DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-4065

TO 16-30PRC8-5

AN 16–30PRC8–5

RADIO SETS AN/PRC-8, -9 AND -10

FIELD MAINTENANCE

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

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TECHNICAL ORDER No. 16-30PRC8-5

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

WASHINGTON 25, D. C., *9 September 1954*

RADIO SETS AN/PRC-8, -9, AND -10, FIELD MAINTENANCE

* This manual supersedes TM 11-4065/TO 16-30PRC8-5, 5 November 1951.

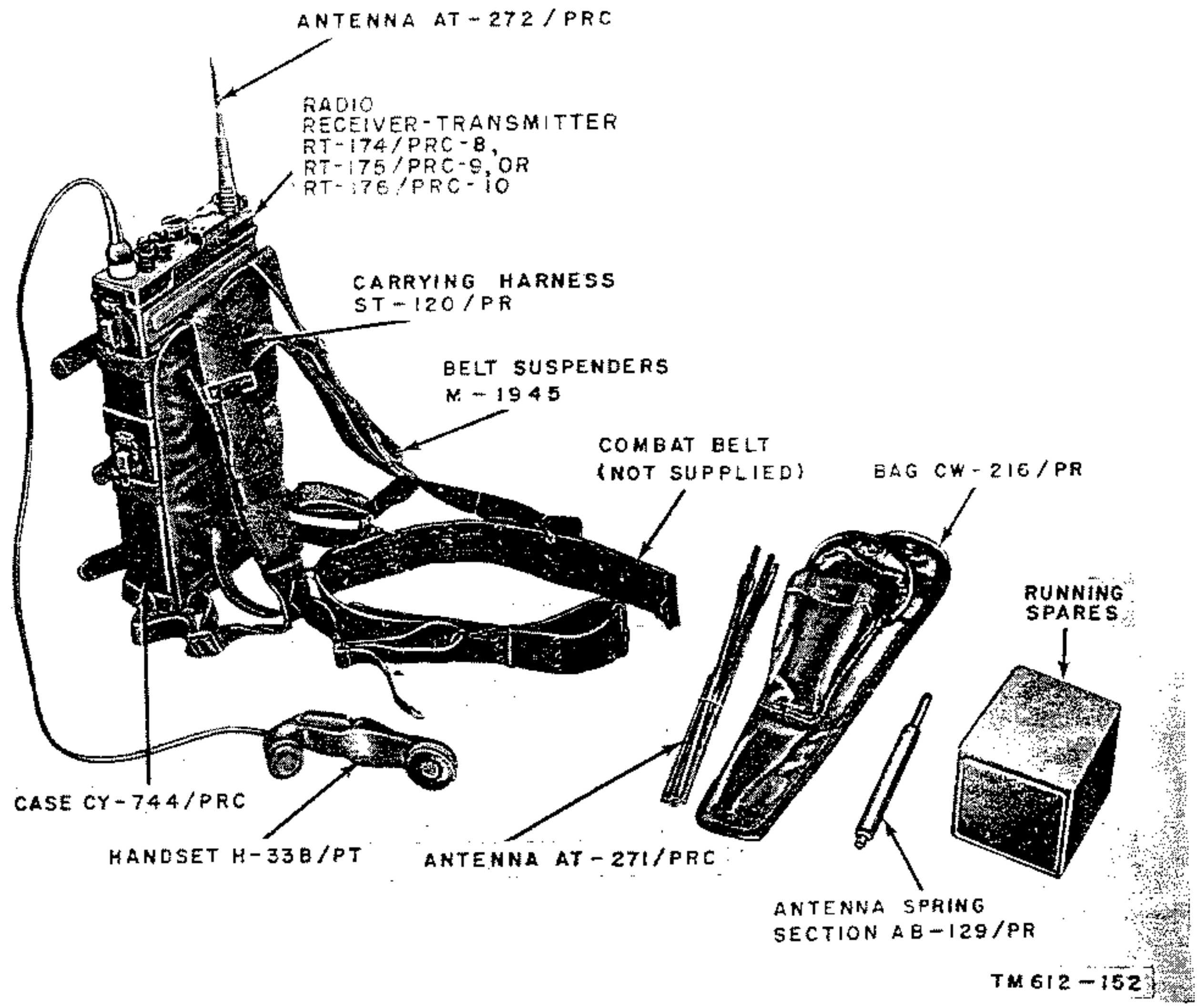


Figure 1. Radio set AN/PRC–8, –9, or –10.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope of Manual

a. This manual contains the theory of operation, and the instructions and data necessary for field maintenance (higher echelon repair) of Radio Sets AN/PRC–8, –9, and –10 (fig. 1). Theory explaining the system functioning of auxiliary equipment used with these sets also is presented.

b. Except for differences pertaining to frequency, Radio Sets AN/PRC–8, –9, and –10 are identical in structure, function, and detailed circuit arrangement. With the above exception, all three sets are treated as one and are referred to as "the radio set." Radio Receiver-Transmitters RT–174/PRC–8, RT–175/PRC–9, and RT-176/PRC–10 (major components of radio sets) are treated similarly and are referred to as "the receiver-transmitter."

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army materiel and equipment and when performing preventive maintenance:

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army), Navy Shipping Guide, Article 1850–4 (Navy) and AFR 71–4 (Air Force).

b. DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

c. DD Form 535, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 and AF TO 00–35D–54.

d. DA Form 11–239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar) will be prepared in accordance with instructions on the back of the form (fig. 26).

e. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

The radio set is a portable receiver-transmitter which is used to provide frequency-modulated (fm) radio communication. It is powered by a battery and is carried by the operator. It also may be used in vehicular, airplane, or semipermanent ground installations where an electronic power supply is used instead of the battery to power the set. Provision also is made for homing use, remote operation, and unattended relay operation. For operating details, see TM 11–612, Radio Sets AN/PRC–8, AN/PRC–9, and AN/PRC–10.

4. Technical Characteristics

a. General.

Frequency range:
- Radio Set AN/PRC–8 ____ 20.0 to 27.9 mc.
- Radio Set AN/PRC–9 ____ 27.0 to 38.9 mc.
- Radio Set AN/PRC–10 ___ 38.0 to 54.9 mc.

Number of tubes ______________ 16.
Type of modulation __________ Frequency.
Type of transmission _________ Voice.

Power source	Battery BA-279/U or Amplifier-Power Supply AM-598/U (not supplied).
Antenna AT-272/PRC	3 feet long; semi-rigid steel tape.
Antenna AT-271/PRC	10 feet long; multi-section whip tape.
Tuning	Single calibrated dial continuously tunes both transmitter and receiver.
Calibration	Built-in calibrator (two Crystal Units CR-18/U, 1 mc and 4.3 mc), provides 1-mc calibration points throughout operating range.
Weight (including components and battery).	26 pounds.

b. Transmitter.

Power output:	
Radio Set AN/PRC-8	1.2 watts.
Radio Set AN/PRC-9	1.0 watt.
Radio Set AN/PRC-10	0.9 watt.
Oscillator	Electron coupled Hartley, with automatic frequency control.
Microphone input impedance	150 ohms.
Distance range	5 miles. (May be 3 to 12 miles, depending on antenna used and siting conditions.)

c. Receiver.

Type	Superheterodyne, fm.
Sensitivity	0.5 microvolt with 2.5 milliwatts output, 15-kilocycle deviation, and a 10-decibel signal-to-noise ratio.
Selectivity	80 kc at 6 db down.
Output impedance	600 ohms.
Type of reception	Fm.
Intermediate frequency	4.3 mc.

5. Differences in Models

Circuit changes have been made in Radio Sets AN/PRC-8, -9, and -10. For details of these circuit changes refer to the notes on the main schematic diagrams (figs. 51-54).

CHAPTER 2
THEORY

Section I. BLOCK DIAGRAM

6. General

The radio set includes a battery (not supplied with set), a long and a short antenna, and a receiver-transmitter. The receiver-transmitter includes a transmitter, a receiver, and calibration circuits. The block diagram (fig. 2) shows the signal paths for each of these circuits and the relationships between them.

7. Receiver Signal Path
(fig. 2)

A fm signal, picked up at the antenna, is applied through the antenna circuit and through a two-stage radio-frequency (rf) amplifier to the mixer stage. The receiver oscillator is tuned to a frequency 4.3 megacycles (mc) above the frequency of the incoming signal. The receiver oscillator signal beats with the incoming signal in the mixer stage where an output frequency of 4.3 mc is developed. This frequency is called the intermediate frequency (if.). The if. signal is amplified by a five-stage if. amplifier and applied to the discriminator. The discriminator converts the fm signal to an audio signal. The audio signal is amplified by the audio amplifier and is applied to the receiver of a handset.

8. Transmitter Signal Path
(fig. 2)

Voice signals, applied from the microphone of the handset, are amplified in the modulator stage and applied to the input circuit of the transmitter oscillator. In this circuit, the audio amplitude variations cause the transmitter frequency to vary above and below its center frequency. The frequency-modulated output of the transmitter oscillator is applied to the antenna circuit and the antenna. A portion of the transmitter oscillator output beats with the receiver oscillator in the mixer stage. The output signal from the mixer is applied to the automatic frequency control (afc) driver stage. This signal is the afc signal. If the transmitter oscillator signal is the correct frequency, the afc signal produces no change in the transmitter oscillator frequency. If the transmitter oscillator signal tends to drift off frequency, the afc signal, applied to the transmitter oscillator stage through the afc driver stage and

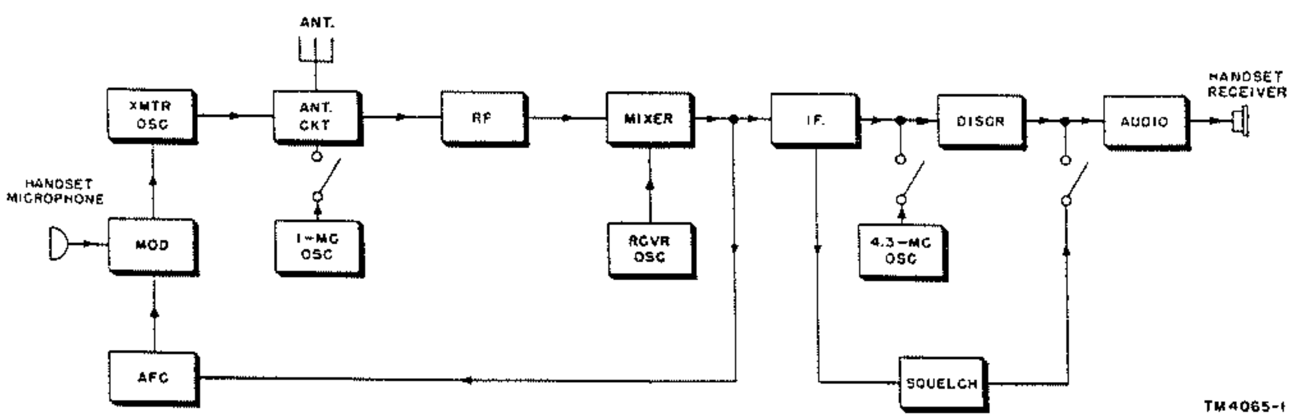


Figure 2. Receiver-transmitter, block diagram.

the modulator stage, reduces this drift to a negligible amount.

9. Calibration Signal Path

The receiver-transmitter contains two crystal-controlled oscillators. One of these is a 1-mc oscillator; the other is a 4.3-mc oscillator. Both of these oscillators are used to calibrate the receiver oscillator. During calibration, when the radio set is tuned to a whole number mc point, the harmonic of the 1-mc oscillator, which is equal to this whole number, is applied to the receiver antenna circuit and is amplified by the two-stage rf amplifier. This signal then beats with the receiver oscillator signal in the mixer and produces an if. signal. If the receiver oscillator is exactly on frequency, the if. signal frequency is 4.3 mc. As this if. signal is applied to the discriminator, it is beat with the accurately tuned 4.3-mc signal from the crystal-controlled 4.3-mc oscillator. When the receiver oscillator is on frequency, the beat frequency is zero. When the receiver oscillator is off frequency, an audio beat frequency is developed in the discriminator, amplified by the audio amplifier, and applied to the handset receiver. When the receiver oscillator is calibrated to produce a zero beat in the handset receiver, it is on frequency. For reference purposes, the control panel of the receiver-transmitter is shown in figure 3.

Section II. RECEIVER STAGES

10. Antenna Circuit
(fig. 4)

The antenna circuit (which is used for both the transmitter and the receiver) has three connectors on the front panel (fig. 3) to which antennas may be connected. A long whip antenna (Antenna AT–271/PRC) plugs into LONG ANT connector J1. A shorting strap on the plug of the long antenna connects C12 and L6, which are necessary to tune the antenna circuit in Radio Sets AN/PRC–9 and –10. In Radio set AN/PRC–8, C12 and L6 are not included. (C12 is ganged with TUNING capacitor C9). A short antenna (Antenna AT–272/PRC) plugs into SHORT ANT connector J2. This antenna is tuned by L7 which also is ganged with TUNING capacitor C9. Antenna Equipment RC–292 or Homing Antenna AT–339/PRC (or AT–340/PRC) can be plugged into AUX ANT connector J3. The signal picked up in the antenna is applied to the tuned circuit consisting of L9, C9A, and C20. C9A is part of the TUNING capacitor. The iron core of L9 is adjustable for alinement of the radio set at the low end of the dial. C20 is a trimmer that is adjustable for alinement at the high

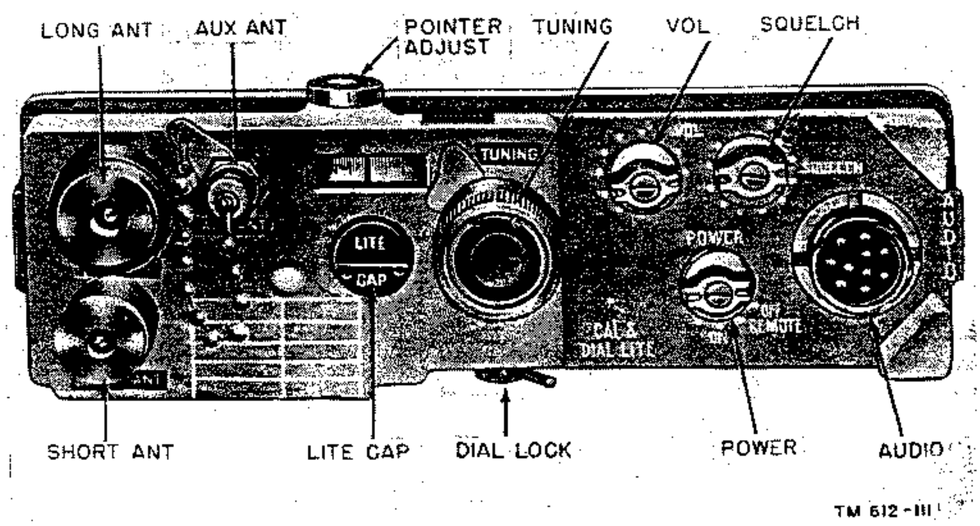


Figure 3. Control panel.

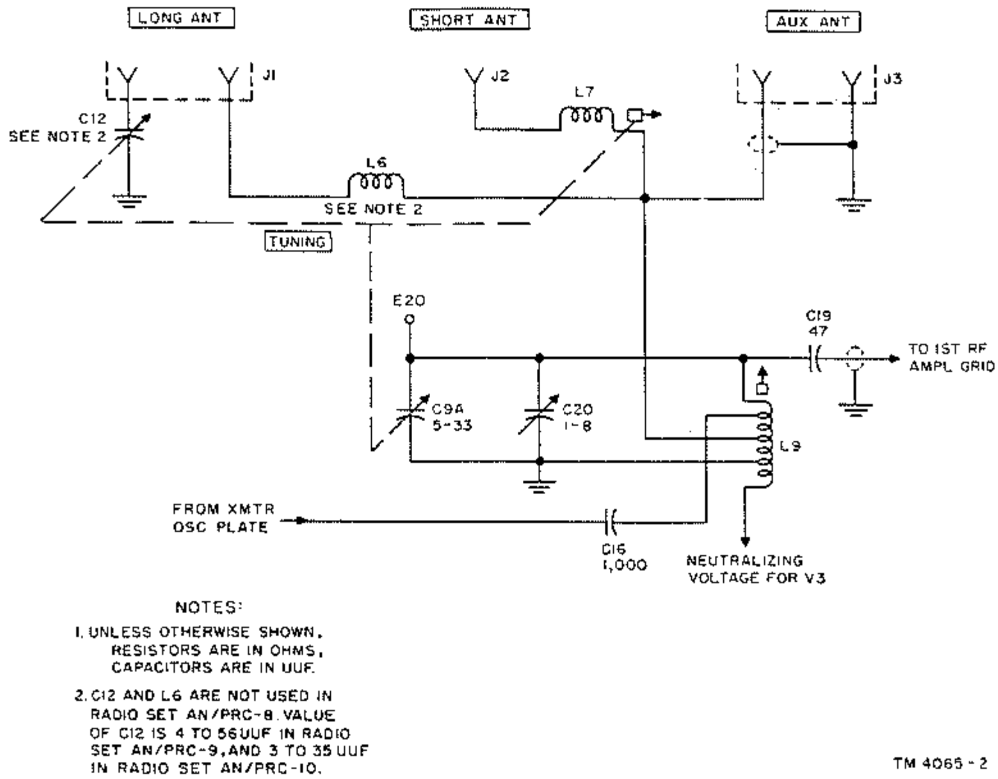


Figure 4. Antenna circuit.

end of the dial. C19 couples the signal from the antenna coil to first rf amplifier V4.

11. Rf Amplifiers
(fig. 5)

a. First Rf Amplifier. The signal from the antenna circuit is applied through coupling capacitor C19 to the control grid of first rf amplifier V4, a pentode type 1AD4. The signal is amplified by V4 and is then fed through coupling capacitor C23 to the grid of second rf amplifier V5.

(1) Grid resistor R14 provides a direct-current (dc) return to ground. The plate tank circuit consists of C9C, C22, and C60 in parallel with L11. C9C is a section of the TUNING capacitor. L11 is adjustable for alinement of the rf amplifier at the low end of the dial. C22 is adjustable for alinement at the high end of the dial. C60, in parallel with C22, has a negative temperature coefficient. When changes in temperature occur, the value of L11 changes. The value of C11, however, changes in the opposite direction from that of L11. This minimizes changes in the resonant frequency of the plate tank circuit. The rf signal is returned to ground through C24 from a tap on L11. The screen grid is connected to the opposite end of L11 from that of the plate. This puts an rf voltage at the screen that is opposite in polarity to that of the plate. This provides a negative feedback voltage that prevents oscillation of the amplifier. In Radio Sets AN/PRC–8 and –9, the gain of the first and second rf amplifiers is higher than it is in Radio Set AN/PRC–10. In order to lower the gain of the rf amplifiers in these sets to provide greater stability, the plates of V4 and V5 are connected to taps on L11 and L13 instead of to the tops of the coils.

(2) B+ is applied to the plate and screen through R15. R15 and C24 form a decoupling filter that isolates the B+ supply from rf voltages. Filament

voltage is applied through contacts 8 and 7 of receive-transmit relay K1 and through rf choke L10. C21 bypasses the filament for rf. Contacts 8 and 7 of K1 are open when the radio set is in the transmit condition and the first rf amplifier is de-energized. This prevents the transmitter oscillator output (which is developed across L9) from being amplified by the first rf amplifier. This would overload the second rf amplifier and the mixer. For further details refer to the afc circuit (par. 21).

b. Second Rf Amplifier. The output signal from the plate circuit of V4 is applied through coupling capacitor C23 to the control grid of second rf amplifier V5. This tube, a pentode type 5678, amplifies the signal and feeds it through coupling capacitor C47 to the input circuit of the mixer. The design of this amplifier is the same as that of the first rf amplifier except that filament voltage is applied directly to the filament instead of through the contacts of relay K1. This keeps the second rf amplifier in operation both for reception and transmission. During transmission, a portion of the transmitter oscillator signal is applied through R18 to the control grid of second rf amplifier V5. It is amplified by V5 and applied to the mixer where it beats with the receiver oscillator signal to form the afc signal (par. 21).

12. Receiver Oscillator
(fig. 6)

a. The receiver oscillator supplies a signal 4.3 mc higher than the frequency to which the receiver-transmitter is tuned. During reception, this signal beats with the incoming signal to produce the required if. frequency. During transmission, this signal beats with a portion of the transmitter oscillator signal to produce the afc signal.

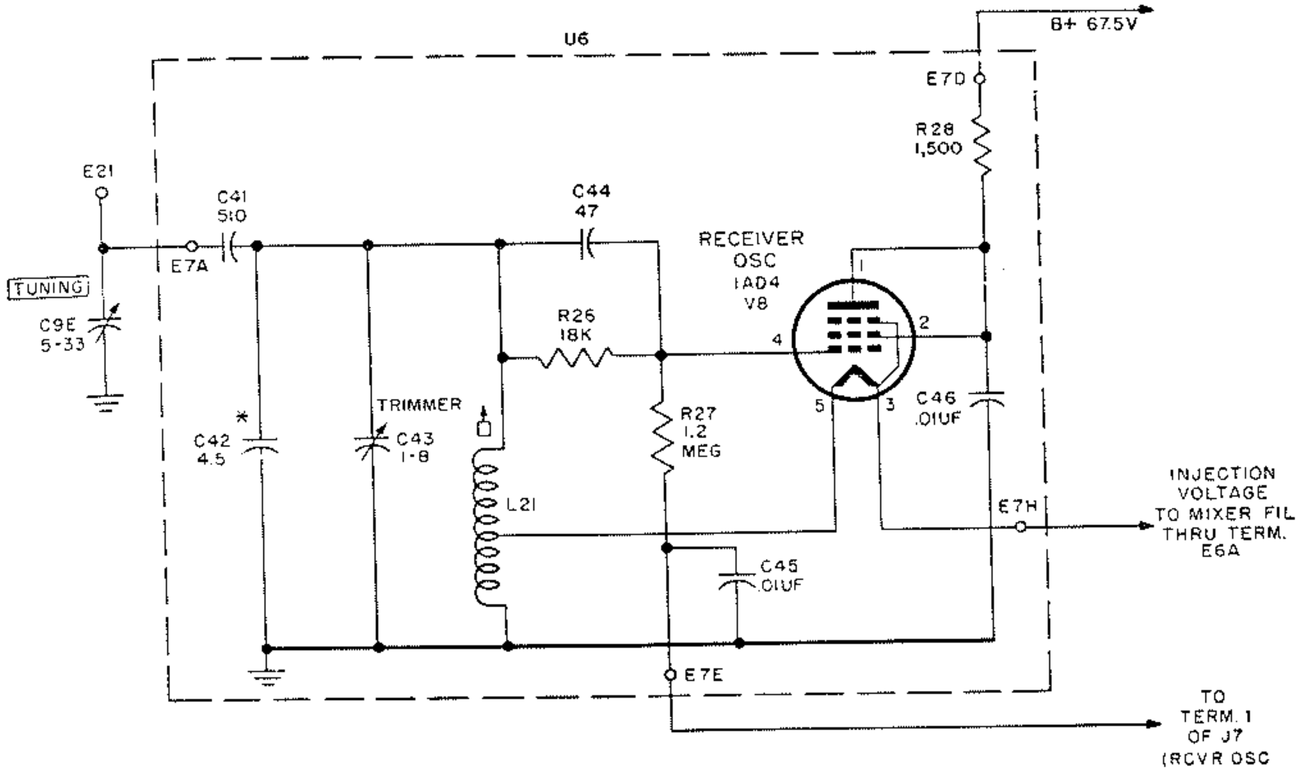
b. The receiver oscillator is a pentode type 1AD4. The plate and screen are tied together externally by a connection between pins 1 and 2 so that the tube operates as a triode. The circuit is a series-fed Hartley oscillator in which plate-to-grid feedback occurs across L21. The plate circuit is from the plate of the tube through C46 to ground and then up through the lower portion of L21 to the cathode. The voltage in the plate (lower) section of L21 induces a voltage in the grid (upper) section of the coil. The grid circuit extends from the grid (pin 4) through the parallel grid capacitor grid resistor combination of C44 and R26 and through the upper section of L21 to the cathode. The tuned circuit consists essentially of L21 in parallel with C9E. C41 is a padder capacitor in series with C9E and serves to reduce the effective capacitance of C9E and track the receiver oscillator 4.3 mc higher than the rf signal. C43 is a variable trimmer. C42 is a temperature compensating capacitor. The core of L21 is adjustable for alinement of the receiver oscillator at the low end of the dial; C43 is adjustable for alinement at the high end of the dial.

c. A portion of the receiver oscillator voltage is applied from the filament of V8 to the mixer stage. Filament power is applied to the receiver oscillator from the mixer filament circuit. B+ power is applied to the plate of V8 through decoupling resistor R28. R27 and C45 form a decoupling filter between the grid and a test point at terminal 1 of test connector J7.

13. Mixer
(fig. 7)

a. A signal at the frequency to which the radio set is tuned is applied to the mixer from the output of the second rf amplifier at the same time that a signal 4.3 mc higher is applied from the receiver oscillator. These two signals beat in the mixer to produce a different frequency (4.3 mc). The output of the mixer is tuned to this frequency which is called the *intermediate frequency.* All frequencies outside of this if. band are rejected.

b. The output from the second rf amplifier is applied to the control grid (pin 4) of mixer V6, a pentode type 5678. R18 is the grid-leak bias resistor. The signal from the receiver oscillator (4.3 mc higher than the signal from the second rf amplifier) is applied across L16. L16 is returned to ground through C29. A portion of the voltage across L16 is applied to the cathode of V6. The beating (mixing) of the rf signal (injected at the control grid) and the receiver oscillator signal (injected at the cathode) produces an intermediate frequency



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

2. V8 IS A TYPE 5676 IN THE FOLLOWING MODELS OF RADIO SET AN/PRC-10:

ORDER NO.	SERIAL NOS.
1758-PHILA-51	BELOW 6500
3374-PHILA-52	21562 THRU 22286

3. * VALUES FOR C42

RADIO SET	UUF
AN/PRC-8	10
AN/PRC-9	6.5
AN/PRC-10	4.5

TM 4065-C1-3

Figure 6. Receiver oscillator circuit.

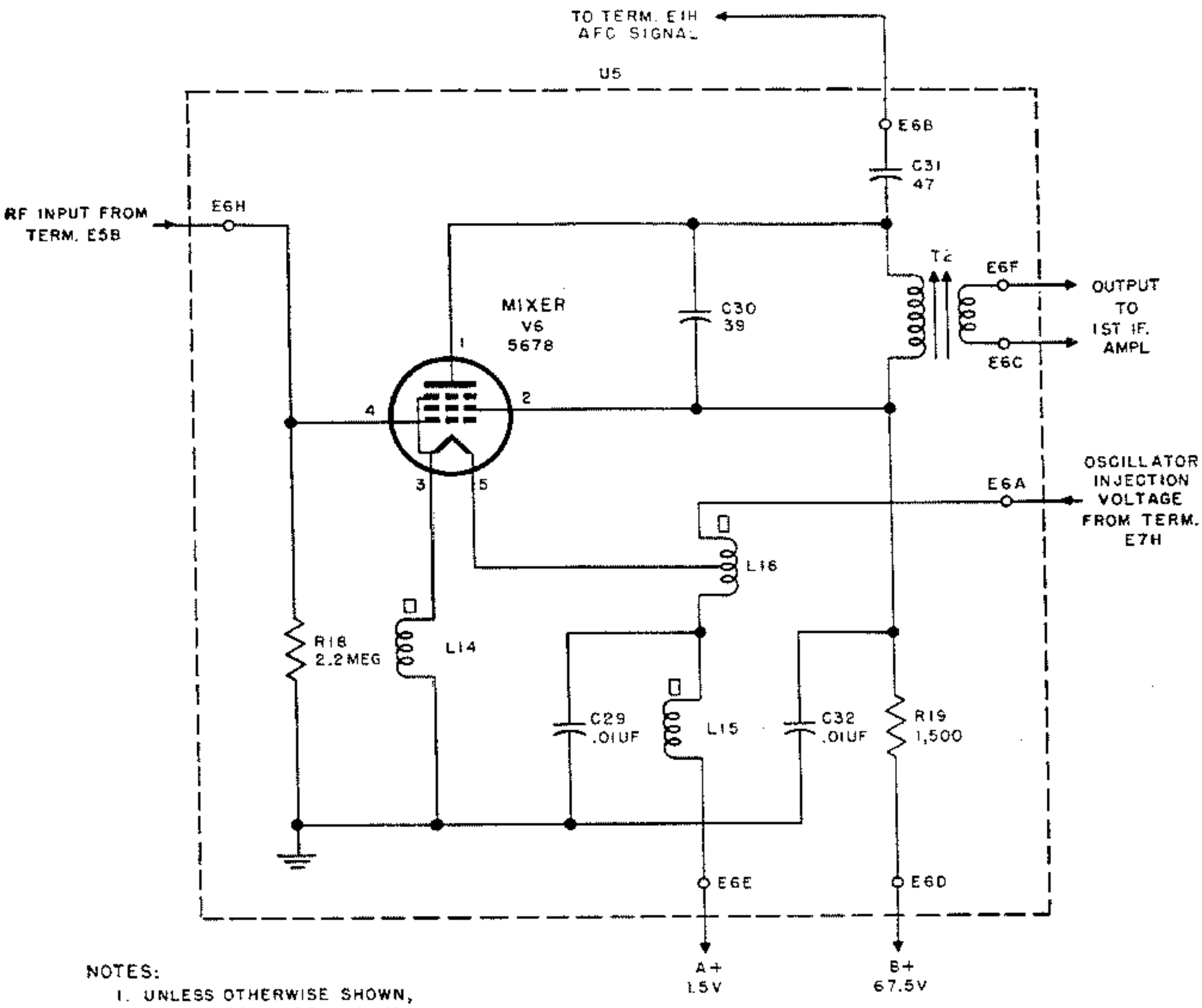
of 4.3 mc in the plate circuit. The plate circuit consists of C30 and the primary of T2. This is a parallel circuit which is tuned to resonance at 4.3 mc. The voltage developed in this circuit is passed through transformer T2 to the grid circuit of the first if. amplifier and through C31 to the grid circuit of afc driver V1.

c. Filament voltage is applied to the filament through L15 and through L16. C29 and L15 decouple the dc filament supply from rf voltages. L14 keeps the filament above rf ground. B+ voltage is applied through R19 to the screen (pin 2) and through the primary of T2 to the plate (pin 1) of the tube. R19 and C32 form a B+ decoupling filter.

14. If. Amplifiers (fig. 8)

a. There are five if. stages in the receiver. These are all identical. Each stage is a hermetically sealed can. The cans have reference symbols U101, U102, U103, U104, and U105. The five cans plug into sockets X7, X8, X9, X10, and X11, respectively. Because the cans are identical, the components and the component reference symbols in each can are identical. Therefore, a description of one of these stages covers all five if. stages.

b. The input signal is applied across terminals 1 and 2 of the can (not the tube) from the secondary of the transformer of the previous stage. The transformer secondary forms a series tuned circuit with L101 and C101 which is resonant at 4.3 mc. The voltage across C101 is applied to the control grid of V101. The if. return to ground from C101 is through C102A. The dc return to ground is through R101. In each succeeding if. stage, the signal level is greater and the grid bias voltage developed across R101 is greater. At the fourth and fifth



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. VALUE OF R18 IS 470K IN FOLLOWING MODELS OF RADIO SET AN/PRC-10:

ORDER NO.	SERIAL NOS.
1758-PHILA-51	BELOW 4700
3374-PHILA-52	21562 THRU 23561

TM 4065-C1-4

Figure 7. Mixer circuit.

if. amplifiers, this bias voltage, together with the relatively low plate voltage, produces limiting action. This clips the positive and negative peaks from signals which exceed a certain amplitude and applies a signal of constant amplitude to the discriminator stage.

c. The plate tuned circuit, consisting of C103 and the primary of T101, is resonant at 4.3 mc. R104 is across this circuit to broaden its response to the desired bandwidth (aprx. 100 kilocycles (kc)). The output signal is passed through T101 to the next stage.

d. The 67.5-volt supply is applied to the plate through decoupling filter R103 and C102D and through the primary of T101. From the top of R103, voltage is applied to the screen through an additional decoupling filter consisting of R102 and C102B. The 1.5-volt supply is applied to the filament through contacts 8 and 7 of receiver-transmit relay K1 and L102. C102C

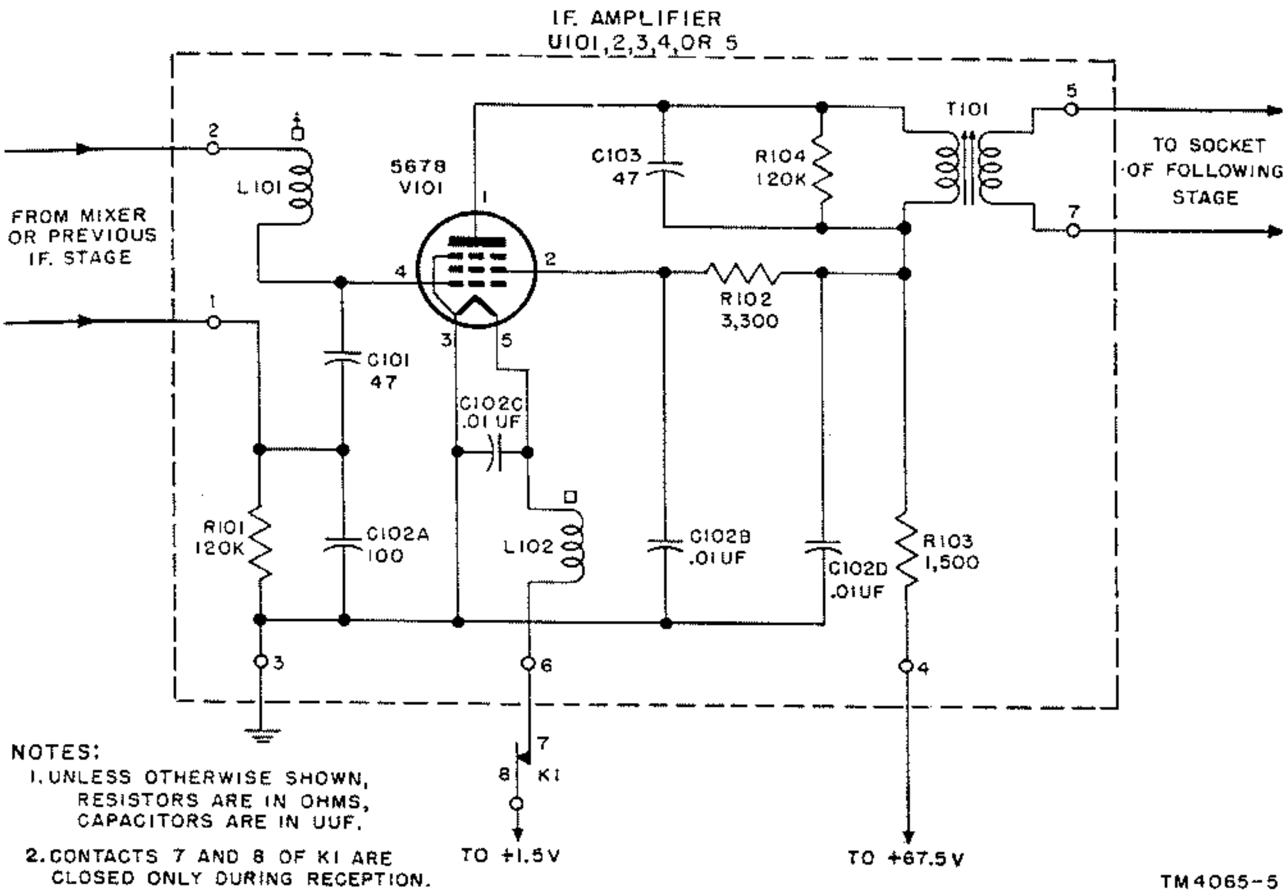


Figure 8. If. amplifier circuit.

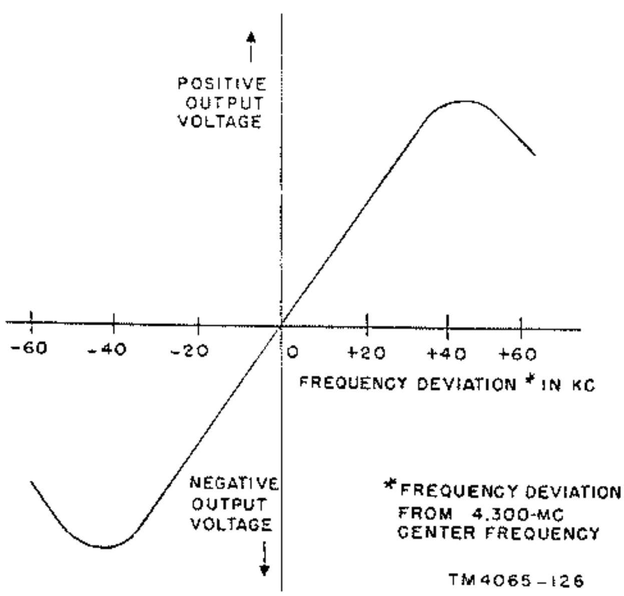


Figure 9. Discriminator frequency response curve.

and L102 form an rf filter which keeps rf out of the filament.

15. Receiver Discriminator
(figs. 9 and 10)

a. Discriminator Function. The receiver discriminator changes fm signals to audio signals. The if. signal applied to the discriminator is frequency modulated and shifts above and below the 4.3-mc center frequency at an audio rate. The amplitude of the modulating voltage at the transmitter determines the amount of deviation of the transmitter rf carrier and the receiver if. signal. The output voltage of the discriminator varies with the frequency of the input signal as shown in figure 9. The discriminator output, therefore, is an audio signal. The amplitude of the audio signal is proportional to the frequency deviation (shift) of the fm signal. The frequency is equal to the frequency with which these deviations occur.

b. Circuit Operation. The series circuit consisting of the secondary of T101 of the fifth if. amplifier (fig. 8), and L201 and C202 in the discriminator can (fig. 10), is tuned to 4.3 mc. The voltage across C202 is coupled through M203 to the discriminator tuned circuit consisting of L202 and C205. This circuit also is tuned to the if. frequency (4.3 mc). C204 unbalances the upper and lower halves of the discriminator circuit. This unbalancing is necessary in order to produce unequal ac voltages across CR201 and CR202 when the if. signal is above or below 4.3 mc. The ac signal in this circuit is rectified by crystal rectifiers CR201 and CR202 to produce dc voltages across R201 and R202. At the if. center frequency, these voltages are equal and opposite so that the dc output of the discriminator is zero. When the signal shifts above the if. center frequency, the dc voltage across R201 exceeds that across R202 and the discriminator output voltage is positive. When the signal shifts below the if. center frequency, the dc voltage across R202 exceeds that across R201 and the discriminator output voltage is negative. As the frequency of the if. signal keeps shifting at an audio frequency, the polarity and amplitude of the discriminator output voltage keeps shifting at an audio frequency. The output voltage, which is an audio signal, is obtained at terminal 7 of T201 and is applied through if. decoupling filter B23 and C38 to VOL control R24. C206 provides a return to ground for if. from CR201. When the radio set is being calibrated, the signal from the 4.3-mc calibration oscillator is applied to the discriminator circuit through terminal 6 of C201. The value of C201 is made small to decouple the calibration oscillator circuit from the discriminator input circuit.

16. Audio Amplifier
(fig. 11)

The audio output from the discriminator is applied to VOL control R24 and from the movable contact on R24 through C39 to the control grid of audio amplifier V7. R25 is the gridleak resistor. A bias of —6 volts is applied through this resistor from the 6-volt supply.

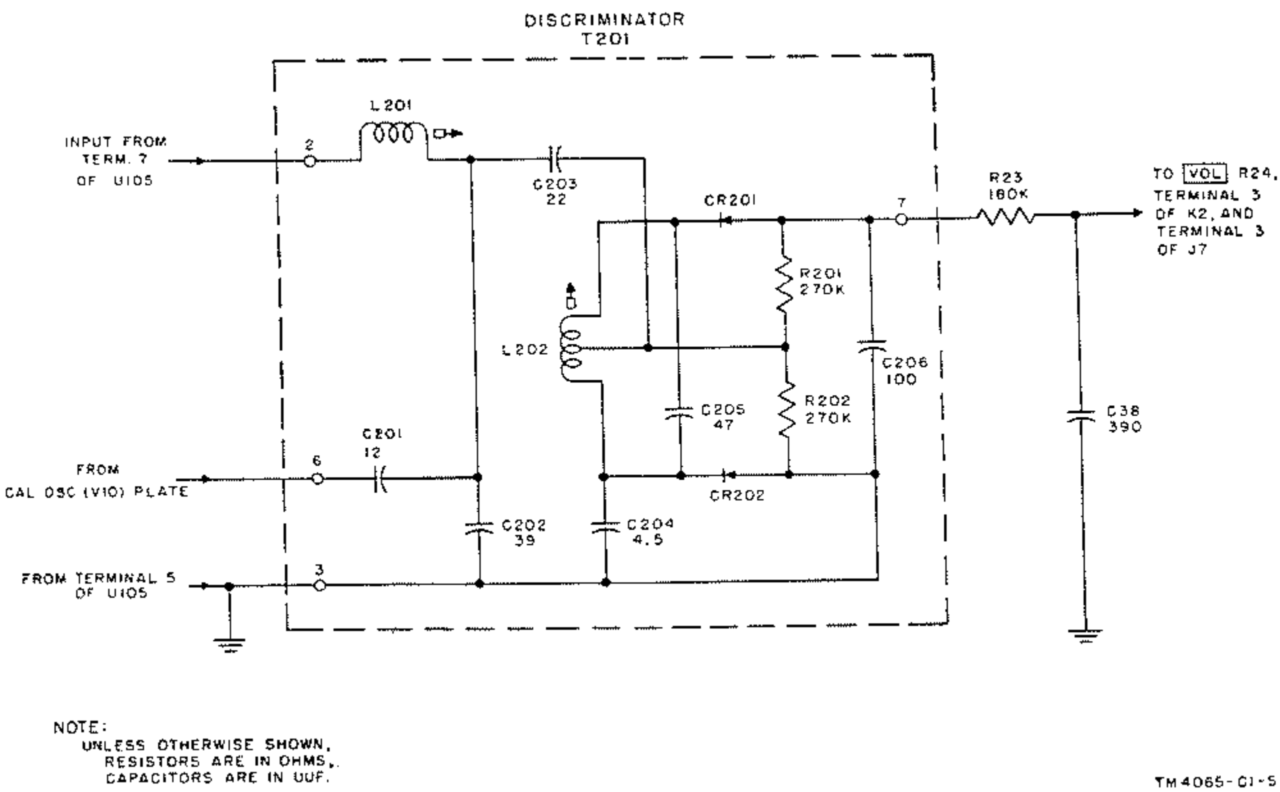


Figure 10. Discriminator circuit.

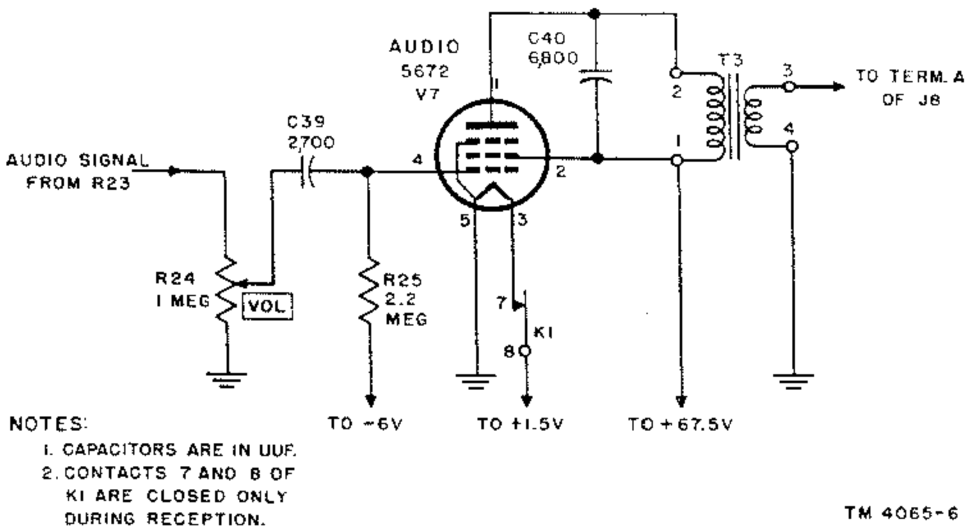


Figure 11. Audio amplifier circuit.

The plate circuit consists of the primary of T3, which is shunted by C40 to reduce the output of the higher audio frequencies. The secondary of T3 is connected across terminal A of AUDIO connector J8 and ground. (The handset receiver is connected to these terminals.) The 1.5-volt supply is applied to the filament through contacts 8 and 7 of receiver-transmit relay K1. When the radio set is transmitting, these contacts open to disable the audio amplifier. The 67.5-volt supply is applied directly to the screen grid of the tube and through the primary of T3 to the plate.

17. Squelch Circuit
(fig. 12)

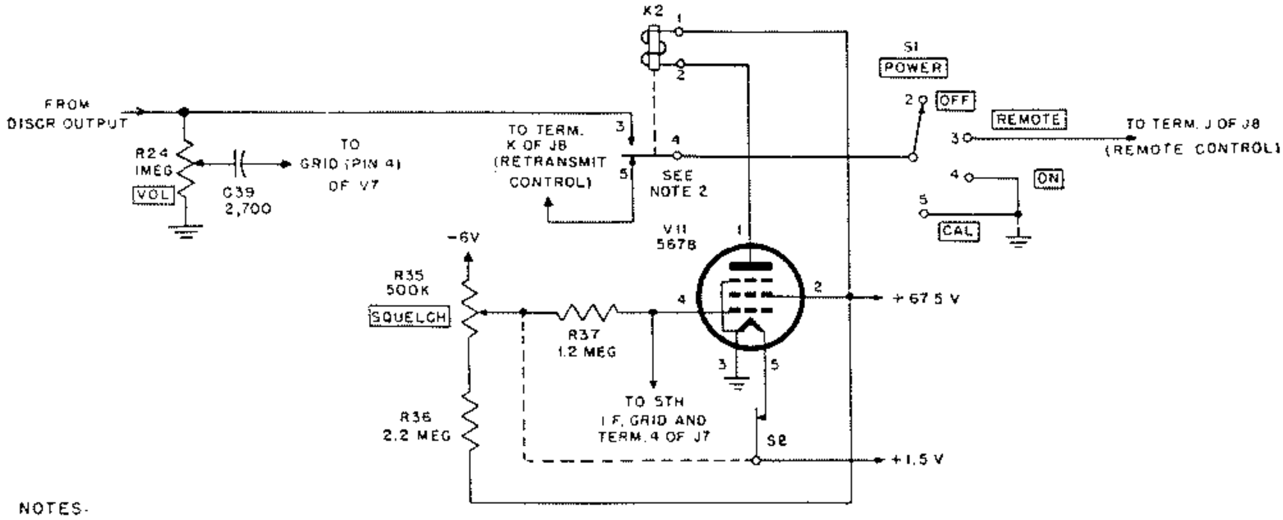
a. When the squelch circuit is operating, it grounds the audio output from the discriminator and silences (squelches) the receiver. The high side of VOL control R24 is connected to contact 3 of squelch relay K2. When K2 is energized, contacts 3 and 4 close and a circuit is completed through these contacts and the ON or CAL position of the POWER switch to ground. (In some earlier models, terminal 4 of K2 was connected directly to ground.) When SQUELCH control R35 is turned to its extreme counter-clockwise position, it opens switch S2 which is in series with the filament of V11. This de-energizes the tube and disables the squelch circuit.

b. The plate current of V11 operates K2. This current is controlled by the grid bias voltage at pin 4 of V11. R35 and R36 form a voltage divider between the —6-volt supply and the +67.5-volt supply. The adjustable tap on R35 is set to apply a low negative voltage (approximately 1.7 volts) to the control grid of the tube through grid current limiting resistor R37. This bias voltage allows just enough plate current to flow to energize (pull in) K2. When the receiver picks up a signal, it develops a negative bias voltage at the grid of the fifth if. amplifier. This voltage is applied to the control grid of V11. When this voltage exceeds 2.5 volts, it reduces the plate current below the value necessary to keep K2 pulled in. K2 releases, breaking the connection between contacts 3 and 4 and removing the short from the audio circuit. This unsquelches the receiver. When the signal stops, K2 pulls in again and squelches the receiver.

c. Contacts 4 and 5 of K2 are used only when two radio sets are used for retransmission (fig. 23). R37 decouples R35 from the grid circuit of the fifth if. amplifier.

18. Calibration Oscillators
(fig. 13)

a. 1-mc Calibration Oscillator. The 1-mc calibration oscillator, V9, is a modified Pierce oscillator. Feedback from plate to grid is through C48 and crystal Y1. C48 and C47 form a voltage divider which determines the amount of feedback voltage applied to the grid circuit. R29 is the grid-leak resistor. C47 and C49 provides



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS. CAPACITORS ARE IN UUF.
2. TERMINAL 4 OF RELAY K2 IS CONNECTED DIRECTLY TO GROUND IN THE FOLLOWING SETS:

RADIO SET	ORDER NO.	SERIAL NOS.
AN/PRC-8	1758-PHILA-51	BELOW 115
AN/PRC-9	1758-PHILA-51	BELOW 6
AN/PRC-10	1758-PHILA-51 3374-PHILA-52	BELOW 9100 BELOW 26020

3. R36 IS 560K IN RADIO SETS AN/PRC-10 ON ORDER NO. 1758-PHILA-51 WITH SERIAL NUMBERS BELOW 4700.
4. POWER SWITCH S1 VIEWED FROM END OPPOSITE KNOB.

TM 4065-C1-6

Figure 12. Squelch circuit.

the proper loading across crystal Y1 for good frequency stability. L22 keeps the cathode above ground potential for rf. R30 is the plate voltage-dropping resistor. Crystal Y1 accurately controls the oscillator frequency at 1 mc. The oscillator voltage is applied from pin 5 of the filament to antenna coil L9. For the theory discussion of receiver calibration, see paragraph 9.

b. 4.3-mc Calibration Oscillator. The 4.3-mc oscillator, V10, is a Pierce electron-coupled oscillator. The screen grid (pin 2) operates as the plate of a triode oscillator. The plate (pin 1) is electron coupled to the triode oscillator through the tube electron flow. Because the output is taken from the plate circuit of the tube, electron coupling isolates the output loading from the oscillator circuit. The output voltage at the plate is coupled to the discriminator input circuit where it beats against the if. frequency produced by the mixing of the receiver oscillator signal with a harmonic of the 1-mc oscillator. The oscillator section of the tube consists of the filament, control grid, and screen grid. This circuit is very similar to the 1-mc oscillator circuit. Voltage is fed back from the screen (pin 2) to the control grid (pin 4) through C52 and crystal Y2. C52 and C50 form a voltage divider which determines the amount of feedback voltage applied to the grid circuit. R31 is the grid-leak resistor. C50 and C51 provide the proper loading across crystal Y2 for good frequency stability. L23 provides rf isolation between the filament of V11 and the 1.5-volt supply. R33 and C54 form a decoupling filter between the B+ supply and the plate and screen of the tube. R32 is the plate load resistor. R34 is the oscillator plate load resistor. (The screen grid, pin 2, is the plate of the triode oscillator.)

c. Filament and Dial Light Circuits. The 1.5-volt supply is applied through the CAL position of the POWER switch to the filament of V9 and V10 and to dial light E8. These three circuits are in parallel. E8 and the filament of V10 are returned directly to ground. The filament of V9 is returned to ground through a portion of antenna coil L9 (figs. 51 through 54).

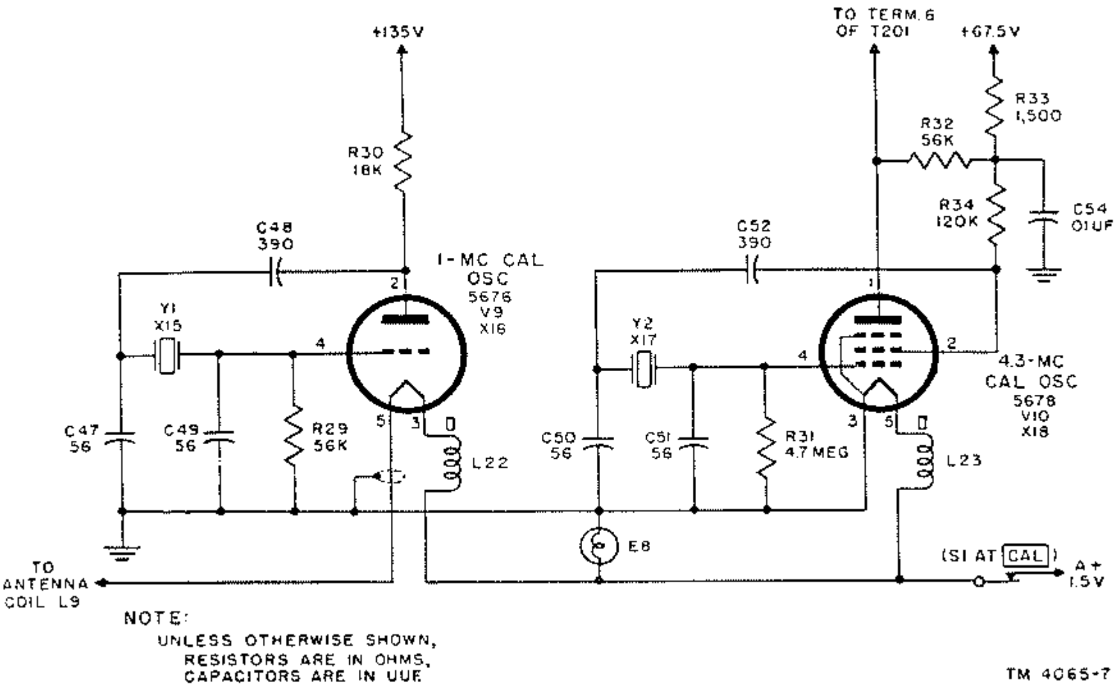


Figure 13. Calibration oscillator circuits.

Section III. TRANSMITTER STAGES

19. Modulator

(fig. 14)

a. The modulator has two functions. It frequency-modulates the transmitter oscillator and is also a part of the afc circuit that prevents the transmitter oscillator from drifting off frequency. Both functions are accomplished by the variation in inductance of transformer L4 when the plate current of V2 varies. The afc circuit is explained in paragraph 21.

b. Transformer L4 is operated near its magnetic saturation point. When the current through L4 is increased, its permeability and inductance decrease. When the current through L4 is decreased, its permeability and inductance increase. This is shown on figure 15. The primary of L4 is in the plate circuit of V2. Therefore, changes in the plate current of V2 produce changes in the inductance of the primary and secondary windings of L4. The secondary winding of L4 is in parallel with a portion of L3 (which is part of the tuned grid circuit of transmitter oscillator V3). Therefore, changes in the inductance of the secondary of L4 produce changes in the frequency of the transmitter oscillator. When these changes occur at a rate which corresponds to the frequency of the audio signal coming from the microphone of the handset, the transmitter oscillator is frequency modulated by this audio signal.

c. Voice signals are applied from the microphone of the handset through transformer T1 to the grid of V2. C7 is the audio-frequency

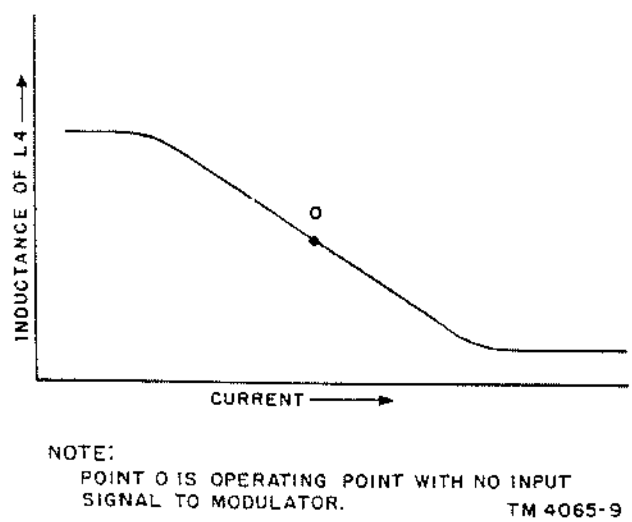


Figure 15. Variation of inductance with current in L4.

(af) ground return for the secondary of T1. In earlier models, C8 and R10 form a voltage divider across the secondary of T1. C8 pre-emphasizes the higher audio frequencies. In later models, C8 is replaced by R12 (note 3, fig. 14). (This new R12 should not be confused with an R12 used in earlier models in the grid circuit of V3.) The audio signals at the grid of V2 cause the plate current of V2 to change at an audio frequency. This causes the inductance of L4, and the frequency of transmitter oscillator V3, to change at an audio frequency.

d. The grid bias circuit for V2 is shown on figure 16. In this circuit, there are two dc voltage sources in series. The first is the negative grid-leak bias voltage developed across R11 by transmitter oscillator V3. The second is the output voltage of the afc discriminator circuit which is developed across C6 (par. 21). When the transmitter oscillator is on frequency, the output voltage of the discriminator circuit is zero. However, when the transmitter oscillator drifts off frequency, a positive or negative dc voltage is developed across the output of the afc discriminator, depending on whether the frequency drift of the transmitter oscillator is up or down. The vector sum of the voltage across R11 and the afc output voltage is the bias voltage at the control grid of V2.

e. The +135-volt supply is applied from contact 6 of receive-transmit relay K1 (fig. 14) and the primary of L4 to the plate of V2. The 1.5-volt supply is applied from contact 9 of K1 to the filament of V2. Both pairs of contacts are closed only during transmission, so V2 operates only during transmission.

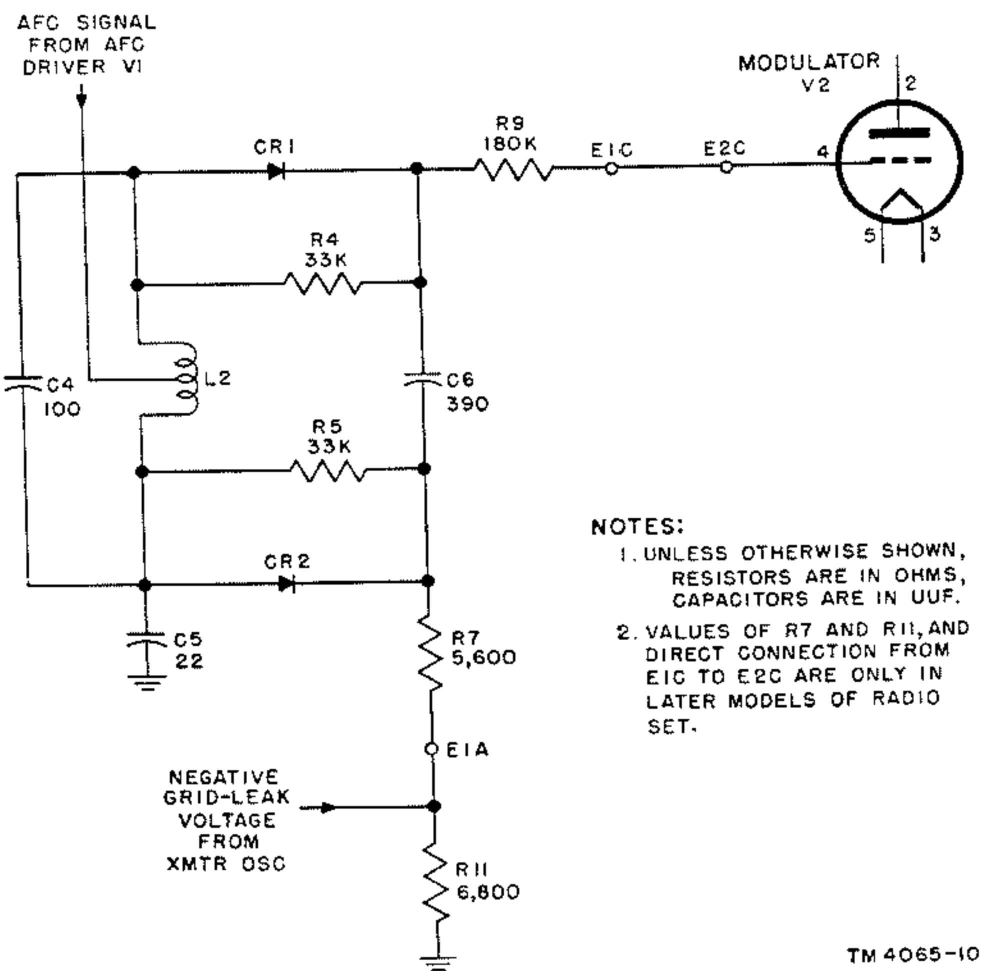


Figure 16. Grid bias circuit for modulator.

20. Transmitter Oscillator
(fig. 17)

a. Transmitter oscillator V3 is an electron-coupled, neutralized output, Hartley oscillator. The oscillator section of the tube consists of the filament, the control grid, and the screen grid. The plate circuit of the tube has no connection to the oscillator section except through the electron coupling in the tube. Variations in frequency or loading in the plate circuit therefore do not affect the stability of the oscillator.

b. The oscillator tuned circuit consists of L3 and C9B. C11 is a trimmer used for transmitter oscillator alinement at the high end of the dial. L3 is slug-tuned to permit alinement at the low end of the dial. The lower tap on L3 is connected to the filament of V3. The portion of L3 between this tap and ground is in the plate section of the Hartley oscillator. (In Radio Sets AN/PRC–8 and –9, this section of L3 is shunted by R6 to provide the proper value of rf plate voltage.) The screen grid (pin 6), which operates as the plate of the oscillator section, is returned to ground through C18 and then back through the lower section of L3 to the filament of V3. The remaining portion of L3 is in the grid circuit of the oscillator. The upper tap on L3 is connected to the secondary of L4 which is in parallel with the portion of L3 below this tap. Changes in the inductance of L4 produce changes in the resonant frequency of the transmitter-oscillator tuned circuit and, therefore, produce changes in transmitter frequency. The tuned circuit is coupled to the control grid of V3 through C10 and parasitic suppressor E3. On earlier models R12 is a grid-leak resistor connected directly between the control grid and cathode of V3. On later models R12 has been omitted and the values of R13 and R11 have been reduced to provide the relatively low dc path from control grid to cathode that was provided by R12. In models from which R12 has been omitted, the return from ground to cathode is made through the lower portion of L3. R13 and C15 form a decoupling filter to prevent rf from being applied to terminal E1A of the afc driver box.

c. The plate (pin 1) of V3 is coupled through C16 to the tank circuit consisting of L9 and C9A. C20 is a trimmer used for alinement of the transmitter oscillator at the high end of the dial. L9 is slug-tuned to permit alinement at the low end of the dial. The portion of L9 below ground potential and C17 provides a path for a neutralizing (compensating) voltage to the cathode of V3. This neutralizing voltage minimizes frequency variations caused by variations in antenna loading. (Variations in antenna loading are produced when different antennas are used or when the distance between the antenna and some object such as a house, tree, vehicle, or ground, is varied.) Frequency variations caused by variations in antenna loading are greater at the high end of the dial than at the low end. Neutralizing adjustment, therefore, is made only at the high end of the dial. This adjustment is made during alinement of the transmitter oscillator.

d. Output coil L9 is tapped down for connection to the antenna jacks. This decreases the transmitter-oscillator frequency variations due to variations in antenna loading. L9 is connected to three antenna jacks. J1 is the LONG ANT jack, J2 is the SHORT ANT jack, and J3 is the AUX ANT jack. When the long antenna is plugged into J1, the connector on the end of this antenna makes a direct connection between C12 and L6, which are used only in Radio Sets AN/PRC–9 and –10 to tune the long antenna. C12 is ganged with TUNING capacitor C9. The short antenna plugs into J2 and is tuned by L7 which is ganged with C9. An auxiliary antenna, used for semipermanent installations is connected to J3. No tuning is provided for this antenna.

e. The output of the transmitter oscillator is coupled through C19 to the control grid of first rf amplifier V4 to develop an afc signal. In most models of Radio Set AN/PRC–10, a direct connection is made from the filament of V3 through R8 to the control grid of second rf amplifier V5. The filament of V3 is above rf ground. This provides an alternate path for the transmitter oscillator signal. The afc circuit is explained in paragraph 21.

f. The +135-volt supply is applied through contacts 5 and 6 of K1 to the screen (pin 6) and from the screen through L8 to the plate (pin 1) of V3. Contacts 5 and 6 of K1 are closed only when the set is transmitting. L8 isolates the plate and the screen for rf. The negative 6-volt supply is connected through contacts 3 and 4 of K1 and rf choke L5 to the filament of V3. C13 is an rf bypass across the filament. C14 and L5 decouple the rf voltage in the filament of V3 from the negative 6-volt supply.

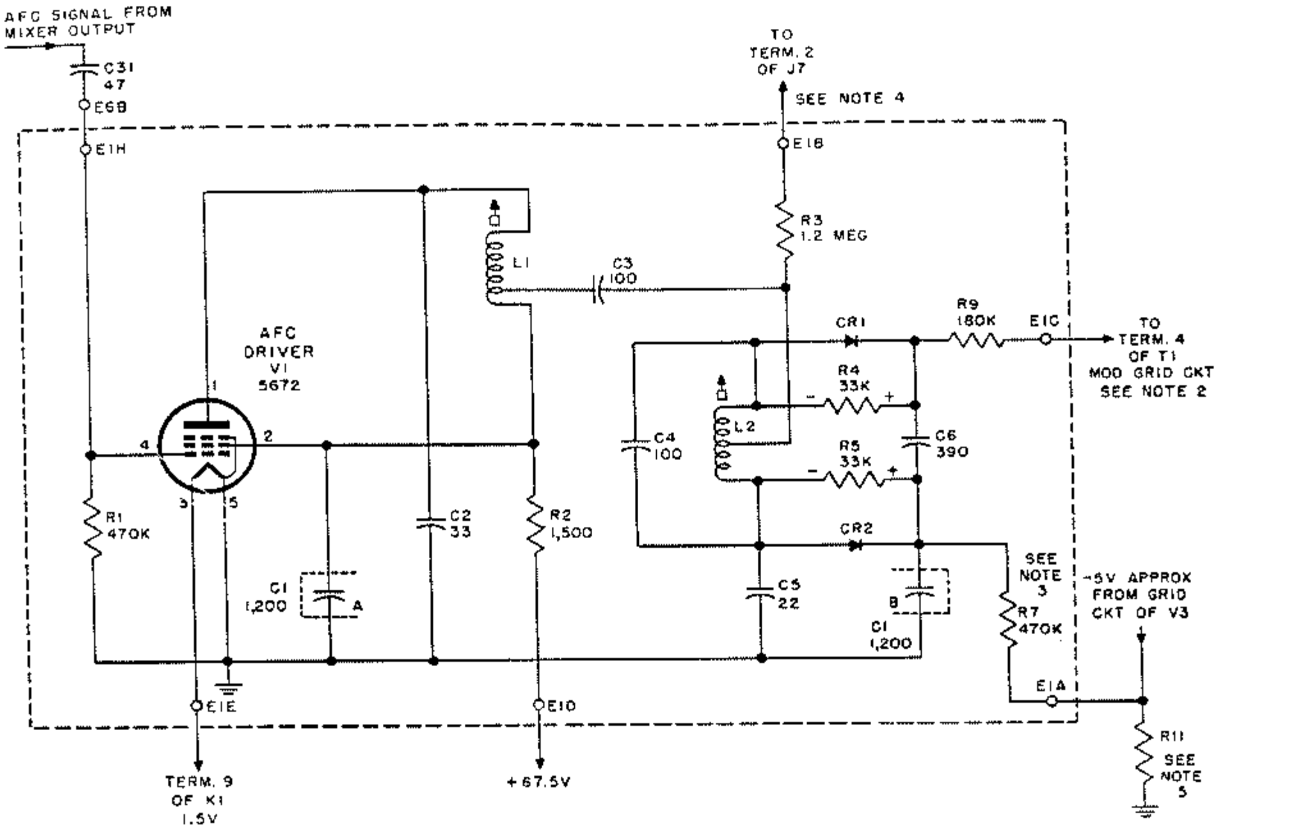
21. Afc Circuit

a. The purpose of the afc circuit is to prevent the transmitter oscillator from drifting off frequency. The transmitter oscillator signal is coupled through C19 (figs. 51–54) to the control grid of first rf amplifier V4. (The first rf amplifier does not operate during transmission because its filament circuit then is open.) From the grid of V4 it is passed through the grid-to-plate interelectrode capacitance of V4 (in Radio Sets AN/PRC–8 and –9) and through distributed wiring capacitance to the control grid of second rf amplifier V5. This is a high impedance path; therefore, only a weak signal reaches the grid of the second rf amplifier. The output of the transmitter oscillator is weaker in Radio Set AN/PRC–10 than in Radio Sets AN/PRC–8 and –9. Therefore, in Radio Set AN/PRC–10, a lower impedance path is provided from the filament of transmitter oscillator V3 (the filament is above rf ground potential) through R8 to terminal E5H which connects to the control grid of second rf amplifier V5. The signal at the control grid of V5 is amplified and applied to mixer V6, where it beats with the receiver oscillator signal to produce an if. output at the mixer plate. A portion of this if. is coupled through C31 to the control grid of afc driver V1. This is the afc signal (fig. 18). When the transmitter oscillator is on frequency, the center frequency of the afc signal is 4.3 mc; when the transmitter oscillator frequency is too high, the center frequency of the afc signal is below 4.3 mc; when the transmitter oscillator frequency is too low, the center frequency of the afc signal is above 4.3 mc.

b. The afc signal is amplified by afc driver V1. The plate tank circuit of V1 consists of C2 and L1, which are tuned to 4.3 mc (fig. 18). C1A is the screen bypass and also returns L1 to ground for rf. The 67.5-volt supply is applied through R2 to the screen and then through L1 to the plate of V1. R2 and C2 decouple the plate and screen from the B+ supply. R1 is the grid-leak resistor. The 1.5-volt supply is applied to the filament through contacts 8 and 9 of K1. These contacts are closed only during transmission.

c. A portion of the afc signal voltage across L1 is applied through C3 to the afc discriminator circuit. L1 is tapped down to prevent the discriminator circuit from varying the load of the plate tank circuit of V1. The discriminator circuit develops a positive voltage across C6 when the center frequency of the afc signal is above 4.3 mc, a negative voltage when the center frequency of the afc signal is below 4.3 mc, and zero voltage when the center frequency of the afc signal is at 4.3 mc. The bias voltage at the control grid of modulator V2 is equal to the vector sum of the dc voltages developed across R11 and C6 (fig. 16). The voltage across R11 is part of the grid-leak bias voltage developed by V3. This is a constant negative voltage. The voltage across C6 varies when the transmitter oscillator drifts off frequency. When the transmitter oscillator frequency is too high, the center frequency of the afc signal is below 4.3 mc and the voltage across C6 becomes negative. This reduces the plate current of V2, increases the inductance of L4, and reduces the transmitter oscillator frequency to its proper value (par. 19*b*). When the transmitter oscillator frequency is too low, the center frequency of the afc signal is above 4.3 mc and the voltage across C6 becomes positive. This increases the plate current of V2, lowers the inductance of L4, and raises the transmitter oscillator frequency to its proper value.

d. C4 and L2 are tuned to 4.3 mc. CR1 and CR2 are germanium diode rectifiers which produce dc outputs across the R4 and R5 respectively. C6 connects CR1 to C1B which provides the if. return to ground. C1B also returns CR2 to ground for if. C5 is an unbalancing capacitor which provides stable discriminator operation. This unbalancing capacitor prevents the development of equal and opposite if. currents which would cause the discriminator output to be zero at all frequencies. R9 and R7 are if isolating resistors which prevent if. signals from being radiated outside the afc box. R3 is an if. decoupling resistor between the afc circuit and terminal 2 of test socket J7 which is used for measuring the dc voltage at the center tap of L2.



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

2. IN RADIO SETS AN/PRC-10 ON ORDER NO. 15176-PHILA-52 WITH SERIAL NUMBERS 4001 AND UP, AND IN LATER MODELS ON ORDER NO. 15178-PHILA-52, E1C IS CONNECTED TO E2C INSTEAD OF TO TERMINAL 4 OF T1.

3. R7 IS 5,600 OHMS IN THE FOLLOWING RADIO SETS:

RADIO SET	ORDER NO.	SERIAL NOS.
AN/PRC-9	15176-PHILA-52	4976 AND UP
AN/PRC-10	15176-PHILA-52	4001 AND UP
	15178-PHILA-52	LATER MODELS

4. CONNECTION FROM E1B TO TERM. 2 OF J7 IS NOT MADE IN THE FOLLOWING SETS:

RADIO SET	ORDER NO.	SERIAL NOS.
AN/PRC-8	3374-PHILA-52	668 THRU 1127
AN/PRC-10	15176-PHILA-52	21562 THRU 27681

5. VALUES OF R11 FOR DIFFERENT MODELS OF THE RADIO SET ARE SHOWN IN THE FOLLOWING CHART:

ORDER NO.	VALUE IN OHMS		
	AN/PRC-8	AN/PRC-9	AN/PRC-10
1758-PHILA-51	270K	330K	470K
3153-PHILA-51	270K	330K	470K
3374-PHILA-52	270K	330K	470K
15176-PHILA-52	270K	330K (SERIAL NOS. 1 THRU 4975)	470K (SERIAL NOS. 1 THRU 4000)
		5,600 (SERIAL NOS. 4976 THRU 8926)	6,800 (SERIAL NOS. 4001 THRU 12433)
15178-PHILA-52	—	—	470K (EARLY MODELS) 6,800 (LATER MODELS)
3432-PHILA-52	—	—	6,800

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Figure 18. Afc circuit.

Section IV. POWER AND CONTROL CIRCUITS

22. Power Sources

a. Battery BA–279/U. Battery BA–279/U is the power source for the radio set when it is pack mounted. The battery voltages are available at an eight-terminal receptacle. The schematic diagram and a test chart of the battery are shown on figure 19. The battery and receiver-transmitter cases are shown separated on figure 20.

b. Amplifier-Power Supply AM–598/U. Amplifier-Power Supply AM–598/U (TM 11–5055) is the power source for the radio set in 24-volt vehicular installations. It supplies approximately the same voltages as Battery BA–279/U. These voltages are available at an eight-terminal receptacle similar to the one on Battery BA–279/U.

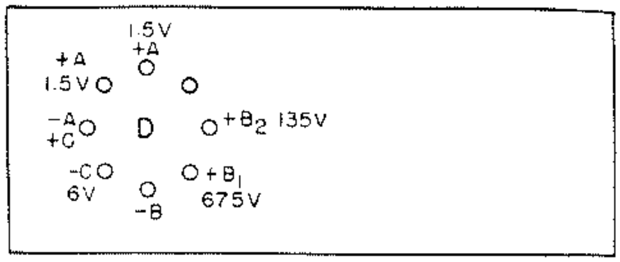
23. Control Circuits
(fig. 21)

Application of power to the radio set is controlled by POWER switch S1. Receive-transmit control is provided by the handset push-to-talk button. Additional controls are provided by SQUELCH switch S2, and by Control Group AN/GRA–6.

a. POWER Switch at OFF. When this switch is at OFF, there is no ground return for the A, B_1, B_2, and C voltage supplies and no power is supplied to the radio set.

b. POWER Switch at ON. In this position of the switch, all four voltage supplies are returned to ground. The filament circuits of all receiver tubes except squelch tube V11 are completed. The filament circuit of V11 is completed when SQUELCH switch S2 is closed. Plate and screen voltages are supplied to all receiver tubes and to calibration oscillators V9 and V10. This puts the receiver in operation. (The calibration oscillators do not operate because their filament circuits are open.)

c. POWER Switch at ON, Push-To-Talk Button Pressed. When the handset push-to-talk button is pressed, it disables the receiver and operates the transmitter. Two pairs of contacts on the push-to-talk switch close and complete circuits through receive-transmit relay K1 and through the handset microphone.



LABEL

TEST WITH TS-183/U

TO TEST UNIT	USE JACK NO.	READ VOLTAGE
−A TO +A	1	(MINIMUM) 1.35
−B TO +B_1	23	60.00
+B_1 TO +B_2	27	60.00
−C TO +C	6	5.00

WIRING DIAGRAM

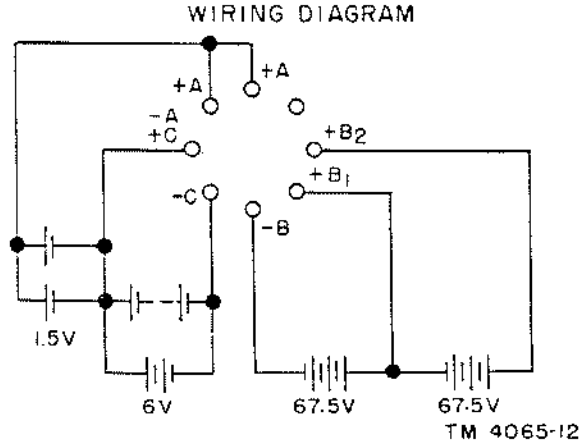


Figure 19. Battery BA–279/U schematic diagram and test chart.

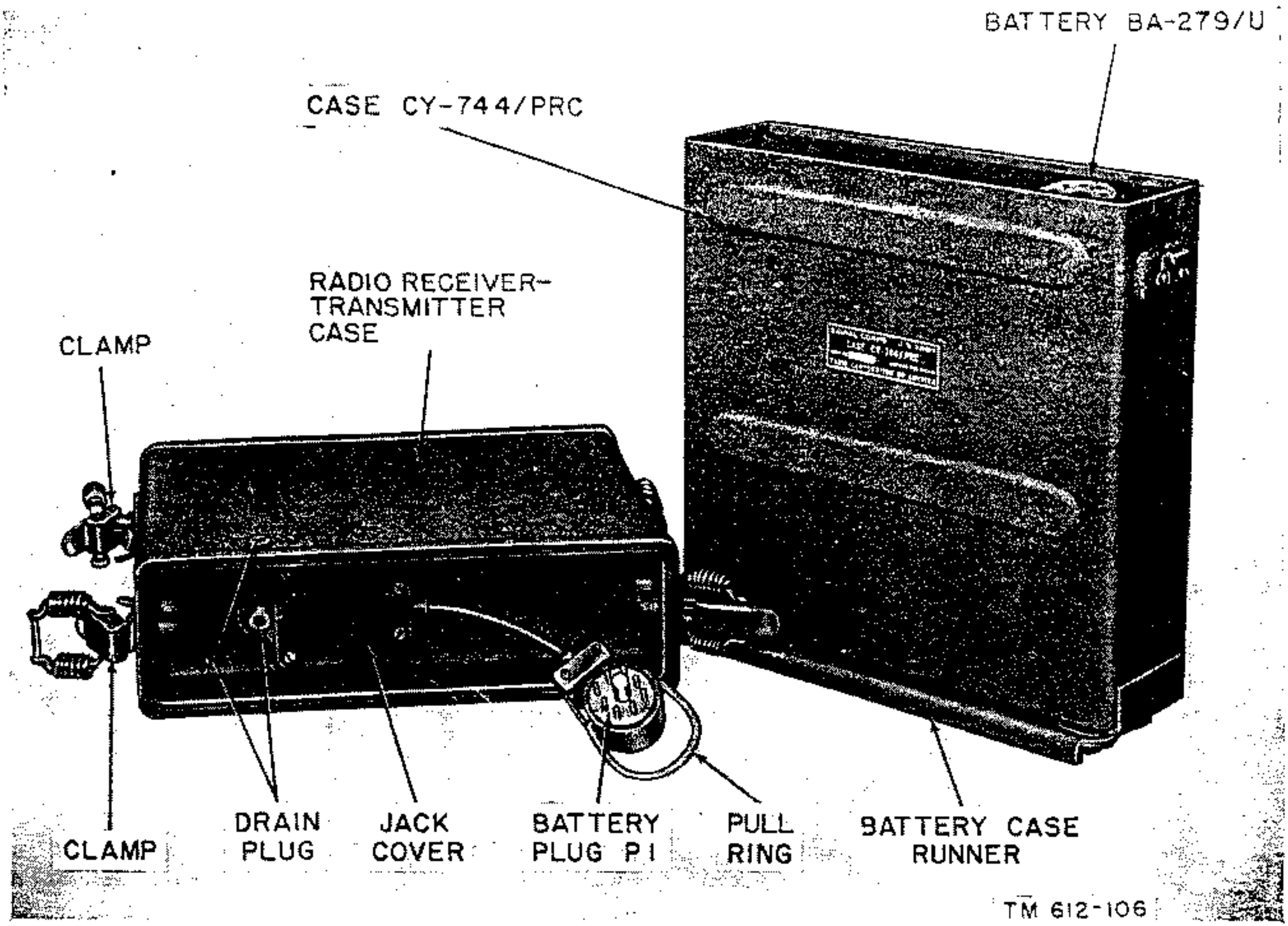


Figure 20. Battery and receiver-transmitter cases, separated.

(1) One pair of contacts completes a circuit from the 6-volt supply through the coil of receive-transmit relay K1. When the relay pulls in, contacts 3 and 4 close, 7 and 8 open, 8 and 9 close, and 5 and 6 close. The closure of contacts 3 and 4 completes the 6-volt filament circuit of transmitter oscillator V3. The opening of contacts 7 and 8 breaks the filament circuits of first rf amplifier V4, the if. amplifiers (U101 through U105), and audio amplifier V7. The closure of contacts 8 and 9 completes the 1.5-volt filament circuits of afc driver V1 and modulator V2. The closure of contacts 5 and 6 connects the 135-volt supply to the plate of transmitter oscillator V3.

(2) The second pair of contacts of the handset push-to-talk switch completes the microphone circuit. This circuit extends from the 1.5-volt supply through contacts 8 and 9 of K1, the primary of microphone transformer T1, the handset microphone, the handset switch, chassis ground, and back through the ON position of POWER switch S1 to the negative terminal of the 1.5-volt supply.

d. POWER Switch at CAL & DIAL LITE. When the switch is at CAL & DIAL LITE, it completes the same circuits as when it is at ON. It also completes a circuit from the 1.5-volt supply through the filaments of the two calibration oscillators (V9 and V10) and through dial lamp E8. This puts the receiver and the calibration oscillators in operation and turns on the dial light. (The CAL & DIAL LITE position of the switch is spring loaded and the switch returns to the ON position when it is released.)

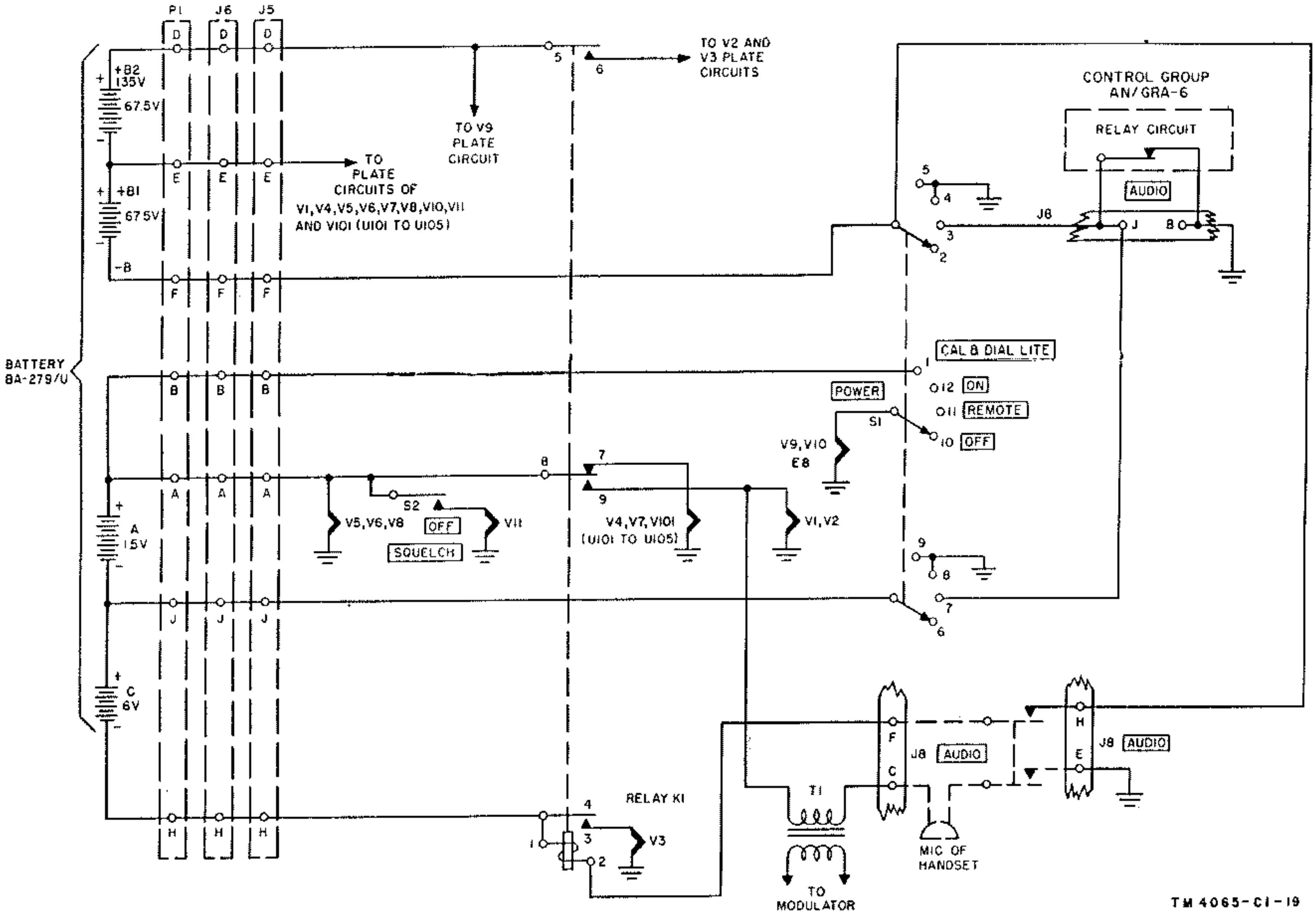


Figure 21. Control circuits.

e. POWER Switch at REMOTE. When the switch is at REMOTE, power can be applied to the receiver-transmitter only through Control Group AN/GRA–6 which is used for remote control of the radio set. In this position of the switch, the voltage supplies are not returned to ground but are connected to terminal J of AUDIO connector J8. Power is applied to the receiver-transmitter when switching action in the control group connects terminal J of J8 to chassis ground. Additional switching in the control group connects terminal F of J8 to ground. This completes the circuit through receive-transmit relay K1 and puts the transmitter in operation. Appropriate connections from the control group to the radio set also are made for reception and transmission of audio signals. For details on Control Group AN/GRA–6, refer to TM 11–5038.

Section V. RELAY OPERATION

24. Arrangement of Radio Sets for Relay Operation
(fig. 22)

Two radio sets connected by a relay cable are used as a relay station. The relay station operates unattended and passes signals in both directions. Sets 1 and 2 (fig. 22) are tuned to one frequency while Sets 3 and 4 are tuned to a second frequency. Two handsets are connected to the relay cable. The handset located nearer to Set 2 is used to receive and transmit through Set 2 while the one located nearer to Set 3 is used to receive and transmit through Set 3. Electrical Special Purpose Cable Assembly CX–1961/U (fig. 24) is used as the relay cable.

25. Relay Circuit Theory
(fig. 23)

a. The relay cable completes circuits between two radio sets which make relay operation possible. These circuits are shown on figure 21.

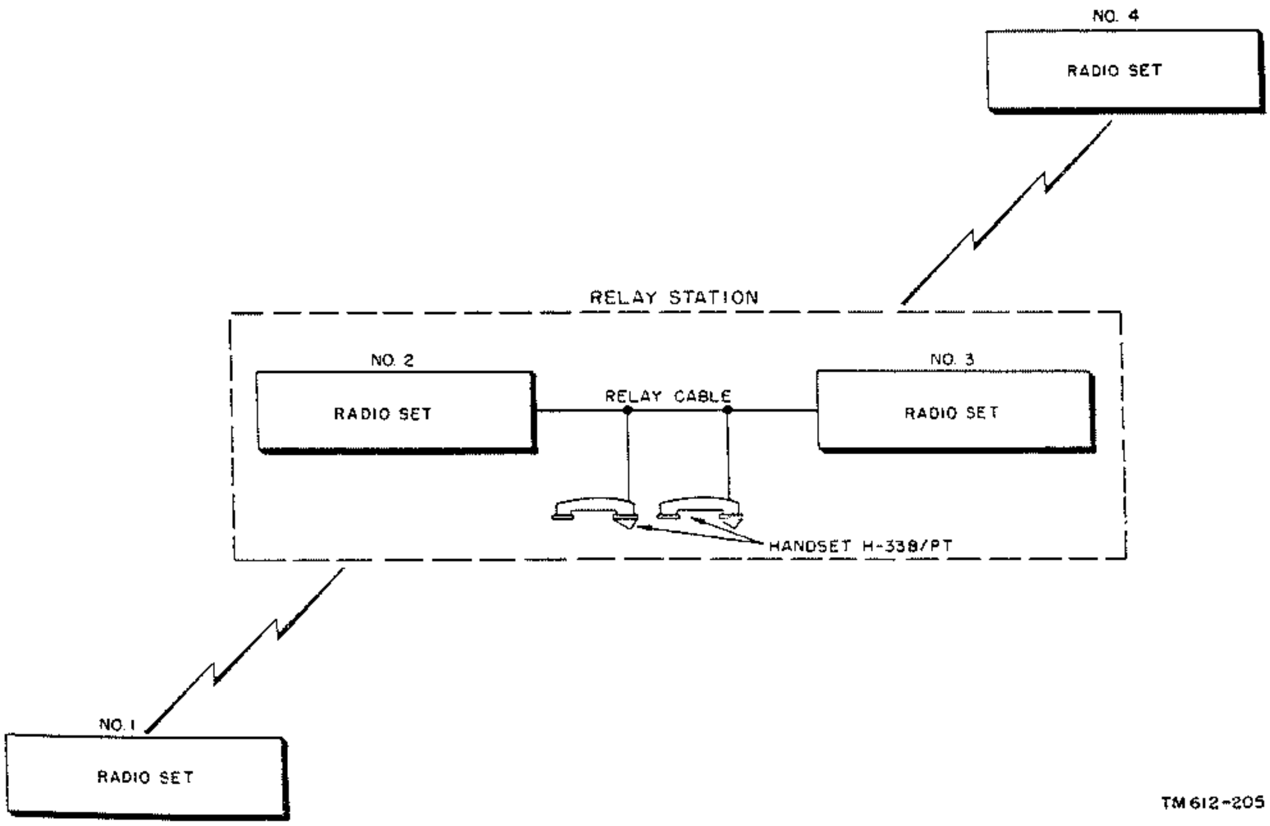
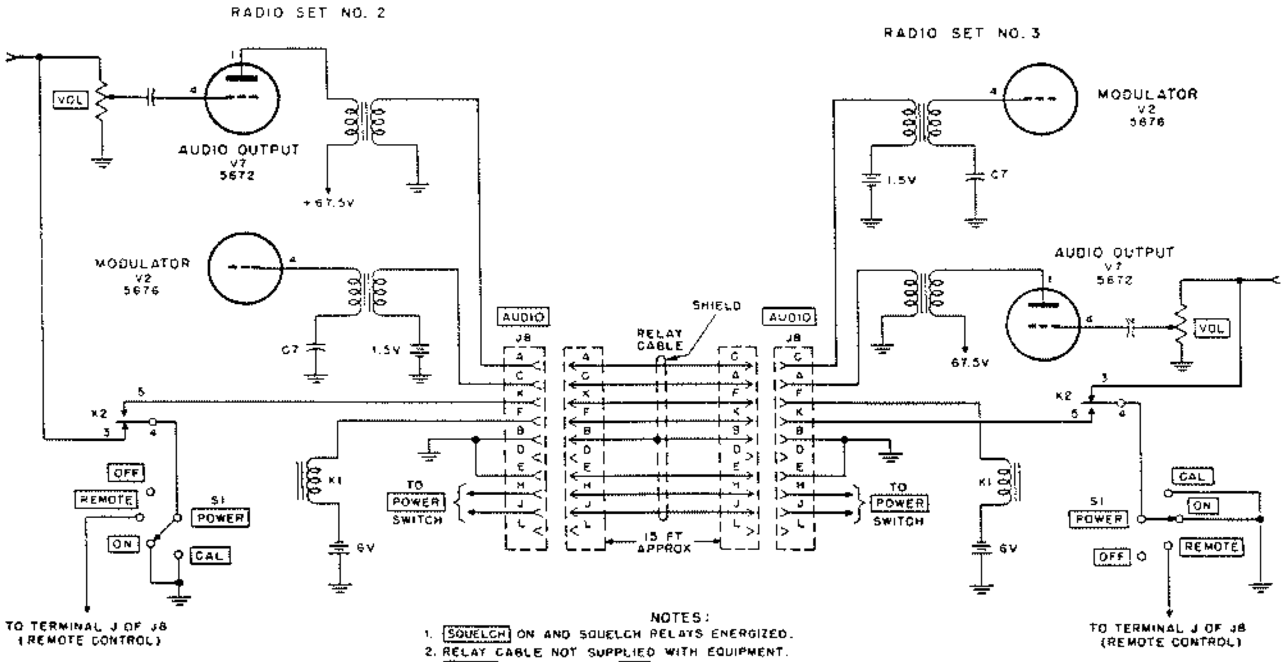


Figure 22. Arrangement of radio sets for relay operation.

The relay station is set up with the two radio sets in the receive condition and with the receivers squelched. This means that squelch relay K2 is pulled in, contacts 3 and 4 are closed, and 4 and 5 are open. If a signal now should be transmitted by Set 1 (fig. 22), this signal is picked up by Set 2 and its squelch circuit is disabled (par. 17). Squelch relay K2 in this set releases and contact 4 transfers from contact 3 to contact 5. When contacts 4 and 5 of K2 close in Set 2, they complete the 6-volt circuit through the coil of receive-transmit relay K1 in Set 3 and energize this relay. When K1 is energized, it disables the Set 3 receiver and operates the Set 3 transmitter. Simultaneously, the opening of contacts 3 and 4 of K2 in Set 2 unsquelches the Set 2 audio signal and this signal is amplified by Set 2 audio output amplifier V7 and fed through the relay cable to the grid circuit of modulator V2 in Set 3. The audio output of V2 then is used to modulate the signal transmitted by Set 3. Set 3 transmits at a different frequency from the incoming signal to Set 2. The Set 3 signal is picked up by Set 4 which is tuned to the same frequency as Set 3. When Set 1 stops transmitting, squelch relay K2 in Set 2 pulls in, contacts 4 and 5 open, receive-transmit relay K1 in Set 3 releases, the Set 3 transmitter is disabled and the Set 3 receiver is again put in operation. When a signal is transmitted by Set 4, it produces the same series of operations in the opposite direction.

b. Figure 24 is a detailed wiring diagram of the relay cable. The relay cable is ordered as Retransmission Cable Kit MK–126/G which consists of Electrical Special Purpose Cable Assembly CX–1961/U and Cable Assembly Case CY–1251/U. The cable assembly consists of Special Purpose Cable WM–69A/U with a junction box at each end. Each junction box contains two connectors, Receptacle Connector U–126/U and Receptacle Connector U–79/U. Receptacle Connector U–126/U is plugged into the AUDIO connector of the radio set and Handset H–33/PT is plugged into Receptacle Connector



NOTES:

1. SQUELCH ON AND SQUELCH RELAYS ENERGIZED.
2. RELAY CABLE NOT SUPPLIED WITH EQUIPMENT.
3. POWER SWITCH S1 AT ON ; S1 VIEWED FROM END OPPOSITE KNOB.
4. RELAY CABLE CONNECTIONS TO HANDSETS NOT SHOWN.
5. TERMINAL 4 OF RELAY K2 IS CONNECTED DIRECTLY TO GROUND IN THE FOLLOWING SETS:

RADIO SET	ORDER NO.	SERIAL NOS.
AN/PRC–8	1758–PHILA–51	BELOW 115
AN/PRC–9	1758–PHILA–51	BELOW 6
AN/PRC–10	1758–PHILA–51	BELOW 9100
	3374–PHILA–52	BELOW 26020

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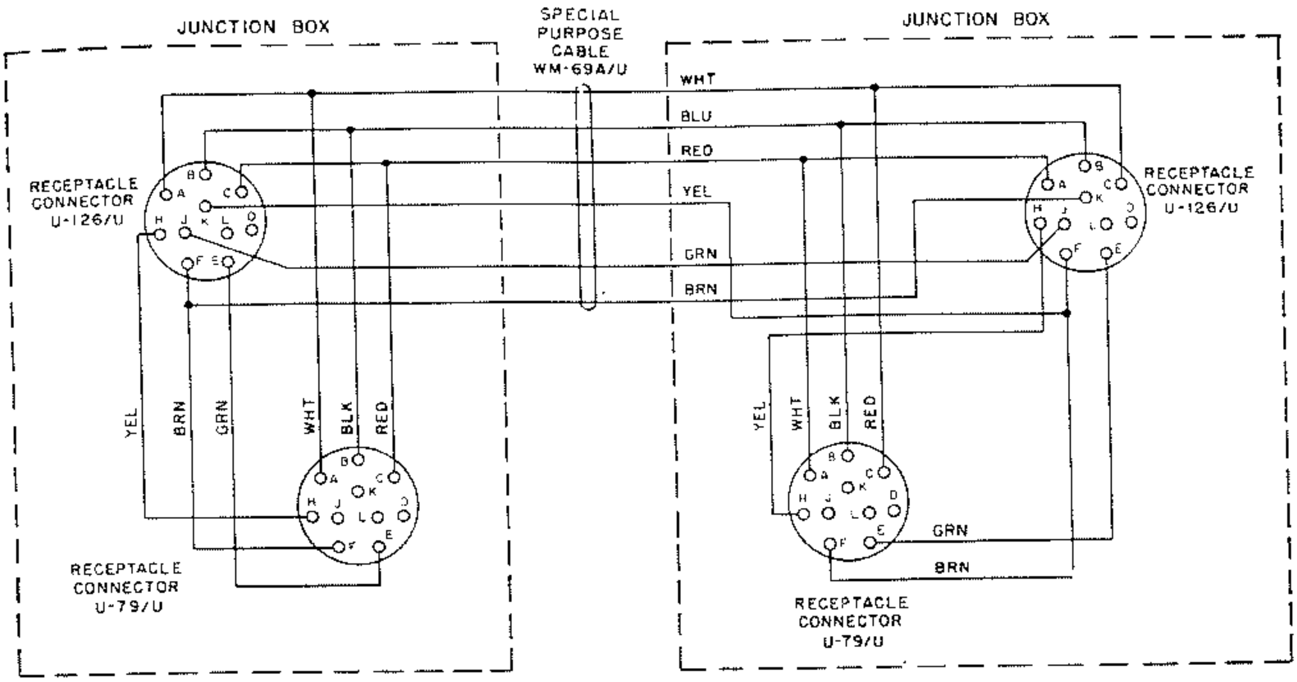
Figure 23. Relay circuit.



NOTE:
THE BROWN (F TO K) AND YELLOW (K TO F) WIRES ARE SIZE NO. 18.

Figure 24. Electrical special purpose cable assembly CX–1961/U.

U–79/U. The handsets are not needed for the actual retransmission but they are necessary when squelch and volume adjustments are made in setting up the relay station. The handset plugged into the left junction box is used for receiving or transmitting on the left-hand radio set; the one on the right-hand side is used for receiving and transmitting on the right-hand radio set. The receiver of each handset is connected through the relay cable to terminals A and B of the radio set near which it is located (figs. 24 and 25). Audio output is supplied from these terminals. When the push-to-talk button is pressed, it completes two circuits. One circuit is through receive-transmit relay K1 and puts the radio set in the transmit condition. The other circuit is through the microphone of the handset and enables audio signals from the microphone to be applied to the transmitter.

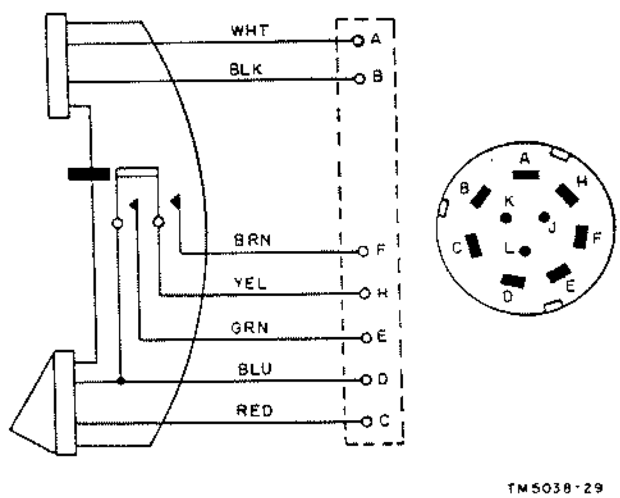


Figure 25. Handset H–33/PT, schematic diagram.

CHAPTER 3

TROUBLESHOOTING

Section I. PREVENTIVE MAINTENANCE

26. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from troubleshooting and repair in that its object is to prevent certain troubles from occurring.

27. General Preventive Maintenance Techniques

a. Use No.0000 sandpaper to remove corrosion.

b. Use a clean, dry lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with Solvent, Dry Cleaning (SD); then wipe the parts with a dry cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

Caution: Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Be sure adequate ventilation is provided. Do not use carbon tetrachloride on polyvinyl insulation; it is a solvent for this resin.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful however, or mechanical damage from the air blast may result.

d. For further information on preventive maintenance techniques, refer to TB SIG 178, Preventive Maintenance Guide for Radio Communication Equipment.

28. Use of Preventive Maintenance Form (fig. 26)

a. The decision as to which items on DA Form 11–239 are applicable to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of the form appear on the reverse side of the form.

b. Circled items on figure 26 are partially or totally applicable to Radio Sets AN/PRC–8, –9, and –10. References in the ITEM block are to paragraphs that contain additional detailed information.

29. Performing Exterior Preventive Maintenance

Caution: Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will become damaged or broken.

a. Check for completeness of equipment, spare parts, technical manuals, and accessories.

b. Check for suitable location and correct installation of the radio set.

c. Remove dirt and moisture from the antenna, handset, and connectors (fig. 1).

d. Inspect TUNING control, VOL control, SQUELCH control, and POWER switch (fig. 3) for binding, scraping, excessive looseness, and for positive action.

e. Check for normal operation. Refer to TM 11–612.

f. Clean the radio set, including antenna mount and cable connections.

g. Inspect the cases, antenna, and all exposed metal surfaces for rust, corrosion, and moisture.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).* FIG. 1		19	ELECTRON TUBES — INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS; INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR. 30 b	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. TM 11-612		20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 29 c		21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION. PAR. 30 c	
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 30 a		22	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS. PAR. 30 d	
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 29 d		23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR. 30 e	
6	CHECK FOR NORMAL OPERATION. PAR. 29 e		24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. FIGS. 30 AND 31	
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. FIG. 1		25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. FIGS. 30 AND 31	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. FIG. 1		26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE. PAR. 30 h	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. FIG. 1		27	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. FIGS. 30 AND 31	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. FIG. 1		28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING. FIG. 1		29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER. PAR. 30 j	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES.		30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES. PAR. 29 k		31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS.	
14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 29 l		32	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE.	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES.		33	BEFORE SHIPPING OR STORING — REMOVE BATTERIES. PAR. 30 k	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.		34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.		35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS. FIG. 19	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.		36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS. FIGS. 30 AND 31	
			37	MOISTURE AND FUNGIPROOF. TM 11-612	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. PAR. 30 o				

DA FORM 11-239, 1 MAY 51 — REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM4065-13

Figure 26. DA Form 11–239.

h. Inspect the handset cable for cuts, breaks, fraying, deterioration, kinks, and strain.

i. Inspect the antenna for eccentricities, corrosion, loose fit, and damaged insulators.

j. Inspect canvas items and cables for mildew, tears, and fraying.

k. When the radio set is used in a vehicle and is powered by Amplifier-Power Supply AM–598 U, inspect vehicular storage battery for dirt, loose terminals, electrolyte level, specific gravity, and a damaged case.

l. Clean dial window (fig. 3).

m. Inspect shelters and covers for adequacy of weatherproofing.

n. If deficiencies noted are not corrected during inspection, indicate action taken for correction.

30. Performing Interior Preventive Maintenance

Caution: Disconnect all power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation. For operating instructions, refer to TM 11–612.

a. Inspect seating of readily accessible pluck-out items: tubes, plug-in cans, and crystals (figs. 30 and 31).

b. Inspect electron tubes for loose envelopes, cracked sockets, insufficient socket spring tension, and emission. Remove dust and dirt from tube pins and sockets.

c. Inspect fixed capacitors for leaks, bulges, and discoloration (figs. 30 and 31).

d. Inspect relay K1 (fig. 30) and relay K2 (fig. 31) for loose mountings, burned, pitted, or corroded contacts, misalined contacts, and insufficient spring tension.

e. Inspect TUNING capacitor C9 (fig. 31) for dirt, moisture, misalinement of plates, and loose mountings.

f. Inspect resistors, bushings, and insulators for cracks, chipping, blistering, discoloration, and moisture.

g. Inspect terminals of large fixed capacitors and resistors for corrosion, dirt, and loose contacts.

h. Clean and tighten subchassis and terminal blocks within each subchassis (figs. 38 through 44).

i. Inspect terminal blocks for loose connections, cracks, and breaks.

j. Lubricate equipment as specified in paragraph 66.

k. Remove batteries from battery case before shipping or storing.

l. Check batteries for low voltage.

m. Inspect for leaking waterproof gaskets and worn or loose parts.

n. Inspect moistureproofing and fungiproofing.

o. If deficiencies noted are not corrected during inspection, indicate action taken for correction.

Section II. PRELIMINARY TROUBLESHOOTING INFORMATION

31. General

The first step in servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to the circuit responsible for the abnormal operation of the set. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults, such as burned-out resistors, rf arcing, and shorted transformers, often can be located by sight, smell, and hearing. The majority of faults, however, must be localized by checking voltage and resistance.

32. Component Sectionalization and Localization

The tests listed below aid in isolating the source of trouble. To be effective, the procedure should be followed in the order given. Servicing procedure should cause no further damage to the receiver. First, trouble should be localized to a single stage or circuit. Then the trouble may be isolated within that stage or circuit by appropriate voltage, resistance, and continuity measurements. The servicing procedure is summarized as follows:

a. Inspection. The purpose of an inspection is to locate any visible trouble. Through this inspection alone, the repairman may frequently discover the trouble or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the receiver which might occur through improper servicing methods and in forestalling future failures.

b. Leakage Checks. These measurements (par. 38) prevent further damage to the radio set from possible short circuits. Since this test gives an indication of the condition of the filter circuits, it may help also to locate the fault.

c. Troubleshooting Chart. The trouble symptoms listed in this chart (par. 40) are useful in localizing common troubles.

d. Individual Stage Checks. Individual stage checks (pars. 41–53) utilize the signal substitution method, voltage and resistance measurements, and any other special checks that are indicated for a specific circuit. This procedure is used to locate the stage in which the trouble exists and then to locate the defective component.

e. Stage Gain Charts. These charts (pars. 54–58) are used to locate defects that reduce the sensitivity of the set but do not make it inoperative.

f. Intermittents. Intermittents are troubles that appear and disappear at different times. If present, this type of trouble may be located by tapping or jarring the radio set. This trouble may be due to poor cable conditions or to external conditions.

33. Figure Reference

The following list of figures is useful in troubleshooting:

Fig.	Title
51	Radio Set AN/PRC–8, schematic diagram.
52	Radio Set AN/PRC–9, schematic diagram.
53, 54	Radio Set AN/PRC–10, schematic diagram.
2	Radio receiver-transmitter, block diagram.
21	Control circuits.
23	Relay circuit.
28	Voltage and resistance measurements, bottom and rear of chassis.
29	Voltage and resistance measurements, top and front of chassis.
9	Discriminator frequency response curve.
25	Handset H–33/PT schematic diagram.
30	Top view of receiver-transmitter chassis.
31	Bottom view of receiver-transmitter chassis.
39	First rf box, inside view.
40	Second rf box, inside view.
41	Receiver oscillator box, inside view.
42	Transmitter oscillator box, inside view.
43	Mixer box, inside view.
44	Afc box, inside view.
37	Vacuum tubes and if. and discriminator cans.
38	If. shelf with shield removed.
19	Battery BA–279/U, schematic diagram.
20	Battery and receiver-transmitter cases, separated.
49	Resistor color codes.
50	Capacitor color codes.

34. Required Test Equipment

The test equipment required for use with Radio Sets AN/PRC–8, –9, and –10, is listed below.

Test equipment	Common name	Technical manual
Audio Oscillator TS–382A/U	Audio oscillator	TM 11–2684A
Signal Generator AN/URM–48	RF signal generator	TM 11–1257
Signal Generator I–208	If. signal generator	TM 11–317
Multimeter TS–352A/U	Multimeter	TM 11–5527
Electronic Multimeter TS–505/U	Vtvm	TM 11–5511
Output Meter TS–585A/U	Output meter	TM 11–5017
RF Wattmeter ME–11/U	Rf wattmeter.	
Frequency Meter TS–174B/U	Frequency meter	TM 11–5044
Battery Tester TS–183/U	Battery tester	TM 11–2571
Electronic Multimeter ME–6A/U	Millivoltmeter	TM 11–5549
Electron Tube Test Set TV–7/U	Tube tester	TM 11–5083

Caution: Flat subminiature tubes that are tested in the flat subminiature sockets of tube testers may be inadvertently inserted in reverse. This places B+ on the filament and causes the tube filament to burn out. To prevent this, always aline the red mark on the tube with the red mark on the tube socket.

35. Unreliability of Oscillator Tube Type 1AD4 in Radio Sets AN/PRC–8 and AN/PRC–10

a. Tube Failure. An undetermined quantity of tubes type 1AD4, manufactured by Ratheon, have a useful life of as little as 10 hours when used as the receiver oscillator (V8) in Radio Sets AN PRC–8 and AN/PRC–10. These tubes are in lot numbers 202 through 226. Failure of this tube is evidenced by oscillation, interrupted at a low repetition rate resembling motor-boating. This type of failure will not be indicated on a tube tester. Present available information indicates that this phenomenon is the result of grid contamination occasioned by an improper aging processing during manufacture.

b. Replacement. If oscillation of this type occurs, remove the original tube and replace it with a new tube (Sig C stock No. 2J1AD4). When replacing this tube, be sure that the red dot on the tube corresponds to the pimple on the socket.

36. Correction of Defect in Socket of Battery BA–279/U

Note. The procedures below apply to Battery BA–279/U procured on Orders No. 16613-Phila–51, 16517-Phila–51, 14453–Phila–51, and 15609–Phila–51.

a. Reason for Failure of Radio Sets AN/PRC–8, –9, and –10. Reports have indicated operational failure because of intermittent or poor contact between battery plug P1 and the socket of Battery BA–279/U. Investigation discloses that the following factors are primarily responsible for such difficulties.

(1) The jacket socket opening is too small to allow the battery plug to be seated properly in the socket.

(2) The battery socket has sufficient *give* under pressure to prevent proper mating because of inadequate support in the socket well.

b. Corrective Action in Production. These difficulties have been corrected in production on contracts awarded after 21 December 1951 by increasing the diameter of the jacket socket opening from 1¼ inches to 1⅜ inches and by providing improved support in the battery socket well.

c. Corrective Action in Field. Application of either of the following measures will insure proper mating between the plug and the connector, whether or not the battery socket is supported adequately in the socket well:

(1) With a knife or other suitable instrument, cut the top of the battery jacket, at the socket end, free from the sides for a depth of 2 inches to permit that portion of the jacket to be folded back from the socket.

(2) Increase the size of the jacket socket opening to approximately 1⅜ inches in diameter by trimming away a portion of the periphery of the jacket socket opening.

37. Modification Work Orders and Technical Bulletin

The following modification work orders and the technical bulletin, which have been issued for Radio Sets AN/PRC–8, –9, and –10, are to be used to modify all early models that do not incorporate the changes described in these work orders and the bulletin.

a. MWO SIG 11–612–1. Modification of Radio Receiver-Transmitter RT–176/PRC–10 To Prevent the Phenolic Inserts of the Battery Connectors from Separating from the Shells.

b. MWO SIG 11–612–2. Modification of Radio Sets AN/PRC–8, AN/PRC–9, and AN/PRC–10 To Replace Antenna Jacks J1 and J2.

c. MWO SIG 11–612–3. Modification of Radio Sets AN/PRC–8, AN/PRC–9, and AN/PRC–10 To Prevent Damage to the Dial Pointer Adjust Mechanism.

d. MWO SIG 11–612–4. Modification of Radio Sets AN/PRC–8, AN/PRC–9, and AN/PRC–10 To Eliminate Sources of Frequency Drift and To Prevent the Runners from Becoming Disengaged from the Battery Case.

e. MWO SIG 11–612–5. Modification of Radio Sets AN/PRC–8, AN/PRC–9, and AN/

PRC–10 To Permit Use of Tube 1AD4 in the Receiver Local Oscillator (V8) When Tube 5676 Fails.

f. TB 11–4065–1. Instructions for Replacing Tuning Gear Assembly on Variable Tuning Capacitor of Radio Receiver-Transmitters RT–174/PRC–8, RT–175/PRC–9, or RT–176/PRC–10 with an Improved Gear Assembly.

Section IV. TROUBLESHOOTING

38. Leakage Checks

Before making any leakage checks, separate the receiver-transmitter and battery cases, remove battery plug P1 (fig. 20) from the battery, and remove the receiver-transmitter chassis from its case. First release the two snap-catches which fasten the receiver-transmitter case to the battery case, and separate the two cases by a few inches. Then remove the battery plug from the battery socket. Then release the two snap-catches which fasten the front panel of the receiver-transmitter to its case, and remove the receiver-transmitter panel and chassis assembly from its case.

a. Battery Cable. With an ohmmeter, measure the resistance between each pin of plug P1 on the battery cable and each of the remaining pins. Also measure the resistance between each pin of plug P1 and the receiver-transmitter case. Any reading below infinity indicates a defective plug or battery cable.

b. POWER Switch S1.

(1) With the POWER switch at OFF, measure the resistance between pins B, F, and J of connector J5 (fig. 27) and chassis ground. Any reading below infinity indicates a defective switch (or connector J5).

(2) With the POWER switch at OFF, measure the resistance between each of terminals 2, 3, 6, 7, 10, 11, and 12 of POWER switch S1 (fig. 27) and chassis ground. Any reading below infinity indicates a defective switch (or connector J5).

c. B+ Supply Circuits. Measure the resistance between terminals D and E of J5 and chassis ground. Any reading below 50 megohms indicates a defect in the 67.5-volt or the 135-volt supply circuit.

39. Purpose and Use of Troubleshooting Chart

The troubleshooting chart is used to locate trouble in the receiver-transmitter, the battery, or in connections between battery and receiver-transmitter. The radio set is connected as in normal operation, with the receiver-transmitter in its case and connected to the battery case. This chart lists the symptoms obtained by the repairman while making a few simple tests. The chart also indicates how to localize trouble to the audio, if. or rf stages of the radio set. The individual stage checks described in paragraphs 41 through 53 then can be used to supplement this procedure and to locate the defective stage. After the trouble has been localized to a stage or circuit, tube checks and voltage and resistance measurements are used to locate the defective part. Voltage and resistance measurements are shown on figures 28 and 29. When using the troubleshooting chart, perform the steps in the order in which they are given. Correct each defect before proceeding with the next step.

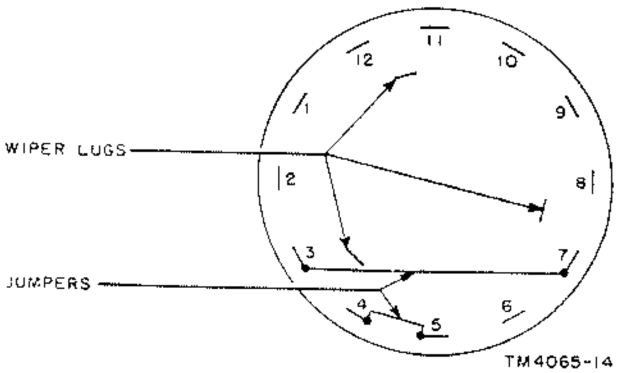
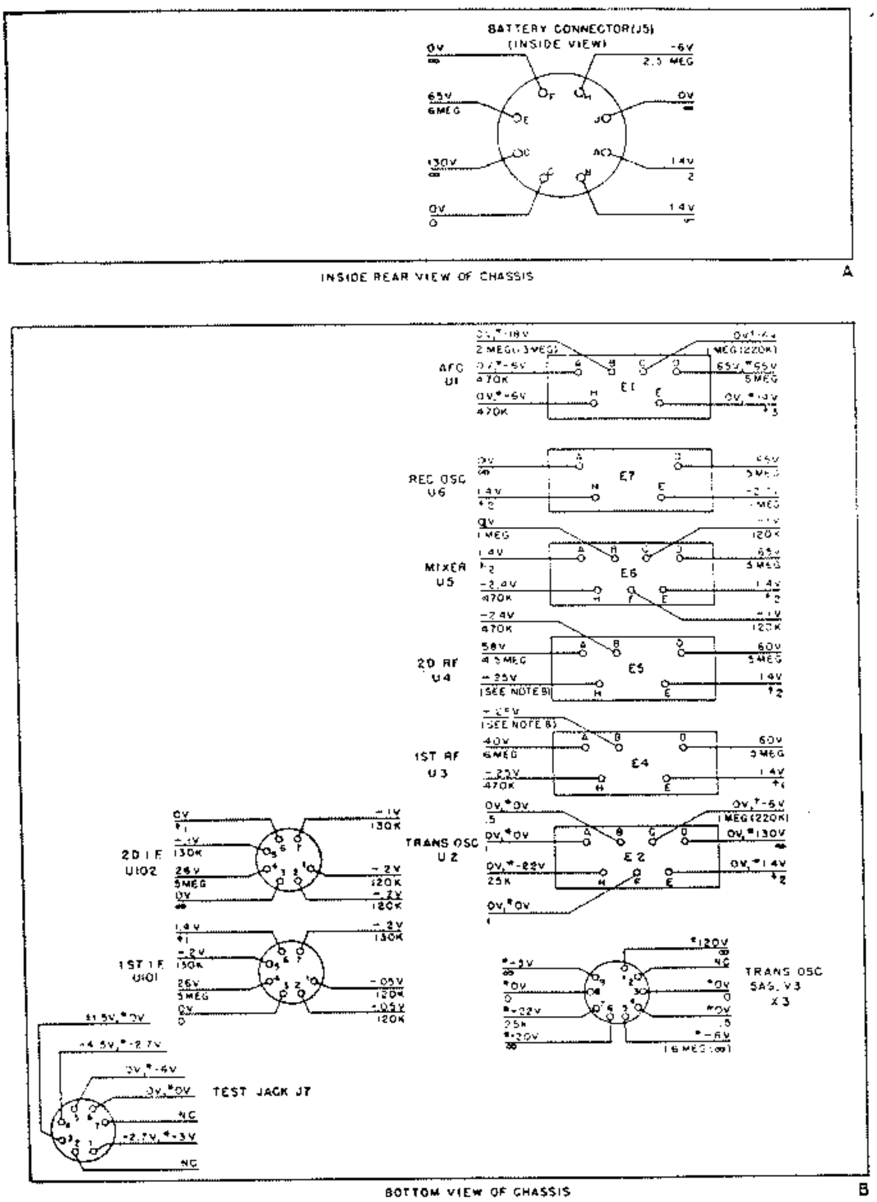


Figure 27. Rear view of terminal locations of power switch S1.



NOTES:

1. ALL VOLTAGES MEASURED WITH VTVM WITH RADIO SET IN RECEIVE CONDITION, POWER SWITCH AT ON, SQUELCH CONTROL AT OFF, VOL CONTROL AT EXTREME CLOCKWISE POSITION, AND HANDSET OUT UNLESS OTHERWISE INDICATED.
2. VALUES BELOW THE LINE ARE IN OHMS MEASURED WITH VTVM WITH BATTERY CABLE OUT, POWER SWITCH AT OFF, SQUELCH CONTROL AT OFF, VOL CONTROL AT EXTREME CLOCKWISE POSITION, V3 OUT, AND HANDSET OUT
3. * INDICATES VOLTAGE MEASURED WITH V3 IN AND RADIO SET IN TRANSMIT CONDITION
4. † INDICATES VOLTAGE (MEASURED WITH V3 IN AND RADIO SET IN TRANSMIT CONDITION) WHICH DIFFERS SLIGHTLY IN INDIVIDUAL SETS
5. ‡ TO AVOID BURNING OUT FILAMENTS, USE OHMMETER ON RANGE OF R×10 OR GREATER.
6. NC INDICATES NO CONNECTION.
7. VALUES IN PARENTHESES APPLY TO FOLLOWING MODELS OF RADIO SETS AN/PRC-9 AND -10:

ORDER NO	SERIAL NOS	
	AN/PRC-9	AN/PRC-10
15176-PHILA-52	4976 THROUGH 8926	4001 THROUGH 12433
15178-PHILA-52	———	LATER MODELS
3432-PHILA-52	———	ALL MODELS

8. RESISTANCE READINGS AT TERMINALS E5H AND E4B ARE 470K FOR ALL MODELS OF RADIO SETS AN/PRC-8 AND -9. FOR RADIO SETS AN/PRC-10, READINGS ARE 16K FOR ALL MODELS EXCEPT THOSE LISTED BELOW, IN WHICH THE READINGS ARE 360K:

ORDER NO	SERIAL NOS.
1758-PHILA-51	1 THROUGH 4699
3374-PHILA-52	21562 THROUGH 23561

Figure 28. Voltage and resistance measurements, bottom and rear of chassis.

40. Troubleshooting Chart

Action	Symptom	Probable trouble	Correction
1. POWER switch at ON, VOL control turned to its extreme clockwise position, SQUELCH control at OFF.	No rushing noise heard in handset receiver.	Weak battery	Replace battery.
		Broken lead in battery cable or at J5, J6, or P1.	Repair broken lead.
		Tube burned out	Check all tubes and replace defective tube.
		Defective handset	Replace handset.
2. SQUELCH control turned clockwise until rushing noise stops.	Rushing noise does not stop.	Defective SQUELCH control R35.	Replace R35.
		Weak battery	Replace battery.
		Defective V11	Replace V11.
		Defective K2	Clean or replace K2.

Action	Symptom	Probable trouble	Correction
3. SQUELCH control at OFF, POWER switch held at CAL & DIAL LITE position, TUNING control varied slowly from low to high end of dial.	Dial light does not light	Defective dial lamp E8	Replace E8.
	Beat notes are not heard at every whole number mc point on dial.	Defective V9 or V10, or crystal Y1 or Y2.	Replace V9, V10, Y1, and Y2.
4. POWER switch at ON, handset push-to-talk button pressed, operator talks into microphone.	Transmitter inoperative	Defective V3	Replace V3.
		Defective K1	Clean or replace K1.
	Transmitter off frequency	Defective V1 or V2	Replace V1 and V2.
		Transmitter or afc circuit out of alinement.	Aline afc and transmitter circuits.

Section V. INDIVIDUAL STAGE CHECKS

41. General

When making individual stage checks, refer to figures 30 and 31 for location of components and test points. Individual stage checks are made with the receiver-transmitter removed from its case and powered by a bench test battery pack. If a bench test battery pack is not available, J5 of the receiver-transmitter chassis may be plugged directly into the socket of Battery BA–279/U. When a Battery BA–279/U is used, it is convenient to use an extension cable between the battery and the receiver-transmitter chassis. This cable must be made up of two plugs, one to mate with the battery socket and the other to mate with J5. The cable must have leads from terminal A on one plug to terminal A on the other, B to B, C to C, and so on. The length of the cable should be about 2 to 5 feet.

Caution: Accidental shorting of the +67.5-volt or +135-volt supplies to ground causes several tubes to burn out either when the POWER switch is at OFF and the handset push-to-talk button is pressed, or when the POWER switch is at REMOTE. Therefore, when making checks inside the receiver-transmitter chassis, be sure that the POWER switch is not at REMOTE, and that the handset push-to-talk button is not pressed by hand or taped down when the POWER switch is at OFF.

42. Audio Amplifier V7

a. Remove the receiver-transmitter chassis from its case and connect it to the power source. Then proceed as follows:

(1) Set the POWER switch at ON.

(2) Set the SQUELCH control at OFF.

(3) Set the VOL control to its extreme clockwise position.

(4) Connect a handset to the AUDIO connector.

b. Connect the output of a 400- or 1,000-cycle audio oscillator across terminal 3 of output transformer T3 and ground. The audio signal should be heard in the handset receiver. If no signal is heard, disconnect power from the receiver-transmitter and make an ohmmeter check of T3 and connections from T3 to the handset.

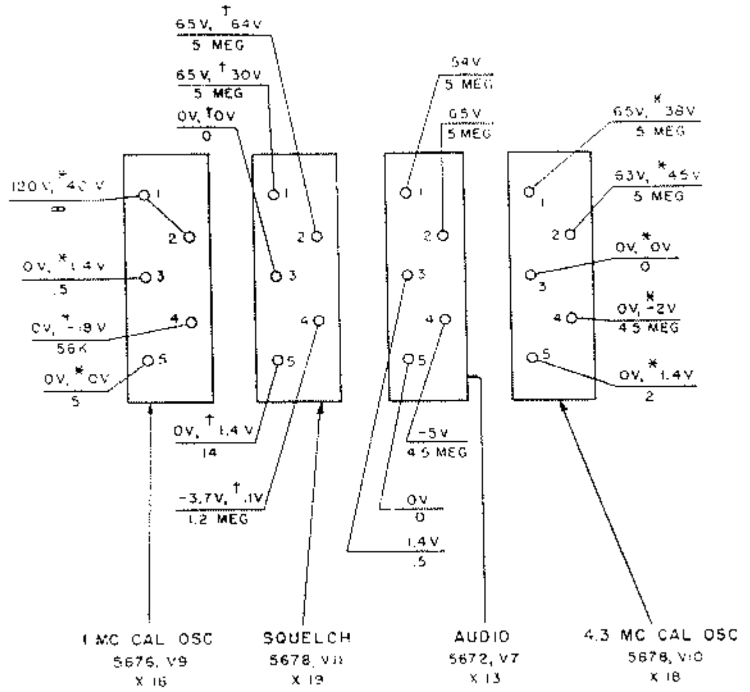
c. Connect a .01-μf capacitor to the end of the ungrounded lead of the audio oscillator, and connect the other end of this capacitor to terminal 2 of T3. The audio signal should be heard in the handset. This checks the primary of T3.

d. Connect the audio oscillator across the grid (pin 4) of V7 (socket X13) and ground. The signal heard in the handset receiver should be much louder than in *b* and *c* above if the output voltage of the audio oscillator is kept constant. If no noticeable increase in loudness is obtained, replace V7.

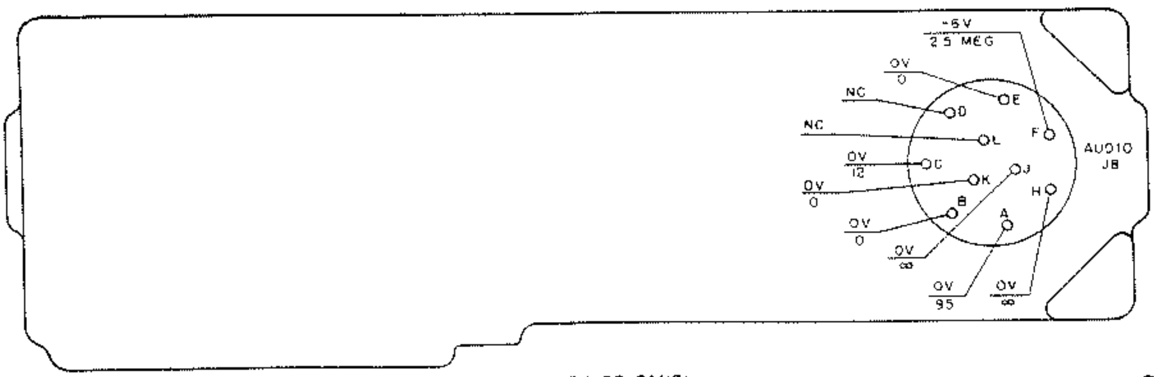
e. Connect the audio oscillator across pin 3 of test connector J7 and ground. The signal in the handset should be as loud as in *d* above. Slowly turn the VOL control counterclockwise. The loudness of the tone in the handset should be reduced gradually until it is inaudible. The complete absence of a signal at the handset may

NOTES:

1. ALL VOLTAGES MEASURED WITH VTVM WITH RADIO SET IN RECEIVE CONDITION, POWER SWITCH AT ON, SQUELCH CONTROL AT OFF, VOL CONTROL AT EXTREME CLOCKWISE POSITION, AND HANDSET OUT UNLESS OTHERWISE INDICATED.
2. VALUES BELOW THE LINE ARE IN OHMS MEASURED WITH VTVM WITH BATTERY CABLE OUT, POWER SWITCH AT OFF, SQUELCH CONTROL AT OFF, VOL CONTROL AT EXTREME CLOCKWISE POSITION, V3 OUT, AND HANDSET OUT.
3. * INDICATES VOLTAGE MEASURED WITH POWER SWITCH HELD AT CAL AND DIAL LITE.
4. † INDICATES VOLTAGE MEASURED WITH SQUELCH CONTROL AT MINIMUM ON POSITION.
5. NC INDICATES NO CONNECTION



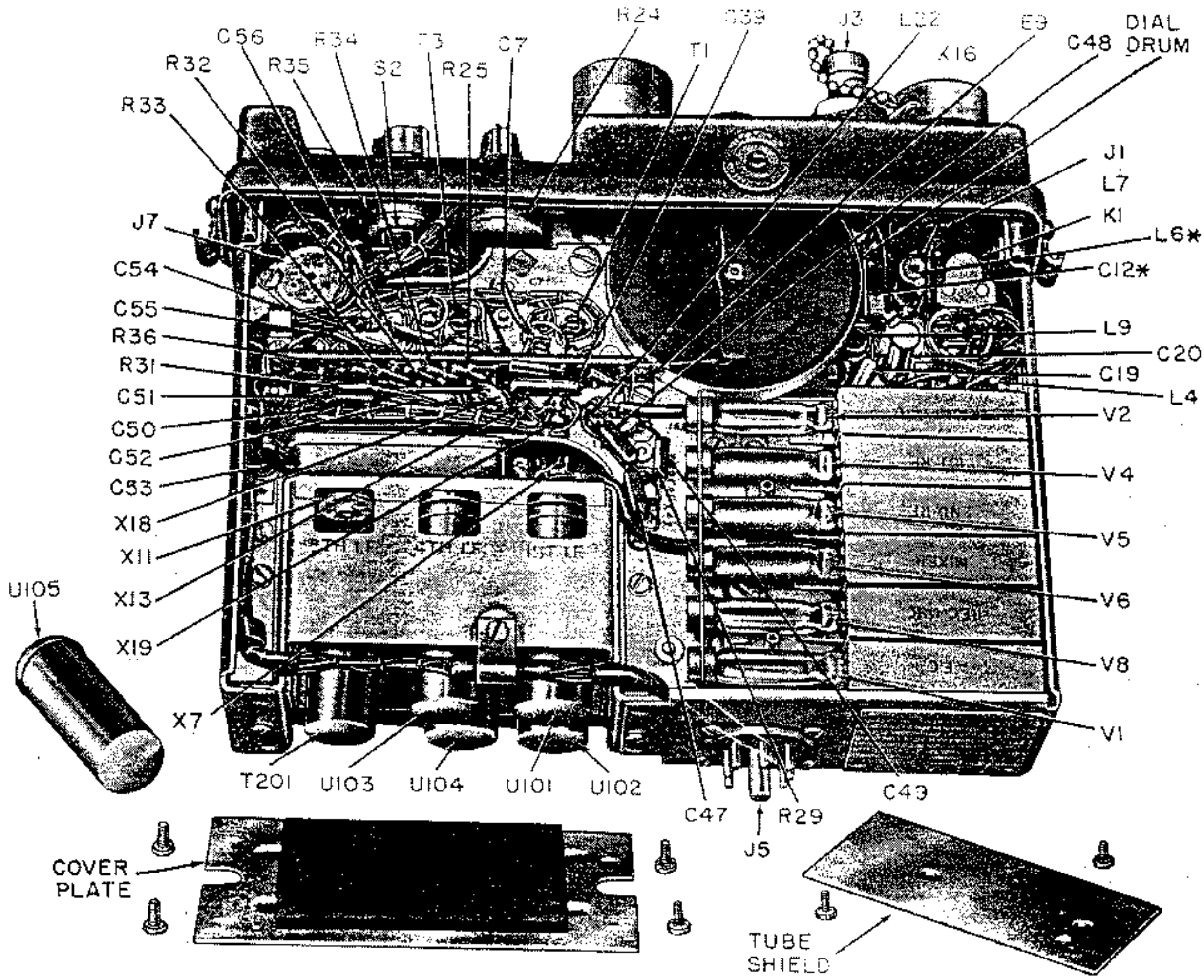
TOP VIEW OF CHASSIS **A**



FRONT VIEW OF PANEL **B**

TM 4065-151

Figure 29. Voltage and resistance measurements, top and front of chassis.



*NOT USED ON RADIO SET AN/PRC-8

TM 4065-15

[illegible]

be caused by sticky contacts of SQUELCH relay K2, by a short in C38, or a short in VOL control R24.

43. Discriminator

Put a 100-micromicrofarad capacitor in series with the hot lead of an rf signal generator, which is putting out an amplitude-modulated 4.3-mc signal. Apply this signal across the plate (pin 1) of V10 (socket X18). (This point connects to the input of the discriminator.) Shift the generator frequency above and below 4.3 mc while listening for a signal in the handset. The audio tone should be heard only when the signal is slightly above or below 4.3 mc. If no tone is heard, replace the discriminator can.

44. If. Amplifiers U101 through U105

a. It is difficult to gain access to the third, fourth, and fifth if. stages because of the shield that is placed over the sockets (X9, X10, and X11) of the if. cans. Feed an unmodulated 4.3 mc signal to pin 5 of sockets X8 (second if. can), and connect a vtvm (10-volt range) to pin 1 of test connector J7. The negative bias voltage obtained at pin 1 of J7 indicates the level of signal at the input to the fifth if.

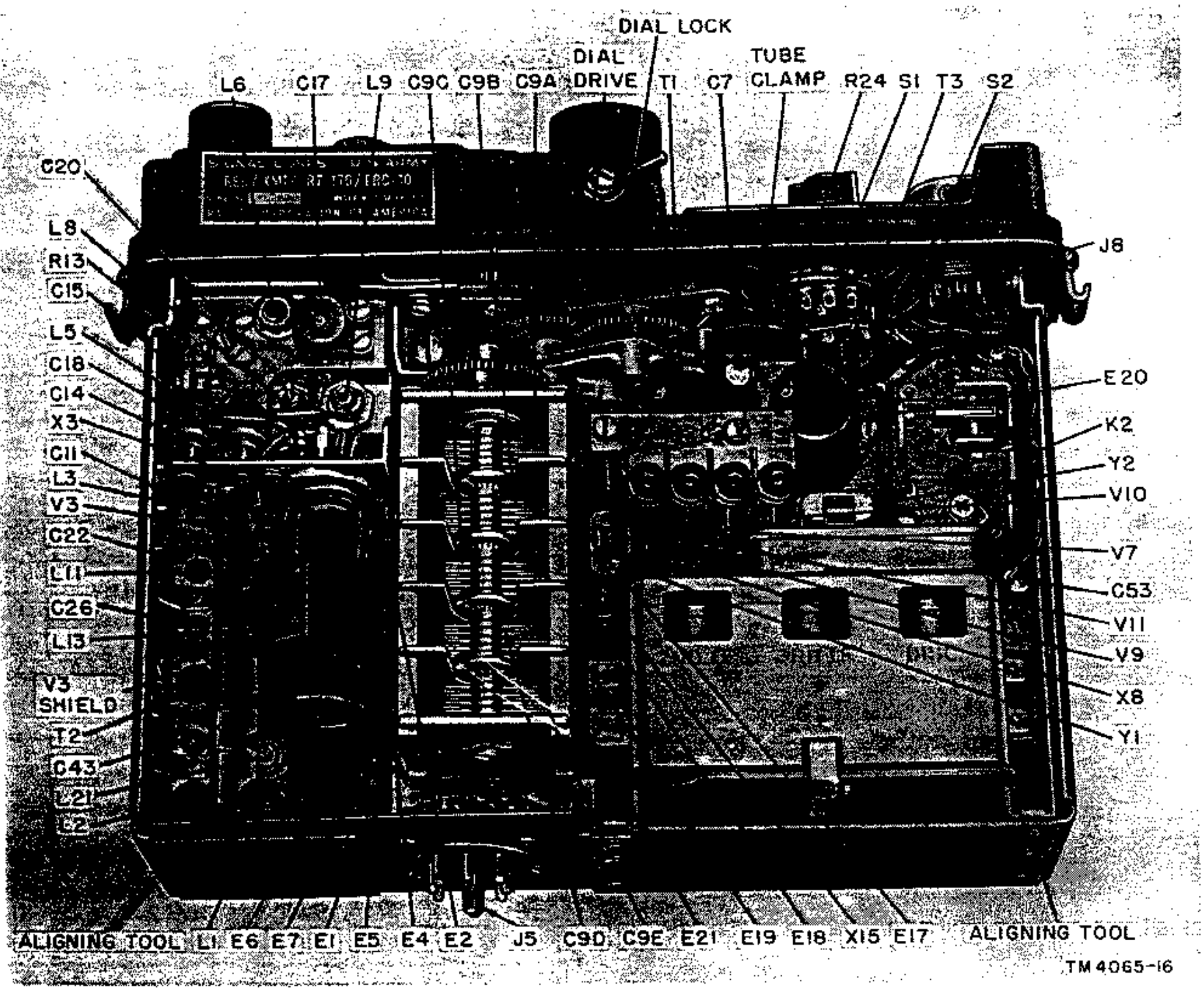


Figure 31. Bottom view of receiver-transmitter chassis.

amplifier and should change when the amplitude of the signal applied at pin 5 of X8 is changed. If no indication is obtained, replace the third, fourth, and fifth if. cans, one at a time, until an indication is obtained. If an indication is obtained, replace the fifth if. can with either the third or fourth. If no indication is obtained after this change is made, the can that was originally in the fifth if. location is defective.

b. An alternate check of the fifth if. can may be performed by connecting the vtvm to pin 3 of J7 and applying a 4.3-mc signal to pin 5 of X8. Vary this signal frequency above and below 4.3 mc. The vtvm reading should vary from positive to negative as the frequency is varied.

c. Apply the 4.3-mc signal to pin 2 of X8. The added gain of the second if. amplifier is now obtained, and the signal output of the generator that is required to produce the same output voltage at the vtvm should now be less than in *a* above. If no indication is obtained on the vtvm or if the input signal required to produce the same output voltage on the vtvm is not considerably less than in *a* above, replace the second if. can.

d. Apply the 4.3-mc signal to pin 2 of X7 (first if. can). Vary the output control of the generator so that the reading on the vtvm (connected to pin 4 of J7) is the same as in *c* above. The input signal should now be considerably less than that applied in *c* above. If it is not, replace the first if. can.

45. Mixer V6

a. Keep the vtvm at pin 4 of J7. Apply a 4.3-mc signal to terminal E1H on the afc box. The vtvm reading should be about the same as in the previous test. If it is not, C31 may be open. Check this capacitor by placing another capacitor of approximately equal value across it and again apply the 4.3-mc signal to terminal E1H.

b. Apply the 4.3-mc signal through a 100-$\mu\mu$f capacitor to terminal E19 of main TUNING capacitor C9. If no indication is obtained at the vtvm, replace the mixer tube or box and aline the receiver-transmitter (ch. 5). If an indication is obtained at the vtvm, change the frequency of the signal generator from 4.3-mc to the receiver-transmitter frequency (as indicated on its tuning dial). If a vtvm indication is obtained, the mixer and receiver oscillator are operating. If no vtvm indication is obtained, receiver oscillator V8 is not operating or is off frequency.

46. Receiver Oscillator V8

a. To check whether receiver oscillator V8 is operating, connect the vtvm across terminal 1 of J7 and ground. This measures the grid-leak bias voltage of V8. If V8 is oscillating, the bias voltage will be about —3 volts; if it is not, the bias voltage will be zero.

b. If no bias voltage is obtained, replace tube V8; if this does not correct the trouble, remove V3 and make resistance and voltage checks at E7 (fig. 28). Be sure to disconnect the power source from the receiver-transmitter before making resistance checks. Replace any defective component.

c. After replacing the defective component, aline the receiver oscillator (par. 73).

47. Rf Amplifiers V4 and V5

Tune the receiver-transmitter to the middle of its frequency range. Tune the signal generator to the same frequency and apply a signal through a 100-$\mu\mu$f capacitor to test point E19 (output of second rf amplifier). Then apply this signal successively to E18, E20, and to the antenna jacks. Test points E18, E19, and E20, are lugs on the stators of C9C, C9D, and C9A, respectively. The defective point is indicated by a loss of signal. Check voltages and, after disconnecting power, check resistances in the defective stage or circuit.

48. Squelch Amplifier V11

Slowly turn the SQUELCH control clockwise until squelch relay K2 is energized (pulls in). If the relay armature does not pull in, disconnect power from the receiver-transmitter and move the armature by hand to check for sticky contacts. If this is not the trouble, replace V11. Also check for low battery voltages. If these tests do not locate the trouble, make voltage and resistance checks on the entire squelch stage.

49. Transmitter Oscillator V3

a. Press the push-to-talk button on the handset and observe receiver-transmit relay K1. If the relay armature does not pull in, disconnect power fom the receiver-transmitter and move the relay armature by hand to check for sticking contacts or for an accumulation of rust on the end of the relay core below the armature. If the contacts are not sticky, check the circuit through the coil of K1.

b. Connect RF Wattmeter ME–11/U to the AUX ANT connector and press the push-to-talk button on the handset. The rf power output should be approximately 1 to 2 watts. An alternative check of transmitter oscillator operation is a measurement with the vtvm of the negative dc bias at the junction of R11 and C15. This voltage should be about —5 volts.

c. If the power output of the transmitter oscillator is low, replace V3. If it is still low, aline this stage (par. 76).

d. If replacing V3 fails to result in any output from the transmitter oscillator, make a complete voltage and resistance check of this stage (fig. 28).

50. Modulator V2

a. Off-frequency transmitter operation and lack of modulation may be caused by a defective modulator stage. Check V2 and L4 and replace them if necessary.

b. If the transmitter frequency is correct but there is no modulation, check the audio input circuit, which includes modulation transformer T1, the handset microphone, and the 1.5-volt supply.

c. If modulation is satisfactory but the transformer oscillator drifts off frequency, a defect exists in the afc circuit (par. 51).

51. Afc Driver V1

a. While pressing the push-to-talk button, measure the voltage between E1B and E1A with a vtvm. E1B should be about 15 volts negative with respect to E1A. Disable receiver oscillator V8 by placing a finger on lug E21 on the stator of main TUNING capacitor C9E. The voltage should drop to 0.

b. Repeat the procedure in *a* above with the vtvm connected between E1B and E1C. E1C should be about 15 volts positive with respect to E1B. When a finger is placed on E21, the voltage should drop to 0.

c. If the results in *a* and *b* above are not obtained, the afc circuit is defective. This may be caused by a defective afc driver tube or by an afc discriminator which is not properly alined or contains defective components. Remove the afc box and check the circuit. To check crystals CR1 and CR2, remove them from the box and measure their resistances. Then reverse the ohmmeter leads and measure their resistances again. Replace a crystal if its high resistance is less than 300,000 ohms.

52. Calibration Oscillators V9 and V10

a. While holding the POWER switch at CAL & DIAL LITE, measure the voltage at pin 4 of 1-mc calibration oscillator V9 with a vtvm. This should be about —20 volts. If no negative voltage is obtained, replace Y1. If the oscillator still does not operate, check the circuit for shorted or open capacitors, resistors, or broken leads.

b. Make the same checks on 4.3-mc calibration oscillator V10. The voltage at pin 4 of V10 should be about —2 volts.

53. Miscellaneous Checks

a. Coil Resistances. Resistance measurements of the components shown in the chart below give readings approximately as shown.

Symbol	Component	Resistance in ohms		
		Primary	Secondary	Coil
K1	Receive-transmit relay	----	-------	43
K2	Squelch relay	-----	-----	16,000
L4	Modulation transformer.	3,500	0.2	
T1	Microphone transformer.	12	4,700	
T2	Mixer to if. coupling transformer.	0.7	0.1	
T3	Audio output transformer.	2,400	75	

b. Battery Cable. If a receiver-transmitter operates when the panel and chassis assembly is out of the case, but does not operate when it is in the case, the trouble may be in the battery cable, which is connected to the case. Insert the receiver-transmitter chassis in another case and operate the radio set. If the trouble was in the first battery cable, the radio set will not operate. To make a continuity check of the battery cable, disconnect the cable from the battery and remove the plate at the back of the receiver-transmitter case (which covers connector J6) by removing the four securing screws. Then make a continuity test with an ohmmeter between each lettered terminal on plug P1 and the corresponding lettered terminal on J6 (A to A, B to B, and so on). There should be continuity (0 ohms) for all eight leads.

c. Retransmission Cable. If two radio sets operate (reception and transmission) individually but do not operate as a relay station when connected by the relay cable, the trouble is in this cable. To check the cable, make continuity tests using figure 24.

d. Battery BA–279/U. Use Battery Tester TS–183/U to check the battery. The chart on figure 19 is a duplicate of one that is printed on the battery. This indicates which jack of the battery tester is to be used for each measurement. The two prods of the battery tester are placed across the two terminals of the battery to be tested. In order not to damage the meter, connect the positive prod to the positive terminal. When the voltage across $+B_1$ to $+B_2$ is to be measured, connect the positive prod to the $+B_2$ terminal.

c. Handset H–33/PT. The resistance measurements made at the terminals of the handset connector specified in the chart below, locate defects in the handset. See figure 25 for the schematic diagram of Handset H–33/PT.

Push-to-talk switch	Terminals of connector	Required reading (ohms)
Unoperated or operated.	A and B	30 (click heard when ohmmeter connection is made or broken).
Operated	F and H	0
Unoperated	F and H	Infinity.
Operated	D and E	0
Unoperated	D and E	Infinity.
Unoperated or operated.	C and D	150 (click heard when ohmmeter connection is made or broken).
Unoperated or operated.	D and F	Infinity.

Section VI. STAGE GAIN MEASUREMENTS

54. General

Stage gain measurements are useful in locating a defective stage when the radio set is operating with reduced sensitivity. Under such conditions, the gain of each stage is compared with the required gain for that stage. The stage which shows a gain appreciably below its required gain then may be checked carefully by resistance and voltage measurements to locate and repair the defect.

55. Receiver RF Stages and Antenna Circuit

The gain of the rf stages and the antenna circuit is checked by adjusting the signal input voltage. This produces the same limiter grid voltage at the fifth if. grid (terminal 4 of test socket J7) as the input signal voltage is changed from stage to stage. Make all rf measurements at the center of the frequency range of the radio set being tested. If gain is low, replace the tube of the stage being tested; then aline the radio set. If gain is still low, remove the rf box and make resistance measurements to locate the trouble.

a. Test Conditions.

(1) Vtvm connected across terminal 4 of test socket J7 and ground.

(2) SQUELCH control at OFF.

(3) Vary frequency control of signal generator slightly until maximum output is obtained.

(4) Input signal voltage is adjusted to produce a reading of —5 volts at terminal 4 of J7. Although input voltages may show some variation from one set to another, the gain for similar stages should be fairly constant. Stage gain shown in the fourth column of the chart in *b* below is calculated from the ratio of two successive input voltage readings. For example, the gain of 3.2 is the ratio of 120/37.5.

(5) Use a 2,000-$\mu\mu$f capacitor in series with the hot lead of the generator except when the signal is applied at AUX ANT conector J3.

b. Stage Gain Chart.

Input signal (μv) (approx)	Input terminal	Reading at terminal 4 of J7 (dc volts)	Stage gain	Remarks
120	E19	—5	-------	Provides first figure from which to calculate gain.
37.5	E18	—5	3.2	Gain of second rf stage.
3.05	E20	—5	12.3	Gain of first rf stage.
0.5	J3	—5	6.2	Gain of antenna circuit. (Use 33-ohm resistor, in series with hot lead of generator, instead of 2,000-$\mu\mu$f capacitor.)

56. Receiver If. and Discriminator Stages

One set of conditions is given for an overall measurement of the gain of all the if. stages because access to the sockets of the last three if. stages is difficult. Location of the defective stage is accomplished by the substitution of a spare if. can.

a. Conditions.

(1) Vtvm connected between terminal 4 of J7 and ground. (This is grid bias voltage of the fifth if. amplifier.)

(2) SQUELCH control at OFF.

(3) Input signal is 4.3 mc; 2,000-$\mu\mu$f capacitor is connected in series with output lead of signal generator.

b. If. Stage Gain Chart.

Input signal (μv)	Terminal	Vtvm reading (volts)
70	Pin 2 of X7	—5

c. Discriminator.

(1) Increase the output of the signal generator until the vtvm reading no longer increases. (This is necessary to operate the limiters at saturation.)

(2) Change the vtvm lead from terminal 4 of J7 to terminal 3. (The vtvm will now measure the dc output of the discriminator.)

(3) Shift the signal generator frequency 15 kc above, then 15 kc below 4.3 mc. An output of 2.8 volts at each of these frequencies indicates normal discriminator sensitivity.

57. Receiver Audio and Squelch Stages

a. Audio Amplifier. Apply a 2-volt, 1,000-cps signal to the grid (pin 4) of audio amplifier V7. Connect Output Meter TS–585A/U, adjusted to provide a 600-ohm load, across terminal 3 of transformer T3 and ground. The output reading must be at least 7.5 milliwatts (mw).

b. Squelch Circuit.

(1) Short AUX ANT connector J3 to ground.

(2) Turn the SQUELCH control slowly clockwise to the point where squelch relay K2 just pulls in (rushing noise stops).

(3) Measure the voltage at terminal 4 of J7 with a vtvm. This voltage should be about —1.5 volts (squelch bias voltage).

(4) Slowly turn the SQUELCH control counterclockwise to the point where K2 just releases. The voltage at terminal 4 of J7 should now be about —2.5 volts (or about 1 volt more negative than the pull-in bias voltage). If the difference between the two readings is considerably more than 1 volt, the squelch circuit is defective.

58. Transmitter Modulator and Afc Discriminator Stages

a. Modulator. The measure of modulator sensitivity is the amount of frequency shift of the transmitter with a given change in modulator (V2) grid voltage.

(1) Tune the receiver-transmitter to the center of its frequency range.

(2) Press the push-to-talk button of the handset to operate the transmitter and check the frequency with Frequency Meter TS–174B/U. The frequency should be the frequency indicated on the dial.

(3) Short terminal 5 of J7 to ground. The frequency of the transmitter should increase by more than 700 kc as measured by the frequency meter.

(4) Remove the short. The transmitter frequency should be the same as in (2) above.

b. Afc Discriminator.

(1) Apply a 1-volt 4.3-mc signal from Signal Generator I–208 to terminal E6H in the mixer box.

(2) Press the push-to-talk button on the handset (to operate the transmitter) and place a finger on terminal E19 (fig. 31) to disable the receiver oscillator.

(3) With a vtvm connected between terminal E1B and ground, the reading should be approximately —18 volts.

(4) Connect the vtvm between terminal E1C and ground and measure the voltage at this point. The reading should be approximately —5 volts.

(5) Raise the frequency of the signal generator to 4.33 mc. The voltage change at terminal E1C should be approximately 3 volts (or about .1 volt per kc deviation).

CHAPTER 4

REPAIRS

59. Precautions

a. When replacing tubes, use the same type tube as the one that was removed. Be sure the tube is oriented above the socket correctly before attempting to insert it. Insert with a firm but gentle pressure. *Do not force.*

b. When replacing a component that has several leads soldered to it, locate and identify each lead on the component before unsoldering it. This assures that the replacement component will be connected properly.

c. When parts with the same voltage or power rating cannot be obtained, use a part with a higher and not a lower rating. Locate the replacement part in the same position as the original part.

d. When soldering, be careful not to allow the soldering iron to touch adjacent components. Use only a small pencil-type iron. Use the minimum amount of solder necessary to make a good electrical joint.

e. After repairs are completed, field organizations will brush moistureproofing and fungiproofing varnish on exposed surfaces of equipment in accordance with TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment. Moisture and Fungus Proofing Equipment MK–2/GSM may be requisitioned for this purpose. Complete moistureproofing and fungiproofing will be accomplished at depots after repairs have been completed.

60. Removal and Replacement of Control Panel

Caution: Removal of the panel is a complicated operation and should be performed only when repair or maintenance of the radio set makes it absolutely necessary.

a. Removal of Panel.

(1) Release the catches on the case and remove the receiver-transmitter from its case.

(2) Turn the TUNING knob counterclockwise until the TUNING capacitor gang plates are meshed fully. Tighten the dial lock to prevent movement of the dial drive mechanism during the removal operation.

(3) Lift and remove the drum dial pointer and dial pointer spring. This will prevent damage to or loss of these items.

(4) Apply the spring tension tool (fig. 32) to the gang scissor gear as shown on figure 33. This maintains shear tension on the two sections of the scissor gear.

(5) Remove the four screws that secure the control panel to the chassis. There are two on each side of the chassis just behind the panel.

(6) Remove the two inside screws that secure the dial drive mechanism to the chassis. One screw is accessible from the top, and the other from the bottom of the chassis.

(7) Unsolder and remove both ends of the leads that interconnect the antenna jacks with the chassis. Make a written note of the positions of the leads so that they may be reconnected properly.

b. Replacement of Panel.

(1) Replace and solder all the antenna jack No. 24 stranded wire leads in their original positions (fig. 34 or 35).

(2) Replace and solder No. 24 stranded wire leads interconnecting the control panel and chassis in their original positions (fig. 34 or 35).

(3) Replace the control panel in its original position and fasten it to the chassis with the original screws and lock washers. If care was taken to keep the TUNING capacitor gang

plates fully meshed, and if the dial gear mechanism was not moved, the gang scissor gear and the pinion will mesh in the same positions in which they were before separation.

(4) Remove the spring tension clip from the TUNING gang scissor gear.

(5) Replace the drum dial pointer and dial pointer spring in their original positions.

c. Mechanical Alinement of Panel and Chassis Assembly. A jig is required to assure correct mechanical alinement of the panel and chassis assembly so that it fits properly in its case.

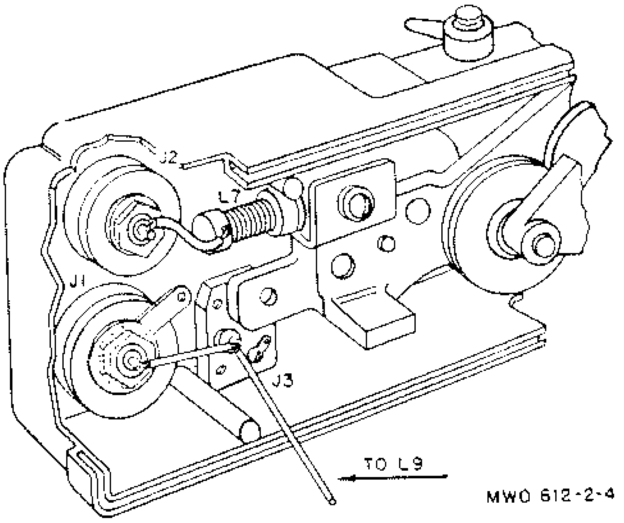


Figure 34. Antenna lead connections for RT–174/PRC–8.

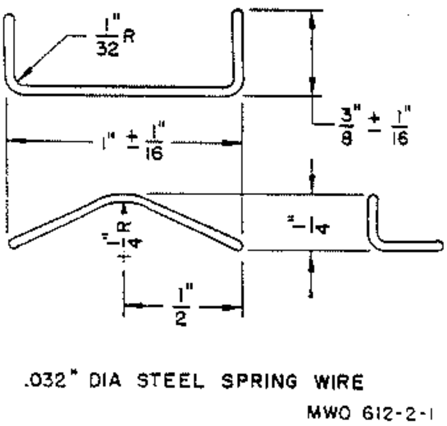


Figure 32. Scissor-gear tension clip.

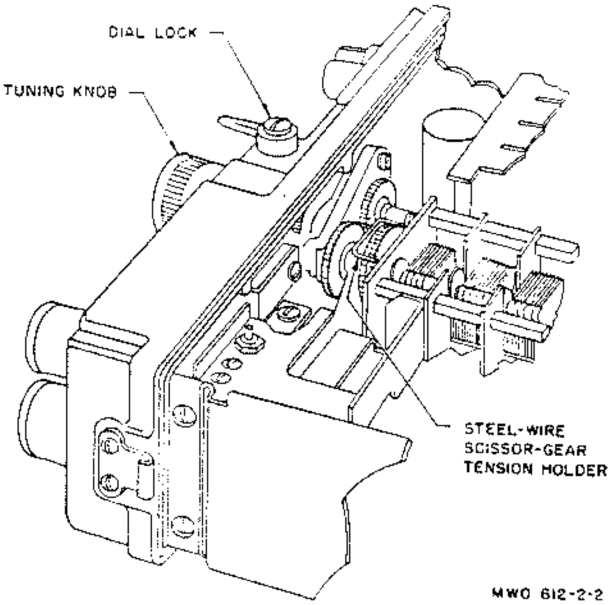


Figure 33. Application of wire clip to gang scissor gear.

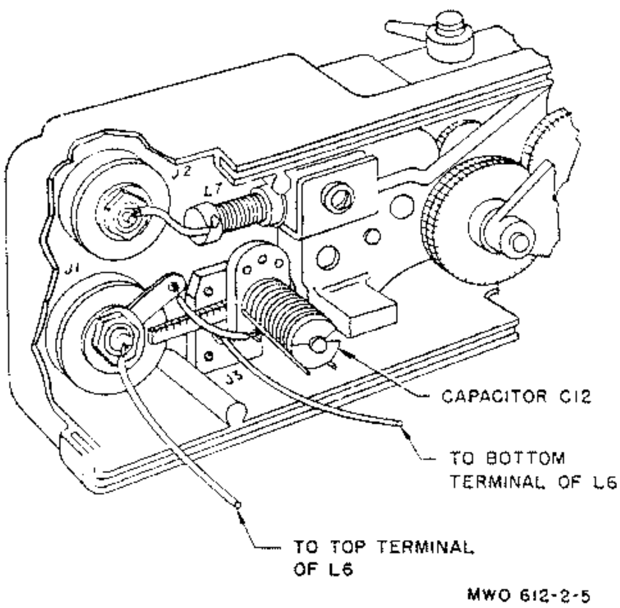


Figure 35. Antenna lead connections for RT–175/PRC–9 and RT–176/PRC–10.

(1) *Fabrication of jig.*

(*a*) The jig is made from the case of a receiver-transmitter which is nonrepairable.

(*b*) Remove the eight-pin male battery plug and flexible cord from the bottom of the case, leaving the female receptacle intact.

(*c*) Remove the two catches located one on each side near the back of the case.

(*d*) Drill four 3/8-inch diameter holes, two on each side of the case, near the front, as shown on figure 36.

(2) *Use of jig.*

(*a*) Loosen the four 6–32 by 1/4-inch long binder-head machine screws that fasten the panel to the chassis. These screws are located two on each side of the chassis and just behind the edge of the panel.

(*b*) Secure the jig in a vertical position in some convenient location. Insert the chassis in the jig and fasten the holddown catches.

(*c*) Tighten the four 6–32 screws that fasten the panel to the chassis. These screws are accessible through the four 3/8-inch holes in the jig.

(*d*) The panel and chassis assembly is now correctly alined. Remove it from the jig and install it in its proper case.

61. Tube Replacement

All accessible tubes and the if. and discriminator cans are shown on figures 30 and 31.

a. If. Tubes. Turn the if. can in for repair. Each if. tube is located in an if. can that is

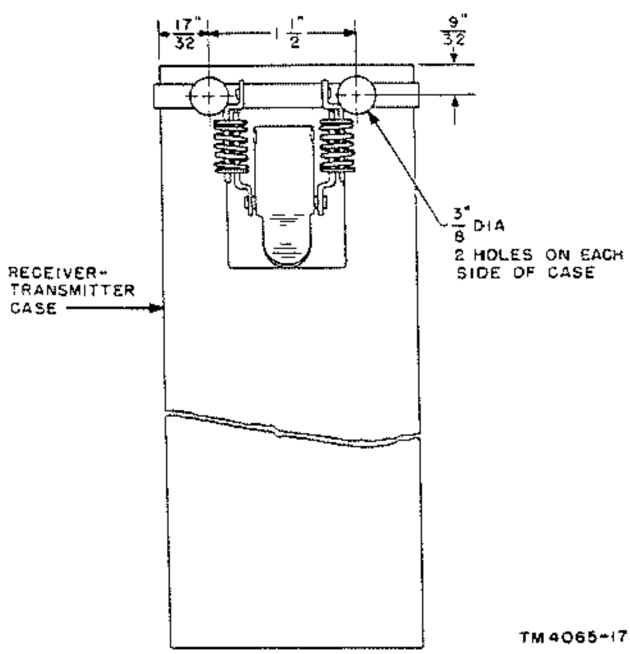


Figure 36. Holes in jig used for panel and chassis alinement.

hermetically sealed. The tube, therefore, is not accessible.

b. Audio, Squelch, and Calibration Tubes. To remove the audio (V7), the squelch (V11), or one of the calibration oscillators (V9 and V10), it is necessary first to remove the tube clamp for these tubes. Remove the two securing screws and then remove the tube clamp. Remove the desired tube by pulling straight up on it. When replacing these tubes, be sure the red mark on the tube corresponds to the pimple on the socket. After tubes are in place, replace the tube clamp and tighten the two screws which secure this clamp.

c. Tubes Mounted on Box Assemblies. Tubes V2, V4, V5, V6, V8, and V1 are mounted on the box assemblies (fig. 30).

(1) Remove the two screws that secure the cover plate, and remove the cover plate.

(2) Loosen but do not remove the two screws that secure the tube clamp for the six tubes, and remove the tube clamp by sliding it away from the tubes.

(3) When replacing each tube, be sure that the red mark on the tube corresponds to the red mark on the tube socket.

(4) When replacing V2 in the tube socket on the TRANS OSC box, insert the pin nearest to the red mark on the tube into the second pin socket from the red mark on the tube socket.

(5) Before installing a new V6 (mixer) or V8 (receiver oscillator), break the electrical connection between the external tube coating and pin 3 of the tube. (An ohmmeter check should indicate a reading of infinity between pin 3 and the metallic tube coating.) When replacing V8, remove the insulating sleeve from the old tube and place it around the new tube. If the old tube does not have an insulating sleeve, obtain some form of *spaghetti* insulation and slip it around the tube. This is required to insulate the metallic coating of this tube from the cover plate.

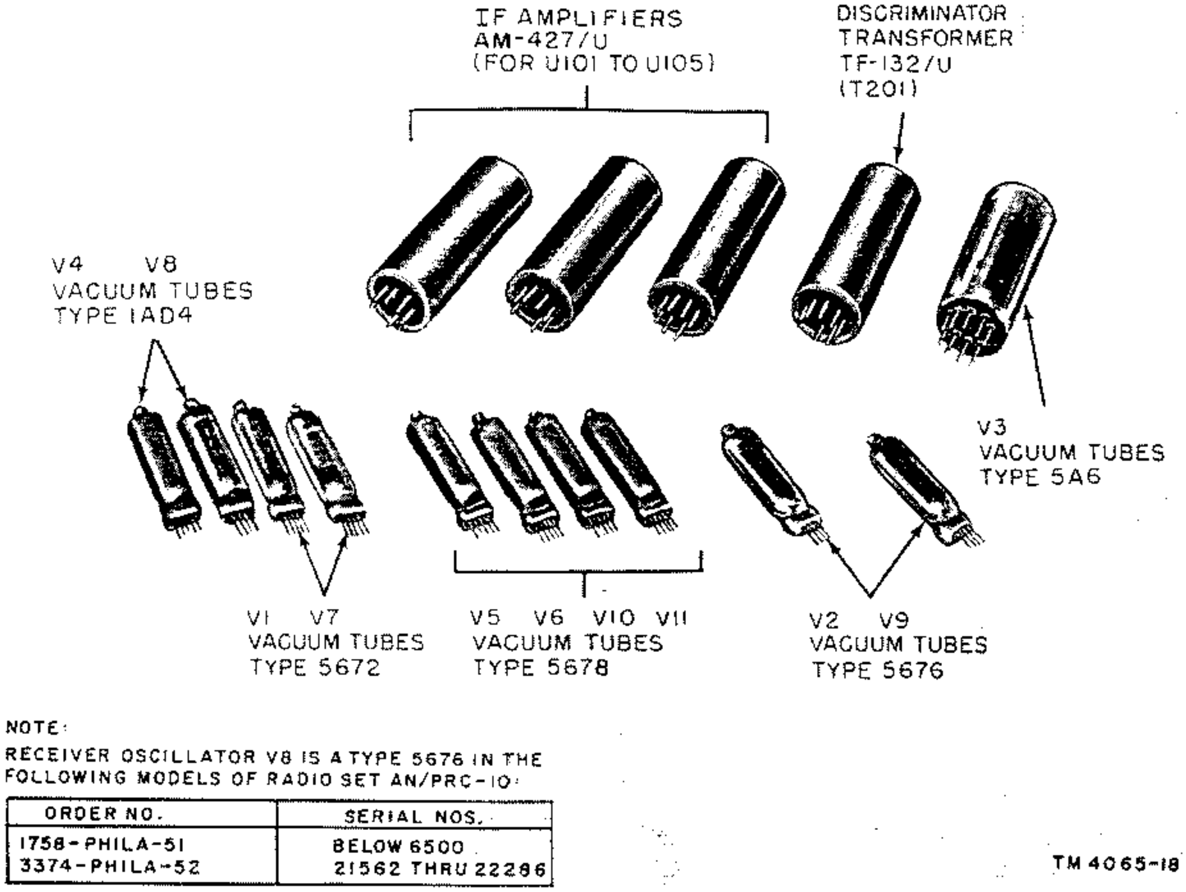


Figure 37. Vacuum tubes and if. and discriminator cans.

(6) When all six tubes have been inserted into the sockets on the boxes, install the tube clamp and tighten the two holding screws.

(7) Install the cover plate and tighten its two holding screws.

62. Replacement of If. and Discriminator Cans

a. Removal. Remove the four screws that hold the cover plate in place on the back of the chassis (fig. 30) and remove the plate. Remove the individual cans by pulling straight out. If necessary, pry under the base with a small screwdriver. The if. shelf with shield removed is shown on figure 38.

b. Replacement. Aline the pins on the back of the can with the holes in the socket and push the can in place. Be sure the cans are placed in the correct sockets by referring to the designations on the cans and chassis. Replace the cover plate and the four screws that hold it in place.

63. Replacement of Box Assemblies

a. Removal. Remove the tube that is mounted on the box assembly as directed in paragraph 61*c*. Unsolder the leads on the terminal board of the box. If the transmitter tube is in the way, first remove the shield by taking out the two screws that hold it to the chassis. Then pull the tube straight out from the socket. Remove the top and two side screws of the box, one right and one left. The box can now be lifted out of the chassis. Inside views of the boxes are shown on figures 39 through 44.

b. Replacement. Place the box in position, start the three screws, and then screw tight. Replace the leads on the terminal board, being careful to use a minimum of solder. Apply

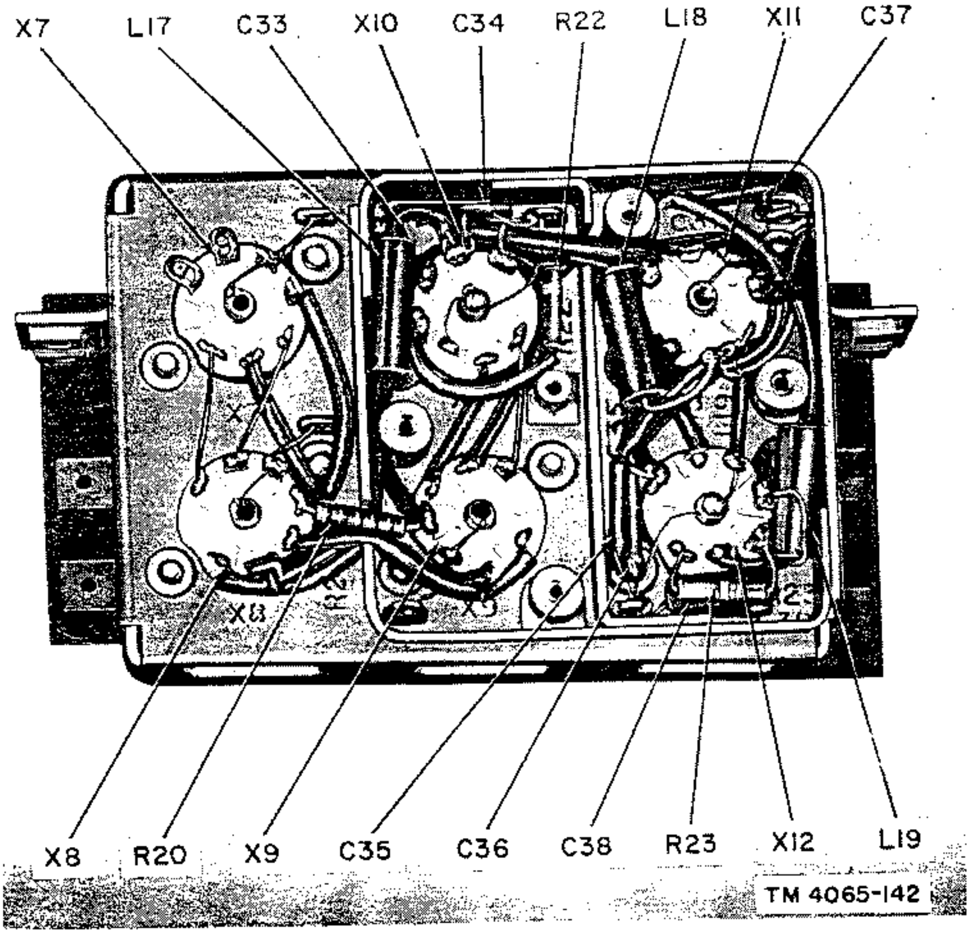


Figure 38. If. shelf with shield removed.

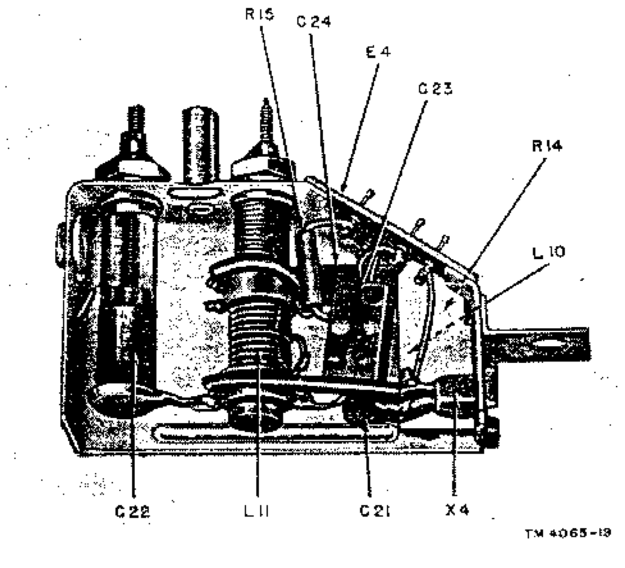


Figure 39. First rf box, inside view.

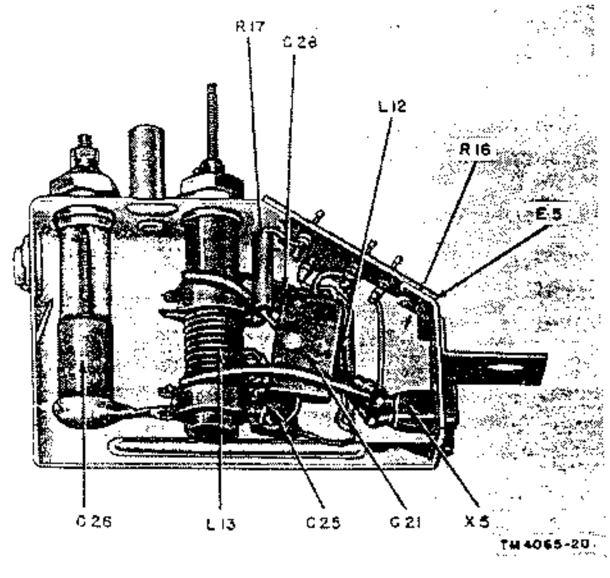


Figure 40. Second rf box, inside view.

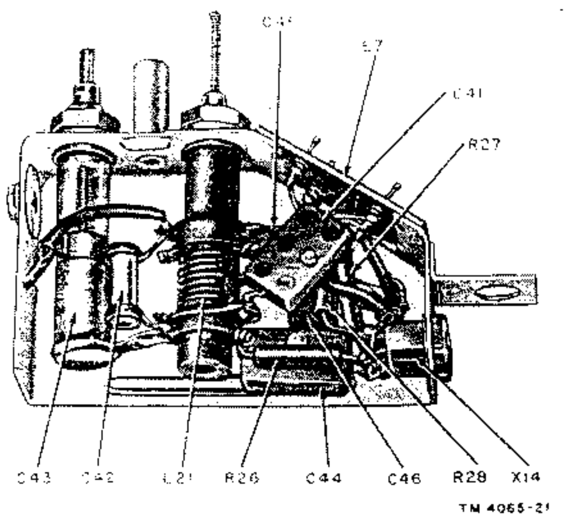


Figure 41. Receiver oscillator box, inside view.

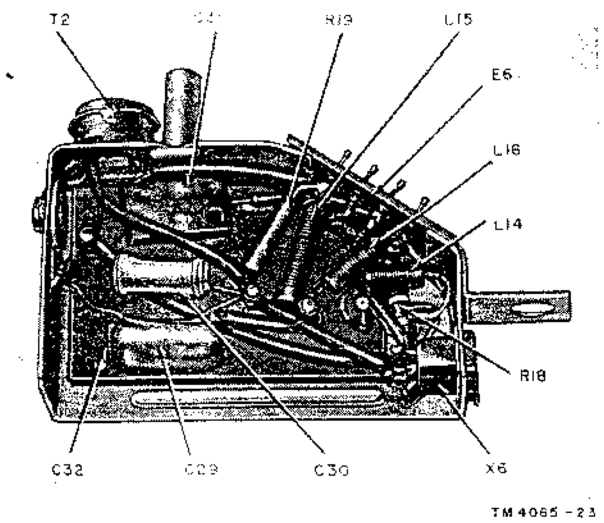


Figure 43. Mixer box, inside view.

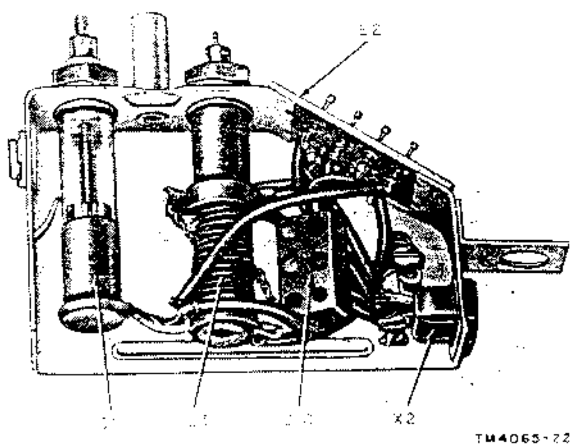


Figure 42. Transmitter oscillator box, inside view.

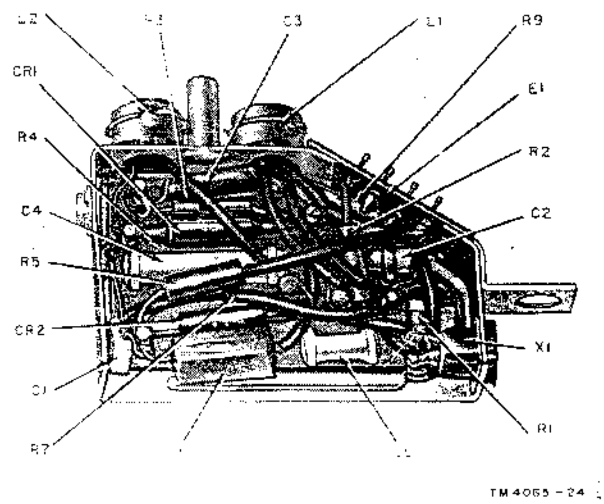


Figure 44. Afc box, inside view.

solder only at the point where the wire touches the terminal.

64. Replacement of Dial Lamp

a. Unscrew the cap marked LITE CAP (located on the front panel) using a screwdriver if necessary.

b. Hold a hand under the opening, turn the receiver-transmitter so that the control panel faces down, and shake slightly until the dial lamp drops out.

c. To insert a new lamp, hold the control panel face up and drop a lamp into the opening, bulb first.

d. Screw on the LITE CAP.

65. Replacement of Calibration Crystals (fig. 31)

Crystal Y1 consists of a 1-mc Crystal Unit CR–18/U. Crystal Y2 consists of a 4.3-mc Crystal Unit CR–18/U.

a. Push back the spring clamp and lift the crystal out of its socket.

b. To insert a new crystal, push the spring clamp to the side and insert the crystal in the socket. No polarity need be observed when inserting the crystal.

c. Push the spring clamp over the crystal to keep it secure in its socket.

66. Lubrication of Dial-Drive Mechanism

a. The dial-drive mechanism is the only assembly in the radio set that requires lubrication. No Department of the Army lubrication order has been issued for Radio Sets AN/PRC-8, -9, and -10.

b. It is expected that the dial-drive mechanism will not require lubrication for the life of the radio set. If, however, the chassis has been exposed to moisture or dirt, and there is corrosion or dirt on the gears, cleaning and lubrication will be necessary. To clean and lubricate the dial-drive mechanism, remove the control panel from the chassis of the receiver-transmitter. *This is a very difficult operation and should be performed only when absolutely necessary.*

c. Remove the control panel from the receiver-transmitter chassis as directed in paragraph 60.

d. Clean the dial-drive mechanism with solvent (SD), being careful not to get it on parts other than those being cleaned. Dry with a cloth while turning the mechanism so that all portions are clean and dry.

e. Using a small toothpick or No. 20 AWG bare wire, apply 1 drop of lubricating oil to all bearings and shafts except the gears. Use Oil, Lubricating, Preservative, Special (PL Special) in accordance with MIL-L-644A specification. Keep oil away from O-ring seals to prevent damage to the seals.

f. Apply grease sparingly to all gears, pinions, and racks, as shown in figures 45 and 46. Use grease in accordance with MIL-G-3278 specification. Work the grease in and spread it by turning the dial knob from one end of travel to the other. Wipe off the excess lubricant from the sides of gears, pinions, and racks.

67. Refinishing

a. When the finish on the cases has been badly scarred or damaged, touch up the bared surfaces with No. 00 or No. 000 sandpaper to prevent rust and corrosion. Clean the surface

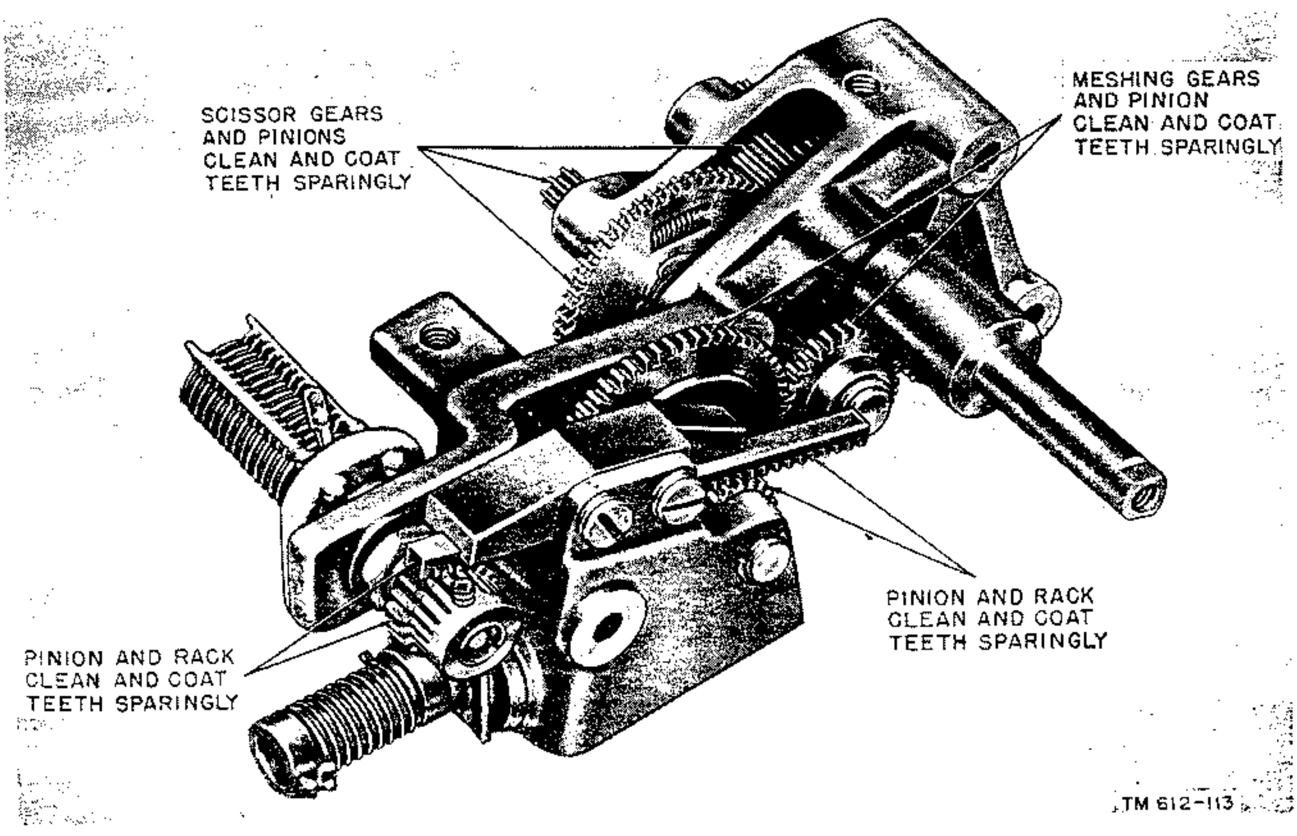


Figure 45. Top view of dial-drive mechanism.

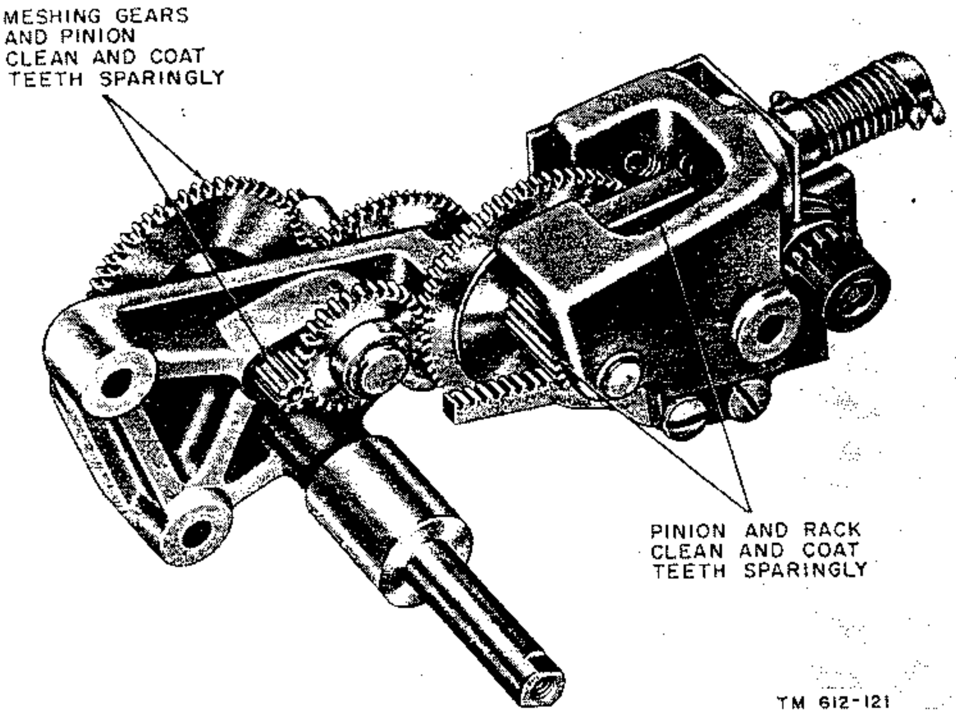


Figure 46. Bottom view of dial-drive mechanism.

down to the bare metal; obtain a bright smooth finish.

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

b. When a touch up job is necessary, apply paint with a small brush. Remove corrosion from the case by cleaning corroded metal with solvent (SD). In severe cases it may be necessary to use solvent (SD) to soften corrosion and to use sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations. Instructions for refinishing badly marred panels are contained in TM 9–2851, Painting Instructions for Field Use. Refer to these instructions as necessary.

68. Dial-Drum Adjustment after Replacement

a. Turn the TUNING capacitor exactly to its fully meshed position. This brings the low-frequency end of the dial scale opposite the dial window.

b. Turn the POINTER ADJUST knob and center the pointer midway between its two extremes of travel.

c. Position the dial drum so that the full-width line, located just below the lowest frequency mark on the dial, is alined with the pointer. Tighten the Allen screw in the center of the tuning dial drum with the wrench and spanner (Sig C stock No. 6R5701–3).

Caution: If the wrench and spanner are not used to hold the bevel gear during tightening and loosening of the Allen screw, damage to the bevel gear will result.

69. Relay Repairs

Repairs or adjustments to relays rarely will be necessary. When hermetically sealed relays are used, replace a defective relay with a new one. In those units in which open relays are used, some adjustment and cleaning can be performed.

a. Adjustments of K1. Bend the spring contact or contacts that appear to be defective until satisfactory operation is obtained.

b. Adjustment of K2. Adjust the spring-locked screw contacts of K2 with a small wrench until satisfactory operation is obtained.

c. Contact Cleaning. Use a small amount of carbon tetrachloride on the relay contacts and wipe dry and clean with a soft cloth.

CHAPTER 5

ALINEMENT

70. Test Equipment Required for Alinement

The following test equipment is required for alinement:

Test equipment	Common name
Signal Generator AN/URM-48.	Rf signal generator.
Electronic Multimeter TS-505/U.	Vtvm.
RF Wattmeter ME-11/U...	Rf wattmeter.

71. If. and Discriminator Alinement

If. and discriminator cans are hermetically sealed. No equipment is available at present in the field for opening and resealing these cans. Therefore, defective if. or discriminator cans are not to be repaired, but are to be returned to appropriate higher repair echelons. Directions for repair of these cans will be issued at a future date.

72. Mixer Alinement
(figs. 30 and 31)

a. Connect the vtvm to terminal 4 of J7 and ground.

b. Apply a 4.3-mc signal to terminal E19 through a .005-$\mu\mu$f or larger capacitor.

c. Use the alinement tool provided with the receiver-transmitter to adjust the core of T2 for maximum negative voltage on the vtvm. *Be careful not to apply excessive pressure to T2 as this transformer is fragile and can easily be broken.*

73. Receiver Oscillator Alinement
(figs. 30 and 31)

a. Center the pointer of the receiver-transmitter (fig. 3) to the middle of its extremes of travel. Turn the TUNING capacitor exactly to its fully meshed position. When this is done, a marker line, located just below the lowest frequency mark on the dial drum, should be within one-half of a small division of the dial from the previously set pointer. If this condition is not satisfied, adjust the dial drum in accordance with instructions in paragraph 68.

b. Set the receiver-transmitter to its lowest frequency. Calibrate the signal generator to this frequency and connect it through a .005-$\mu\mu$f or larger capacitor to terminal E19. Connect the vtvm across terminal 4 of J7 and ground.

c. Adjust coil L21 for maximum negative voltage on the vtvm. Reduce the output voltage of the signal generator to a level just sufficient to enable a peak reading to be obtained at the vtvm. To check against unwanted signal pickup from other sources, vary the output control of the signal generator. The vtvm reading should show a corresponding variation.

d. Raise the frequency of the signal generator 8.6 mc. This signal also should cause a peak reading on the vtvm. This indicates that the receiver oscillator has been tuned correctly to a frequency 4.3 mc higher than the signal applied as directed in *b* above.

e. Set the receiver-transmitter to the highest frequency on its dial, and tune the signal generator to this frequency. Adjust C43 for maximum voltage on the vtvm.

f. Repeat procedures in *c* and *e* above until no further adjustments are necessary.

74. Rf Alinement
(figs. 30 and 31)

The first and second rf amplifiers are alined jointly first at the low frequency end of the dial and then at the high frequency end of the dial. The frequencies to be used for each of the radio sets are shown in the chart following:

Radio set	Low frequency (mc)	High frequency (mc)
AN/PRC-8	20.6	27.4
AN/PRC-9	27.9	38.1
AN/PRC-10	39.2	53.8

a. Insulate coil L8 (connected to pin 1 of V3) with friction or cellophane tape, or spaghetti. (This is to prevent accidental shorting of B+ to ground while adjustments are being made to L9 and C20.)

b. Tune the signal generator and the radio set to the low frequency end of the dial shown in the chart above.

c. Connect the vtvm across terminal 4 of J7 and ground.

d. Connect the signal generator in series with a 33-ohm resistor to AUX ANT connector J3. Vary the signal generator tuning dial slightly up and down for maximum reading on the vtvm. Adjust coils L13, L11, and L9 in that order for maximum reading on the vtvm. (Reduce the output voltage of the signal generator to a level just sufficient to enable a peak reading to be obtained at the vtvm.)

e. Tune the radio set and the signal generator to the high frequency shown on the chart above. Vary the signal generator tuning dial slightly up and down for maximum reading on the vtvm. Adjust C26, C22, and C20 in that order for maximum reading on the vtvm.

f. Repeat the adjustments of L13, L11, and L9 at the low alinement frequency and C26, C22, and C20 at the high alinement frequency until no further adjustments are necessary.

g. Check the receiver alinement using the calibration oscillator test. In this test, the POWER switch is held at CAL while the TUNING control of the radio set is turned slowly from the low to the high end of the dial. With a handset connected to the AUDIO connector, a beat note should be heard at each whole number mc point. If satisfactory results are not obtained, repeat the mixer, receiver oscillator, and rf alinement procedures.

75. Afc Alinement

(figs. 30 and 31)

a. Apply a 4.3-mc signal at maximum output through a .005-μf or larger capacitor to terminal E19. (If the maximum output voltage of the signal generator is .1 volt or less, remove tube V3 from the receiver-transmitter and apply the signal to terminal E6H on the mixer box.) Be careful not to ground to chassis the lead that is connected to E19 as this point is at +65 volts.

b. Press the push-to-talk button on a handset connected to the AUDIO connector, and tape the button down in this position.

c. Connect a vtvm across terminal E1B and ground.

d. Disable receiver oscillator V8 by placing a finger on E21. (If V3 has been removed, V8 need not be disabled.)

e. Tune coil L1 for maximum reading on the vtvm. (Be careful not to exert too much pressure on L1 because this coil is very fragile.)

f. Remove the vtvm leads from across E1B and ground; connect the ground lead to the junction of R13 and R11, and the high lead to terminal 5 of J7.

g. Adjust coil L2 (being careful not to exert excessive pressure on this coil) for zero reading on the vtvm within ±1 volt.

h. If the afc circuit is operating properly and has been adjusted properly, a rotation of L2 of approximately one full turn in one direction should give a reading of at least +2 volts, and in the other direction, a reading of at least —2 volts. Make this check and then be sure to readjust L2 to give zero reading.

76. Transmitter Alinement

(fig. 47)

Perform the transmitter alinement only after the alinements described in paragraphs 72 through 75 have been made.

a. Insulate coil L8 (connected to pin 1 of V3) with friction or cellophane tape, or spaghetti. This prevents accidental shorting of B+ to ground while L9 and C20 are being adjusted.

b. Turn stem of coil L3 clockwise to bottom position.

c. Turn C11 to the position where the top of the stem is flush with the bottom of the mounting plate on which the mounting brackets for the alinement tool are located. (In those units in which C11 is adjusted by the alinement tool, clockwise rotation of the stem raises it and counterclockwise rotation lowers it. In those units in which C11 is screwdriver adjusted, clockwise rotation of the stem lowers it and counterclockwise rotation raises it.)

d. Adjust C17 to minimum capacitance by setting the arrow on this capacitor to point toward A as shown in figure 47.

e. Connect a 50-ohm rf wattmeter such as RF Wattmeter ME-11/U (Sig C stock No. 4C5611) or equivalent to AUX ANT jack J3. If a suitable wattmeter is not available, use a .25-ampere, 6- to 8-volt pilot Lamp LM-27 (Sig C stock No. 2Z5927), or a 47-ohm 2-watt resistor in series with an rf ammeter (200 ma, Sig C stock No. 3F920-30).

f. Connect the ground lead of the vtvm to the junction of R13 and R11; connect the dc probe to pin 5 of jack J7. Use zero center of vtvm if available.

g. Set the POWER switch of the radio set to ON. Tape down the push-to-talk button on the handset.

h. For alinement at the low end of the dial, tune the AN/PRC-8 to 20.6 mc, the AN/PRC-9 to 27.9 mc, and the AN/PRC-10 to 39.2 mc.

i. Adjust L3 for *correct* zero on the vtvm. (When *correct* zero is obtained, adjustment of L3 (approximately one full turn) in one direction produces a reading of at least +2 volts, and in the other direction a reading of at least —2 volts.)

j. Adjust L9 for maximum rf power output (as indicated on the wattmeter or its equivalent).

k. Readjust L3 for *correct* zero on the vtvm.

l. For alinement at the high end of the dial, tune the AN/PRC-8 to 27.4 mc, the AN/PRC-9 to 38.1 mc, and the AN/PRC-10 to 53.8 mc.

m. Adjust C11 for *correct* zero on the vtvm. (*Correct* zero is indicated by +2- and —2-volt readings when C11 is adjusted off zero as L3 was adjusted in *i* above.)

n. Adjust C20 for maximum power output.

o. Readjust C11 for *correct* zero on the vtvm.

p. Remove rf power indicator from AUX ANT jack J3.

q. Adjust C17 for *correct* zero on vtvm. If this zero cannot be obtained, obtain a reading as close as possible to zero, with C17 oriented with its arrow pointing within the range of A and B as shown on figure 47. (Adjust C17 only at the high end of the radio set TUNING dial at the frequencies indicated in *l* above.)

r. Connect the rf power indicator to AUX ANT jack J3. Readjust C20 for maximum power output; then readjust C11 for *correct* zero on the vtvm.

s. Repeat the procedure in *h* through *r* above until no further adjustment is necessary. (It usually is necessary to repeat the procedure in *h* through *r* above three or four times.)

t. The set is considered to be alined properly under the following conditions:

(1) When the set is at the high alinement frequency and the rf power indicator *is* connected to AUX ANT jack J3, the voltage on the vtvm does not exceed .1 volt (without readjusting C11).

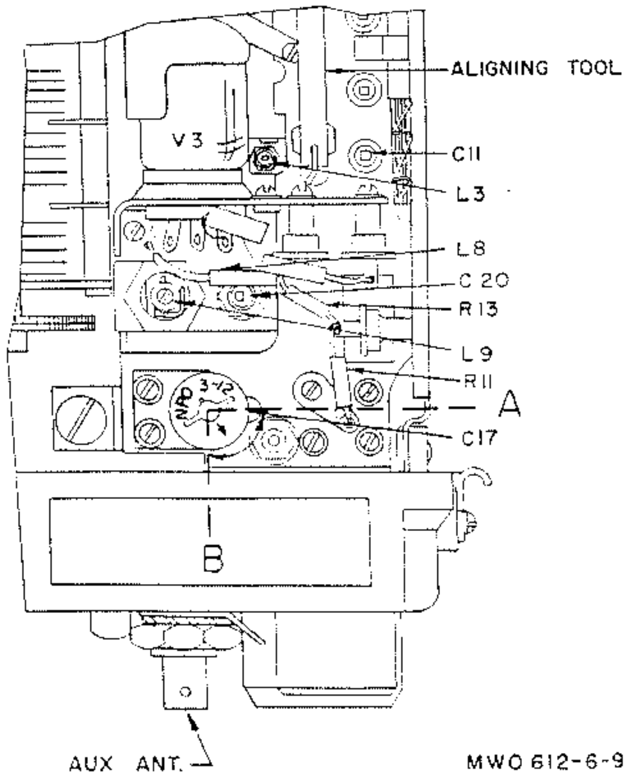


Figure 47. Location of controls used in transmitter alinement.

(2) When the set is at the high alinement frequency and the rf power indicator *is not* connected to AUX ANT jack J3, the voltage on the vtvm does not exceed .1 volt (without readjusting C17).

(3) When the set is at the low alinement frequency and the rf power indicator is connected to AUX ANT jack J3, the voltage on the vtvm must not exceed .1 volt (without readjusting L3).

Note. If the frequency is monitored during alinement of the transmitter while the vtvm is connected, a distorted note may be heard as a result of pickup on the vtvm test leads.

CHAPTER 6
FINAL TESTING

Section I. GENERAL

77. Purpose of Final Testing

The tests described in this chapter are made to assure that a repaired equipment meets minimum performance standards before being issued for service. If the equipment fails to pass any of these tests, troubleshooting and repair procedures must be performed to correct the trouble.

78. Test Equipment Required for Final Testing

Test equipment of the type listed below is required for final testing Radio Sets AN/PRC–8, –9, and –10.

a. Rf Signal Generator. The rf signal generator (Signal Generator AN/URM–48 or equivalent) must supply up to 1,000 microvolts (μv) at 20 mc to 100 mc; must have up to 25 kc deviation; must have modulating frequencies of 250, 400, 1,000, 2,500, and 5,000 cps, or provide for external modulation; and must have an output impedance not exceeding 50 ohms.

b. If. Signal Generator. The if. signal generator (Signal Generator I–208 or equivalent) must supply a 4.3-mc signal with an output of at least .2 volt. The signal frequency must be continuously variable between 4.27 and 4.33 mc.

c. Audio Oscillator. The audio oscillator (Audio Oscillator TS–382A/U or equivalent) must supply audio signals from 250 to 5,000 cps.

d. Millivoltmeter. The millivoltmeter (Electronic Multimeter ME–6A/U or equivalent) must be able to measure ac voltages in millivolts.

e. Frequency Meter. The frequency meter (Frequency Meter TS–174B/U or equivalent) must be capable of measuring frequencies from 20 to 55 mc.

f. Electronic Voltohmmeter. The electronic voltohmmeter (Electronic Multimeter TS–505/U or equivalent) must be able to measure dc voltages and must have an input resistance of not less than 10 megohms on all voltage ranges.

g. Output Meter. The output meter (Output Meter TS–585A/U or equivalent) must read directly in mw and must offer an impedance of 600 ohms.

h. Panoramic Indicator. The panoramic indicator (Panoramic Indicator IP–173/U or equivalent) must be capable of indicating deviation frequencies from 5 kc to 17 kc.

Section II. RECEIVER TESTING

79. Standard Test Conditions

Make all measurements under the test conditions listed below unless otherwise indicated:

a. Dummy antenna is a 33-ohm resistor in series with the rf signal generator.

b. Rf input signal is .7 microvolt, 15-kc deviation at 1,000 cps, and unless otherwise specified, shall be applied to AUX ANT connector J3 of the receiver-transmitter.

c. Audio output at terminal A of AUDIO connector J8 shall be 1 milliwatt (by adjustment of the VOL control on the receiver-transmitter) through a load impedance of 600 ohms.

80. Signal-Plus-Noise to Noise Ratio

The signal-plus-noise to noise ratio is the ratio of audio output of the radio set with standard modulated input to the audio output with unmodulated input. This ratio is determined at each of the following frequencies for each of the three radio sets:

Radio set	Frequencies (mc)
AN/PRC-8	21, 24, and 27
AN/PRC-9	28, 33, and 38
AN/PRC-10	39, 47, and 54

a. Connect the rf signal generator to AUX ANT connector J3. Set the generator to supply the standard modulated input signal at the frequency to which the radio is tuned.

b. Connect a 600-ohm (¼- or ½-watt) resistor across terminals A and B of AUDIO connector J8. Connect a millivoltmeter such as Electronic Multimeter ME–6A/U across these terminals also. (Connect the ground lead of the voltmeter to terminal B of J8.)

c. Adjust the VOL control of the radio set so that the voltmeter reads about 775 millivolts. If this meter has a db scale, note the db reading of the meter.

d. Apply the same rf signal to the AUX ANT connector as in *a* above but without modulation. The voltmeter reading should be no more than about 245 millivolts. This reading is 10 db down from the 775-millivolt reading obtained in *c* above.

81. Overall Selectivity

a. Connect the signal generator to the AUX ANT connector. Tune the receiver-transmitter to a frequency in the middle of its frequency range. Adjust the signal generator to put out an unmodulated signal at the same frequency as the receiver-transmitter. The correct frequency will be taken as the one which produces maximum quieting in a handset receiver connected to the AUDIO connector.

b. Connect a vtvm to terminal 4 of test socket J7. Note the meter reading when a 1-μv signal is applied by the signal generator.

c. Increase the output of the signal generator to 2 μv and vary its frequency on both sides of the resonant frequency until the same meter reading is obtained at terminal 4 of J7 as in *b* above. The frequencies at which these readings are obtained are the *two times down* points. When varying the frequency of the signal generator, do this in a uniform manner so that irregularities in the response characteristic may be observed.

d. Repeat procedure in *c* above for a 1,000-μv input. The two frequency points obtained are the *1,000 times down* points.

e. The center frequency of the overall selectivity curve will be taken as that frequency midway between the two frequencies at the two times down points. The center frequency will be within ±5 kc of the carrier frequency.

f. The bandwidth will be as follows:

Times down	Total bandwidth (kc)
2	75 ± 10
1,000	not greater than 250

g. There will be no irregularities in the response characteristics.

82. Spurious Responses

Spurious responses are responses to undesired signals. A good radio receiver should have a high rejection ratio for such signals.

a. Apply an unmodulated input signal of 1 μv to the AUX ANT connector at the following frequencies:

Radio set	Frequency (mc)
AN/PRC-8	24
AN/PRC-9	33
AN/PRC-10	47

b. Measure the voltage at terminal 4 of J7 (limiter grid voltage) with a vacuum tube voltmeter (vtvm) and record these readings.

c. Increase the signal generator output voltage 100,000 times (100 decibels (db)), and tune the signal generator over the frequency range from 2 to 100 mc while observing the voltage reading at terminal 4 of J7. At those frequencies that produce a limiter grid voltage greater than the readings recorded in *b* above, decrease the signal generator voltage to a value that will produce the same limiter grid voltage reading. The ratio of this signal voltage to 1 μv will be taken as the rejection ratio for that frequency.

d. The rejection ratios of spurious responses, including those of the image (dial plus 8.6 mc) and the if. frequencies, will be equal to or greater than the values listed below:

Radio Set	If. rejection ratio		Rejection ratio of all other spurious frequencies	
	Db ratio	Voltage ratio	Db ratio	Voltage ratio
AN/PRC-8	100	100,000	80	10,000
AN/PRC-9	100	100,000	70	3,000
AN/PRC-10	100	100,000	60	1,000

83. Limiting

a. Tune the receiver to the frequencies noted below and adjust the volume control to standard output (par. 79) with a 3-μv input at standard modulation.

Radio set	Frequency (mc)
AN/PRC-8	24
AN/PRC-9	33
AN/PRC-10	47

b. Increase the signal generator input to 1,000 μv and measure the audio output. The audio output will not vary by more than 1 db for any input variation between 3 and 1,000 μv.

84. Af Power Output

a. Make this test with the signal generator input voltage adjusted to 10 μv at standard modulation (par. 79), and the receiver VOL control at maximum.

b. The maximum audio output will be not less than 2.5 milliwatts.

85. Audio Fidelity

a. Make the test under standard conditions (par. 79) except that the signal generator input voltage will be 10 μv, and the audio power at 1,000 cycles per second (cps) will be fixed at 2.5 milliwatts by the receiver VOL control.

b. The overall audio response of the receiver will be within the following limits:

Audio frequency (cps)	Response
1,000	0 db equals 2.5 mw
250	+4 to 0 db
400	+2 to + 6 db
2,500	—7 to —13 db
5,000	At least —15 db

86. Squelch Sensitivity

a. With the SQUELCH control in the OFF position, operate the receiver under standard conditions (par. 79). Reduce the signal generator input to zero, and turn the SQUELCH control ON to the minimum clockwise position at which the output is cut off.

b. Increase the signal generator input until standard output (par. 79) is noted in the audio output of the receiver. The input will be not greater than 2 μv.

c. It then will be possible to advance the SQUELCH control clockwise until some squelch position is reached where standard audio output is realized only with input signals at least five times the value described in *b* above.

d. Perform this test at the following frequencies:

Radio set	Frequencies (mc)		
AN/PRC-8	21	24	27
AN/PRC-9	28	33	38
AN/PRC-10	39	47	54

87. Microphonics

a. Operate the receiver under standard test conditions (par. 79) except that the rf input voltage will be 10 microvolts, there will be no modulation, and the VOL control will be at maximum clockwise position.

b. Tapping upon the case with a rubber mallet will cause no objectionable microphonics in the receiver output.

88. Discriminator Tests

a. Discriminator Center Frequency. Apply a 4.3-mc signal to test point E19 (mixer grid) through a .006-μf capacitor. The signal should produce —8 volts at terminal 4 of J7 (limiter grid). Vary the frequency of the signal to produce zero discriminator output as measured from terminal 3 of J7 to ground. This signal frequency will be 4.3 ±.002 mc.

b. Discriminator Linearity. Apply a signal as described in *a* above, and set its frequency to 4.33 mc and to 4.27 mc successively. The dc output voltage from terminal 3 of J7 to ground at each of these frequencies will be at least 3 volts. If the two readings differ, the smaller reading will be at least 75 percent of the larger reading.

c. Discriminator Bandwidth. Apply a signal as described in *a* above, and vary the frequency above and below 4.3 mc to points of maximum positive and negative potential of the discriminator as measured from terminal 3 of J7 to ground. The bandwidth will be not less than 90 kc between positive and negative dc voltage peaks.

89. Frequency Stability

a. Couple a frequency meter to receiver oscillator V8, and set the receiver dial to its highest megacycle frequency. The receiver will be powered with standard input voltage (par. 79). After not more than 30 seconds have elapsed measure the oscillator frequency. Thereafter, measure the oscillator frequency at 5-minute intervals for 30 minutes.

b. The frequency drift of the receiver oscillator will not exceed .015 percent in the first 30 minutes.

90. Reception Tests

Screw the short antenna to the SHORT ANT jack. With a similar radio set located at least 50 feet away and tuned to the same frequency, voice signals transmitted from that radio set should be clear and of good quality in the radio set being tested.

Section III. TRANSMITTER TESTING

91. Standard Test Conditions

a. A dummy load of 50 ohms, nonreactive at 20 to 55 mc, is connected to AUX ANT connector J3 and ground. Rf Wattmeter ME–11/U or equivalent satisfies these requirements.

b. Audio input to the transmitter is 85 millivolts (mv) at 1,000 cps as measured on Electronic Multimeter ME–6A/U or equivalent in the test setup shown in figure 48.

92. Transmitter Frequency

a. Compare the receiver and the transmitter frequencies of the receiver-transmitter being checked at each of the frequencies shown in the chart below. In each case, calibrate the receiver frequency (using the CAL position of the POWER switch) before operating the transmitter at that frequency.

Radio set	Frequencies (mc)		
AN/PRC–8	20	24	28
AN/PRC–9	27	33	39
AN/PRC–10	38	47	55

b. Measure the transmitter output frequency with a frequency meter such as Frequency

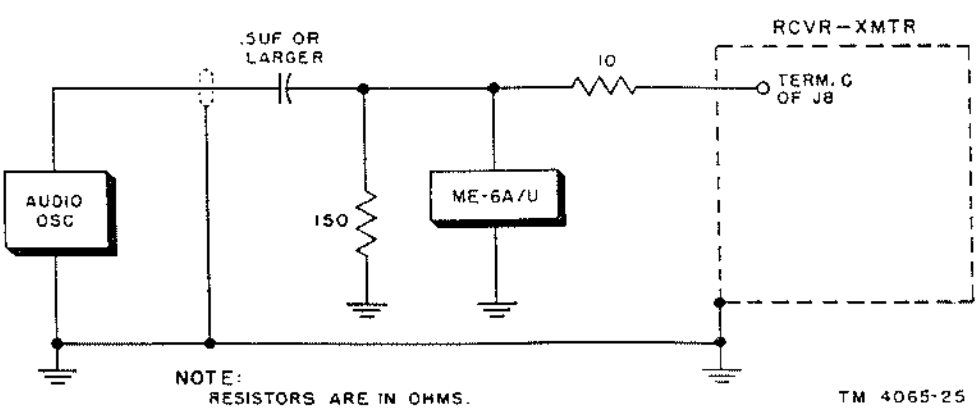


Figure 48. Test setup for audio input to the transmitter.

Meter TS–174B/U or equivalent. The transmitter output frequency must not differ from the calibrated receiver frequency by more than 5 kc. If it does, realine the afc circuit (par. 75).

93. Automatic Frequency Control

a. Make this test at the following frequency:

Radio set	Frequency (mc)
AN/PRC–8	27.4
AN/PRC–9	38.1
AN/PRC–10	53.8

b. Measure the frequency of the transmitter oscillator with afc drive tube V1 removed. For a correctly alined transmitter oscillator, this frequency should correspond with the TUNING dial setting of the receiver-transmitter.

c. Detune the transmitter oscillator 300 kc by means of C11.

d. Replace V1 and again measure the transmitter oscillator frequency. This frequency must not differ from that mentioned in *b* above by more than 10 kc. If it does, realine the afc circuit.

e. After completing this test, realine the transmitter oscillator (par. 76).

94. Transmitter Frequency Deviation

a. Measure the frequency deviation with the transmitter operating at the frequencies shown below and with standard audio input.

Radio set	Frequencies (mc)		
AN/PRC–8	21	24	27
AN/PRC–9	28	33	38
AN/PRC–10	39	47	54

b. Measure the deviation with Panoramic Indicator IP–173/U and Signal Generator I–208. The deviation will be not less than 5 kc nor more than 17 kc.

95. Transmitter Rf Output

Operate the transmitter at each of the rf frequencies listed below. The rf output across AUX ANT connector J3 and ground as measured on RF Wattmeter ME–11/U will be not less than the limits noted.

Radio set	Frequencies (mc)			Rf output (watts)
AN/PRC–8	21	24	27	1.2
AN/PRC–9	28	33	38	1.0
AN/PRC–10	39	47	54	0.9

96. Transmission Test

Receive voice transmissions from the transmitter on a similar radio set located at least 50 feet away. Signals should be heard clearly and distinctly. Extraneous noises or microphonics should not be present even when the set under test is tapped with a mallet.

97. Neutralization

a. Make this test at the high end of the frequency range.

b. Measure the afc voltage with a vtvm at terminal 5 of J7 with the AUX ANT connector open circuited and then short circuited.

c. The difference between the two afc voltages will be not greater than .2 volt. If it is, realine the transmitter (par. 76).

Section IV. RECEIVER-TRANSMITTER TESTING

98. System Fidelity

a. Make this test at the following frequencies:

Radio set	Frequency (mc)
AN/PRC–8	24
AN/PRC–9	33
AN/PRC–10	47

b. Operate the transmitter under standard conditions (par. 91) except that the modulating frequencies will be 250, 400, 1,000, 2,500, and 5,000 cps. Receive its transmitted signal in a similar type receiver located at least 50 feet away.

c. Set the VOL control to adjust the output of the receiver to 1 milliwatt at the modulating frequency of 1,000 cps. At all other modulating frequencies, measure the output of the receiver with no further adjustment of the volume control.

d. The audio response will be as follows:

Audio frequency (cps)	Response (db)
1,000	0
250	—3 to — 9
400	0 to — 4
2,500	—7 to —13
5,000	At least —15

99. Parasitic Oscillations

a. With the radio set operated alternately as a receiver and a transmitter at the frequencies listed below, note the reception in an adjacent receiver as the latter is tuned from 20 to 100 mc for any disturbing effects:

Radio set	Frequency (mc)
AN/PRC–8	24
AN/PRC–9	33
AN/PRC–10	47

b. The receiver-transmitter will be free of parasitic oscillations at all settings of the controls.

100. Relay Operation

Set up for radio sets as shown in figure 22. Set No. 1 and set No. 2 are tuned to the same frequency. Set No. 3 and set No. 4 are tuned to a second frequency which differs from the first frequency by a few megacycles. Sets No. 2 and No. 3 are the relay station. Sets No. 1 and No. 4 each should be about a mile from the relay station and in opposite directions. With operators at sets No. 1 and No. 4, signals should be received clearly and distinctly from both directions without any noise.

101. Remote Operation

Set up the radio set and Control Group AN/GRA–6 as shown in figure 21. Locate Remote Control C-433/GRC 1 mile from the radio set. Set up another radio set next to the remote control, but not connected to it. In Local Control C–434/GRC, set the LOCAL switch at TEL, the REMOTE switch at SET 1, and the switch inside the case on the chassis at BELL. On the remote control, set the SELECTOR switch at the left write-in position, and the switch inside the case on the chassis, at BELL. On the radio set which is to be operated remotely, set the POWER switch at REMOTE. Tune this set and the one located next to the remote control unit to the same frequency. When an operator presses the push-to-talk button on the handset which is plugged into the remote control, he transmits over the set located 1 mile away while another operator receives on the set located next to the remote control. When the operator presses the push-to-talk button of the handset plugged into the receiver located next to the remote control, he transmits over that set and the other operator receives on the handset which is plugged into the remote control. Communication in both directions should be clear and distinct.

CHAPTER 7

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

102. Disassembly

Reverse the assembly instructions given in TM 11–612. Pack the accessories in the pouch. Tie the rods of the long antenna. Wrap the handset cord around the handset handle. Pack the pouch to make as small a package as possible. Remove the battery pack from the battery case. Fasten the empty battery case to the receiver-transmitter case.

103. Repacking for Shipment or Limited Storage

a. The exact procedure for repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. Refer to the unpacking instructions in TM 11–612 and reverse the order of these instructions.

b. Whenever practicable, place a dehydrating agent such as silica gel inside the chests. Protect the chests with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected chests in a padded wooden case, providing at least 3 inches of excelsior padding or some similar material between the paper barrier and the packing case.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

104. Authority for Demolition

Demolition of equipment will be accomplished only upon the order of the commander. The demolition procedures in paragraph 105 will be used to prevent the enemy from using or salvaging the equipment.

105. Methods of Destruction

a. Smash. Smash the crystals, controls, tubes, coils, switches, capacitors, and transformers; use sledges, axes, handaxes, pickaxes, hammers, crowbars, or heavy tools.

b. Cut. Cut the handset cord and the battery cable of the receiver-transmitter; use axes, handaxes, or machetes.

c. Burn. Burn technical manuals, bag, belt, and suspenders; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Bend. Bend panel and cases.

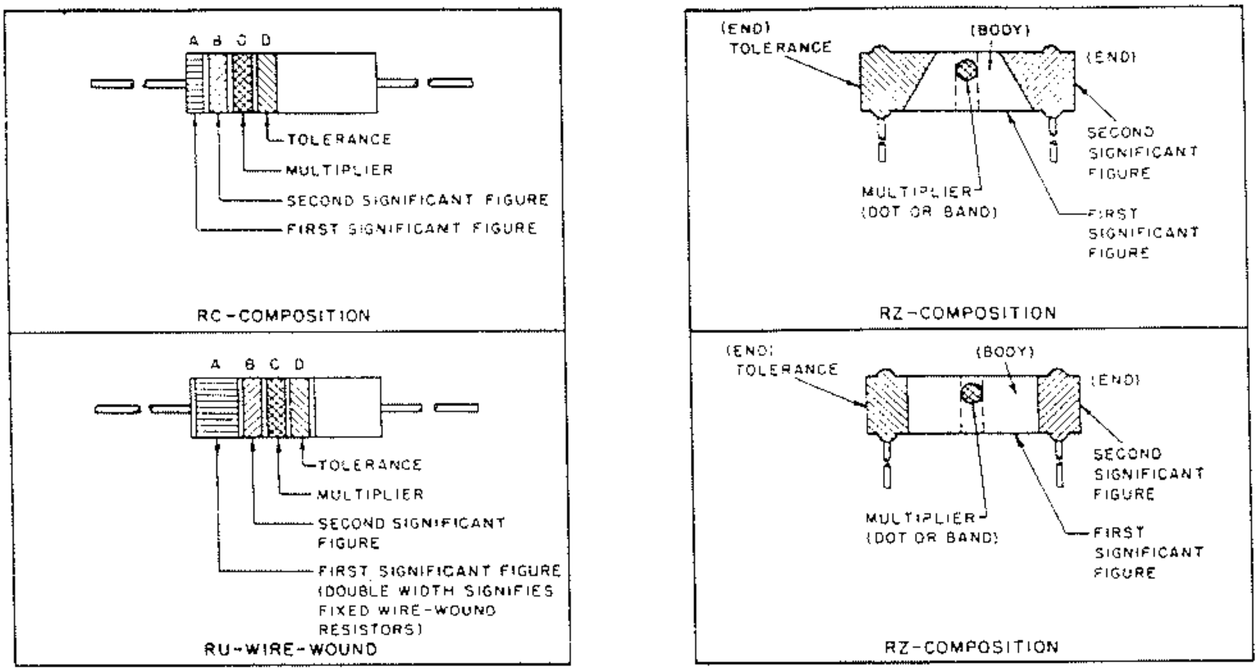
e. Explode. If necessary, use firearms, grenades, or TNT.

f. Dispose. Bury or scatter the destroyed parts in slit trenches or fox holes, or throw them into streams.

g. Destroy. Destroy everything.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS (INSULATED) / RADIAL-LEAD RESISTORS (UNINSULATED)



RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

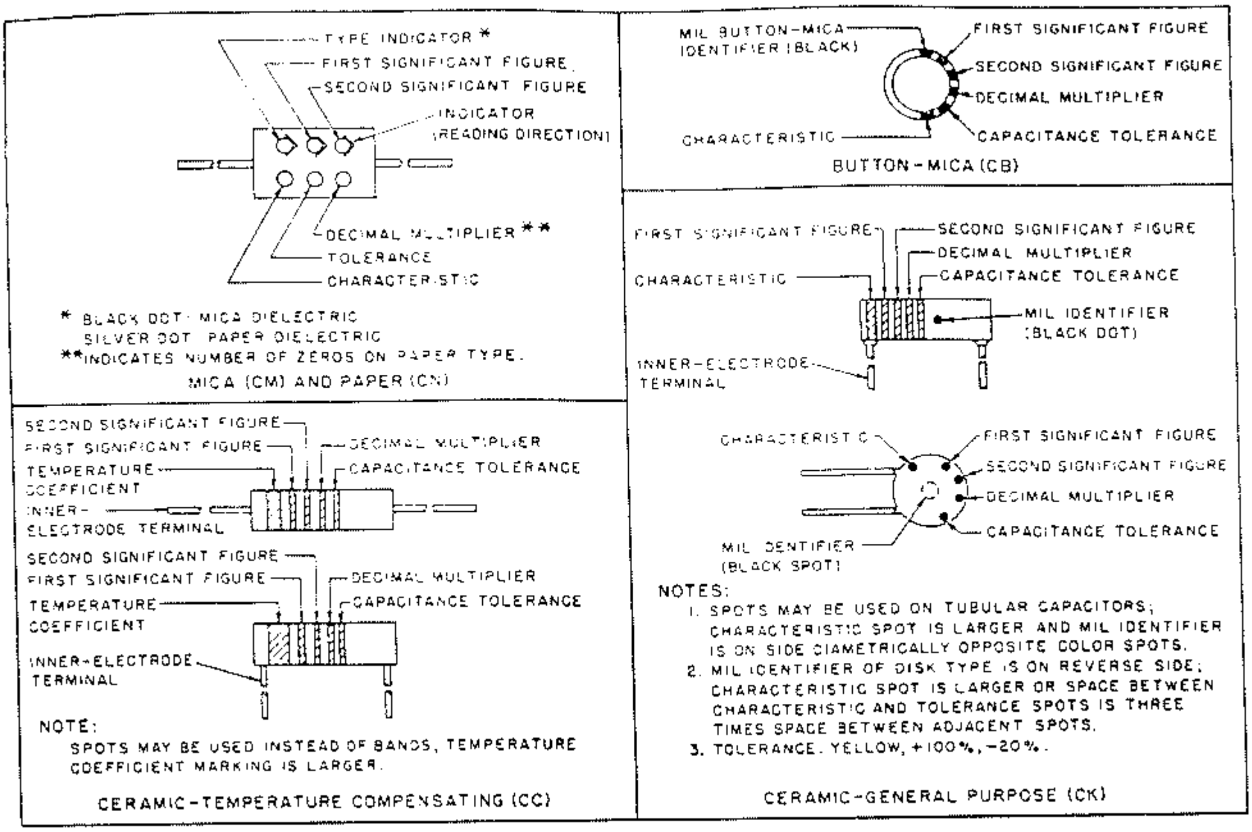
EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY, BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY, BLACK END; RED DOT OR BAND; SILVER END.

STD-R1

Figure 49. Resistor color codes.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC [1]				TOLERANCE [2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC OVER 10UUF	CC 10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H	'	X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500) [3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-C1

Figure 50. Capacitor color codes.

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[AG 413.44 (6 Jul 54)]

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

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NG: Same as Active Army except allowance is one copy for each unit.
USAR: None.
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For explanation of abbreviations used see SR 320-50-1.

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