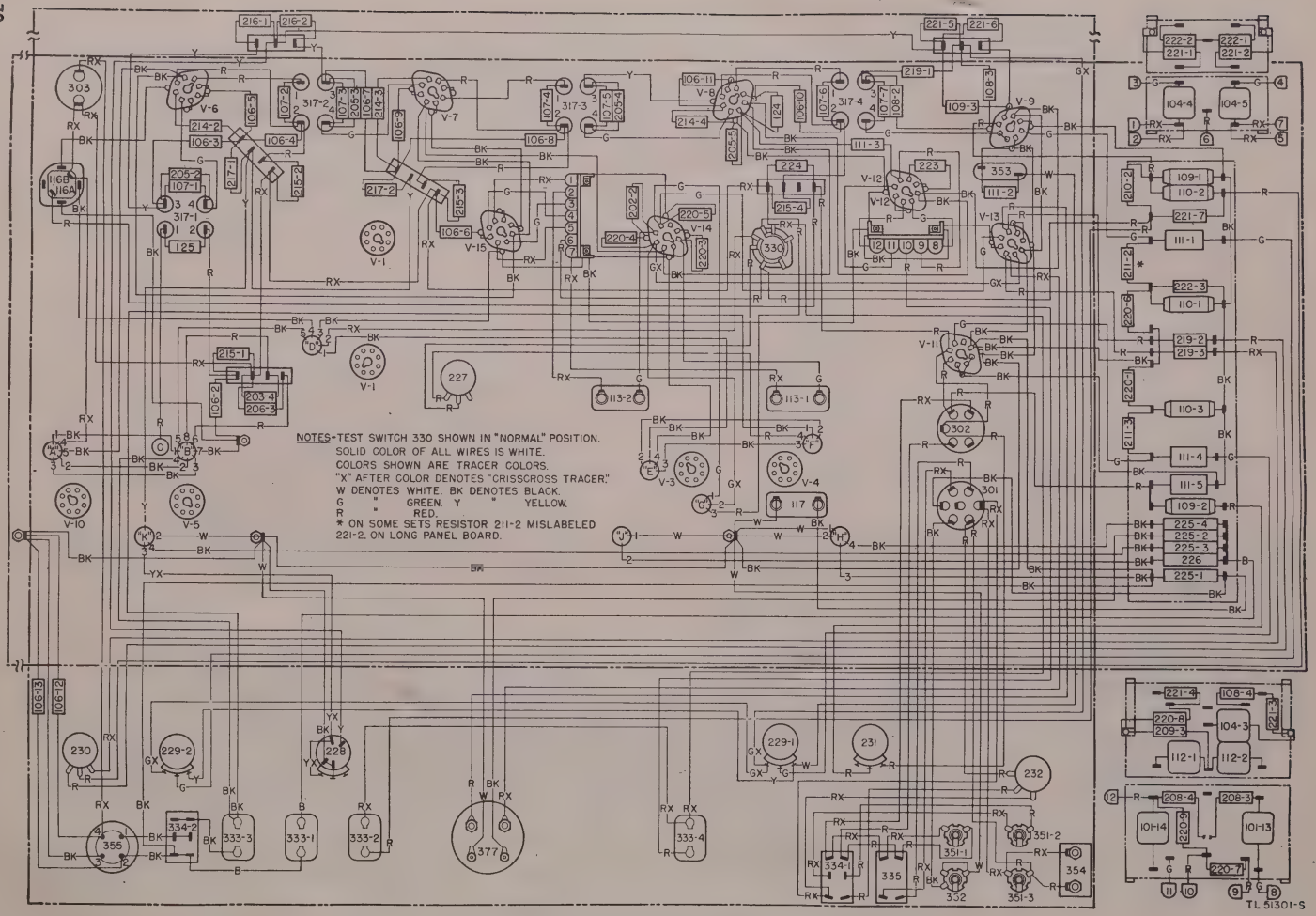
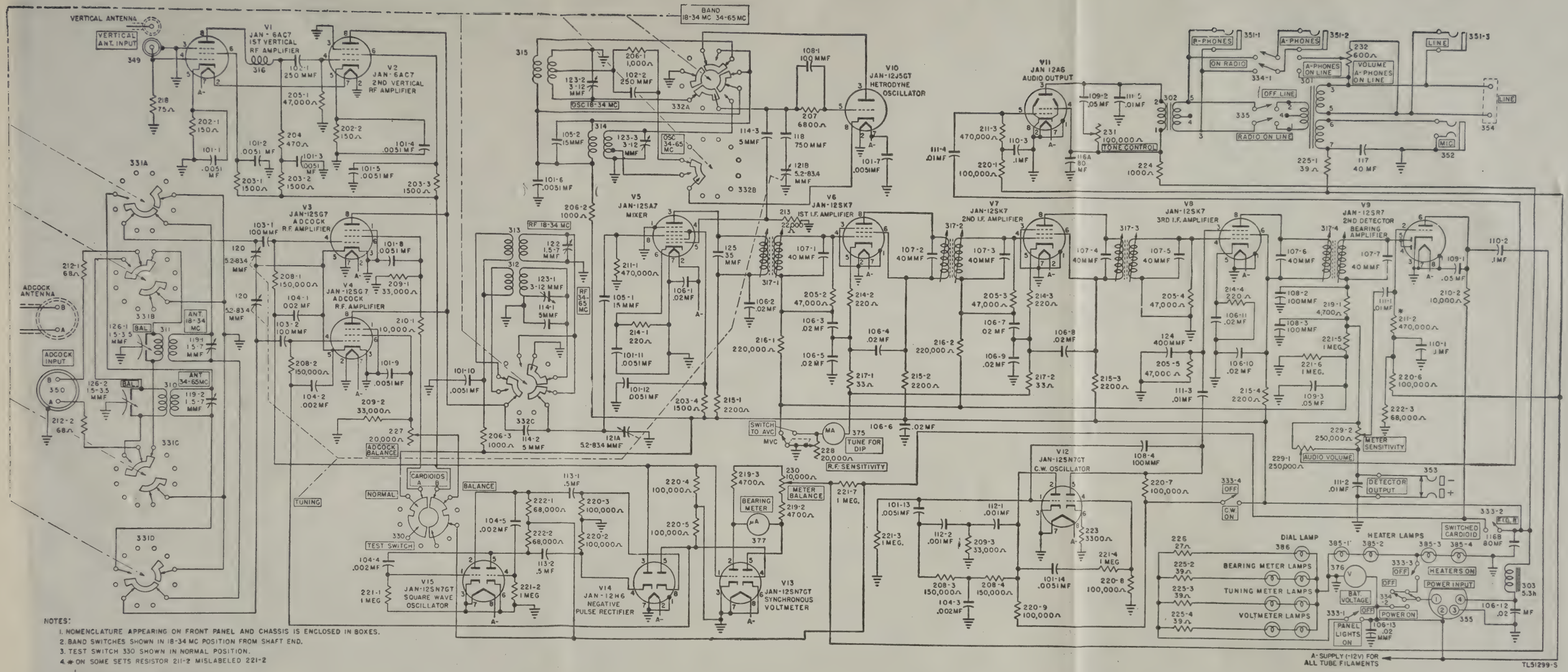


Figure 40. Radio Receiver BC-1005-A, connection diagram, bottom view.

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NOTES:

1. NOMENCLATURE APPEARING ON FRONT PANEL AND CHASSIS IS ENCLOSED IN BOXES.
2. BAND SWITCHES SHOWN IN 18-34 MC POSITION FROM SHAFT END.
3. TEST SWITCH 330 SHOWN IN NORMAL POSITION.
4. * ON SOME SETS RESISTOR 211-2 MISLABELED 221-2

⏤ IS SYMBOL FOR FIXED CAPACITOR.

⏤ IS SYMBOL FOR VARIABLE CAPACITOR.

Figure 41. Radio Receiver BC-1005-A, schematic wiring diagram.