TM 11-4023

WAR DEPARTMENT TECHNICAL MANUAL

RADIO RECEIVER AND TRANSMITTERS

BC-659-A, -B, -H, AND -J

REPAIR INSTRUCTIONS

WAR DEPARTMENT • JUNE 1945

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

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SECTION I

DESCRIPTION OF RADIO RECEIVER AND TRANSMITTERS BC–659–A, –B, –H, AND –J*

1. General

a. USE. Radio Receiver and Transmitter BC–659–(*) is designed for short-range two-way voice communication. It is a low power, portable, frequency-modulated radio receiver and transmitter.

b. RANGE. The set is designed to operate over distances up to 5 miles. The maximum range will be greater when operating from an elevated position.

*See TM 11–615 for installation, operation, and other maintenance data on this equipment.

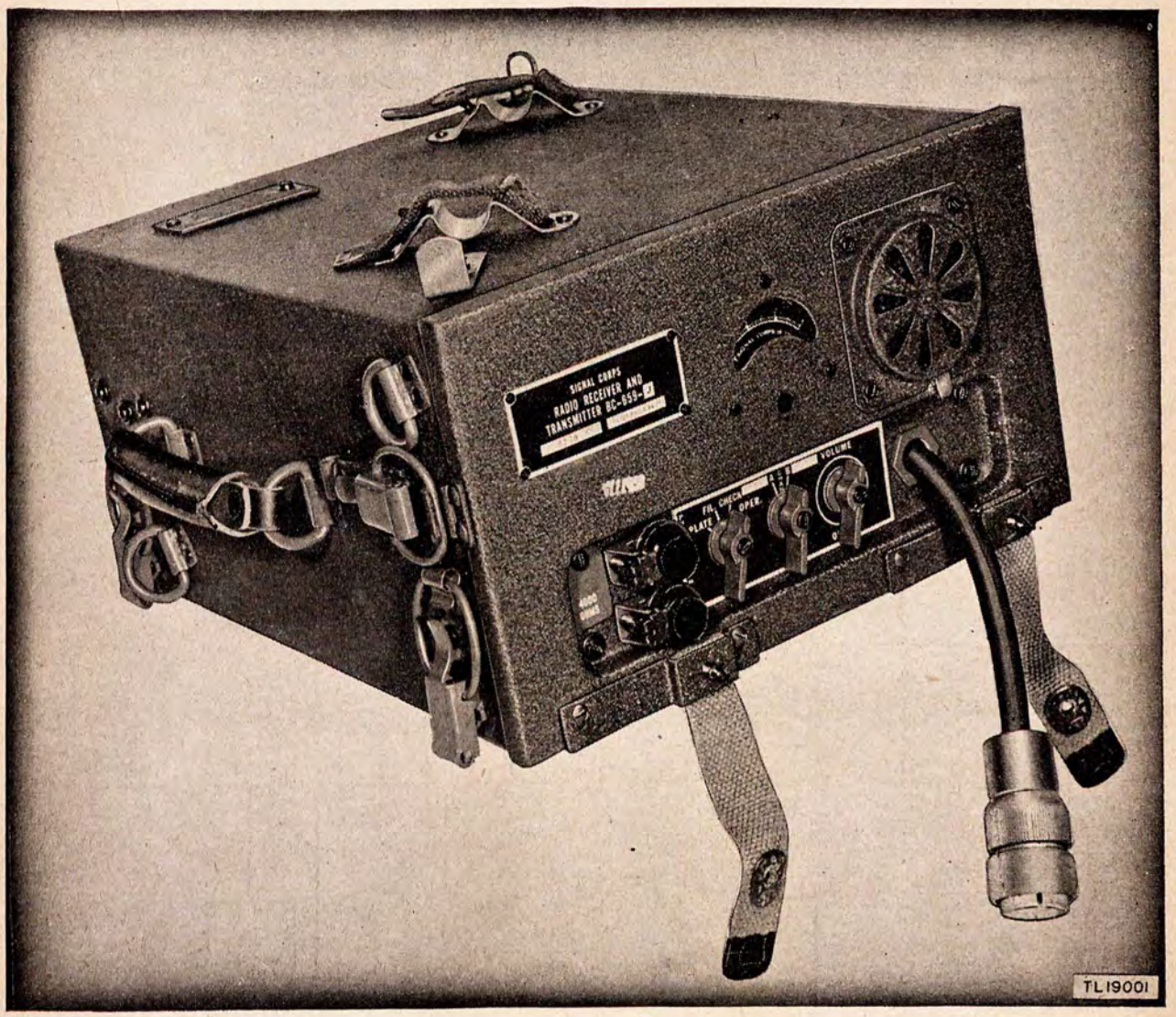


Figure 1. Radio Receiver and Transmitter BC–659–(*).

by the antenna, and resonated in the power-amplifier (p-a) plate tank circuit. It is impressed on the control grid of first r-f amplifier tube VT–179 (V5). It is further amplified by second r-f amplifier tube VT–179 (V6). The resulting voltage is impressed on the control grid of mixer tube VT–178 (V7). Crystal-controlled local oscillator Tube VT–185 (V8), operates on the fourth harmonic to produce the i-f beat. Two stages of i-f amplification are included, using tubes VT–179 (V9) and VT–179 (V10). The amplified i-f signal is impressed on the grid of limiter tube VT–179 (V11). This stage eliminates the amplitude variations present in the signal, and feeds the signal into tube VT–177 (V13) and VT–183 (V12) in a conventional discriminator circuit. The triode portion of tube VT–177 (V13) is used as a d-c amplifier. The resulting audio signal is fed into output tube VT–185 (V14). For use of d-c amplifier (V13) see *c* below.

c. TRANSMITTER. (1) The transmitter consists of a reactance modulator, tube VT–185 (V4), an electron-coupled oscillator, tube VT–185 (V3), a transmitter buffer-doubler, tube VT–182 (V2), and an r-f, p-a tube VT–182 (V1).

(2) The oscillator is designed for good stability over a wide temperature range. It uses an LC circuit in conjunction with the reactance tube to control its frequency. A portion of the transmitter signal is fed back into the receiver and since the receiver is crystal controlled, the transmitter frequency is made to follow any frequency change that appears at the receiver input. The bias produced by the d-c amplifier tends to hold the transmitter frequency constant.

(3) The doubler input circuit is tuned to twice the oscillator frequency and therefore amplifies the second harmonic. The output tuned circuit is tuned to twice the amplified signal or four times the oscillator frequency. The resulting voltage is amplified by the r-f power amplifier and passed to the antenna.

SECTION II

DIFFERENCES BETWEEN MODELS

3. Operational Differences

There are no operational differences in the models of BC–659–(*).

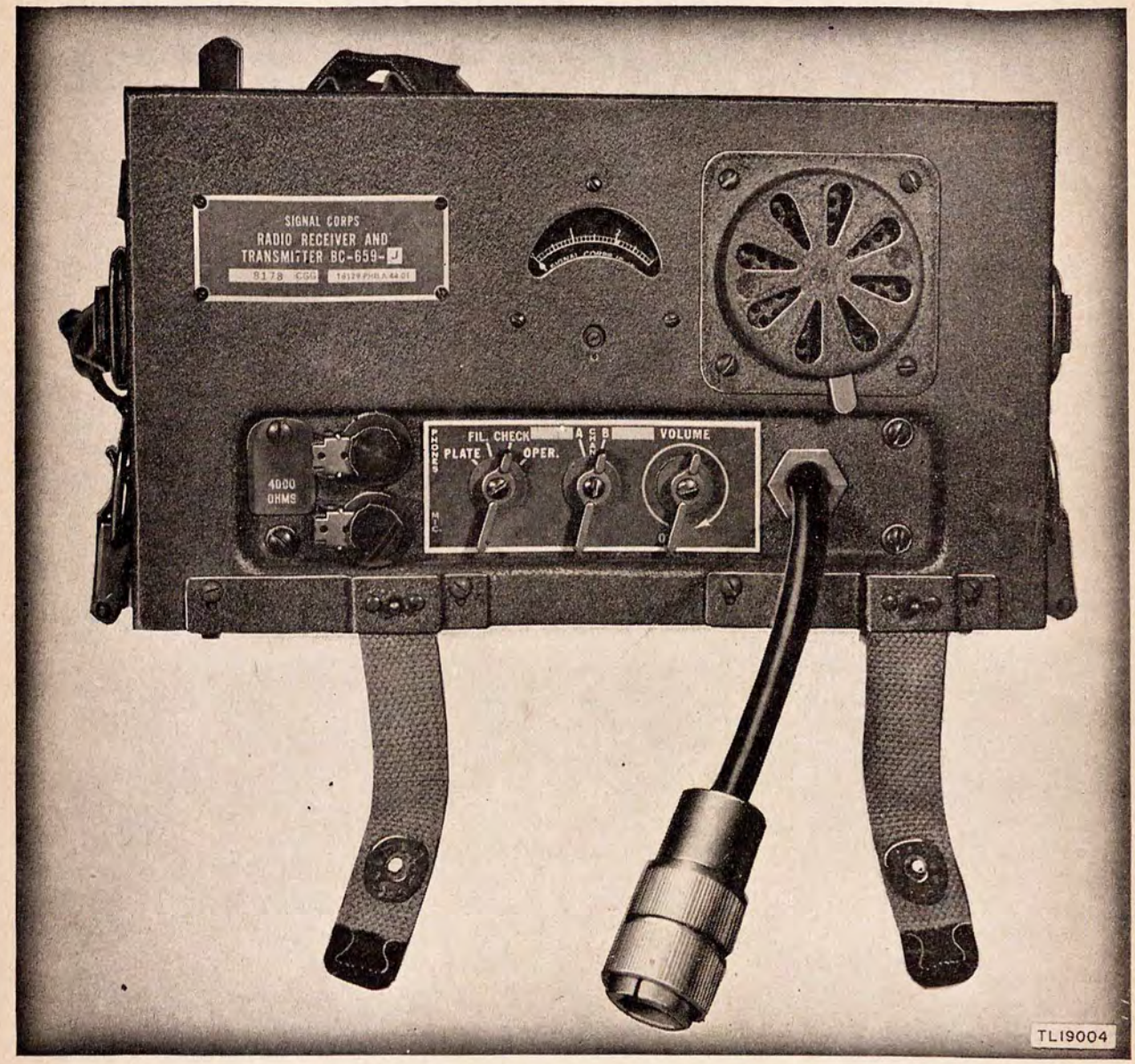


Figure 4. Front Panel, Radio Receiver and Transmitter BC–659–(*).

4. Design Differences

a. In Radio Receiver and Transmitter BC–659 manufactured on Orders No. 16130–Phila–44 and 16129–Phila–44, capacitor C72 has been replaced by capacitor C76, 0.03 microfarad (mf), 400 volts direct current. The output transformer has been changed to provide an extra impedance matching tap to accommodate a 250-ohm load in addition to the 4,000-ohm load. A label located on the outside chassis wall indicates the manner in which the change of impedance should be made. A reversible metal tag is mounted near the phone jack to indicate the impedance connection. All impedance changes should be accompanied by a corresponding reversal of tag.

b. All Radio Receiver and Transmitters BC–659–A, –B, and –H are to be modified by the addition of a loudspeaker cover (6C18) in accordance with MWO SIG 11–615–3. All other models of BC–659 will be equipped with the above-mentioned cover.

c. All Radio Receiver and Transmitters BC–659–A, –B, and –H are to be modified to incorporate Adapter M–399 in order to permit use of the meter and the receiver amplifier tube of the set for alignment procedure. The BC–659–J will be equipped with Adapter M–399 by the manufacturer.

SECTION III

INITIAL REPAIR PROCEDURES

5. General

Note. Before making any repairs or any adjustments, all authorized Modification Work Orders should be applied. See FM 21–6 for list of applicable Modification Work Orders.

Maintenance personnel should follow the procedure outlined in this manual when repairing and overhauling Radio Receiver and Transmitter BC–659–(*). The repair information in this and the following sections is presented in the order in which the repairman should actually perform the various operations in the repair shop. This procedure permits repair of the equipment in the shortest time possible, resulting in sensitivity and selectivity comparable to that of new equipment.

6. Tools, Test and Cleaning Equipment

The following items should be available for repair of this set.

Table II

Item	Description
Assorted hand tools.	
Insulated alignment tool (provided with equipment).	
Soldering iron and solder.	
R-f signal Generator.....	Covering the range 4.0 mc to 40.0 mc.
A-f signal Generator.....	Covering the range 250 cps to 3000 cps.
Alignment Equipment ME–73–(*).	
Maintenance Equipment ME–13–(*).	
Solvent, Dry-cleaning	Approved symbol (SD).
Assorted brushes.	
Pipe cleaners.	
Clean cloths	Lint-free.
Sandpaper	#0000.
Crocus cloth.	

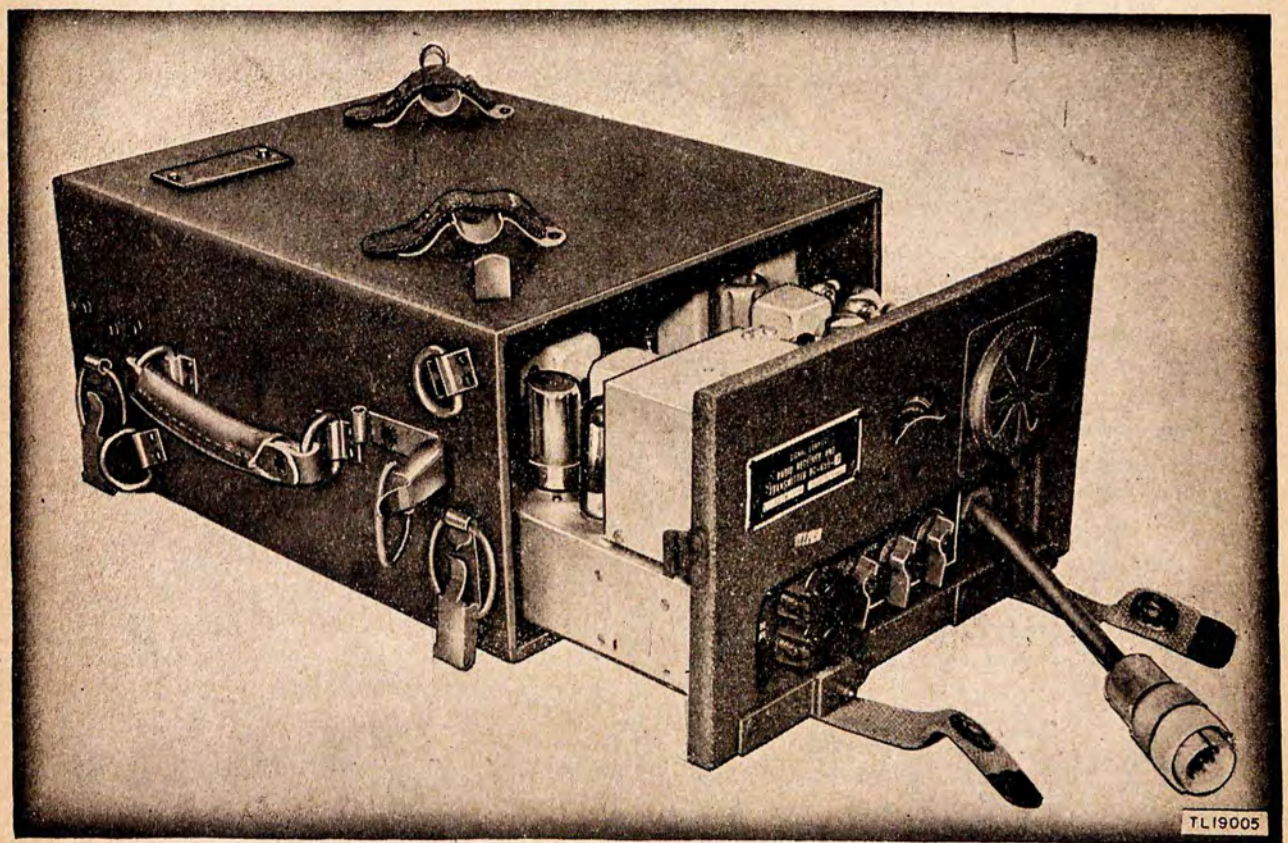


Figure 5. Removing chassis from housing, Radio Receiver and Transmitter BC–659–(*).

7. Disassembly for Inspecting and Cleaning

a. CHASSIS. Remove the chassis from the housing by opening the tension clamps on either side of the operating panel. The radio receiver transmitter can then be slid out from the housing.

b. DESICCATOR. Remove desiccator by removing the four binderhead screws holding the perforated desiccator frame.

c. CRYSTAL REMOVAL. Remove both crystals from the chassis by lifting the crystal retaining spring.

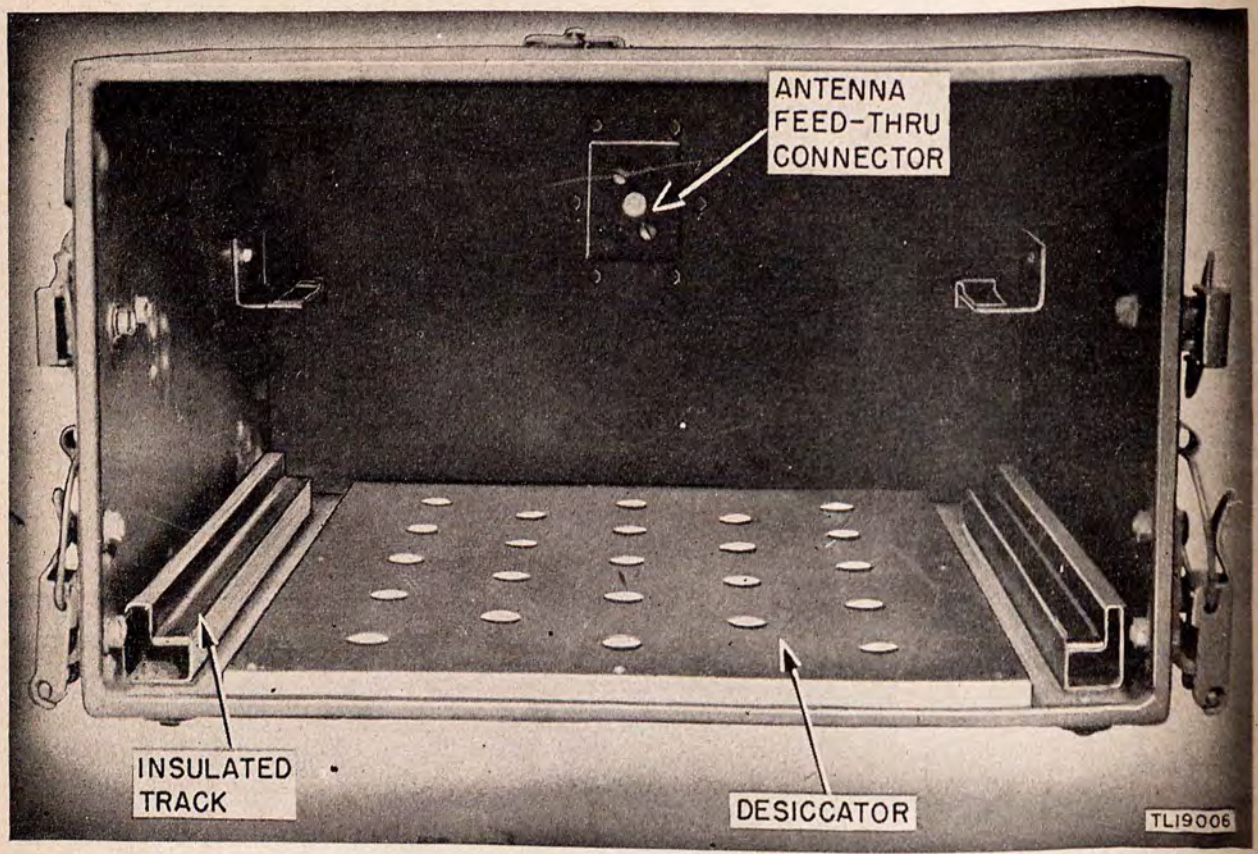


Figure 6. Desiccator position in Radio Receiver and Transmitter BC–659–(*).

d. REMOVAL OF TUBES. The removal of the lock-in type of tubes as supplied with the set requires a special technique to prevent possible crushing of tube and injury to the hands. To remove, grasp tube firmly, rock it back and forth in the direction of the tube socket mounting screws and pull upward.

e. INTERNAL BATTERY REMOVAL. The battery box is located on the transmitter side of the radio receiver and transmitter chassis and behind the front control panel. The cover plate is held in place by four binderhead screws, two on the top and two on the left side. The removal of the battery will necessitate the removal of the four screws.

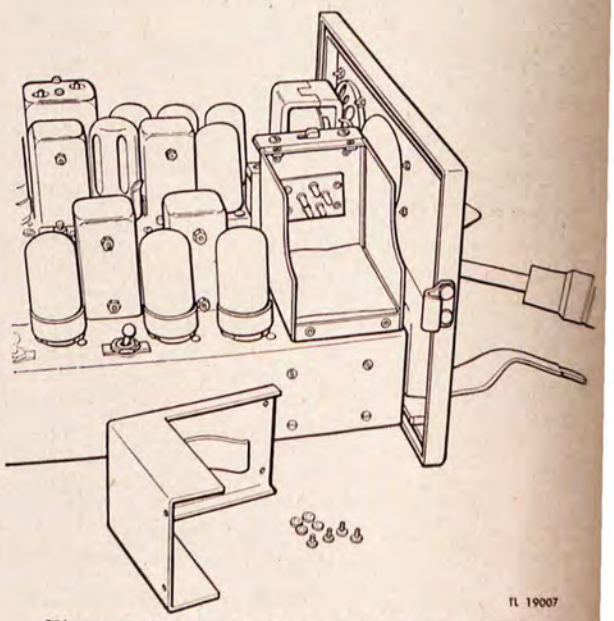


Figure 7. Removal of internal battery of Radio Receiver and Transmitter BC–659–(*).

8. Cleaning and Inspecting of Chassis

a. CLEANING OF MAIN CHASSIS. Chassis must be clean and free from rust and corrosion. Blow

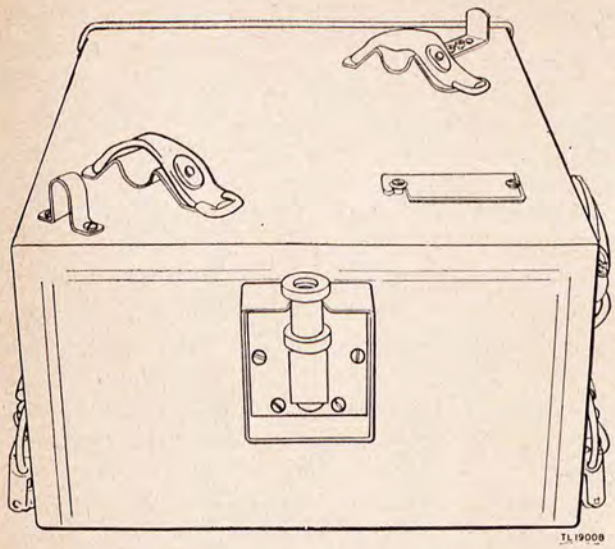


Figure 8. Antenna coupling, Radio Receiver and Transmitter BC–659–(*).

out all dust and dirt using clean, dry compressed air. Use solvent applied with lintless cloth, brushes or pipe cleaners.

Caution: Do not attempt to remove tarnish from silver-plated switch contacts.
Remove rust and corrosion with a stiff brush and solvent. Heavier rust and corrosion may be removed by careful use of crocus cloth, solvent, and compressed air.

b. INSPECTING MAIN CHASSIS. After cleaning the set, inspect the chassis to determine the exact model. Check to see that model has been modified as required. During inspection a careful check must be made for any evidence of temporary field repairs. All electrical components must be free from obvious mechanical and electrical defects when inspected visually. *Any part, the failure of which was obviously caused by an electrical fault, must not be replaced until circuit is checked and cause of failure is determined.*

(1) *Wiring.* All soldered joints must present a good mechanical and electrical connection. Wiring insulation must not be worn or chafed. Insulated tubing must not be torn or missing, and bare wires must not be shorted to chassis or other parts. The chassis must be clean and free from corrosion.

(2) *Housing.* The housing must not have cracks or breaks in the metal. It must be free from corrosion. It must not be scratched, and must have no outside unpainted areas.

(3) *Speaker shield.* The set should be inspected to determine if the speaker shield has been installed in accordance with MWO SIG 11–615–3. It should be actuated by the lever to determine whether or not the shutter is free.

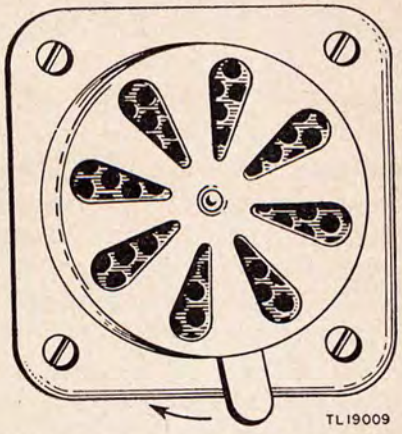


Figure 9. Speaker shield, Radio Receiver and Transmitter BC–659–(*).

(4) *Chassis straps.* The chassis straps should be inspected for rips in the fabric or general signs of wear.

(5) *Painting.* The housing should be touched up using olive drab wrinkle finish paint if the housing presents a poor appearance. If scratches are deep or unpainted areas are large, the entire assembly should be repainted with olive drab.

(6) *1299 tube socket check.* Check all 1299 tube sockets for solder in socket pin No. 8. It is to be noted that the 1299 tube contains only seven pins, with No. 8 missing. The exception to the above is the Raytheon type 1299, which has all eight pins. Therefore, it is important, from the standpoint of replacement, that the No. 8 socket pin be free of foreign material.

(7) *Antenna spring tension.* Check antenna spring tension. This spring will be found in the back of the chassis mounted on an insulator. This spring must make good contact with antenna coupling on set housing.

(8) *I-f transformer alignment screws.* The alignment screws on the top and bottom of transformers T2, T3, T4, and T5, should be checked for tightness.

(9) *Variable capacitor rotor locking nuts.* With a 5/16-inch Spintite wrench, or alignment tool, tighten the locking nuts on all variable air capacitors, and check to see that the rotor setting does not change. If this condition exists, it will be necessary to replace the capacitor. Unlock the nuts after this test.

(10) *Alignment-screw position.* Check the position of all alignment screws on transformers T3, T4, and T5. The position shall not be such that the screw-driver slot is flush or almost flush to the containing bushing. Note that there are two positions of the aligning screw at which it is possible to align the transformer. The correct position is the one in which the aligning screw is extended the farthest.

(11) *Leakage resistance.* With a high reactance ohmmeter, measure for leakage resistance between panel and chassis. This resistance value should be more than 10 megohms. If leakage exists, check condition of insulating bushing around jacks, and other panel insulating bushings.

(12) *Meter protecting fuse F2.* On some models of the BC–659–(*), it will be found that resistor R13, wire-wound, 100 ohms, 1 watt, is substituted for fuse F2. It has been found that the presence of resistor R13 is beneficial in regard to filtering of vibrator hash in the plate voltage. In all sets substitute resistor R13 for fuse F2. In no case should both resistor R13 and fuse F2 be installed in the same set.

(13) *Panel nuts.* It may be found in some cases that the bushings under the nuts are too thick to allow sufficient surface pressure between the nuts and the panel, in which case the bushings should be replaced with thinner ones.

(14) *Coil shields.* All coil shields should be tight, as well as the shield under the chassis. It is to be noted in particular that poor grounds at these points are responsible for narrow bandwidth and nonlinearity in the i-f response.

(15) *Red dots on trimmer capacitors.* The red dots on trimmer capacitors should be repainted when original paint is missing or defaced.

(16) *Shorted A and B trimmer.* With an ohmmeter, check for short circuits across all A and B trimmer capacitors as each capacitor is rotated through its entire range. It will be necessary to put channel selector switch in A position while checking B trimmers and vice versa.

c. CLEANING AND INSPECTING REMOVED PARTS. (1) *Crystals.* Inspect and clean the pins of crystal units with dry-cleaning solvent (SD), applied with a brush. If the pins are bent or broken replace the crystal unit with a new unit. Remove any heavy corrosion by careful use of crocus cloth. Wipe off the unit with a lint-free cloth moistened with dry-cleaning solvent (SD).

(2) *Desiccator.* The silica gel desiccator, inclosed in a spun glass bag, is used in this set as an extra precaution to absorb any moisture. A portion of this bag is coated with cobalt chloride to serve as an indicator of the moisture content of the silica gel. A blue color indicates a dry desiccator; a pink color indicates a moisture-saturated desiccator requiring regeneration.

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

(4) *Battery BA–41.* Check the battery for rated voltages. If battery checks low it should be discarded.

d. REPLACING REMOVED PARTS. Replace crystals, desiccator, tubes, and internal battery in the chassis and fasten them in place.

SECTION IV

PRELIMINARY TROUBLE-SHOOTING PROCEDURES

9. General

a. CRYSTALS AND TUBES. Choose and insert the proper crystals for the desired operating frequency. Insert one set of tubes as listed in table III below.

Table III

Tube type		Quantity
JAN 3B7/1291	VT–182	2
JAN 3D6/1299	VT–185	4
JAN 1LN5	VT–179	5
JAN 1LN4	VT–177	1
JAN 1R4/1294	VT–183	1
JAN 1LC6	VT–178	1

b. REPLACING CRYSTAL UNITS IN CHASSIS. Care must be taken to insure the proper placement of the two crystal units. Crystals should be placed in holder with their metal plates facing out away from each other. When crystals are in place, close the retaining spring.

10. Returning Chassis to Housing

Return the chassis to the housing by sliding it into the open end with the chassis riding on the bakelite insulated track. Fasten the clamps holding the chassis in place.

11. Input Resistance Check

Trouble within the unit can often be detected by checking the resistance at the power input terminals of the set before applying power to the equipment, thereby preventing damage to the unit or its power supply. Check the resistance at the power and control cable plug and compare with values shown below. If the readings indicated are incorrect see section VIII, and correct the fault before proceeding. All measurements are made between plug pins and the chassis. Pins on the plug are identified by letters.

Pin No.	Resistance to chassis
A	Open
B	Open
C	Open
D	Open
E	Open
F	1 megohm minimum (depends on current leakage through electrolytic capacitor C31).
G	Open
H	Continuity

12. Operational Test

Connect the set to the power supply and turn on by rotating the volume control clockwise. Inspect set for any signs of abnormal operation such as smoking, arcing, crackling or burning. If abnormal behavior is noted, turn off the set immediately. See section VIII, and correct the fault before proceeding. If all indications appear normal check the performance of the set by communicating with another unit operating on the same frequency.

SECTION V

ALIGNMENT PROCEDURE

13. Presetting

a. GENERAL. Radio Receiver and Transmitter BC–659–(*) is designed to operate on any frequency within the range of 27.0 to 39 megacycles (mc). The frequency of the receiver is crystal controlled for operation on any two of 120 different channels, spaced 100 kc apart, within this range. An automatic frequency-control bias voltage is generated in the receiver and applied to the reactance modulator to control the frequency of the transmitter oscillator. Sets, when issued, are properly aligned and preset on the two channels marked on the container. However, the P-A PLATE stage should be realigned before operation. With batteries and crystals installed, and proper connections made in accordance with procedures, the set can be operated on these two frequencies. Check to see that the set operates properly before attempting to change the channel presettings.

b. TRIMMER SETTINGS. Before placing the set in operation on any two assigned channels, it is necessary first to have the proper crystal for each assigned channel, and then to adjust properly the trimmer capacitors on the chassis to the assigned channels. These trimmers are arranged in seven pairs, marked A1 (B1) to A7 (B7) on the chassis and are provided with dial cards. *Only these trimmers need to be adjusted when presetting channels. Do not disturb any other adjustments.*

c. CHANNEL MARKINGS. For convenience in distinguishing between the controls for the two channels, all of the controls for one channel are labeled A, and all of the controls for the other are labeled B. The channel selector switch marked CHAN, is on the panel of the Radio Receiver and Transmitter BC–659–(*). The two positions in the crystal sockets on top of the chassis are labeled A and B.

d. METERING SOCKET. A metering socket is provided on the chassis of Radio Receiver and Transmitter BC–659–(*) for connecting a meter at various points in the circuit for alignment and test. The pin jacks on this socket are numbered from 1 to 8 and are connected to the various parts of the circuit so that when the common lead of an electronic voltmeter is connected to the chassis of the set and a d-c probe of the electronic voltmeter is inserted into a pin jack, the corresponding voltage is read on the electronic voltmeter.

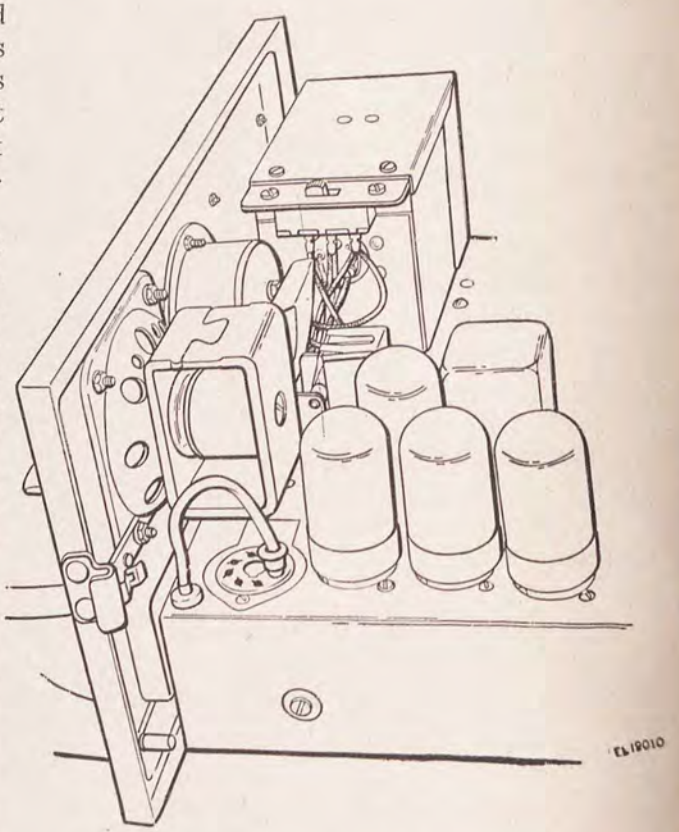


Figure 10. Metering socket, Radio Receiver and Transmitter BC–659–(*).

e. PIN JACK CONNECTIONS. The metering socket pin jack connections are as follows:

Pin jacks	Meter indication
Pin jack No. 1	Receiver oscillator grid voltage.
Pin jack No. 2	Receiver converter injection grid voltage.
Pin jack No. 3	Receiver limiter grid voltage.
Pin jack No. 4	Reactance modulator grid voltage (d-c amplifier output).
Pin jack No. 5	Transmitter buffer grid voltage.
Pin jack No. 6	Transmitter oscillator grid voltage.
Pin jack No. 7	Receiver discriminator output voltage.
Pin jack No. 8	Output of one discriminator diode (VT-177).

f. TEST EQUIPMENT. The following items of test equipment required to preset channels are furnished in or issued with Maintenance Equipment ME–13–(*) and Alignment Equipment ME–73.

(1) An electronic voltmeter for measuring voltages at the metering sockets which may be:

(*a*) Voltohmmeter I–107–(*), part of Alignment Equipment ME–13–(*). See TM 11–306.

(*b*) The panel meter of the Radio Receiver and Transmitter BC–659–(*) in conjunction with Adapter M–399.

(*c*) Any other electronic voltmeter such as Hickok Model 202, R.C.A. Voltohmyst, etc.

(2) Alignment tool TL–150 or TL–207.

(3) Adapter RS–259.

(4) Other tools such as hexagon socket wrench, screw driver, etc.

g. PROCEDURE FOR SETTING TRIMMERS. In setting up equipment these steps can be followed regardless of the type of electronic voltmeter used.

(1) Remove the chassis of the radio receiver and transmitter from its case by removing all screws, or unfastening the catch clips around the edge of the panel and pulling the chassis forward.

(2) Set switches SW1 and SW2 at OFF. Set panel meter switch at CHECK.

(3) Insert the required crystals in the proper channel sockets. The nameplates should face outward, away from each other. Plug in the handset.

(4) Set the locknuts on trimmers A1 (B1) through A7 (B7) with Alignment Tool TL–207 until the trimmer adjusting shafts are taut. *Do not tighten them so that trimmer shafts jam. Do not tighten locknuts further after presetting as further tightening tends to change the adjustment and may damage the capacitors.*

(5) Set each trimmer to its approximate setting as shown in the following chart:

Table IV. Approximate trimmer settings

Channel	A1–B1 recvr. osc.	A2–B2 mixer	A3–B3 r-f grid	A4–B4 Xmtr. osc.	A5–B5 buffer	A6–B6 PA	A7–B7 PA plate
270	0.0	1.0	0.8	0.2	0.4	0.0	1.0
280	0.6	1.9	1.4	1.2	1.2	0.7	1.8
290	1.4	2.4	2.0	1.7	1.7	1.3	2.4
300	2.2	3.0	2.4	2.3	2.2	1.8	2.8
310	2.9	3.6	3.1	2.8	2.7	2.3	3.1
320	3.6	4.1	3.8	3.5	3.3	3.0	3.8
330	4.0	4.2	4.2	3.9	3.7	3.4	3.9
340	4.1	4.6	4.5	4.2	3.9	3.7	4.0
350	4.6	5.0	4.7	4.5	4.0	3.9	4.1
360	4.9	5.2	4.8	4.8	4.5	4.2	4.2
370	5.4	5.5	5.2	5.2	4.9	4.6	4.7
380	5.6	5.6	5.3	5.5	5.0	4.8	4.8
389	5.8	5.8	5.4	5.9	5.1	5.0	5.0

Note. Red dots on the trimmer shafts indicate the side of the slot that should be toward the dial card. The width of the slot is about one-tenth of a division. In case the red dot has worn off, its proper location can be found by fully meshing the capacitor. The end of the slot near the 0 of the 0–6 scale is the end that should carry the red dots.

Caution: In adjusting the trimmers in the following operations they need not be turned very far from the approximate setting shown in the chart. If it does appear necessary to turn them far from these settings, it means that some adjustment has been incorrectly made, or that these capacitors are defective. Recheck your previous steps and examine the capacitors for misalignment of plates or breakage.

(6) Check the condition of Battery BA–41 by means of an electronic voltmeter by inserting the probe in pin jack No. 4 of the metering socket. Replace the battery if the voltage is less than 20 volts.

(7) Connect Radio Receiver and Transmitter BC–659–(*) to its source of power by joining the two halves of the power and control cable

connector. If Case CS–79–(*) is to be used, insert Adapter RS–259 (part of Maintenance Equipment ME–13–(*) and Alignment Equipment ME–73) between Battery BA–39 and its plug. Adapter RS–259 places a 500 ohm resistor in series with the high-voltage lead to protect the transmitter tubes while making adjustments. If Plate Supply Unit PE–117–C is to be used, the adapter is not necessary because of the voltage regulation characteristics of this plate supply unit.

(8) Presetting procedure using Voltohmmeter I–107–(*) or other electronic voltmeters.

(*a*) Set up and calibrate Voltohmmeter I–107–(*) as directed in TM 11–306. Connect the common lead alligator clip to the chassis, not to the front panel, of Radio Receiver and Transmitter BC–659–(*). The front panel, speaker, etc., are insulated from the chassis and you cannot use them as a return.

(*b*) Set panel meter switch at CHECK. Rotate volume control fully clockwise (right). Set CHAN switch at A or B, whichever is to be the lower frequency channel. Remember that the lower frequency channel must be preset first.

(*c*) The following steps preset the receiver. Do not press the microphone switch.

1. To check crystal activity, insert the meter probe in pin jack No. 1 of metering socket. A meter reading of approximately —15 volts or more indicates a good crystal.
2. Insert the probe in pin jack No. 2 of metering socket and tune A1 (or B1 if channel B is to be set first) for maximum meter reading.
3. Tune A2 (B2) for maximum noise in the handset.
4. Tune A3 (B3) for maximum noise in the handset.
5. Tune A7 (B7) for maximum noise in the handset.

Note. In steps 3, 4, and 5 it is recommended that the probe be inserted in pin jack No. 8 of metering socket and the meter be observed for a slight peak at maximum noise peak in order to obtain a fine adjustment. Use low range of meter for best sensitivity.

(*d*) The following steps preset the transmitter. Press the microphone switch only while making adjustments. Switches SW1 and SW2 in OFF position.

1. Insert the probe in pin jack No. 3 of metering socket. Slowly tune A4 (B4) about its approximate setting. You will see that more than one peak can be found. Choose the highest peak near the approximate setting and adjust A4 (B4) for maximum.

Note. If difficulty is experienced in distinguishing the right peak, the first r-f amplifier tube may be removed *for this step only.* This is tube VT–179 (V5).

2. Insert the probe in pin jack No. 4 of metering socket, press microphone switch, and note the reading on the electronic voltmeter. Then very carefully and slowly make a slight readjustment of A4 (B4) in the direction that brings the meter reading to —6 volts. Listen in the handset while making this adjustment. If a rushing background noise comes up, A4 (B4) has been moved too far. Go back to step 1 and get back on the correct peak again. Check that it is now possible to hear your voice in the phones when speaking into the microphone.
3. Insert the probe in pin jack No. 5 of metering socket, and tune A5 (B5) for maximum meter reading.
4. Check to see that the panel meter switch is at CHECK. The rest of these adjustments will be made using the panel meter.
5. Set switch SW1 to ON. Tune A6 (B6) for maximum reading on the panel meter.
6. Set switch SW2 to ON. Turn panel meter switch to OPER. Quickly tune A7 (B7) for *minimum* on the panel meter.

Caution: Do not press the microphone switch until you are ready to make the adjustment swiftly, as it is easy to ruin the p-a tube during this adjustment.

(*e*) The lower frequency channel is now completely preset. Set switches SW1 and SW2 at OFF, panel meter at CHECK, and CHAN switch at the other channel. Preset this channel in the same manner, tuning the other set of trimmers.

(*f*) Check to see that switches SW1 and SW2 are ON, replace the set in its case, and connect the antenna that will be used. Recheck A7 (B7) for minimum. There is a covered opening at the rear top of the case for this purpose. The panel meter should now read between 1.8 and 3 (OPER.).

14. Alignment Indicator

The alignment indicator consists of the essential components of Adapter M–399. The alignment indicator switch is mounted on a bracket on the end of the battery box. When the alignment indicator switch is at ALIGN, the receiver amplifier stage of the set is converted into a vacuum-tube voltmeter circuit, the meter on the front panel being utilized as an indicator. This makes possible the changing of channels as well as complete alignment of the set without using an external meter. When the alignment indicator switch is at OFF, the alignment indicator does not interfere with the normal use of the set.

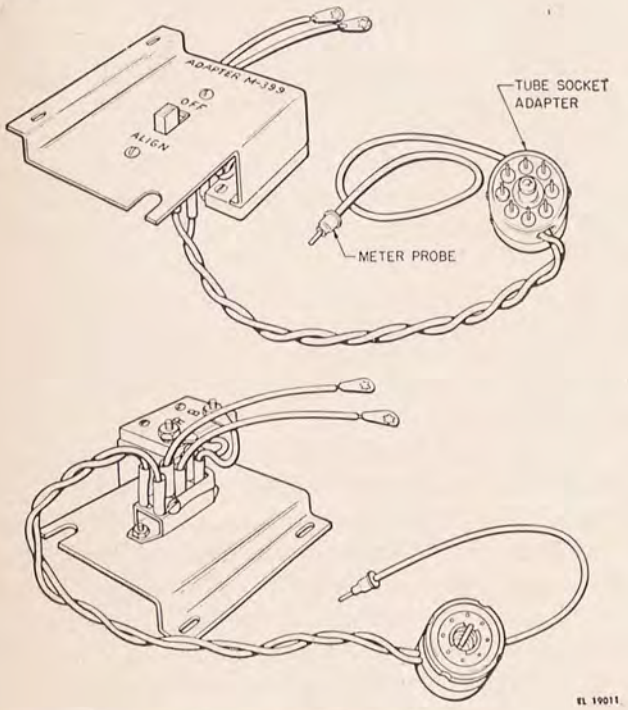


Figure 11. Adapter M–399.

15. Presetting Procedure Using Alignment Indicator

a. Check the alignment indicator before presetting. Set the OFF-ALIGN switch to ALIGN, VOLUME control full on, and note the panel meter reading. Turn the VOLUME control all the way back to the left from full on, and note the change in the meter reading. If the change is more than one division, try other tubes VT–185 in the receiver audio-frequency (a-f) p-a socket until one is found that is satisfactory. This tube should give a meter reading between 1.5 and 2.5. Next turn the volume control full on. Note the meter reading with the probe free (held away from the set); then ground the probe to the chassis. If the meter reading does not increase at least five divisions, check tube VT–185 and Battery BA–40. Replace either or both as necessary.

b. When the probe is not in use, place it in the Fahnestock clip. This clip is located on the bakelite strip held by the lower left speaker mounting screw, when viewed from the rear.

c. Set the OFF-ALIGN switch at ALIGN. Set switches SW1 and SW2 at the OFF positions. Set the panel meter switch at CHECK. Rotate the volume control fully clockwise and set the CHAN switch at A or B, whichever is to be the lower frequency channel. *Remember that the lower frequency channel is to be preset first. The receiver must be preset before the transmitter.*

d. To preset the *receiver,* proceed as follows: In adjusting the trimmers in the following operations, do not press the microphone switch. The trimmers need not be turned very far from the approximate settings shown in the table. If it is necessary to turn them far from these settings, some adjustment has been incorrectly made, or the capacitors are defective. Recheck the previous steps, and examine the capacitors for breakage or misalignment of plates.

(1) Check crystal activity by inserting the probe in pin jack No. 1 of the metering socket. With the volume control fully clockwise, the meter reading should be approximately zero for good crystals.

(2) Insert the probe in pin jack No. 2 of the metering socket, and tune A1 (B1) for minimum on the meter.

(3) Tune A2 (B2) for maximum noise in the handset.

(4) Tune A3 (B3) for maximum noise in the handset.

(5) Tune A7 (B7) for maximum noise in the handset.

(6) Repeat steps (3), (4), and (5).

Note. In order to obtain a fine adjustment in steps (3), (4) and (5), it is recommended that the probe be inserted in pin jack No. 8 of the metering socket. Observe the meter for a slight dip at the maximum noise peak. VOLUME control should be full on.

e. To preset the transmitter, proceed as follows:

(1) Insert the probe in pin jack No. 3 of the metering socket. Slowly tune A4 (B4) about its approximate setting. More than one dip will be found. Choose the dip that gives the *minimum* reading on the meter and is still near the approximate setting. Tune A4 (B4) accurately for

minimum in this dip.

Note. If it is difficult to distinguish the right dip, remove first r-f amplifier tube VT–179 (V5) for this step only.

(2) Calibrate the meter. Battery BA–41 in the set must be in good condition. Note the meter reading with the probe held free. Then note the meter reading with the probe grounded to the chassis. Reduce the volume control setting until the difference between the two readings is exactly four and one-half divisions. *Do not disturb the volume control setting during the following operations.*

(3) Press the microphone switch and note the reading with the probe held free. Insert the probe in pin jack No. 4 of the metering socket. Then very carefully and slowly make a *slight* readjustment of A4 (B4) in the direction that brings the meter reading to *exactly* one division less than it was with the probe free. Listen in the receiver of the handset while making this adjustment. If a rushing background noise is heard, A4 (B4) has been moved too far. Go back to *e*(1) above and tune for the correct dip again. Speak into the microphone. If your voice can be heard in the receiver of the handset, this step has been made correctly.

(4) Insert the probe in pin jack No. 5 of the metering socket, and tune A5 (B5) for minimum on the meter.

(5) Set the OFF-ALIGN switch at OFF. Place the probe in the Fahnestock clip on the speaker mounting screw. Make the rest of these adjustments, using the panel meter in its normal circuits.

(6) Set switch SW1 at ON. Tune A6 (B6) for maximum reading on the panel meter.

(7) Set switch SW2 at ON. Turn the panel meter switch to OPER. Quickly tune A7 (B7) for the minimum on the panel meter.

Caution: Do not press the microphone switch until the adjustment is ready to be made, as the p-a tube may be easily damaged during this adjustment.

Note. It should not be necessary to turn A7 (B7) more than slightly from the setting made in *d*(5) above, as A7 (B7) should already be part way into the dip. If the meter needle is not in the dip, A4 (B4) is probably adjusted to a false dip. It will therefore be necessary to go back to (1) above and start over.

f. The lower frequency channel is now completely preset. Set switch SW1 and SW2 to OFF, panel meter switch at CHECK, and CHAN switch at the other channel. Preset the channel in the same manner tuning the other set of trimmers.

g. Make sure that switches SW1 and SW2 are ON, replace the set in the case, and connect the antenna to be used. Recheck A7 (B7) for minimum. There is a cover opening at the rear top of the case for this purpose. The panel meter should now read between 1.8 and 3.0 (OPER).

h. The following alignment procedure uses Alignment Equipment ME–73 and the alignment indicator which is built into Radio Receiver and Transmitter BC–659–J.

(1) Check for the proper functioning of the alignment indicator as described in paragraph 15.

(2) Insert the 4.3-mc crystal (part of ME–73) in either crystal socket, and set the CHAN switch accordingly. Set the OFF-ALIGN switch at ALIGN.

(3) Rotate the VOLUME control of Radio Receiver and Transmitter BC–559–J fully clockwise (to the right).

(4) Insert the probe in pin jack No. 3 of the metering socket. Adjust the secondary (bottom) and the primary (top) of the i-f transformers T4, T3, and T2 in that order for minimum on the panel meter. If the meter goes to zero, reduce the volume control setting.

(5) Readjust the primary and secondary of T2, T3, and T4 in that order. The i-f amplifier is now aligned.

(6) Note the panel meter reading with the probe grounded to the chassis (VOLUME control full on). This is a zero voltage reading.

(7) Insert the probe in pin jack No. 7 of the metering socket. Adjust the secondary of discriminator transformer T5 until the meter indication is the same as in (6) above.

(8) Insert the probe in pin jack No. 8 of the metering socket and adjust T5 primary for minimum on the panel meter.

(9) Check the secondary of T5 as described in subparagraph (7) above, and readjust to 0 volts if necessary. The discriminator is now aligned.

(10) Turn the set off. Set OFF-ALIGN switch at OFF, and remove the 4.3-mc crystal. Place the probe in the Fahnestock clip on the speaker mounting screw. Replace the channel crystals in their proper sockets, and check the presetting adjustment for both channels. Return the set to its case.

16. I-f and Discriminator Alignment

a. In addition to the equipment mentioned in paragraph 15, a means of generating a signal

at the intermediate frequency (4.3 mc) is required. Maintenance Equipment ME–13–(*) includes Oscillator VO–4–(*). Alignment Equipment ME–73 includes a 4.3 mc crystal that is used in the receiver oscillator circuit.

b. Set up equipment and remove crystals from the set.

c. The following alignment procedure using Maintenance Equipment ME–13–(*) is based on the use of Voltohmmeter I–107–(*) as an indicator. However, any other electronic voltmeter will serve equally well.

(1) Set up and calibrate Voltohmmeter I–107–(*) as indicated in TM 11–306. Connect the common lead alligator clip to the chassis of Radio Receiver and Transmitter BC–659–(*).

(2) Set up Oscillator VO–4–(*) as indicated in TM 11–306 and set its switch at 4.3 mc. Turn ATTENUATION control clockwise only enough to turn Oscillator VO–4–(*) on.

Note. During the i-f alignment, reduce the output of the oscillator whenever possible, by turning the attenuation control still further to the right. Work with as weak a signal as possible.

(3) Turn Radio Receiver and Transmitter BC–659–(*) on by means of the volume control. Do not connect the microphone.

(4) Connect the hot lead of the oscillator to pin jack No. 4 of mixer tube V7 (VT–178).

(5) Insert the meter probe in pin jack No. 3 of the metering socket. Adjust the secondary (bottom) and primary (top) of i-f transformers T4, T3, and T2 in that order for maximum on Voltohmmeter I–107–(*).

(6) Readjust the primary and secondary of T2, T3, and T4 in that order. The i-f amplifier is now aligned.

(7) Insert the probe in pin jack No. 7 of the metering socket. Using the full output of Oscillator VO–4–(*) and the lowest range of the voltmeter, adjust the secondary of discriminator transformer T5 for 0 volts.

(8) Insert the probe in pin jack No. 8 of the metering socket, and adjust transformer T5 primary for maximum on Voltohmmeter I–107–(*).

(9) Check the secondary of transformer T5 as in step (7) and readjust it to zero if necessary. The discriminator is now aligned.

(10) Turn the set off, disconnect the test equipment, and replace the crystals. Be sure that the crystals are inserted in the proper channel sockets. Check presetting adjustments for both channels.

17. Neutralization

a. GENERAL. Neutralization of the final p-a stage should not be necessary unless the original setting of the neutralizing capacitors has been accidentally changed. Neutralizing capacitors C4 and C5 are accessible from the bottom of the chassis. Do not move them unless it actually becomes necessary to reneutralize the final p-a stage.

b. TO CHECK NEUTRALIZATION. (1) Remove the set from the case. Turn the panel meter switch to CHECK. Set switch SW2 at OFF and CHAN switch at A.

(2) Press the microphone switch and tune A7 through its range, watching for a dip on the panel meter.

(3) Repeat steps (1) and (2) above for channel B.

(4) If the dip is more than one division, the stage must be neutralized.

c. TO NEUTRALIZE. (1) Set CHAN switch at the higher frequency channel.

(2) Adjust capacitor C4 and C5 equally in small steps, checking between adjustments for dip as in *b*(2) above until the dip is less than one division. Settings of C4 and C5 must be kept approximately equal. Check by observing the mesh of the plates.

(3) Check dip on the other channel. The same adjustment of capacitors C4 and C5 must serve for both channels.

d. SWITCH CHANGE. Set switch SW1 at ON and the panel meter switch at OPER. Replace the set in its case.

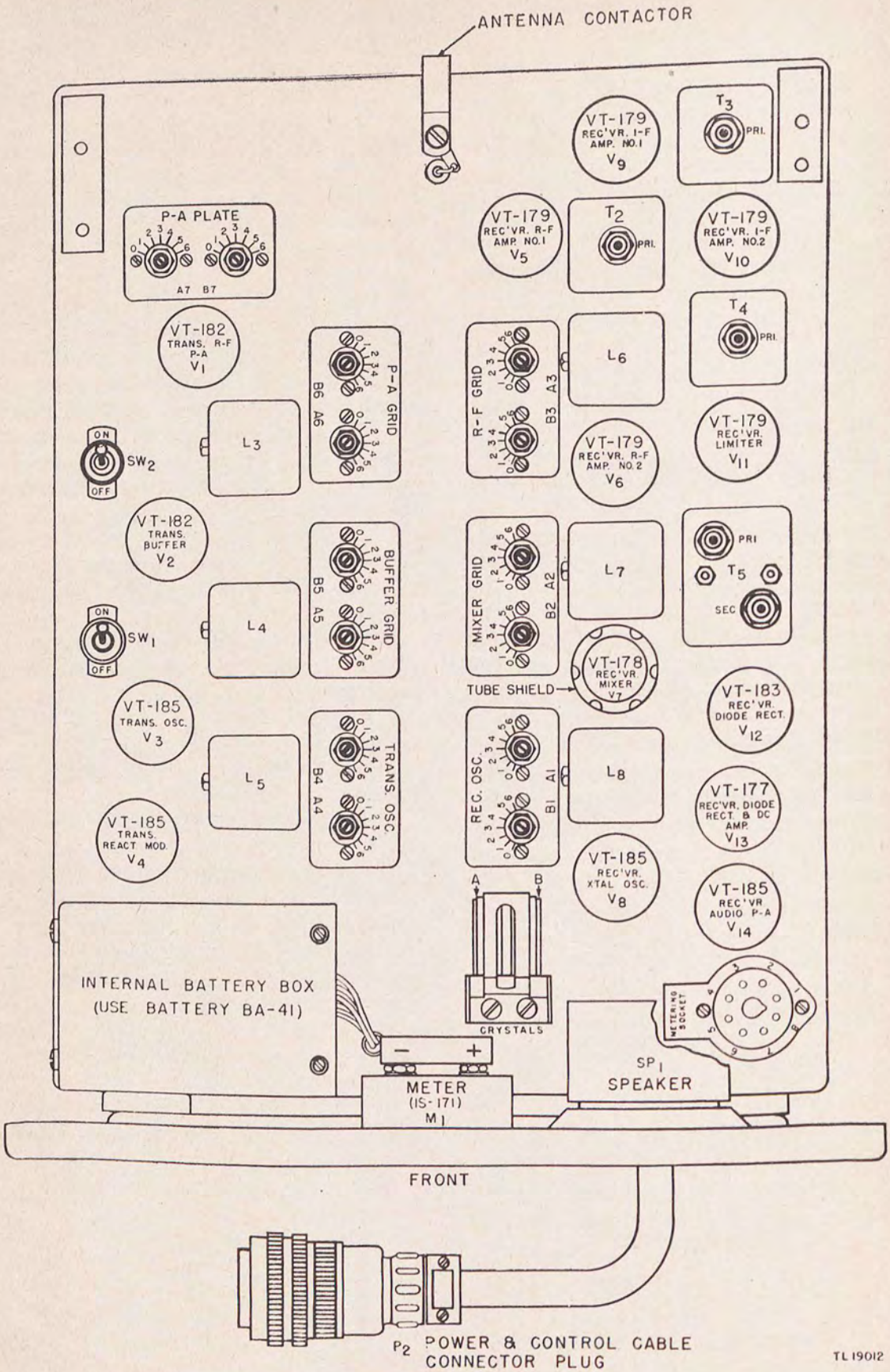


Figure 12. Top view of chassis, Radio Receiver and Transmitter BC–659–(*).

SECTION VI

DETAILED TROUBLE-SHOOTING PROCEDURES

18. Signal Substitution

a. GENERAL. If the set is inoperative or has weak output when aligned, the trouble may be localized to a particular stage by signal tracing or substitution. Such a system is outlined in this section.

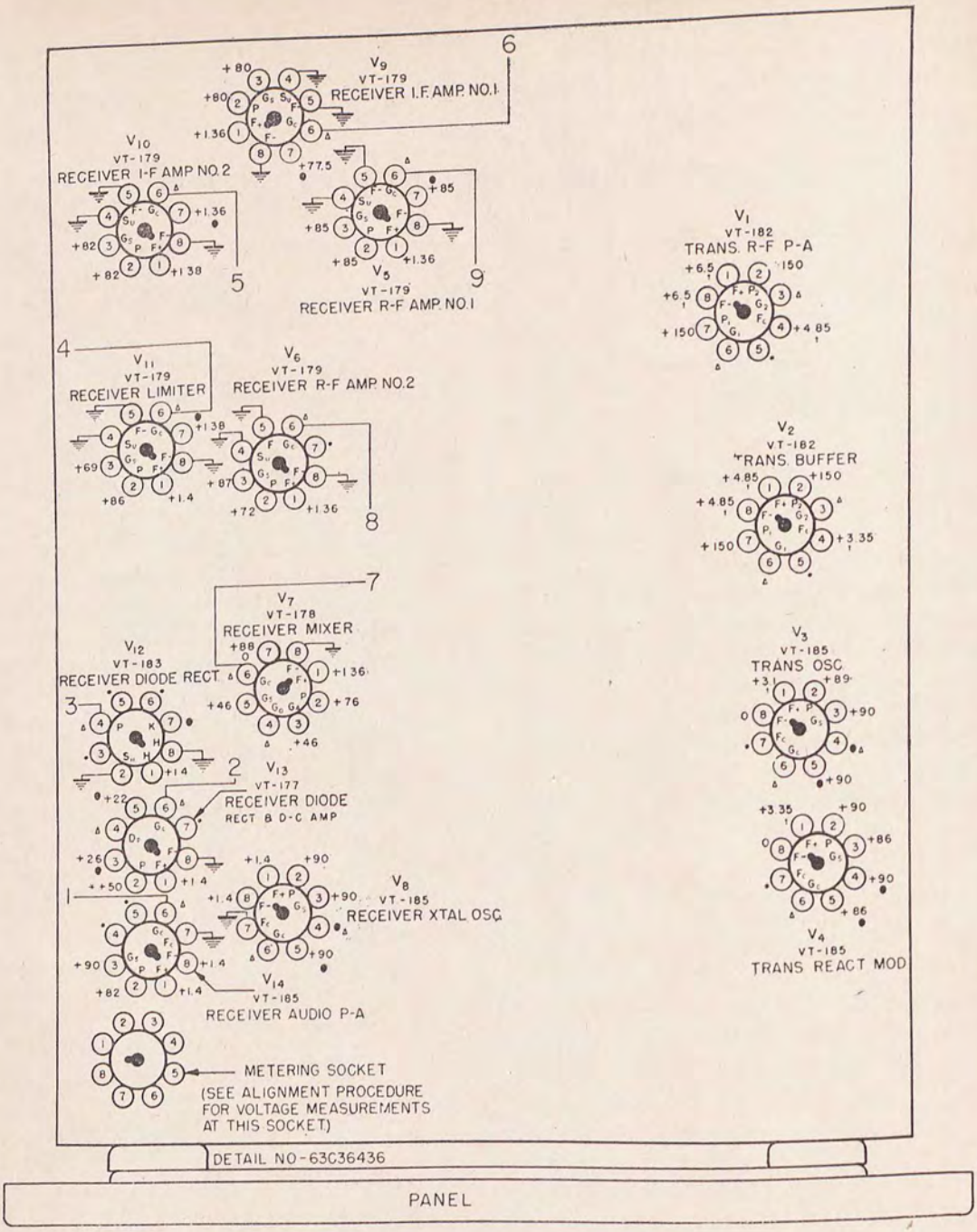
b. TEST EQUIPMENT. The following equipment is necessary: one a-f signal generator (250–3,000 cycles per second (cps)) and an r-f signal generator covering at least 3.0 to 40.0 mc. Maintenance Equipment ME–13–(*) includes Oscillator VO–4–(*). This may be substituted for the r-f signal generator. Alignment Equipment ME–73 includes a 4.3 mc crystal that is used for receiver oscillator circuit. An electronic voltmeter for measuring voltages at the metering socket which may be:

(1) Voltohmmeter I–107–(*) part of Maintenance Equipment ME–13–(*). (See TM 11–306.)

(2) The panel meter of Radio Receiver and Transmitter BC–659–(*) in conjunction with adapter M–399.

(3) Any other electronic voltmeter such as Hickok Model 202, RCA Voltohmyst, etc.

c. PROCEDURE. With the aid of figure 13 and table V, inject the signal within a particular stage. Apply the *hot* lead of the signal generator to the lug of the tube socket in accordance with figure 13. A signal should be heard in the phone or read on an output meter. See table VI for type of signal generator, frequency, and input voltage. After the trouble has been localized to a particular stage make a resistance and voltage check of the individual components using table VII to XX to locate the faulty part.



NOTE - VOLTAGES MEASURED IN 'RECEIVE' POSITION, EXCEPT WHERE NOTED. ALL VOLTAGES MEASURED BETWEEN CHASSIS AND SOCKET TERMINAL INDICATED; VALUES ARE IN D.C. VOLTS.

VOLUME CONTROL FULL ON.

METER SWITCH AT 'OPERATE'.

CHANNEL SWITCH 'A' OR 'B'.

VOLTAGES SHOWN ARE OBTAINED BY USING FRESH BATTERIES.

ALL VALUES SHOWN ARE NOMINAL.

VOLTAGES MEASURED WITH TUBE VOLTMETER (R.C.A. VOLT OHMYST, STOCK NO. 165), VOLT-OHMMETER 1-107-A OR B, OR EQUIVALENT.

* WITH ZERO DISCRIMINATOR VOLTS.

† WITH TRANSMITTER SWITCH ON 7V WITH TRANSMITTER SWITCH OFF.

• WITH TRANSMITTER SWITCH OFF.

• NO EXTERNAL CONNECTION.

Δ NOT MEASURED.

● SOCKET TERMINAL USED AS TIE OR DUMMY LUG ONLY. NO TUBE ELEMENT CONNECTS TO THIS LUG.

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Figure 13. Bottom view of chassis with step-by-step signal substitution procedure, Radio Receiver and Transmitter BC-659-(*).

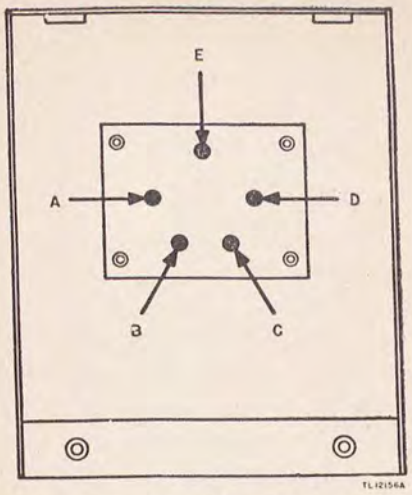


Figure 13A. Pin view of internal battery box plug.

Table V. Condition for signal substitution

Set	Set placed upside down, panel toward operator, case removed.
Power	Battery connected. Volume control panel ON.
Channel	Channel switch turned to either A or B.
Recvr-Xmtr	Set operating as receiver.
Signal Generator	Outside shield or cable marked ground of outside cable connected to set chassis (not front panel).
Meter switch	Meter switch is turned to OPER.

Table VI. Signal substitution steps

Step	Signal generator connected to	Frequency	Input voltage
1	Audio grid	1,000 or 400 cps.	1v
2	D-c amp. grid	1,000 or 400 cps.	1v
3	Receiver diode	1,000 or 400 cps.	1v
4	Limiter grid	4.3 mc	.01v
5	2d i-f amp	4.3 mc	.01v
6	1st i-f amp	4.3 mc	.01v
7	Mixer grid	R-f frequency*	.001v
8	2d r-f grid	R-f frequency*	.001v
9	1st r-f grid	R-f frequency*	.001v

*R-f frequency—of channel used.

Table VII. Transmitter r-f power-amplifier stage voltage and resistance measurements (V1)

Pin	Element	Volts	Resistance
1	Fil +	+6.5	1 megohm.
2	Plate	+115	Infinity.
3	Grid 2		2,800
4	Fil center	+4.85	Infinity.
5			Infinity.
6	Grid 1		2,800
7	Plate	+115	Infinity.
8	Fil	+6.5	1 megohm.

Table VIII. Transmitter buffer stage voltage and resistance measurements (V2)

Pin	Element	Volts	Resistance
1	Fil +	+4.85	Infinity.
2	Plate	+120	Infinity.
3	Grid 2		22 M.
4	Fil center	+3.35	Infinity.
5			
6	Grid 1		22 M.
7	Plate	+115	Infinity.
8	Fil	+4.85	Infinity.

Table IX. Transmitter oscillator voltage and resistance measurements (V3)

Pin	Element	Volts	Resistance
1	Fil	+3.1	Infinity.
2	Plate	+89	Infinity.
3	Screen	+90	Infinity.
4			
5	Terminal	+90	Infinity.
6	Control grid		Infinity.
7	Fil center tap		
8	Fil	0	Infinity.

Table X. Transmitter reactance modulator voltage and resistance measurements (V4)

Pin	Element	Volts	Resistance
1	Fil	+3.35	Infinity.
2	Plate	+90	Infinity.
3	Screen	+86	Infinity.
4		+90	Infinity.
5	Terminal	+86	Infinity.
6	Control grid		Infinity.
7	Fil center tap		
8	Fil	0	Infinity.

Table XI. Receiver r-f amplifier voltage and resistance measurements (V5)

Pin	Element	Volts	Resistance
1	Fil	+1.36	Infinity.
2	Plate	+85	Infinity.
3	Screen	+85	Infinity.
4	Suppressor	0	
5		0	
6	Control grid		470 M.
7	Terminal	+85	Infinity.
8	Fil	0	

Table XII. Receiver 2d r-f amplifier voltage and resistance measurements (V6)

Pin	Element	Volts	Resistance
1	Fil	+1.36	Infinity.
2	Plate	+72	Infinity.
3	Screen	+87	Infinity.
4	Suppressor	0	
5	Fil center tap	0	
6	Control grid		0
7			
8	Fil	0	

Table XIII. Receiver mixer voltage and resistance measurements (V7)

Pin	Element	Volts	Resistance
1	Fil	+1.36	Infinity.
2	Plate	+76	Infinity.
3	Osc anode	+46	Infinity.
4	Osc grid		270 M.
5	Screen	+46	Infinity.
6	Control grid		Infinity.
7	Terminal point	+88	Infinity.
8	Fil	0	

Table XIV. Receiver oscillator voltage and resistance measurements (V8)

Pin	Element	Volts	Resistance
1	Fil	+1.4	Infinity.
2	Plate	+90	Infinity.
3	Screen	+90	Infinity.
4	Control grid		1.47 meg.
5	Terminal point	+90	Infinity.
6	Control grid		470 M.
7	Fil center tap	0	
8	Fil	+1.4	Infinity.

Table XV. Receiver 1st i-f voltage and resistance measurements (V9)

Pin	Element	Volts	Resistance
1	Fil	+1.36	Infinity.
2	Plate	+80	Infinity.
3	Screen grid	+80	Infinity.
4	Suppressor	0	
5		0	
6	Control grid		27
7	Terminal point	+77.5	Infinity.
8	Fil	0	

Table XVI. Receiver 2d i-f voltage and resistance measurements (V10)

Pin	Element	Volts	Resistance
1	Fil	+1.38	Infinity.
2	Plate	+82	Infinity.
3	Screen grid	+82	Infinity.
4	Suppressor	0	
5		0	
6	Control grid		2.7
7	Terminal point	+1.36	Infinity.
8	Fil		

Table XVII. Receiver limiter voltage and resistance measurements (V11)

Pin	Element	Volts	Resistance
1	Fil	+1.4	Infinity.
2	Plate	+86	Infinity.
3	Screen grid	+69	Infinity.
4	Suppressor	0	
5	Fil	0	
6	Control grid	0	100 M.
7	Terminal point	+1.38	Infinity.
8	Fil	0	

Table XVIII. Receiver diode rectifier voltage and resistance measurements (V12)

Pin	Element	Volts	Resistance
1	Fil	+1.4	Infinity.
2	Terminal point	0	
3			
4	Plate		270 M.
5			
6			
7	Cathode	0	540 M.
8	Fil	0	

Table XIX. Receiver diode rectifier and d-c amplifier voltage and resistance measurements (V13)

Pin	Element	Volts	Resistance
1	Fil	+1.4	Infinity.
2	Plate	+50	Infinity.
3	Terminal point	+26	Infinity.
4	Diode		270 M.
5		22	Infinity.
6	Control grid		
7			540 M.
8	Fil	0	

Table XX. Receiver audio voltage and resistance measurements (V14)

Pin	Element	Volts	Resistance
1	Fil	+1.4	Infinity.
2	Plate	+82	Infinity.
3	Screen grid	+90	Infinity.
4			
5			
6	Control grid		Infinity.
7	Fil center tap	0	
8	Fil	+1.4	Infinity.

19. Normal Point-to-point Resistance Values

a. NORMAL RESISTANCE VALUES OBTAINED BY POINT-BY-POINT MEASUREMENTS. Normal resistance values obtained by point-to-point measurements on Radio Receiver and Transmitter BC–659–(*) in a satisfactory condition, are indicated below. Use of this data in connection with similar measurements on faulty equipment, combined with a logical circuit analysis, will frequently disclose the source of trouble in an improperly operating or dead receiver and transmitter. The readings were taken under the following conditions, and these must be reproduced exactly if comparison measurements on a faulty unit are to be effected.

(1) *Remove all tubes.* Besides producing erroneous readings, tube filaments can be burned out by the high ohmmeter current used in some ohmmeters.

(2) *Turn meter switch to OPER.* This position affords the meter greatest protection (prevents high ohmmeter current from flowing through meter) and prevents erroneous readings by removing the shunting effect.

(3) *Remove battery BA–41.* Besides providing false ohmmeter readings, the ohmmeter may be damaged by battery current.

(4) Turn the volume knob fully clockwise, turning the power switch on and the volume control to maximum.

(5) The channel switch may be at A or B.

(6) Both the microphone and headphone must be disconnected from the set.

(7) All readings were taken on the voltohmmeter unit of Signal Corps Test Set I–56–(*). The meter scale used should give the greatest usable deflection. In general, ohmmeter readings will be more accurate when taken on the upper two-thirds of the scale, and whenever possible, the range should be chosen that will give indications in this region.

b. POWER AND CONTROL CABLE PLUG POINT-TO-POINT RESISTANCE VALUES. All measurements are made between plug pins and chassis. Pins on plug are identified by letters.

Pin No.	Resistance to chassis
A	Open
B	Open
C	Open
D	Open
E	Open
F	1 megohm minimum (depends on current leakage through electrolytic capacitor C31).
G	Open
H	0 ohm

c. INTERNAL BATTERY PLUG RESISTANCE VALUES FOR BATTERY BA–41. All measurements made as indicated in chart below. Pins are identified by letters as shown in figure 13A. The pin identifying letters do not appear on the plug.

Reading between	Resistance
Pin A and chassis	Open
Pin B and chassis	Open
Pin C and chassis	Open
Pin D and chassis	0 ohm
Pin E and chassis	Open
Pin A and pin B	1 megohm

Table XXI. Normal choke coil and transformer d-c resistance values BC–659–(*)

Ref No.	Description	D-c resistance
CH1	Choke, r-f	0.13 ohms
CH2	Choke, r-f	40 ohms
CH3	Choke, r-f	40 ohms
CH4	Choke, r-f	0.13 ohms
CH5	Choke, r-f	40 ohms
CH6	Choke, r-f	10 ohms
CH7	Choke, r-f	0.13 ohms
CH8	Choke, r-f	40 ohms
CH9	Choke, r-f	0.13 ohms
CH10	Choke, r-f	0.13 ohms
L1	Coil, antenna loading*	
	1–2	0.024 ohms
L2	Coil, power amplifier plate*	
	1–2	0.012 ohms
	1–3	0.009 ohms
	1–4	0.007 ohms
L3	Coil and shield, power-amplifier*	
	1–2	0.006 ohms
	1–3	0.012 ohms
L4	Coil and shield, buffer grid*	
	1–2	0.107 ohms
	1–3	0.034 ohms
L5	Coil and shield, transmitter oscillator*	
	2–1	0.017 ohms
	2–3	0.032 ohms
	2–4	0.089 ohms
L6	Coil and shield, r-f grid*	
	1–3	0.019 ohms
L7	Coil and shield, mixer grid*	
	1–3	0.019 ohms

*See figure 29.

Table XXII

Ref No.	Description	D-c resistance
L8	Coil and shield, receiver oscillator*	
	1–2	0.019 ohms
T1	Transformer, microphone	
	1–2	3 ohms
	3–4	225 ohms
T2	Transformer and shield, 1st i-f*	
	1–2	2.7 ohms
	3–4 and 5	2.7 ohms
T3	Transformer and shield, 2d i-f*	
	1–2	2.7 ohms
	3–4	2.7 ohms
T4	Transformer and shield, 3d i-f*	
	1–2	2.7 ohms
	3–5	2.7 ohms
	5–4	100,000 ohms
T5	Transformer and shield, discriminator*	
	1–2	1.7 ohms
	5–3	1.8 ohms
	5–4	0.9 ohms
T6	Transformer, output	
	1–2	750 ohms
	3–4	0.35 ohms (with speaker disconnected)

*See figure 29.

20. Moistureproofing, Fungiproofing, and Refinishing

After the set has been repaired and is functioning correctly a check should be made of the date of the last moistureproofing and fungiproofing treatment. If new treatment is required, see TB SIG–13 and TM 11–615 for the method of application. If the receiver has been scarred or chipped, remove any rough paint and touch up spots with a small brush. If the case is sufficiently scarred and scratched to warrant complete refinishing, remove the chassis from the case and mask or remove parts which are not to be refinished. Spray the entire case with the proper paint authorized by existing regulations.

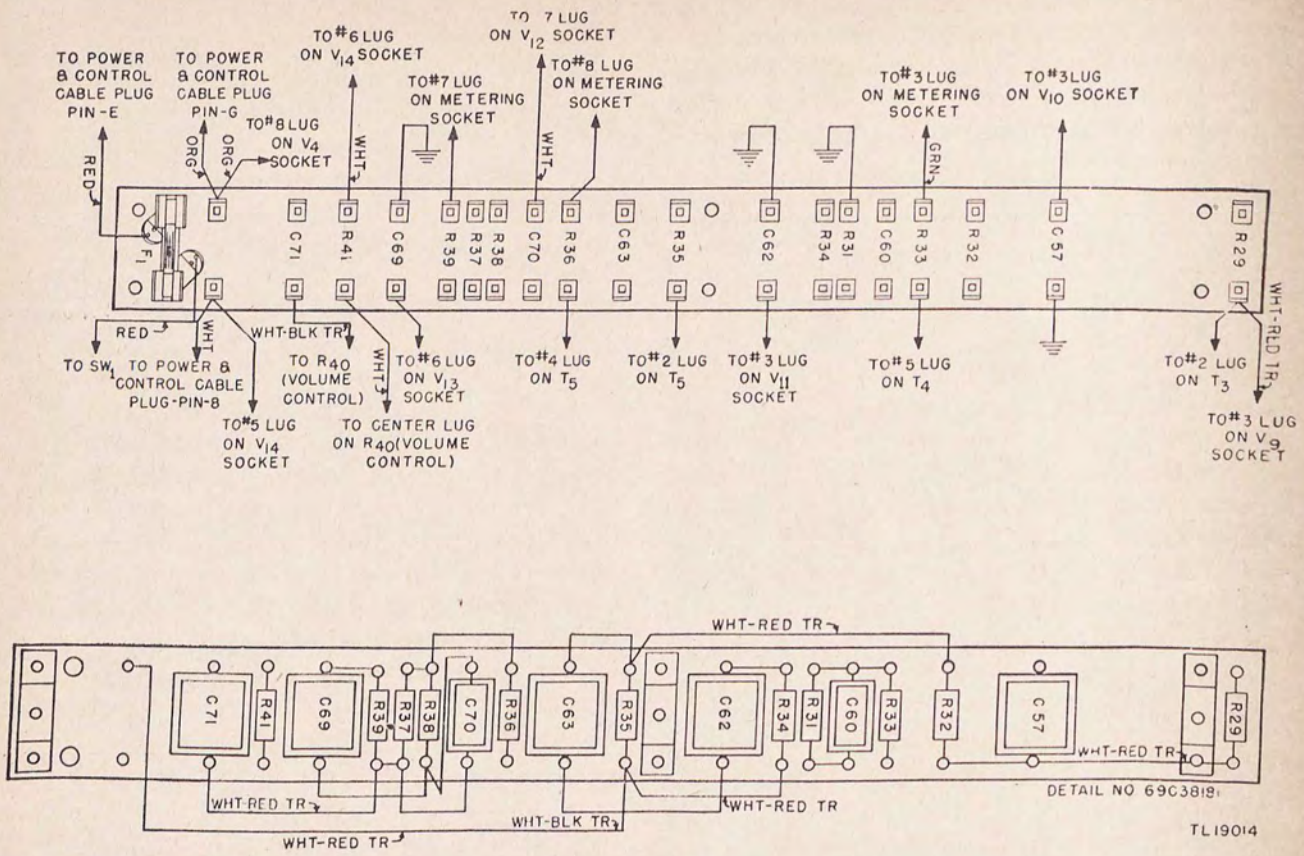


Figure 14. Terminal Board View, Radio Receiver and Transmitter BC–659–(*).

SECTION VII

FINAL TESTING

21. Alignment Check

Although the unit was correctly aligned during the repair procedure, a recheck of set alignment is necessary after the moistureproofing and fungiproofing treatment has been completed. Check alignment as shown in section V. After the alignment has been checked, over-all performance tests are made as outlined below.

22. I-f Selectivity Test

For testing i-f selectivity follow the procedure outlined below.

a. Adjust the signal generator to i-f frequency 4.3 mc and connect it to pin No. 6 of the converter tube.

b. Adjust the signal generator voltage to give 1 volt at pin No. 3 of the metering socket.

c. BANDWIDTH DETERMINATION. Double the output voltage of the signal generator.

(1) Vary frequency of signal generator of i-f in turn until at each frequency extreme output of radio set reads 1 volt at pin No. 3 of the metering socket.

(2) Bandwidth is the difference in frequency readings. Bandwidth shall be between 45 kc and 60 kc.

(3) Repeat the same procedure with the signal generator voltage output 10 times the value in *b* above. Bandwidth limits should be between 45 kc and 120 kc.

(4) Repeat the same procedure at 100 times the signal generator voltage of *b* above. Bandwidth limits should be between 45 kc and 200 kc.

(5) Repeat same procedure at 1,000 times the signal generator voltage. Bandwidth shall be between 45 kc and 300 kc.

23. I-f Rejection Ratio Test

a. For testing i-f rejection ratio follow the procedure outlined below.

(1) Connect the signal generator to the antenna through a 2,000-ohm resistor.

(2) Connect the chassis of the receiver to ground.

(3) Tune the receiver to 38.9 mc.

b. Set the signal generator at the i-f frequency (4.3 mc). Adjust the generator voltage to a 10-microvolt (μv) output.

c. Record voltage reading at pin No. 3 of the meter socket. This reading is V in *e* below.

d. Set signal generator at 38.9 mc, and adjust voltage output of the signal generator so that it reads the same on pin No. 3 as in *c* above. Record signal generator output on chart. This reading is V2 in *e* below.

e. The ratio $\frac{V}{V2}$ of the signal generator output voltages is the i-f rejection ratio. It shall be greater than 40,000 to 1. Formula: i-f rejection ratio $= \frac{V}{V2}$.

24. D-c Amplifier Gain Test

For testing d-c amplifier gain follow the procedure outlined below.

a. Connect the signal generator to pin No. 6 of the mixer tube and set it at 4.3 mc.

b. Adjust the signal generator to give —6 volts on pin No. 4 of the meter socket. This voltage is E1 in *d* below.

c. Record the voltage on pin No. 7 of metering socket, then change frequency of the signal generator until voltage at pin No. 7 shifts by 0.1 volt. Note the voltage at pin No. 4 of the metering socket. This reading is E2 in *d* below.

d. Difference between the readings of voltages on pin No. 4 (E1 — E2), multiplied by 10 is the d-c gain. It should not be less than 15.

25. Image Rejection Ratio Test

For testing image rejection ratio follow the procedure outlined below.

a. Connect the signal generator as in paragraph 23.

b. With the signal generator set to 30.3 mc, adjust the generator output to 10 mv. This read-

ing is G in subparagraph *d* below. Note reading at pin No. 3 of the metering socket.

c. Set the signal generator to 38.9 mc and adjust its output to give the same reading at pin No. 3 as in subparagraph *b* above. Note the output voltage of the signal generator. This reading is G2 in *d* below.

d. The ratio $\frac{G}{G2}$ of the two signal generator voltages is the image rejection ratio. It shall not be less than 2,000 to 1.

26. Receiver Sensitivity Test

For testing receiver sensitivity follow the procedure outlined below.

a. Connect the signal generator as in paragraph 23.

b. Adjust the generator output to give 1 volt at pin No. 3 of the metering socket at each of the following frequencies: 27.2 mc, 33.5 mc, and 38.9 mc.

c. The signal generator output must not exceed 20 mv.

27. Audio-frequency Response Test

a. PROCEDURE. For testing a-f frequency response follow the procedure outlined below.

(1) Connect the audio oscillator to pin No. 7 of the metering socket.

(2) Adjust it so that 2.7 volts are applied.

b. MEASUREMENT OF AUDIO OUTPUT. The receiver output is fed to a 10,000-ohm impedance output meter, and the audio output measured as various audio frequencies are applied. Limits for acceptance should be as listed below:

Table XXIII. Frequency response

Frequency setting	Minimum output in volts
250 cps	8.4
1,000 cps	18.3
3,000 cps	20

28. Transmitter Power Output

For testing transmitter power output follow the procedure outlined below.

a. Check the power output of the transmitter at 27.2 mc, 33.5 mc and 38.9 mc. Use a 300-ohm carbon resistor in series with a 0 to 100 r-f milliameter, connected across the antenna post and chassis. This simulates the equivalent radiation resistance of a half-wave vertical antenna.

b. Minimum output should be at least 65 ma on all frequencies.

29. Transmitter Neutralization

For testing transmitter neutralization follow the procedure outlined below.

a. Turn the final amplifier switch OFF.

b. See that PLATE CHECK OPER. switch, on the front panel, is at CHECK.

c. Tune the final amplifier capacitor through resonance.

d. Observe the panel meter. It should not deflect more than 1 division.

e. Conduct this test at 27.3 mc, 28.1 mc, 35.5 mc and 38.0 mc.

SECTION VIII

INDIVIDUAL STAGE AND CIRCUIT REPAIR DATA

30. Filament Circuit

The filament circuit, because of the many bypass capacitors, can give troubles which will be indicated as shorts or leaks in the power cable plug. Check for proper resistance measurements.

*Table XXIV. Filament trouble location**

Pin C	Pins F and G
C31	C29
C36	J
C47	C11
C52	C23
C56	
C61	

*Shorts or unusually high leakage in the pin connections will indicate faulty components listed.

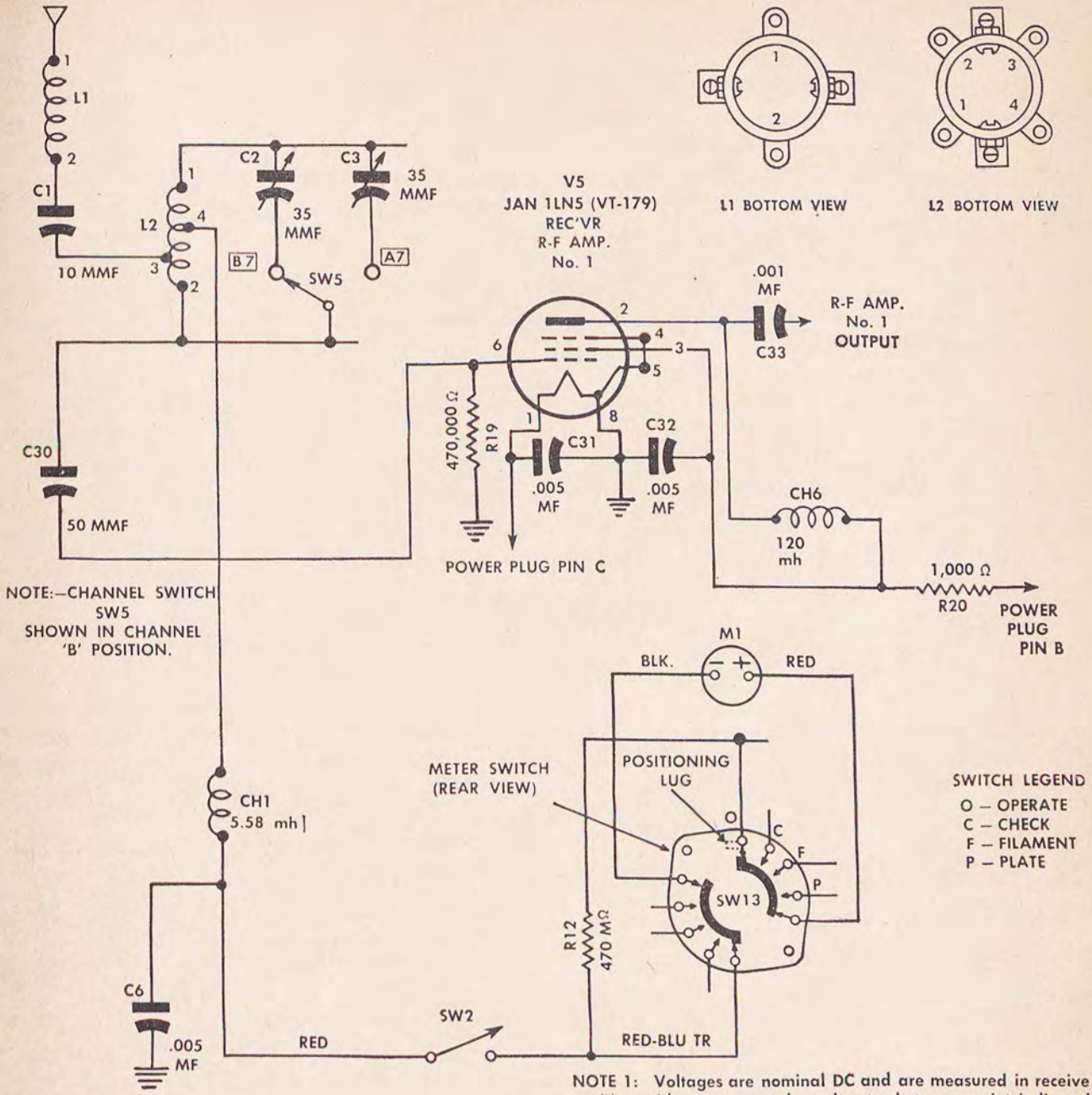
31. Receiver R-f Amplifier No. 1

a. GENERAL. If in signal tracing the results indicate the receiver r-f amplifier to be inoperative, trouble may be readily located by reference to the voltage and resistance chart.

b. VOLTAGE CHECK. If there is an absence of plate voltage, check choke CH6 and resistor R20 for continuity. If the voltage, as applied to the plate, is low, capacitor C32 might be found to be leaking. If voltages are found to be normal check capacitor C33 for open. This is usually done by placing a capacitor of approximately the same value in parallel with the component being tested. If trouble is not located in the above steps, the grid circuit and tuning components should be checked. Capacitor C30 should be checked for open. Such a condition will prevent the injection of the r-f signal on the grid of V5. If capacitor C30 is shorted, the voltage on the grid pin No. 6 will be highly positive. Resisitor R19 would show evidences of burning if this condition were allowed to persist. Check resistor R19 for proper value. Should resistor R19 be open the r-f stage would in some cases motorboat. (Motorboating is a very low-frequency audio oscillation). See the transmitter r-f power-amplifier stage repair for tests on the tuning section.

Table XXV. Receiver r-f amplifier No. 1 (fig. 15)

Ref No.	Signal Corps stock No.	Name of part and description	Function
C31		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Filament bypass, V5.
C32		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Screen grid bypass, V5.
C33	3DA1–48	CAPACITOR: fixed; 0.001-mf, +14%, —6%, 300 vdcw.	Coupling V5 to V6.
CH6	3C362–2	CHOKE: r-f; 120 mh at 1,000 cycles.	Plate, V5.
R19	3Z6747–10	RESISTOR: fixed; carbon, insulated, 470,000 ohms ±10%, ½-watt.	Control grid, V5.
R20	3Z6100–9	RESISTOR: fixed; carbon, insulated, 1,000 ohms ±10%, ½-watt.	B+ decoupling V5.
V5		TUBE JAN 1LN5 (VT–179).	Receiver r-f amplifier No. 2.



NOTE 1: Voltages are nominal DC and are measured in receive position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in.

NM — Not measured. NC — Not connected.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON. Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM — Not measured. NC — Not connected.

NOTE 3: Socket terminal used as tie or dummy lug only. No tube element connects to this lug.

TL 19015

Figure 15. Schematic wiring diagram first r-f stage, Radio Receiver and Transmitter BC–659–(*).

32. R-f Amplifier No. 2

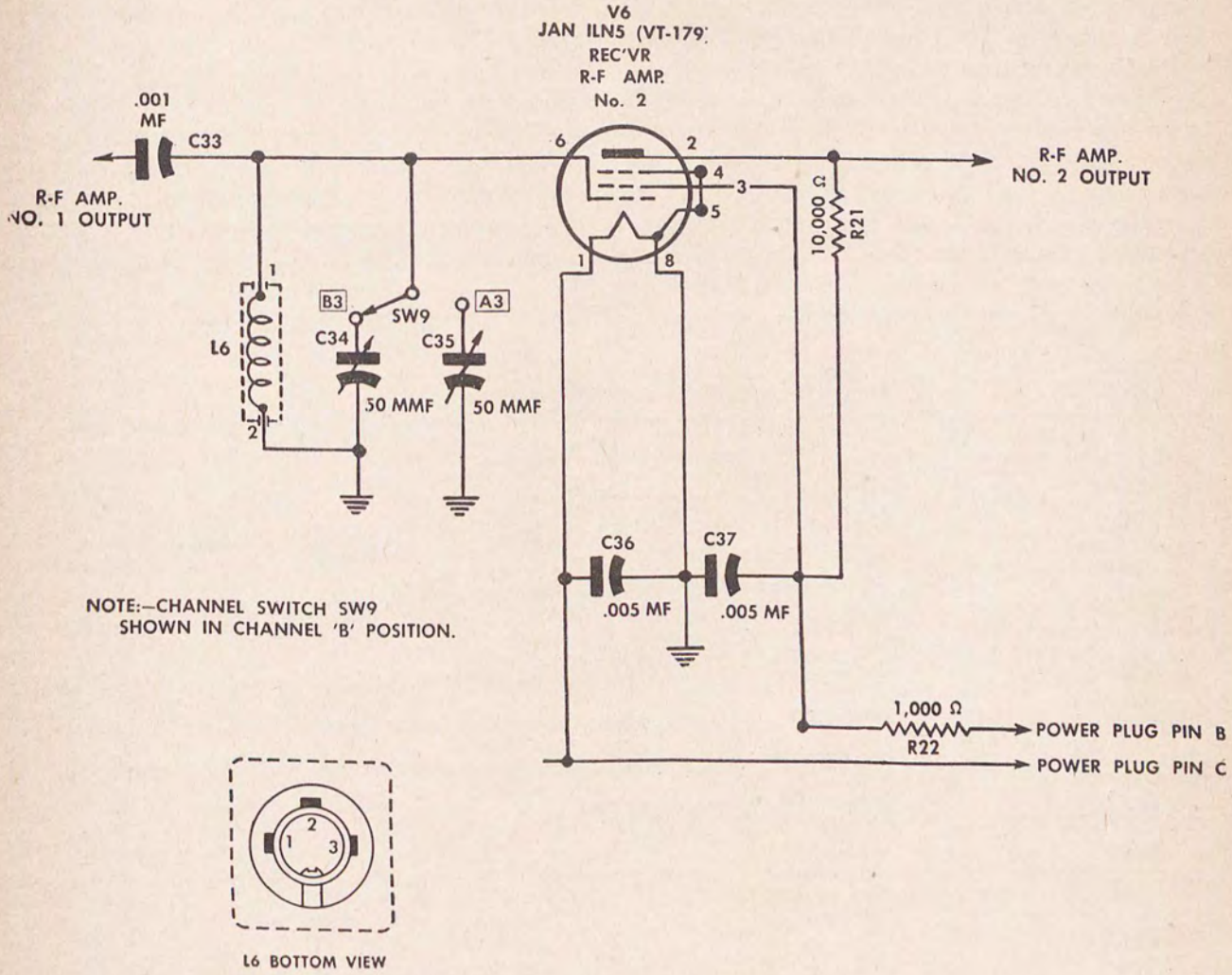
a. GENERAL. See paragraph 18 *a.*

b. VOLTAGE CHECK. If there is an absence of plate voltage check resistors R21, R22, and also capacitor C37. The components should be checked for proper value. In the case of capacitors check for short. If the voltage as applied to the plate is low, check capacitor C38 and C37 for leakage. Resistors R21 and R22 should be checked for proper resistance values. If trouble is not located by voltage checks trouble may be located in the grid or grid tuning circuits. Check coil L6 for continuity and switch SW9 for proper contact with B3 and A3 capacitors. Additional trouble may be encountered in the form of motorboating due to open capacitors C36 or C37.

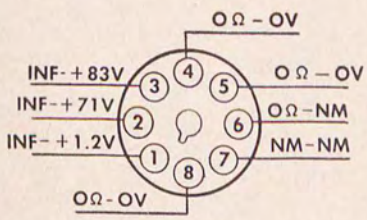
Table XXVI. Receiver r-f amplifier No. 2 (fig. 16)

Ref. No.	Signal Corps stock No.	Name of part and description	Function
C34	3D9050–V–29	CAPACITOR: variable; 50-mmf, maximum.	Tuning L6, channel B.
C35	3D9050V–30	CAPACITOR: variable; 50-mmf, maximum.	Tuning L6, channel A.
C36		CAPACITOR: fixed; 0.005-mf +80%, —20%, 300 vdcw.	Filament bypass, V6.
C37		CAPACITOR: fixed; 0.005-mf +80%, —20%, 300 vdcw.	B+ bypass, V6.
C38	3DA1–48	CAPACITOR: fixed; 0.001-mf +14%, —6%, 300 vdcw.	Coupling V6 to V7.
L6	2C5379( )/C3	COIL AND SHIELD: r-f grid.	Grid, V6.
R21	3Z6610–7	RESISTOR: fixed; carbon, insulated, 10,000 ohms ±10%, ½-watt.	Plate load, V6.
R22	3Z6100–9	RESISTOR: fixed; carbon, insulated, 1,000 ohms ±10%, ½-watt.	B+ decoupling, V6.
SW9		SWITCH: channel changing.	V6 grid.
V6		TUBE JAN 1LN5 (VT–179).	Receiver r-f amplifier No. 2.

*Switch SW9 is part of channel changing switch 3Z8311–1.



L6 BOTTOM VIEW



NOTE 1: Voltages are nominal DC and are measured in receive position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in.

NM – Not measured. NC – Not connected.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON. Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM – Not measured. NC – Not connected.

TL19016

Figure 16. Schematic wiring diagram second r-f stage, Radio Receiver and Transmitter BC–659–(*).

33. Receiver Mixer Stage

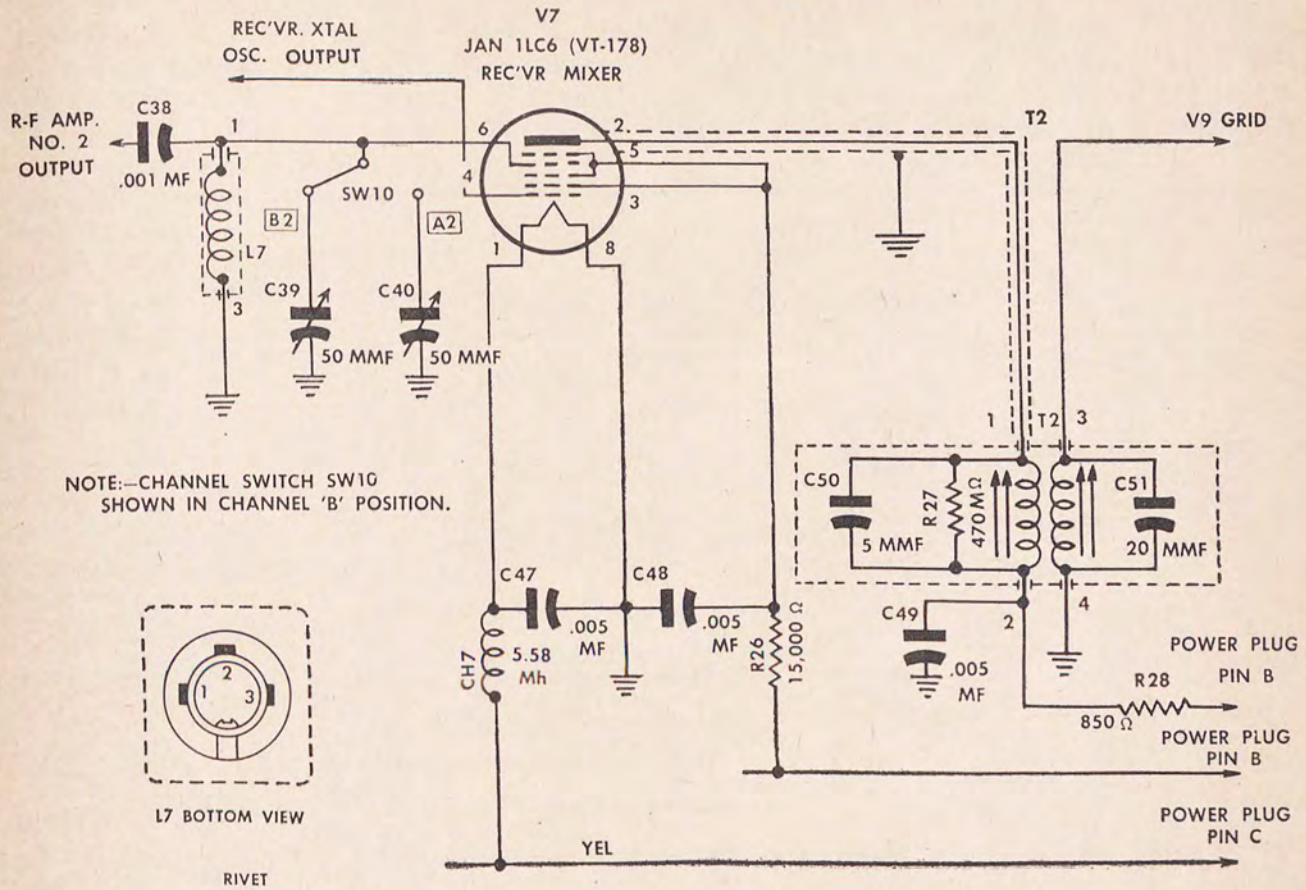
a. GENERAL. See paragraph 18.

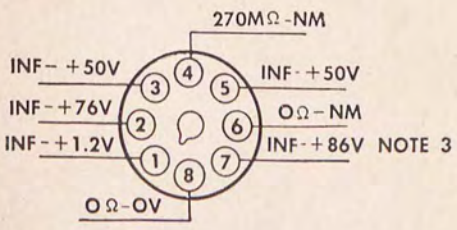
b. PLATE VOLTAGE. If the voltage check indicates no plate voltage a check shall be made of the continuity of T2 primary. Also check capacitor C28 for open and capacitor C49 for short. Low plate voltage would indicate capacitor C49 to be in a leaking condition. The screen voltage as measured on pin No. 5 will be absent if resistor R26 is open or capacitor C48 is shorted. Low screen voltage will indicate a partially shorted (leaking) capacitor C48. If the resistance to ground on pin No. 4, the oscillator injection grid, is wrong, refer to the next paragraph for repair procedure on the receiver crystal oscillator. The absence of proper voltage at this point will not have too great an effect on the operation as an amplifier of the receiver mixer stage; however, a thorough check of the grid circuit should be made. The operation of switch SW10 and the continuity of coil L7 should be checked before trouble shooting the receiver crystal oscillator stage. If, after proper operation of the receiver crystal oscillator stage is ascertained, the receiver mixer stage persists in causing additional trouble, check capacitor C47 for open circuited condition. This component (C47) may cause oscillation.

Table XXVII. Receiver mixer (fig. 17)

Ref No.	Signal Corps stock No.	Name of part and description	Function
C39	3D9050–V–29	CAPACITOR: variable; 50-mmf maximum.	Tuning L7, channel B.
C40	3D9050V–30	CAPACITOR: variable; 50-mmf maximum.	Tuning L7, channel A.
C47		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Filament bypass, V7.
C48		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Screen and anode grid bypass, V7.
C49		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Plate bypass, V7.
C50	Part of T2	CAPACITOR: fixed; 5-mmf ±5%, 500 vdcw.	Padder T2 primary.
CH7	3C362–1	CHOKE: low r-f; 5.58 mh at 4 mc.	Filament, V7.
L7	2C5379( )/C5	COIL AND SHIELD: mixer grid.	Grid, V7 mixer.
R26	3Z6615–1	RESISTOR: fixed; carbon insulated, 15,000 ohms.	Screen and anode grid dropping V7.
R27	Part of T2	RESISTOR: fixed; carbon insulated, 470,000 ohms ±10%, ½-watt.	Loading, T2 primary.
R28	3Z6082	RESISTOR: fixed; carbon, insulated, 850 ohms ±10%, ½-watt.	B+ decoupling, V7.
SW10		*SWITCH: channel changing.	V7 grid.
T2	2Z9978–2	TRANSFORMER AND SHIELD: 1st i-f.	Interstage coupling.
V7		TUBE JAN 1LC6 (VT–178).	Receiver mixer.

*Switch SW10 is part of channel changing switch 3Z8311–1.





NOTE 1: Voltages are nominal DC and are measured in receive position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in.

NM — Not measured. NC — Not connected.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON. Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM — Not measured. NC — Not connected.

NOTE 3: Socket terminal used as tie or dummy lug only. No tube element connects to this lug.

TL19017

Figure 17. Schematic wiring diagram receiver mixer stage, Radio Receiver and Transmitter BC–659–(*).

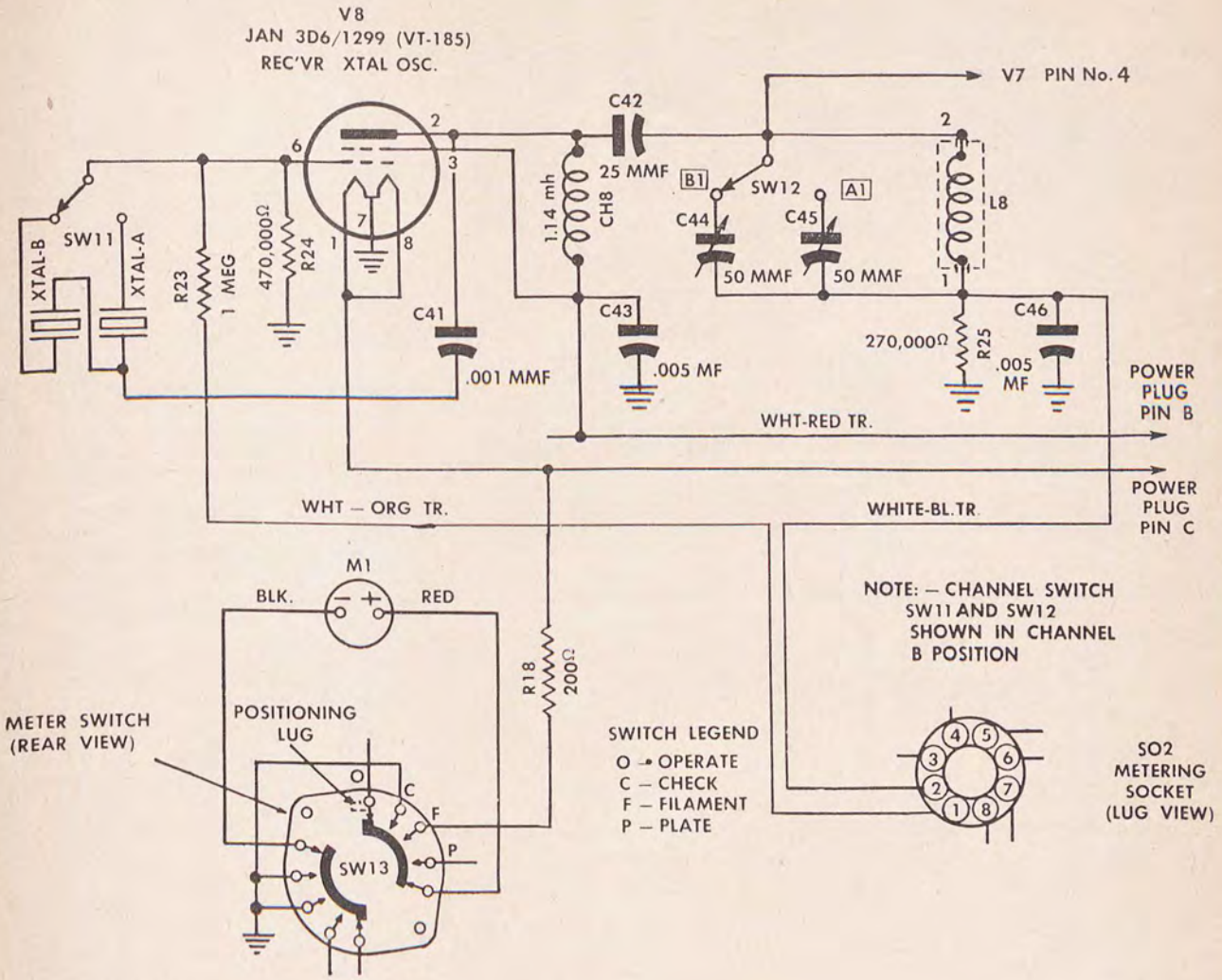
34. Receiver Crystal Oscillator Stage

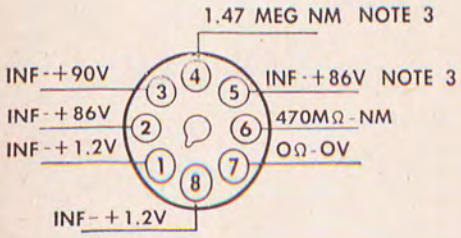
The first step in trouble shooting the receiver crystal oscillator stage is to measure the crystal activity as described in secion V. If after this test the crystals used for the A and B bands are found to give the proper activity the tube socket voltages should be checked for proper values. If the plate voltage as measured on Pin No. 2 is absent, check choke CH8 for continuity. If the plate voltage measured is low, check capacitor C42 for leakage. The screen voltage should be normal at all times for it uses a direct line from the power supply through the power cable. The voltage measured on pin No. 6 should be present if the receiver crystal oscillator is oscillating. If oscillation is not indicated, check capacitor C41 for open or short. If oscillation is not present, capacitor C42 should be checked for open, also capacitor C44 and C45 should be checked for short.

Table XXVIII. Receiver crystal oscillator (fig. 18)

Ref No.	Signal Corps stock No.	Name of part and description	Function
C41	3DA1–48	CAPACITOR: fixed; 0.001-mf, +14%, —6%, 300 vdcw.	Crystal feedback coupling.
C42	3D9025–20	CAPACITOR: fixed; 25-mmf, +5%, 300 vdcw.	Coupling V8 to L8.
C43		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	B+ bypass, V8.
C44	3D9050V–29	CAPACITOR: variable; 50-mmf maximum.	Tuning L8, channel B.
C45	3D9050V–30	CAPACITOR: variable; 50-mmf maximum.	Tuning L8, channel A.
C46		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Receiver oscillator metering lead bypass.
CH8	3C362–2	CHOKE: r-f; 120 mh at 1,000 cycles.	Plate, V8.
L8	2C5379( )/C4	COIL AND SHIELD: receiver oscillator; frequency range, 26.7 mc to 34.6 mc.	Grid, V7 oscillator.
R23	3Z4534	RESISTOR: fixed; carbon, insulated, 1-megohm, ±10%, ½-watt.	Isolating, V8 grid metering lead.
R24	3Z6747–10	RESISTOR: fixed; carbon, insulated, 470,000 ohms, ±10%, ½-watt.	Bias, V8.
R25	3Z6727	RESISTOR: fixed; carbon, insulated, 270,000 ohms, ±10%, ½-watt.	Mixer bias, V4.
SO1		SOCKET: crystal, 4-contact.	Receptacle for crystals.
SW11		*SWITCH: channel changing.	Crystal changing.
SW12		*SWITCH: channel changing.	V7 oscillator.
V8		TUBE JAN—3D6/1299 (VT–185).	Receiver crystal oscillator.
XTAL A		CRYSTAL UNIT: channel A.	Receiver stability.
XTAL B		CRYSTAL UNIT: channel B.	Receiver stability.

*Switch SW11 and SW12 are part of channel changing switch 3Z8311–1.





NOTE 1: Voltages are nominal DC and are measured in receive position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in.

NM – Not measured. NC – Not connected.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON. Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM – Not measured. NC – Not connected.

NOTE 3: Socket terminal used as tie or dummy lug only. No tube element connects to this lug.

TL19018

Figure 18. Schematic wiring diagram oscillator stage, Radio Receiver and Transmitter BC–659–(*).

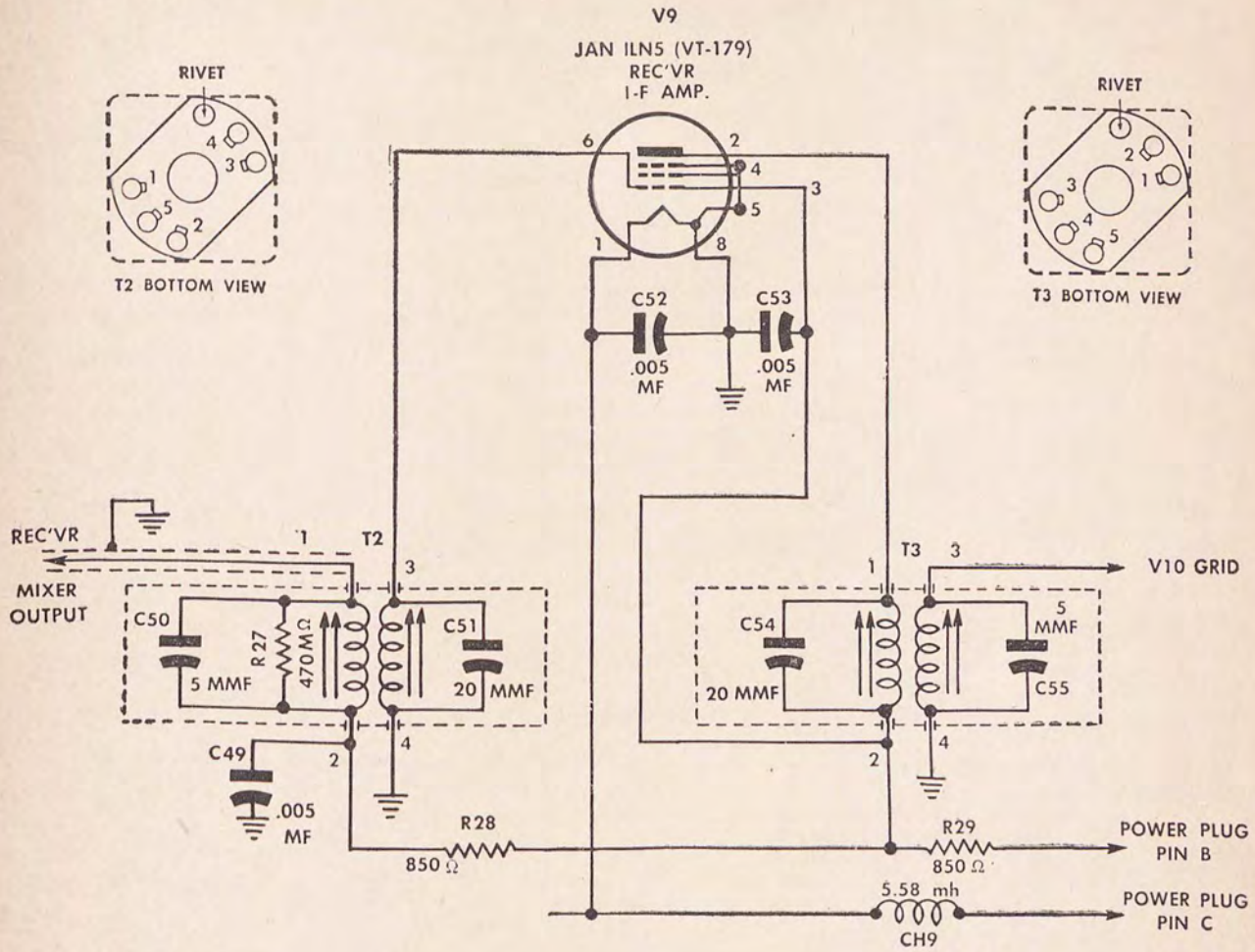
35. Receiver I-f Amplifier No. 1

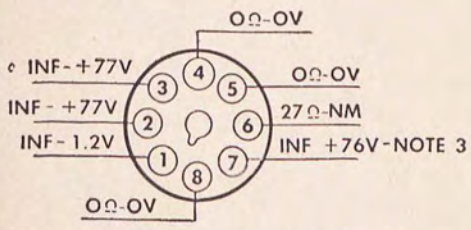
a. GENERAL. See paragraph 18.

b. VOLTAGE CHECK. If the voltage as measured on pin No. 2 plate circuit is absent check transformer T3 primary and resistor R29 for continuity. Capacitor C53 should be checked for short. If the voltage on the plate is low, check capacitor C53 for leakage. The voltage on the screen will be effected by the same component break-down as the plate. The resistance to ground on the No. 6 terminal (control grid) should be measured. This will determine the continuity of secondary transformer T2. Oscillation in the i-f amplifier may be traced to an open capacitor C52 or C53.

Table XXIX. Receiver i-f amplifier No. 1 (fig. 19)

Ref No.	Signal Corps stock No.	Name of part and description	Function
C51	Part of T2	CAPACITOR: fixed; 20-mmf ±5%.	Padder, T2 primary.
C52		CAPACITOR: fixed; 0.005-mf +80%, —20%, 300 vdcw.	Filament bypass, V9.
C53		CAPACITOR: fixed; 0.005-mf +80%, —20%, 300 vdcw.	B+ bypass, V9.
C54	Part of T3	CAPACITOR: fixed; 20-mmf ±5%.	Padder, T3 primary.
CH9	3C362–1	CHOKE: low r-f; 5.58 mh at 4 megacycles.	Filament, V9.
R29	3Z6082	RESISTOR: fixed; carbon, insulated, 850 ohms ±10%, ½-watt.	B+ decoupling V9.
T2	2Z9978–2	TRANSFORMER AND SHIELD: 1st i-f.	Interstage coupling.
T3	2Z9978–3	TRANSFORMER AND SHIELD: 2d i-f.	Interstage coupling.
V9		TUBE JAN 1LN5 (VT–179).	Receiver i-f amplifier No. 1.





NOTE 1: Voltages are nominal DC and are measured in receive position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in.

NM – Not measured. NC – Not connected.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM – Not measured. NC – Not connected.

NOTE 3: Socket terminal used as tie or dummy lug only. No tube element connects to this lug.

19019

Figure 19. Schematic wiring diagram first i-f stage, Radio Receiver and Transmitter BC–659–(*).

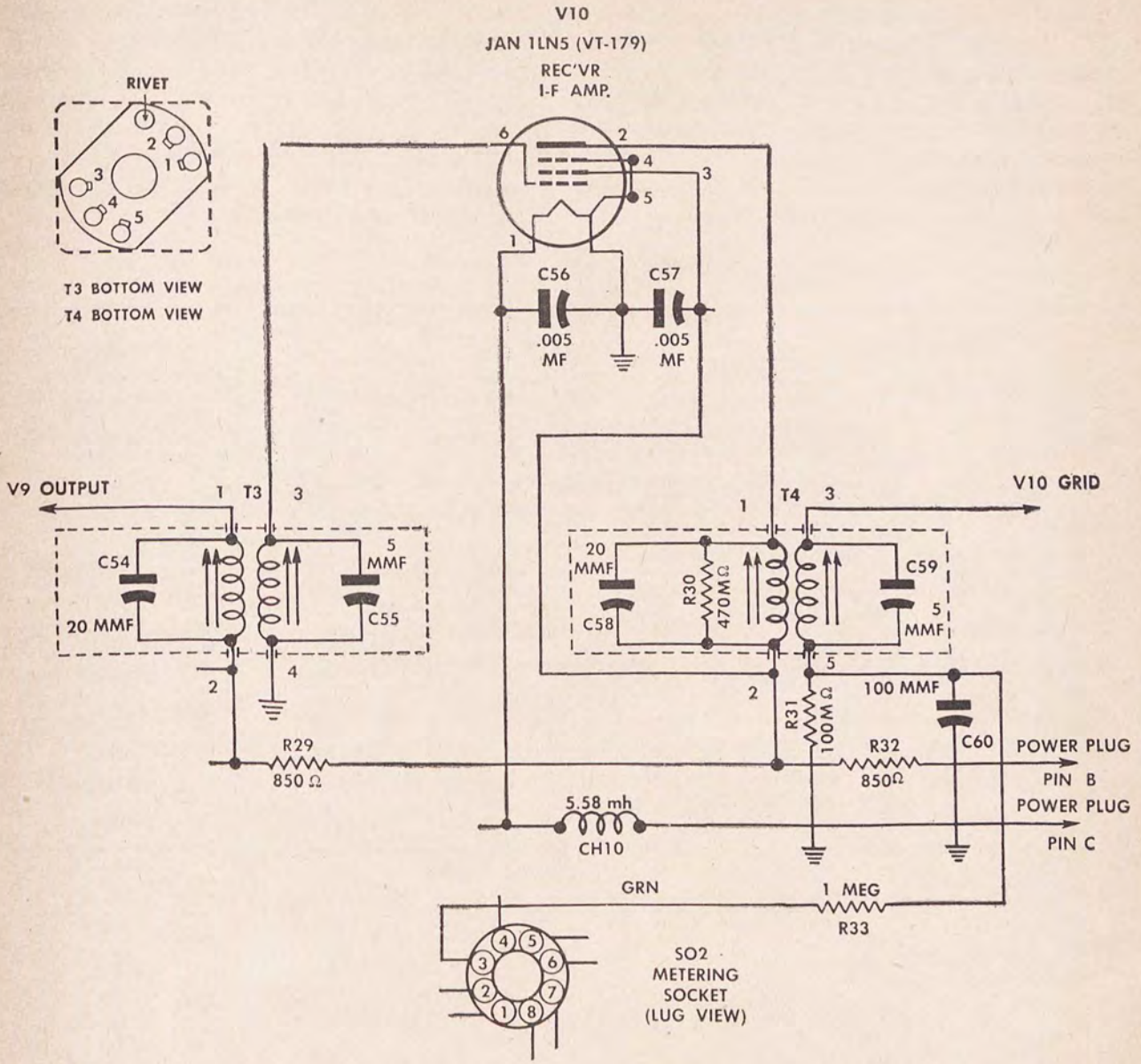
36. Receiver I-f Amplifier No. 2

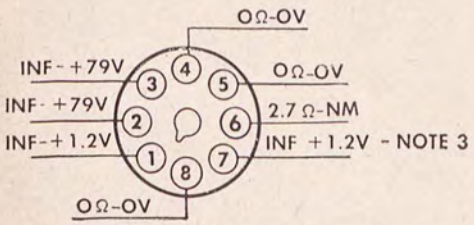
a. GENERAL. See paragraph 18.

b. VOLTAGE CHECK. If no plate voltage is measured on pin No. 2 the primary of transformer T4 and resistor R2 should be checked for continuity. Also capacitor C57 should be checked for short. With the exception of transformer T4 continuity measurement the screen measured on pin No. 3 is subject to the same component failure if no voltage is measured. Low voltage measured on the plate and screen can be caused by a leaking capacitor C57. A continuity measurement of the grid circuit (pin No. 6) should be made to ascertain the continuity of the secondary of the i-f transformer T3. Oscillation may be caused by an open circuit condition in capacitors C56 and C57.

Table XXX. Receiver i-f amplifier No. 2 (fig. 20)

Ref No.	Signal Corps stock No.	Name of part and description	Function
C55	Part of T3	CAPACITOR: fixed; 25-mmf, ±5%, 500 vdcw.	Padder, T3 secondary.
C56		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Filament bypass, V10.
C57		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	B+ bypass, V10.
C58	Part of T4	CAPACITOR: fixed; 20-mmf, ±5%, 500 vdcw.	Padder, T4 primary.
CH10	3C362–1	CHOKE: low r-f; 5.58 mh at 4 mc.	Filament, V10.
R29	3Z6082	RESISTOR: fixed; carbon, insulated, 850 ohms, ±10%, ½-watt.	B+ decoupling, V9.
R30	Part of T4	RESISTOR: fixed; carbon, insulated, 470,000 ohms, ±10%, ½-watt.	Loading, T4 primary.
R32	3Z6082	RESISTOR: fixed; carbon, insulated, 850 ohms, ±10%, ½-watt.	B+ decoupling, V10.
T3	2Z9978–3	TRANSFORMER AND SHIELD: 2d i-f; includes C54 and C55.	Interstage coupling.
T4	2Z9978–4	TRANSFORMER AND SHIELD: 3d i-f; includes C58, C59, and R30.	Interstage coupling.
V10		TUBE JAN 1LN5 (VT–179).	Receiver i-f amplifier No. 2.





NOTE 1: Voltages are nominal DC and are measured in receive position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in.

NM – Not measured. NC – Not connected.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON. Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM – Not measured. NC – Not connected.

NOTE 3: Socket terminal used as tie or dummy lug only. No tube element connects to this lug.

TL19020

Figure 20. Schematic wiring diagram second i-f amplifier stage, Radio Receiver and Transmitter BC–659–(*).

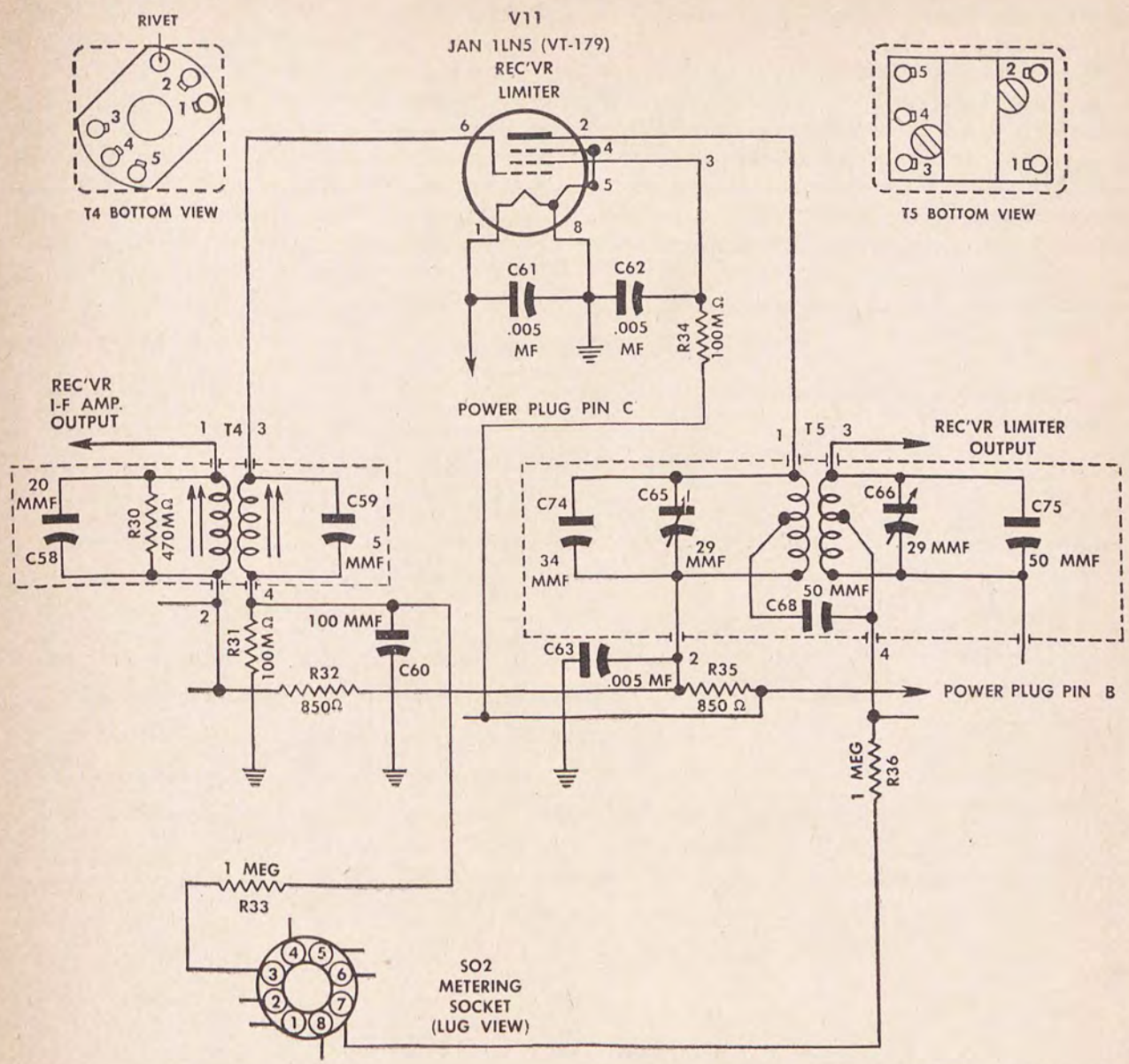
37. Receiver Limiter Stage

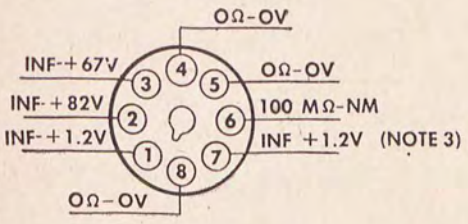
a. GENERAL. See paragraph 18.

b. VOLTAGE CHECK. If the voltage measurement on the plate (pin No. 2) produces no reading, check the primary of transformer T5 and resistor R35 for continuity. If the voltage is measured and found to be low, check capacitor C63 for leakage or a short circuit. If the screen voltage is absent on pin No. 3, check resistor R34 for continuity and capacitor C62 for short. If the voltage is found to be low check capacitor C62 for leakage or a short circuit. A continuity measurement should be made of the secondary of transformer T4 and resistor R31 to ascertain a complete grid circuit. See resistance chart for proper ohmic value because leakage of C60 will produce an erroneous reading and improper operation of the limiter stage.

Table XXXI. Receiver limiter (fig. 21)

Ref No.	Signal Corps stock No.	Name of part and description	Function
C59	Part of T4	CAPACITOR: fixed; 25-mmf, ±5%, 500 vdcw.	Padder, T4 secondary.
C60	3D9100–46	CAPACITOR: fixed; 100-mmf, +14%, —6%, 400 vdcw.	Bias resistor bypass, V11.
C61		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Filament bypass, V11.
C62		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Screen grid bypass, V11.
C63		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Plate bypass, V11.
C65	Part of T5	CAPACITOR: variable; 29-mmf maximum, 6-mmf minimum, ±7%.	Tuning, T5 primary.
C68	Part of T5	CAPACITOR: fixed; 50-mmf, ±10%, 500 vdcw.	Coupling T5.
C74	Part of T5	CAPACITOR: fixed; 34-mmf, ±5%, 500 vdcw.	Padding, T5 primary.
R31	3Z4550	RESISTOR: fixed; carbon, insulated, 100,000 ohms, ±10%, ½-watt.	Bias, V11.
R33	3Z4534	RESISTOR: fixed; carbon, insulated, 1-megohm, ±10%, ½-watt.	Isolating, V11 grid metering lead.
R34	3Z4550	RESISTOR: fixed; carbon, insulated, 100,000 ohms, ±10%, ½-watt.	Screen dropping, V11.
R35	3Z6082	RESISTOR: fixed; carbon, insulated, 850 ohms, ±10%, ½-watt.	B+ decoupling, V11.
T4	2Z9978–4	TRANSFORMER AND SHIELD: 3d i-f; includes C58, C59, and R30.	Interstage coupling.
T5	2Z9978–5	TRANSFORMER AND SHIELD: discriminator; includes C65, C66, C68, C74, and C75.	Interstage coupling.
V11		TUBE JAN 1LN5 (VT–179).	Receiver limiter.





NOTE 1: Voltages are nominal DC and are measured in receive position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in.

NM — Not measured. NC — Not connected.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON. Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM — Not measured. NC — Not connected.

NOTE 3: Socket terminal used as tie or dummy lug only. No tube element connects to this lug.

TL19021

Figure 21. Schematic wiring diagram limiter stage, Radio Receiver and Transmitter BC–659–(*).

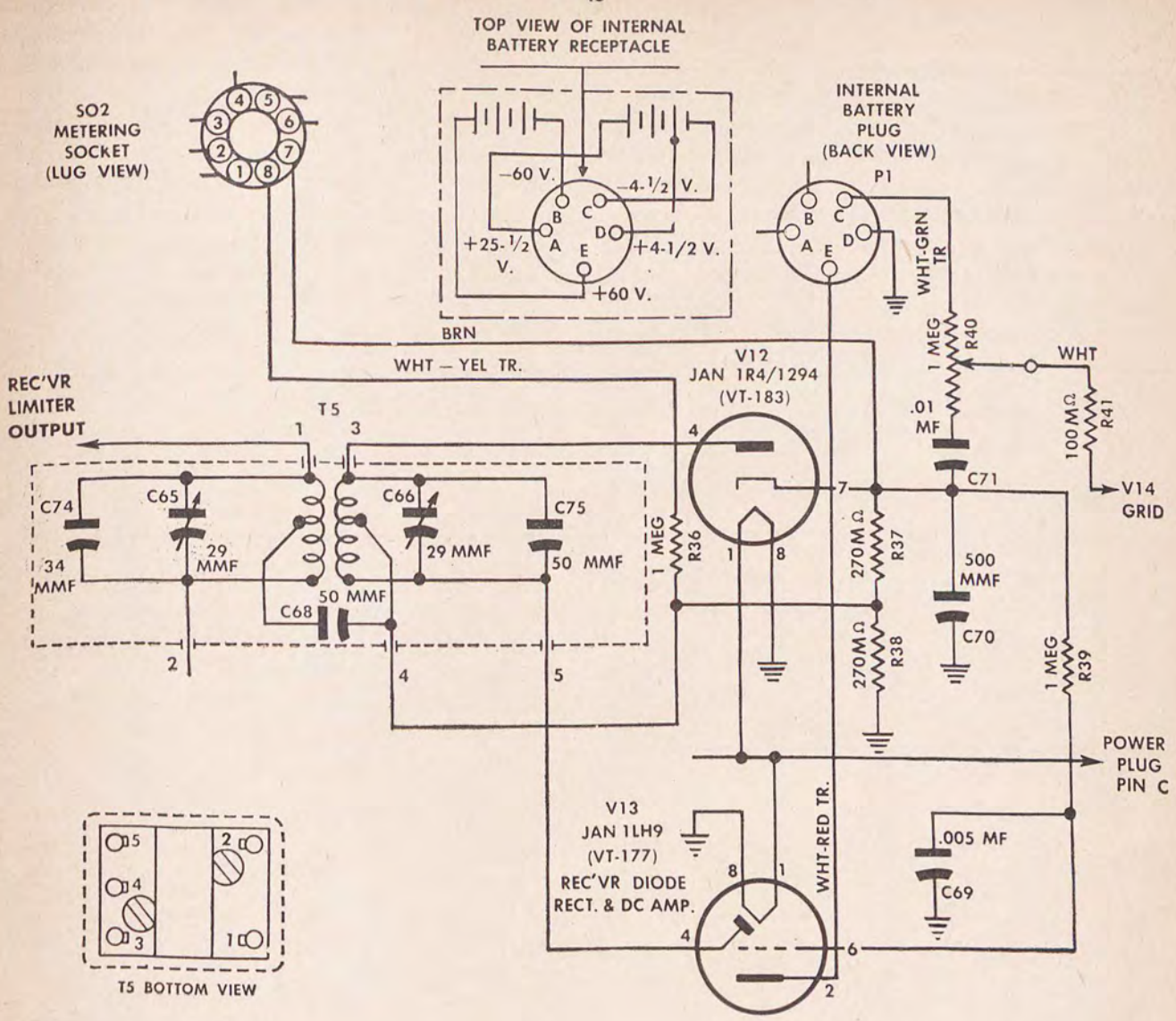
38. Receiver Diode Rectifier and D-c Amplifier Discriminator

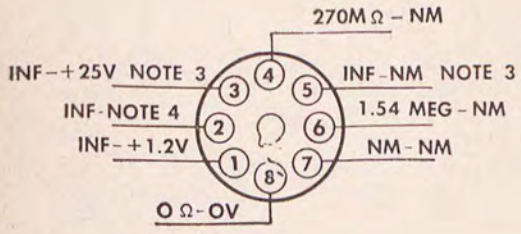
a. GENERAL. See paragraph 18.

b. RESISTANCE CHECK. The discriminator circuit can be checked more readily for component break-down by using the resistance analysis method. There should be a low resistance measurement between pin No. 4 of V12 and pin No. 4 of V13. If this measurement indicates an open or high resistance circuit, the secondary of transformer T5, the discriminator transformer, is defective. If a dead short is indicated, capacitor C75 is defective. Measure the resistance to ground on pin No. 7 of tube V12. If the resistance is high, resistor R37 or R38 is open. If the resistance is low, capacitor C70 can be assumed to be shorted or partially shorted. Measure the resistance to ground on pin No. 6, tube V13. If the resistance is high, resistor R39 is defective. If the resistance is low, capacitor C69 is shorted or partially shorted. Check capacitor C71 for open or short circuit.

Table XXXII. Receiver diode rectifier and d-c amplifier (fig. 22)

Ref No.	Signal Corps stock No.	Name of part and description	Function
C66	Part of T5	CAPACITOR: variable; 29-mmf, maximum, 6-mmf, maximum, ±7.0%.	Tuning, T5 secondary.
C69		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Control grid audio bypass, V13.
C70	3D9500–16	CAPACITOR: fixed; 500-mmf, +14%, —6%, 400 vdcw.	Pre-emphasis capacitor.
C71	3DA10–78	CAPACITOR: fixed; 0.01-mf, ±20%, 300 vdcw.	Audio coupling.
C75	Part of T5	CAPACITOR: fixed; 50-mmf, ±5%.	Padding, T5 secondary.
R36	3Z4534	RESISTOR: fixed; carbon, insulated, 1-megohm, ±10%, ½-watt.	Isolating, V12 grid metering.
R37	3Z6727	RESISTOR: fixed; carbon, insulated, 270,000 ohms, ±10%, ½-watt.	Discriminator load.
R38	3Z6727	RESISTOR: fixed; carbon, insulated, 270,000 ohms, ±10%, ½-watt.	Discriminator load.
R39	3Z4534	RESISTOR: fixed; carbon, insulated, 1-megohm, ±10%, ½-watt.	Grid, V13.
T5	2Z9978–5	TRANSFORMER AND SHIELD: discriminator includes C65, C66, C68, C74, and C75.	Interstage coupling.
V13		TUBE JAN 1LH4 (VT–177).	Receiver diode rectifier and d-c amplifier.





NOTE 1: Voltages are nominal DC and are measured in receive position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in.

NM – Not measured. NC – Not connected.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON. Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM – Not measured. NC – Not connected.

NOTE 3: Socket terminal used as tie or dummy lug only. No tube element connects to this lug.

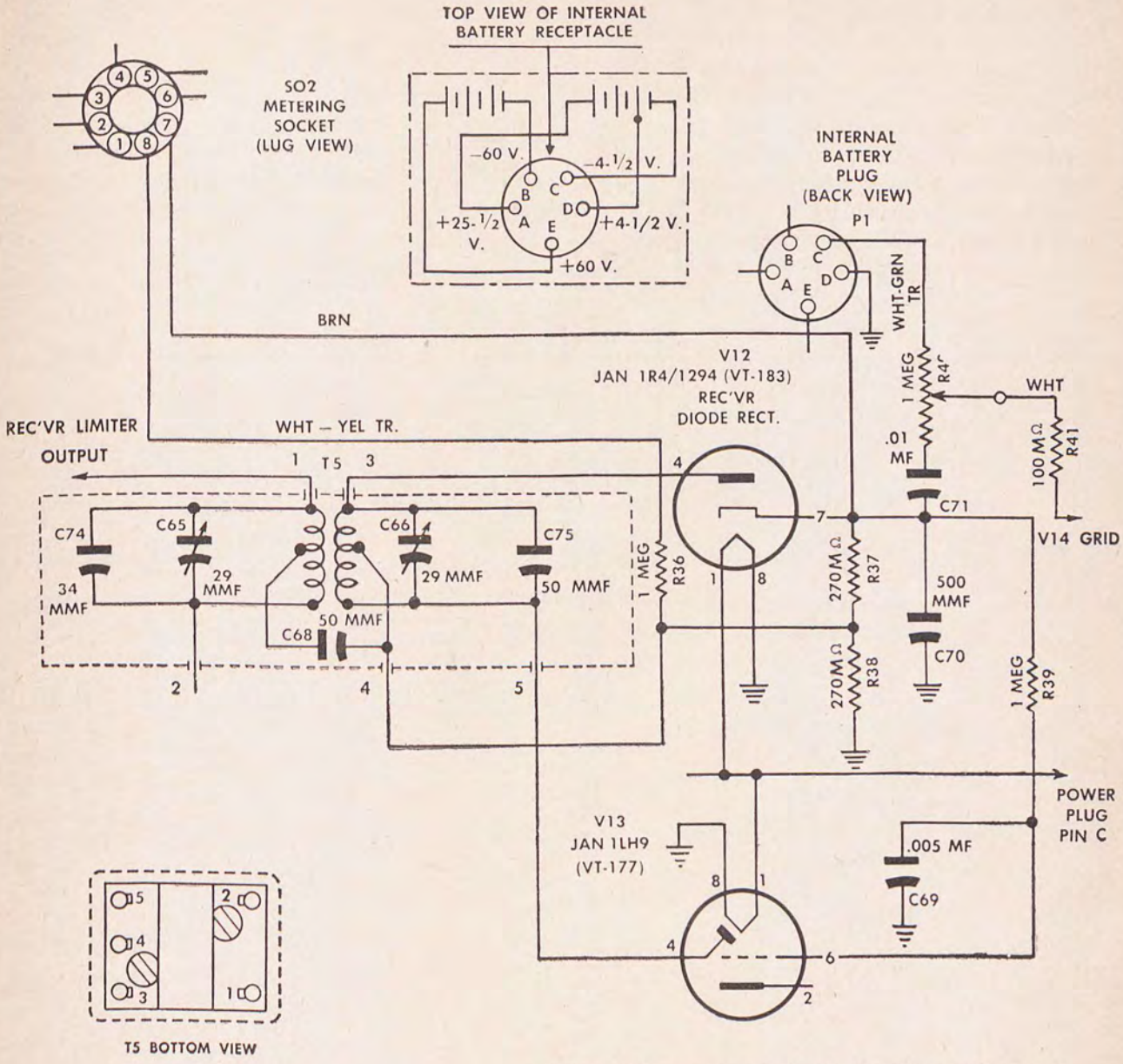
NOTE 4: Value is 50v with zero volts at pin 7 of metering socket.

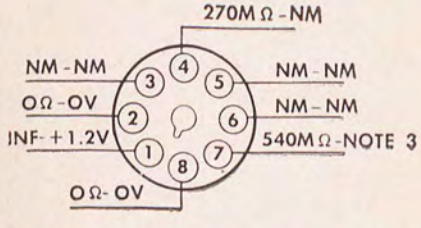
TL 19023

Figure 22. Schematic wiring diagram d-c amplifier discriminator, Radio Receiver and Transmitter BC–659–(*).

Table XXXIII. Receiver diode rectifier (fig. 23)

Ref No.	Signal Corps stock No.	Name of part and description	Function
C66	Part of T5	CAPACITOR: variable; 29-mmf, maximum, 6-mmf, minimum, ±7.0%.	Tuning, T5 secondary.
C69		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Control grid audio bypass, V13.
C70	3D9500–16	CAPACITOR: fixed; 500-mmf, +14%, —6%, 400 vdcw.	Pre-emphasis capacitor.
C71	3DA10–78	CAPACITOR: fixed; 0.01-mf, ±20%, 300 vdcw.	Audio coupling.
C75	Part of T5	CAPACITOR: fixed; 50-mmf, ±5%.	Padding, T5 secondary.
R36	3Z4534	RESISTOR: fixed; carbon, insulated, 1-megohm, ±10%, ½-watt.	Isolating, V12 grid metering.
R37	3Z6727	RESISTOR: fixed; carbon, insulated, 270,000 ohms, ±10%, ½-watt.	Discriminator load.
R38	3Z6727	RESISTOR: fixed; carbon, insulated, 270,000 ohms, ±10%, ½-watt.	Discriminator load.
R39	3Z4534	RESISTOR: fixed; carbon, insulated, 1-megohm, ±10%, ½-watt.	Grid, V13.
T5	2Z9978–5	TRANSFORMER AND SHIELD: discriminator; includes C65, C66, C68, C74, and C75.	Interstage coupling.
V12		TUBE JAN–1R4/1294 (VT–183).	Receiver diode rectifier.





NOTE 1: Voltages are nominal DC and are measured in receive position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in.

NM – Not measured. NC – Not connected.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON. Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM – Not measured. NC – Not connected.

NOTE 3: Value is zero volts with zero volts at pin 7 of metering socket.

TL19022

Figure 23. Schematic wiring diagram receiver diode rectifier, Radio Receiver and Transmitter BC–659–(*).

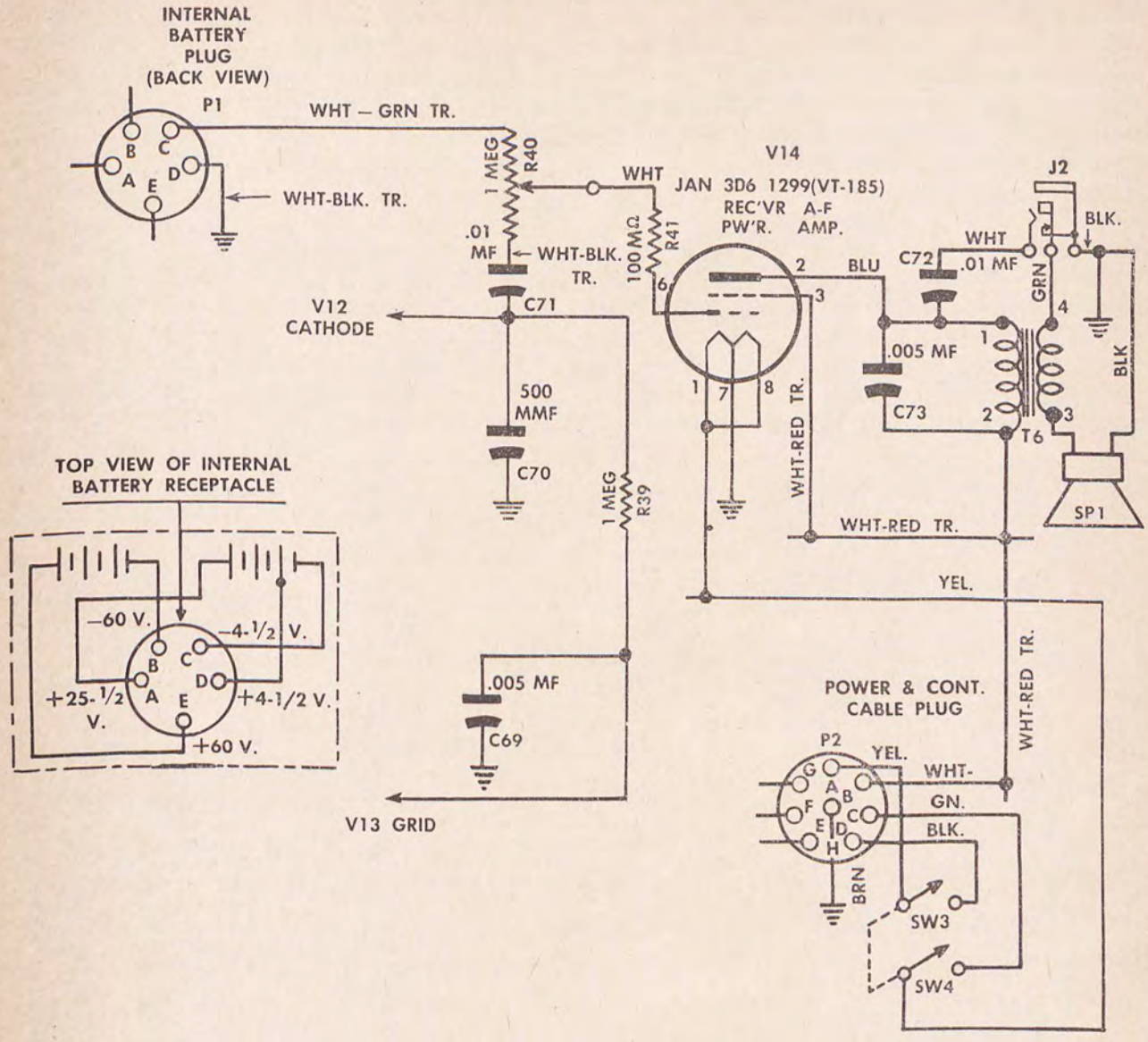
39. Receiver Audio-frequency Power Amplifier

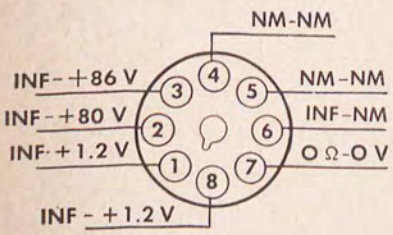
a. GENERAL. See paragraph 18.

b. VOLTAGE CHECK. If in measuring the plate voltage on pin No. 2 no voltage is apparent, check primary of transformer T6 for an open circuit. If the voltage is low, check primary of transformer T6 for higher resistance circuit. There will be no trouble in obtaining proper screen voltage as measured on pin No. 3. Check voltage on pin No. 6. This voltage provides grid bias to the a-f amplifier and is supplied by a 4½-volt battery in the internal battery of the set. Check connection on plug pin C if voltage is not apparent. Also check continuity of resistors R40 and R41. If the voltage checks do not indicate trouble that can be corrected, check the secondary of audio transformer T6 for continuity and also continuity of voice coil on permanent magnet speaker SP1. If headphone operation is not available from the jack provided, check capacitor C72 for open circuit.

Table XXXIV. Receiver a-f power amplifier (fig. 24)

Ref No.	Signal Corps stock No.	Name of part and description	Function
C72	3DA10–78	CAPACITOR: fixed; 0.01-mf, ±20%, 300 vdcw.	Audio coupling to headphones.
C73	3D9040–5	CAPACITOR: fixed; 0.005-mf, +14%, —6%, 300 vdcw.	Audio bypass.
R40		POTENTIOMETER: variable; 1 megohm.	Volume control.
R41	3Z4550	RESISTOR: fixed; carbon, insulated, 100,000 ohms, ±10%, ½-watt.	Grid, V14.
T6	2Z9978–6	TRANSFORMER: output.	Audio output.
V14		TUBE JAN 3D6/1299 (VT–185).	Power a-f power amplifier.





NOTE 1: Voltages are nominal DC and are measured in receive position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in.

NM – Not measured. NC – Not connected.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON. Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM – Not measured. NC – Not connected.

TL19024

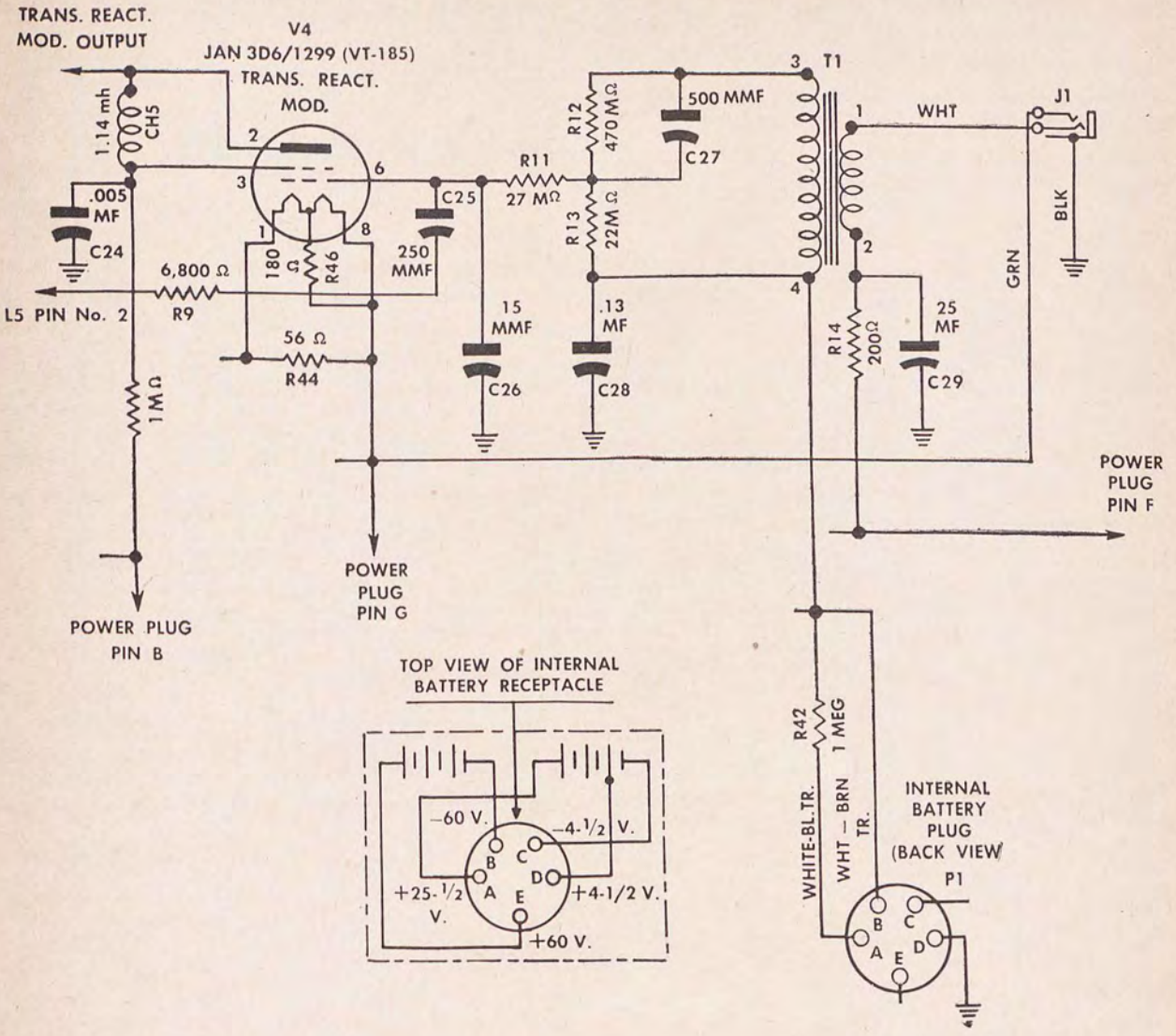
Figure 24. Schematic wiring diagram receiver audio-frequency power amplifier, Radio Receiver and Transmitter BC–659–(*).

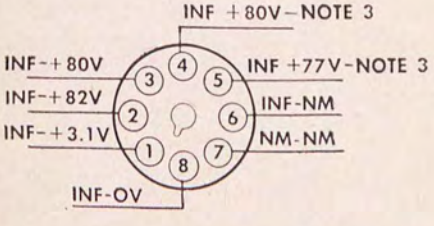
40. Transmitter Reactance Modulator

As the first step in trouble shooting the reactance modulation, it is important to find the presence of a-f voltage on the grid, pin No. 6, of tube V4. This will verify the operation of microphone transformer T1 and accompanying circuits. If voltage is not present on the grid as mentioned above, check operation and contacts made by jack 1 on the microphone plug. Check continuity of primary of transformer T1 by placing ohmmeter plugs on the jack and of the primary winding and ground. If continuity is measured it will show as a high resistance. If resistance is low, continuity of the primary is present and capacitor C29 is leaking or is short-circuited. If trouble is not located at this point in the test, check capacitors C25, C26, and C28 for a short circuit. Check resistors R11, R12, and R13 for proper value. Recheck the a-f voltage applied to the grid of tube V4. This is to be done with a low voltage a-c electronic voltmeter. Other circuit troubles can be located by checking the tube voltages. If no plate voltage is present on pin No. 2, check choke CH5 and resistor R8 for continuity. Also check capacitor C24 for a short circuit. The screen voltage as measured on pin No. 3 will be subject to the same checks as the plate circuit with the exception of the continuity check of choke CH5.

Table XXXV. Transmitter reactance modulator (fig. 25)

Ref No.	Signal Corps stock No.	Name of part and description	Function
C22	3D9250–25	CAPACITOR: fixed; 250-mmf ±5%, 300 vdcw.	Coupling V4 to V3.
C24		CAPACITOR: fixed; 0.005-mf +80%, —20%, 300 vdcw.	Screen grid bypass V4.
C25	3D9250–25	CAPACITOR: fixed; 250-mmf ±5%, 300 vdcw.	Blocking capacitor.
C26		CAPACITOR: fixed; 15-mmf ±5%, 300 vdcw.	Phase shifting, V4.
C27	3D9500–16	CAPACITOR: fixed; 500-mmf +14%, —6%, 400 vdcw.	Discriminator load bypass.
C28	3DA130–1	CAPACITOR: fixed; 0.13-mf ±20%, 100 vdcw.	Audio bypass, T1.
C29		CAPACITOR: electrolytic; 25-mf, —10%, +50%, 25 vdcw.	Microphone current filter.
CH5	3C362–2	CHOKE: r-f; 120 mh at 1,000 cycles.	Plate, V4.
J1	2Z5572	JACK: microphone.	Microphone plug receptacle.
R8	3Z6100–9	RESISTOR: fixed; carbon, insulated, 1,000 ohms ±10%, ½-watt.	B+ dropping, V4.
R9	3Z6568–2	RESISTOR: fixed; carbon, insulated, 6,800 ohms ±10%, ½-watt.	Oscillator modulator phase shift.
R11	3Z6627–1	RESISTOR: fixed; carbon, insulated, 27,000 ohms ±10%, ½-watt.	Control grid coupling, V4.
R12	Part of T2	RESISTOR: fixed; carbon, insulated, 470,000 ohms ±10%, ½-watt.	Voltage divider, T1.
R13	3Z6622–2	RESISTOR: fixed; carbon, insulated, 22,000 ohms ±10%, ½-watt.	Voltage divider, T1.
R44	3Z6005A6	RESISTOR: fixed; molded wire wound; 56 ohms, ±10%.	Filament equalizing.
R46		RESISTOR: fixed; carbon, insulated, 180 ohms, ±10%, ½-watt.	Filament equalizing.
T1	2Z9666A	TRANSFORMER: microphone.	Microphone input.
V4		TUBE JAN 3D6/1299 (VT–185).	Transmitter reactance modulator.





NOTE 1: Voltages are nominal DC and are measured in transmit position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in and push-to-talk switch in "talk" position.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON. Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM – Not measured. NC – Not connected.

NOTE 3: Socket terminal used as tie or dummy lug only. No tube element connects to this lug.

TL19025

Figure 25. Schematic wiring diagram transmitter reactance modulator, Radio Receiver and Transmitter BC–659–(*).

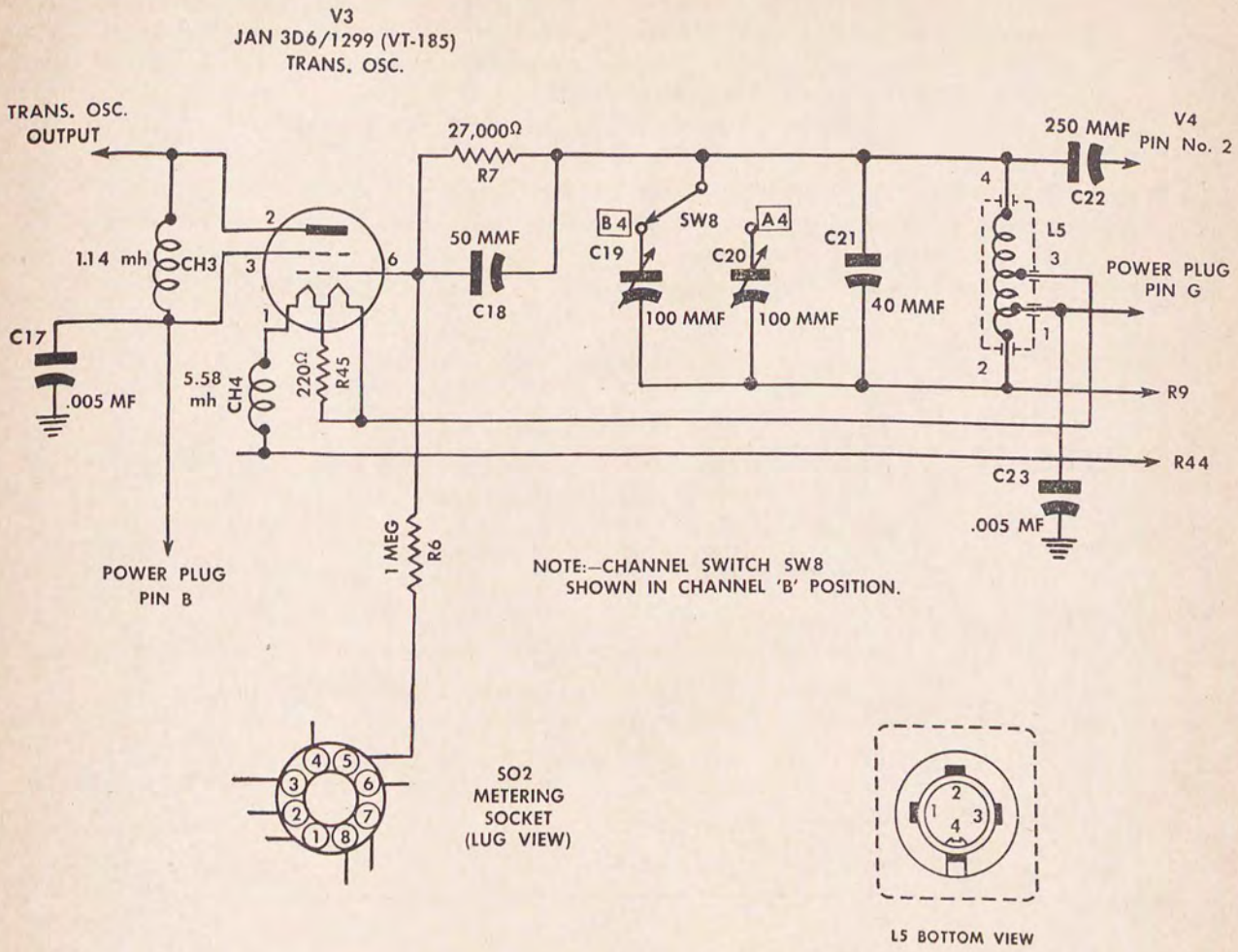
41. Transmitter Oscillator

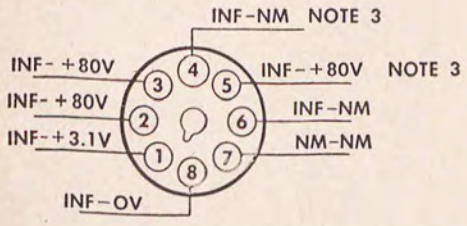
Measure the voltage on pin No. 6. If it is found to be positive, check capacitor C22 for a short circuit. If voltage on pin No. 6 is not negative as proper operation would indicate, check resistor R7 for continuity, and check capacitor C18 for either a short or open circuit. Trouble in these components prevents oscillation. If oscillation is indicated but is weak, check switc SW8 and capacitor C21 for an open or shor circuit. Coil L5 should have continuity and re sistance value as indicated in table XXI. If n plate voltage is measured on pin No. 2, chec choke CH3 for continuity. The screen voltage a measured on pin No. 3 is directly connected t B+.

Table XXXVI. Transmitter oscillator (fig. 26)

Ref No.	Signal Corps stock No.	Name of part and description	Function
C16	3D9250—24	CAPACITOR: fixed; 250-mmf, +14%, —6%, 400 vdcw.	Coupling V3 to V2.
C17		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Screen grid bypass, V3.
C18	3D9050–35	CAPACITOR: fixed; 50-mmf, +14%, —6%, 400 vdcw.	Grid leak bypass, V3.
C19	3D9100V–4	CAPACITOR: variable; 100-mmf, maximum, 5.0-mmf minimum.	Tuning L5, channel B.
C20	3D9100V–5	CAPACITOR: variable; 100-mmf maximum.	Tuning L5, channel A.
C21	Part of L5	CAPACITOR: fixed; 40-mmf, ±2%.	Padding, L5.
C23		CAPACITOR: fixed; 0.005-mf, ±80%, —20%, 300 vdcw.	Microphone switch filter.
CH3	3C362–2	CHOKE: r-f; 120 mh at 1,000 cycles.	Plate, V3.
CH4	3C362–1	CHOKE: low r-f; 5.58 mh at 4 mc.	Filament, V3.
L5	2C5379( )/C2	COIL AND SHIELD: transmitter oscillator.	Grid, V3.
R6	3Z4534	RESISTOR: fixed; carbon, insulated, 1-megohm, ±10%, ½-watt.*	Isolating, V3 grid metering lead.
R7	3Z6627–1	RESISTOR: fixed; carbon, insulated, 27,000 ohms, ±10%, ½-watt.	Bias, V3.
R45		RESISTOR: fixed; molded wire wound, 220 ohms, ±10%.	Filament equalizing.
SW8	Note 1	SWITCH: channel changing.	Grid, V3.
V3		TUBE JAN 3D6/1299 (VT–185).	Transmitter oscillator.

*Switch SW8 is part of channel changing switch 3Z8311–1.





NOTE 1: Voltages are nominal DC and are measured in transmit position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in and push-to-talk switch in "talk" position.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON. Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM – Not measured. NC – Not connected.

NOTE 3: Socket terminal used as tie or dummy lug only. No tube element connects to this lug.

TL19026

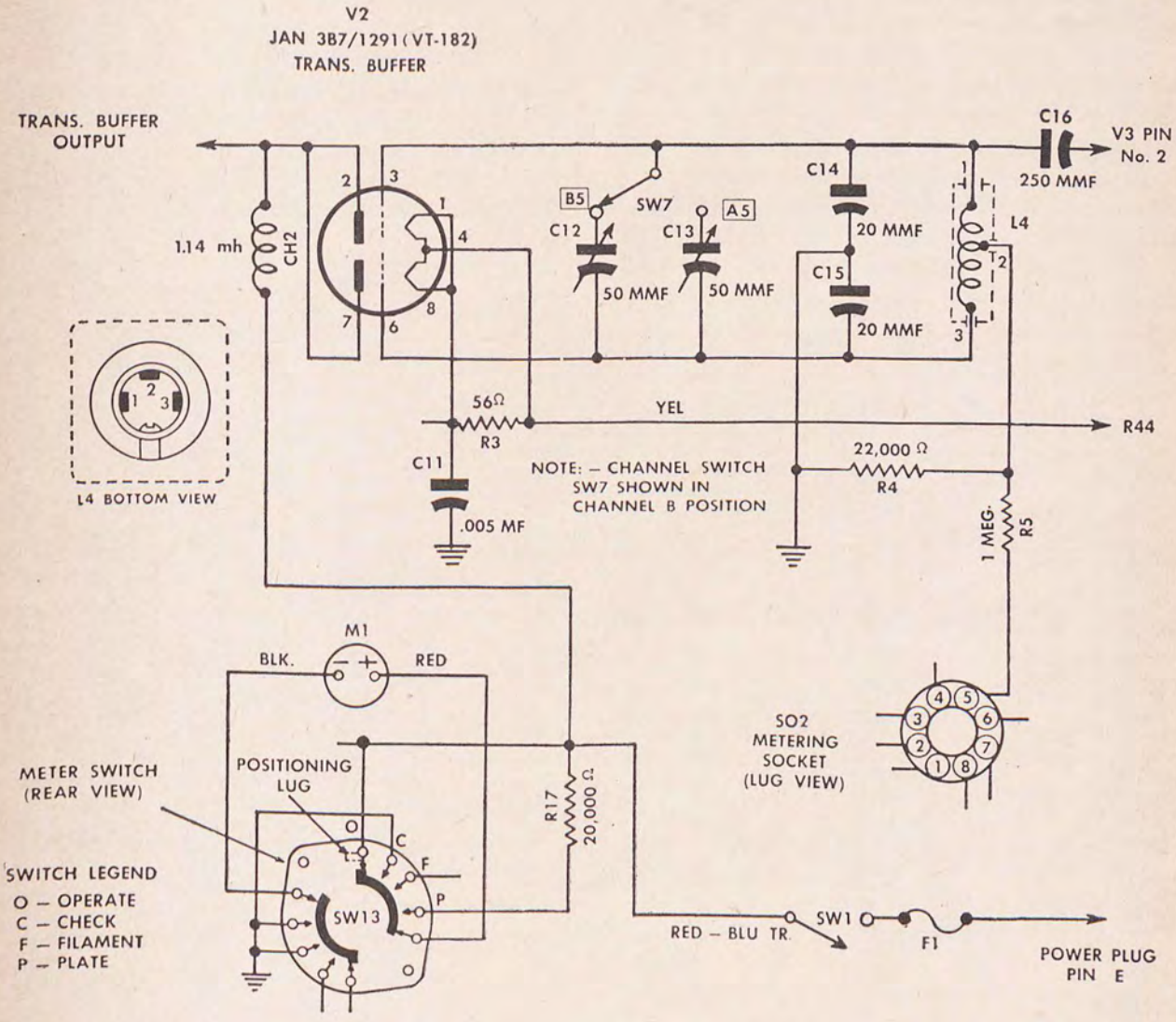
Figure 26. Schematic wiring diagram transmitter oscillator, Radio Receiver and Transmitter BC–659–(*).

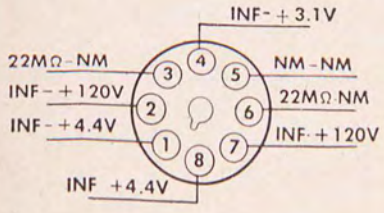
42. Transmitter Buffer

Measure the voltage on the grid of the transmitter buffer (pin No. 3 or 6). If the voltage is found to be positive, check capacitor C16 for a short circuit. Measure the voltage of the plate circuit pin No. 2 or 7. If no voltage is present, check choke CH2 for continuity. If an electronic a-c voltmeter designed for the measurement of radio frequencies is available, determine whether or not a-c voltage is present between the plate of the buffer tube and ground. If a-c voltage is present, swing variable capacitor C12 or C13 depending on channel used to determine the operation of the grid tube circuits. Check capacitor C14, C15, C13, and C12 for a short circuit, if tuning cannot be accomplished. The continuity of coil L4 should be checked also. If grid voltage, as measured on pin No. 3 of the buffer, tube or at pin 5 on the metering socket, is not of the proper value as indicated on the voltage chart check resistor R4 for proper value.

Table XXXVII. Transmitter buffer (fig. 27)

Ref No.	Signal Corps stock No.	Name of part and description	Function
C9	3DA1–48	CAPACITOR: fixed; 0.001-mf, +14%, —6%, 300 vdcw.	Coupling V8 to V1.
C11		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Filament bypass.
C12	3D9050V–29	CAPACITOR: variable; 50-mmf, maximum.	Tuning L4, channel B.
C13	3D9050V–30	CAPACITOR: variable; 50-mmf, maximum.	Tuning L4, channel A.
C14	3D9020–3	CAPACITOR: fixed; 20-mmf, ±5%.	Padder, T3 primary.
C15		CAPACITOR: fixed; 20-mmf, ±5%.	Padding, L4.
CH2	3C362–2	CHOKE: radio frequency; 120 mh at 1,000 cycles.	Plate, V5.
L4	2C5379( )/C1	COIL AND SHIELD: buffer grid.	Grid, V2.
R3	3Z6005A6	RESISTOR: fixed; 56-ohms ±10%.	Filament equalizing, V2.
R4	3Z6622–2	RESISTOR: fixed; 22,000 ohms, ±10%.	Bias, V2.
R5	3Z4534	RESISTOR: fixed; 1-megohm, ±10%.	Isolating, V2 grid metering lead.
R17	3Z6620–11	RESISTOR: fixed; 20,000 ohms, ±5%.	Meter multiplier.
SW1	3Z9859–17	SWITCH: toggle.	Opens B+ lead — to V1 and V2.
SW7		SWITCH: channel.	Channel changing V2 grid.
V2		TUBE JAN 3B7/1291 (VT–182).	Transmitter buffer.





NOTE 1: Voltages are nominal DC and are measured in transmit position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in and push-to-talk switch in "talk" position.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON. Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM – Not measured. NC – Not connected.

TL19027

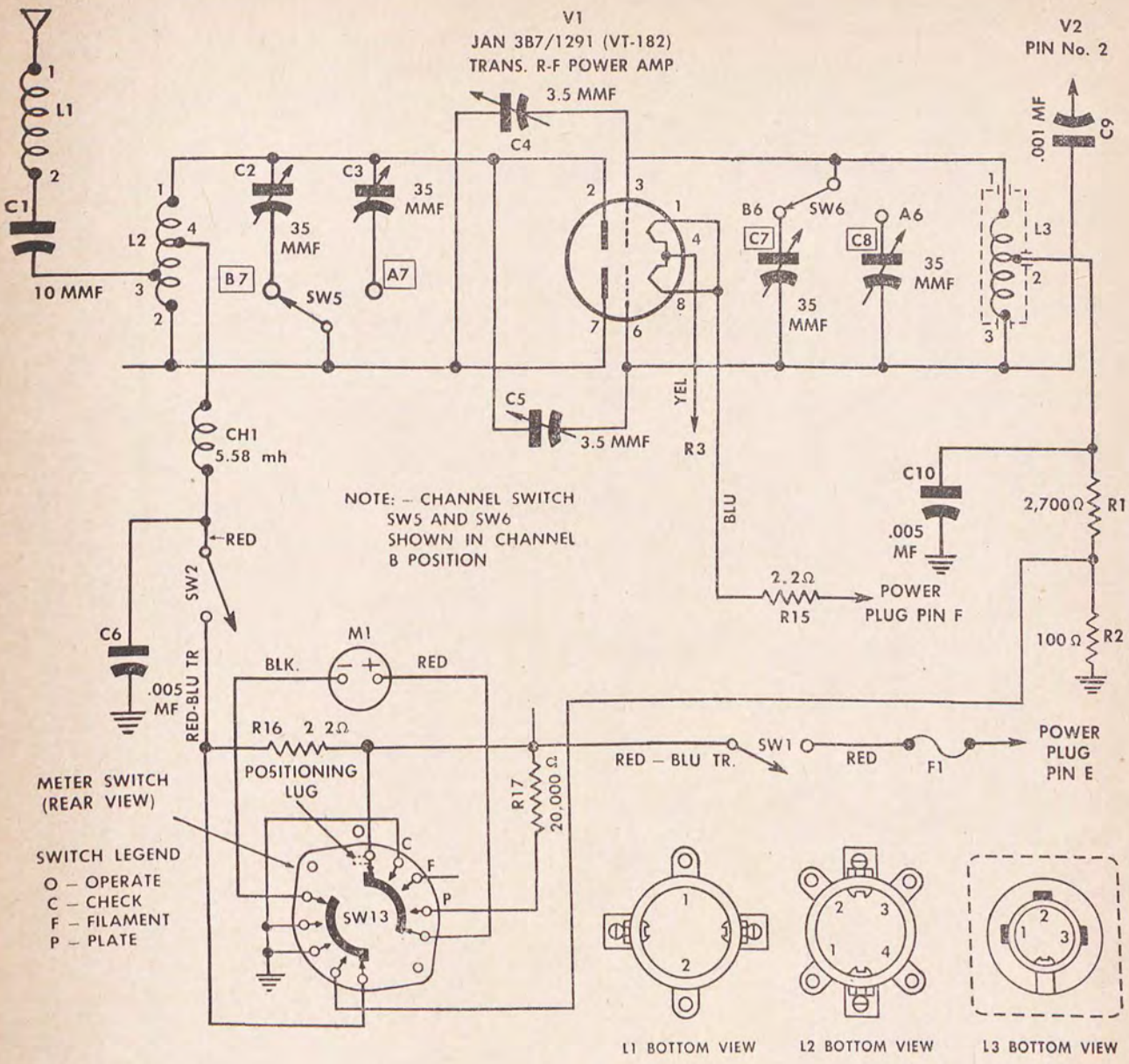
Figure 27. Schematic wiring diagram transformer buffer, Radio Receiver and Transmitter BC–659–(*).

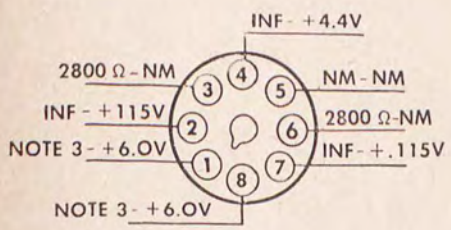
43. Transmitter R-f Power Amplifier

Determine whether or not capacitor C4 or C5 is shorted. Measure the voltage on grids of tube V1 (pin No. 3 and 6). If voltage is measured and found to be positive, check C9 for short circuit. With the proper operation of the transmitter buffer, the grid voltage should be as indicated on the tube voltage chart. If not, check resistor R1, R2, and capacitor C10 for open and short circuits. The plate voltage should be present on pin No. 2 and 7. If no plate voltage is present, check capacitor CH1 and resistor R16 for open circuit conditions. Also check coil L2 for open circuit. If the antenna terminal has a positive voltage, capacitor C1 is shorted. If the final power amplifier does not draw the proper current, check all tuning capacitors and inductances for trouble. If the r-f voltage supplied to the antenna is unusually low and other circuit constants are normal, check capacitor C30 for leakage. This capacitor would produce a loading effect and severely attenuate the output r-f signal.

Table XXXVIII. Transformer r-f power amplifier (fig. 28)

Ref No.	Signal Corps stock No.	Name of part and description	Function
C1	3D9010–B	CAPACITOR: fixed; 10-mmf, ±5%, 300 vdcw.	Coupling L1 to L2.
C2	3D9035V–4	CAPACITOR: variable; 35-mmf, maximum.	Tuning L2, channel B.
C3	3D9035V–2	CAPACITOR: variable; 35-mmf, maximum.	Tuning L2, channel A.
C4	3D9001V	CAPACITOR: variable; 1.0- to 3.5-mmf.	Neutralizing, V1.
C5		CAPACITOR: variable; 1.0- to 3.5-mmf.	Neutralizing, V1.
C6		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	B+ bypass, V1.
C7		CAPACITOR: variable; 35-mmf, maximum.	Tuning L3, channel B.
C8		CAPACITOR: variable; 35-mmf, maximum.	Tuning L3, channel A.
C10		CAPACITOR: fixed; 0.005-mf, +80%, —20%, 300 vdcw.	Bias resistor bypass, V1.
C30	3D9050–36	CAPACITOR: fixed; 50-mmf, ±5%, 300 vdcw.	Receiver antenna coupling.
CH1	3C362–1	CHOKE: low r-f; 5.58 mh at 4 mc.	Plate, V1.
L1	3C1078	COIL: antenna loading.	Antenna loading.
L2	3C1082	COIL: p-a plate.	Plate, V1.
L3		COIL AND GRID: p-a grid.	Grid, V1.
R1	3Z6270	RESISTOR: fixed; 2,700 ohms, ±10%, ½-watt.	Bias, V1.
R2	3Z6010–39	RESISTOR: fixed, 100 ohms, ±5%, ½-watt.	Meter shunt.
SW2		SWITCH: toggle.	Alignment, V1 plate.
SW5	3Z8311–1	SWITCH: channel.	Channel changing, V1 plate.
SW6		SWITCH: channel.	Channel changing, V1 grid.
V1		TUBE JAN 3B7/1291 (VT–182).	Transmitter, r-f power amplifier.





NOTE 1: Voltages are nominal DC and are measured in transmit position with a vacuum tube voltmeter between point indicated and chassis. Set connected to PE-117-(*) with fully charged storage battery. Fresh Battery BA-41 installed and tubes in place. VOLUME control full on. Meter switch at OPERATE. Channel switch at A or B. Switches SW-1 and SW-2 at ON. Handset plugged in and push-to-talk switch in "talk" position.

NOTE 2: Resistance values are nominal and are measured between point indicated and chassis. VOLUME control full on. Meter switch at OPERATE. CHANNEL switch at A or B. Switches SW-1 and SW-2 at ON. Handset and power cable disconnected. All tubes and Battery BA-41 removed.

NM – Not measured. NC – Not connected.

NOTE 3: Value depends upon leakage through C29, but should be 1 MEG minimum.

TL 19028

Figure 28. Schematic wiring diagram transmitter r-f power amplifier, Radio Receiver and Transmitter BC–659–(*).

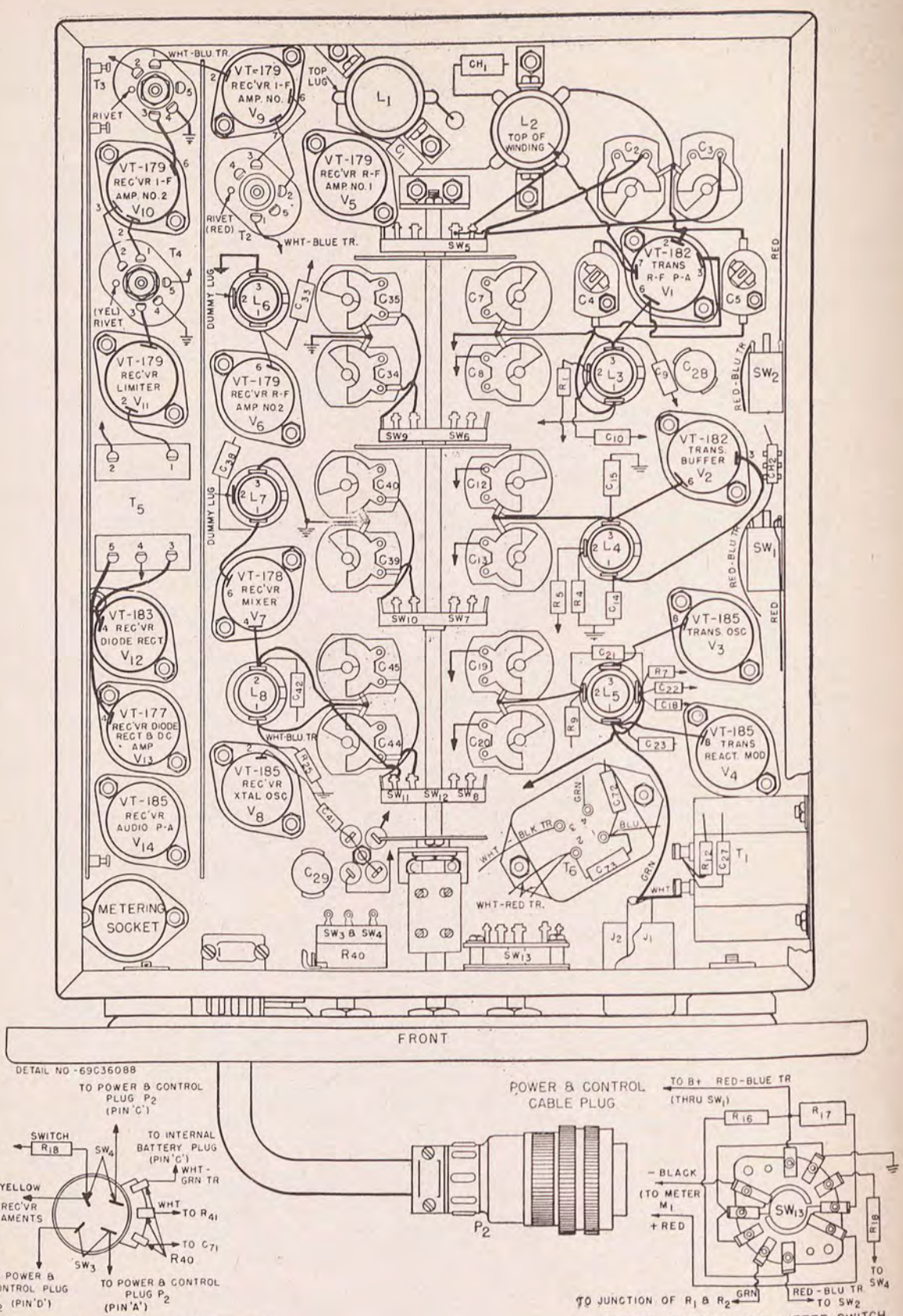


Figure 29. Component parts bottom of chassis, Radio Receiver and Transmitter BC-659-(*).

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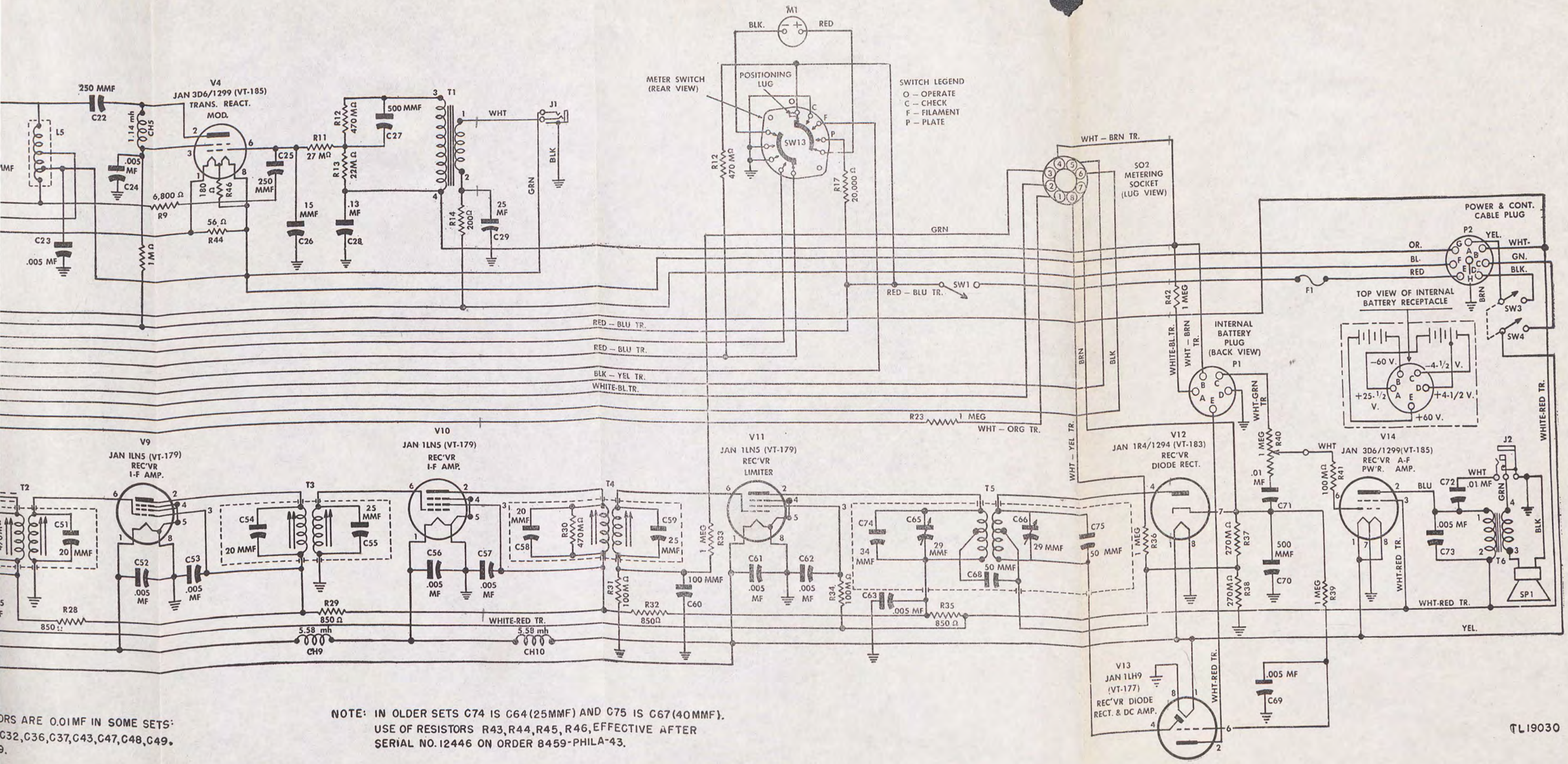
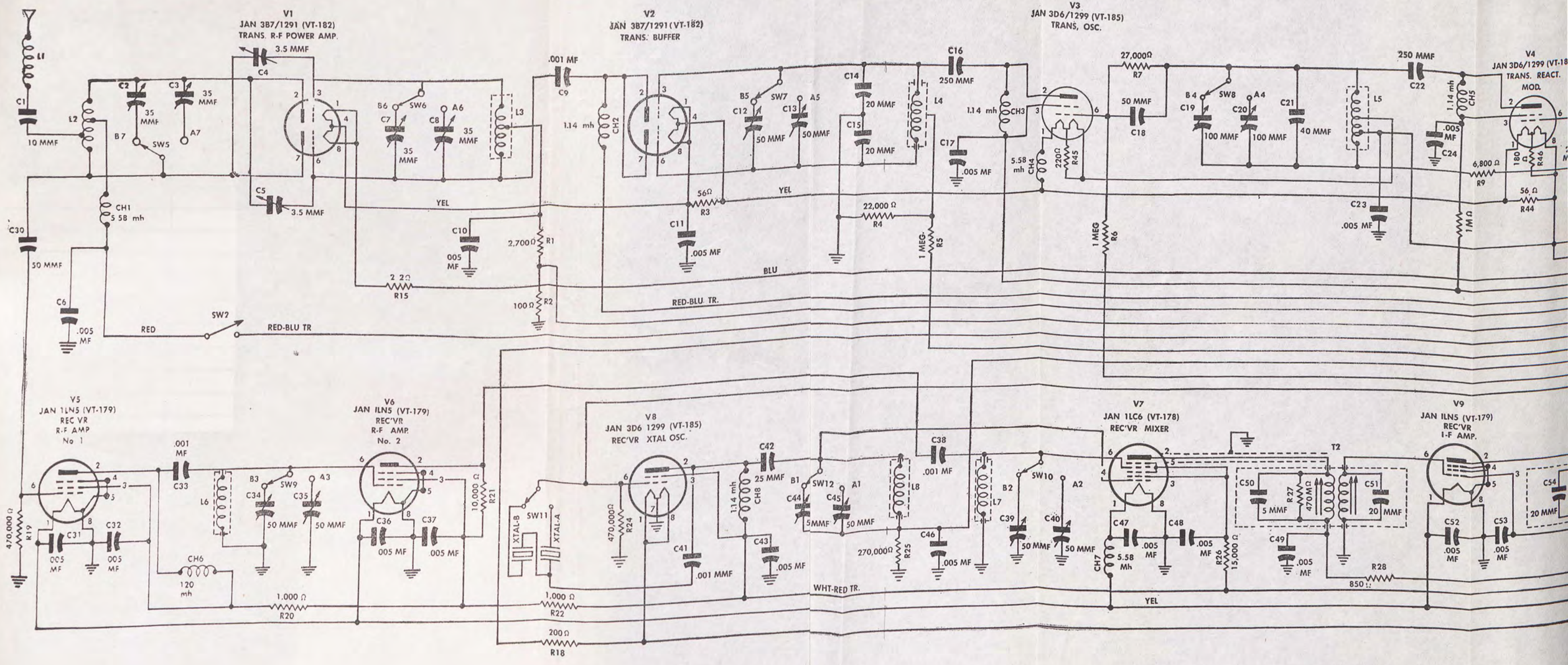


NOTE: IN OLDER SETS C74 IS C64(25MMF) AND C75 IS C67(40MMF).
USE OF RESISTORS R43,R44,R45,R46,EFFECTIVE AFTER
SERIAL NO. 12446 ON ORDER 8459-PHILA-43.

TL19030

ORS ARE 0.01MF IN SOME SETS:
C32,C36,C37,C43,C47,C48,C49.
9.



NOTE: THE FOLLOWING CAPACITORS ARE 0.01MF IN SOME SETS:
C6, C10, C17, C23, C24, C31, C32, C36, C37, C43, C47, C48, C49, C52, C53, C61, C63, AND C69.

Figure 30. Schematic wiring diagram, Radio Receiver and Transmitter BC–659–A, –B, and –H.