

A. DESCRIPTION OF EQUIPMENT

A-1. GENERAL - The Model S-39 "Sky Ranger" radio receiving equipment consists of a completely self contained 9-tube superheterodyne communications receiver mounted in a steel cabinet suitable for table operation or portable use. It provides continuous coverage of the broadcast and short-wave bands accepting either c-w telegraph or amplitude modulated telephone signals. Self contained telescoping antenna, speaker and batteries provide the utmost in versatility and convenience. In addition, the receiver may be operated from either a-c or d-c commercial power sources. An external antenna may be used to increase the overall performance. See section C-2 for types of antennas and connection.

A-2. RECEIVER - The Model S-39 receiver employs a conventional superheterodyne circuit composed of a single stage of r-f amplification, a combination converter and oscillator stage, two stages of i-f amplification, two stages of a-f amplification, a beat frequency oscillator for code signals, a noise limiter circuit, and automatic volume control circuit. Refer to figure 2 for the schematic diagram.

The tuning range of the receiver provides continuous coverage of the frequencies between .55 and 35 megacycles. The overall range is covered in 4 bands, the desired band being selected by the BAND SWITCH on the front panel. The four dial scales, corresponding to the 4 bands are calibrated to read the frequency of reception directly in megacycles provided the BANDSPREAD pointer is set at "0". Any section of the MAIN TUNING dial scale can be spread out by tuning over the section with the BANDSPREAD control.

In addition to the MAIN TUNING, BANDSPREAD TUNING and BAND SWITCH controls, there are the R.F. GAIN or sensitivity control; the A.F. GAIN or volume control; the

POWER SWITCH; and ANL, AVC, STAND BY, and BFO switches. The use of these controls will be covered in Section D.

The complete tube complement of the Model S-39 receiver is as follows:

TUBE	TYPE	PURPOSE
V ₁	1T4	R-F amplifier
V ₂	1R5	Converter and oscillator
V ₃	1P5GT	First i-f amplifier
V ₄	1P5GT	Second i-f amplifier
V ₅	1H5GT	Detector, A-V-C and first audio amplifier
V ₆	3Q5GT	Audio amplifier
V ₇	35Z5GT	Rectifier
V ₈	1H5GT	Beat frequency oscillator and automatic noise limiter
V ₉	35Z5GT	Rectifier

A-3. POWER SUPPLIES - Two separate and independent power supplies are incorporated in the receiver, namely an internal battery supply and a rectifier-filter type of supply for use with an external a-c/d-c source.

The battery supply consists of two 45-volt "B" batteries (BA₂ and BA₃) connected in series, and one 6-volt "A" battery (BA₁) all of which are located in the back section of the carrying-case cabinet. See figure 6.

The a-c/d-c supply consists of two type 35Z5GT rectifier tubes (V₇ and V₉) and the associated filter (L₂, C₃₅ and C₂₇) and filament voltage dropping resistors (R₃₂, R₃₃, R₃₄ and R₃₅). This supply may be used whenever commercial power lines, delivering 110-to 117-volts A-C or D-C are accessible. Refer to Section D for operating instructions.

The supply to be used is selected from the front panel by POWER SWITCH, SW₇. Refer to figure 2 for circuit details.

B. CIRCUIT FUNCTIONS

B-1. RECEIVER CIRCUIT - Figure 2 shows the complete schematic circuit diagram of the S-39 receiver. The signal is picked up on the built-in telescoping antenna or on an external antenna connected to socket SO₁. The signal current flows through the primaries of the antenna transformers T₅, T₆, T₇ and T₈, depending upon the position of the BAND SWITCH (SW_{6A} and B) which serves to connect the proper inductance and capacity in the circuit for the various fre-

quency ranges. Reference to figure 2 will show how this is accomplished.

The signal voltage induced in the secondary winding of antenna transformer T₅, T₆, T₇ or T₈, depending on the setting of the BAND SWITCH, is applied to the grid of the type 1T4 r-f amplifier tube (V₁). BAND SWITCH SW_{6C} determines the proper secondary section to be used for the particular band of frequencies being received. The amplified

signal voltage from the 1T4 r-f amplifier tube (V_1) is coupled to the grid of the converter tube V_2 by transformers T_{13} , T_{14} , T_{15} or T_{16} , switches SW_{6G} and H determining the transformer used. Condensers C_{10} and C_{11} furnish additional coupling on the high frequency end of the range. Condensers C_{51} , C_{52} , C_{53} and C_{54} trim the respective secondaries of the r-f transformers T_{13} , T_{14} , T_{15} and T_{16} and switch SW_{6H} selects the proper coil and condenser to tune the incoming signal.

The type 1R5 tube (V_2) serves the multiple purpose of converter and high frequency oscillator. The oscillator grid, screen and filament serve as a triode oscillator, tuned by the oscillator transformers T_9 , T_{10} , T_{11} and T_{12} and the main tuning condenser to produce the high frequency signal, which, when combined with the received signal in the mixer section of tube V_2 produces the intermediate frequency. Switch SW_{6D} , E and F select the coil and condenser circuits that will produce the oscillator voltage for the band to be used to give an intermediate frequency of 455 KC. when combined with the incoming signal.

This intermediate frequency is the difference between the incoming signal frequency and the oscillator frequency. On the three lower frequency ranges, Bands 1, 2 and 3, the high frequency oscillator section is tuned 455 KC. higher in frequency than the incoming signal frequency. On the highest frequency range, Band 4, it is tuned 455 KC. lower in frequency than the incoming signal frequency.

The intermediate frequency voltage from the mixer section of tube V_2 , which contains all the characteristics of the incoming signal, is amplified in the two i-f stages composed of transformers T_1 , T_2 and T_3 , the two 1P5GT intermediate frequency amplifier tubes (V_3 and V_4) and associated circuit components.

The amplified i-f signal from the secondary of transformer T_3 is fed into the diode section of the 1H5GT detector tube (V_5). The rectified output from this diode section is capacity coupled to the triode section of the same tube (V_5) through condenser C_{22} . The audio signal level is controlled by the A.F. GAIN control (R_{14}). The amplified audio frequency output from the triode section of tube V_5 is capacity coupled to the 3Q5GT final audio amplifier tube (V_6) which is in turn inductively coupled to the loudspeaker LS_1 through transformer T_4 . When headphones are plugged

into Jack J_1 , the loudspeaker is silenced and the phones are capacitively coupled to the output of tube V_6 through condenser C_{26} .

A-V-C (automatic volume control) voltage is also supplied from the diode circuit of tube V_5 through resistor R_{11} and applied to the grids of tubes V_1 and V_2 through switch SW_5 which disconnects the A-V-C voltage when receiving c-w signals.

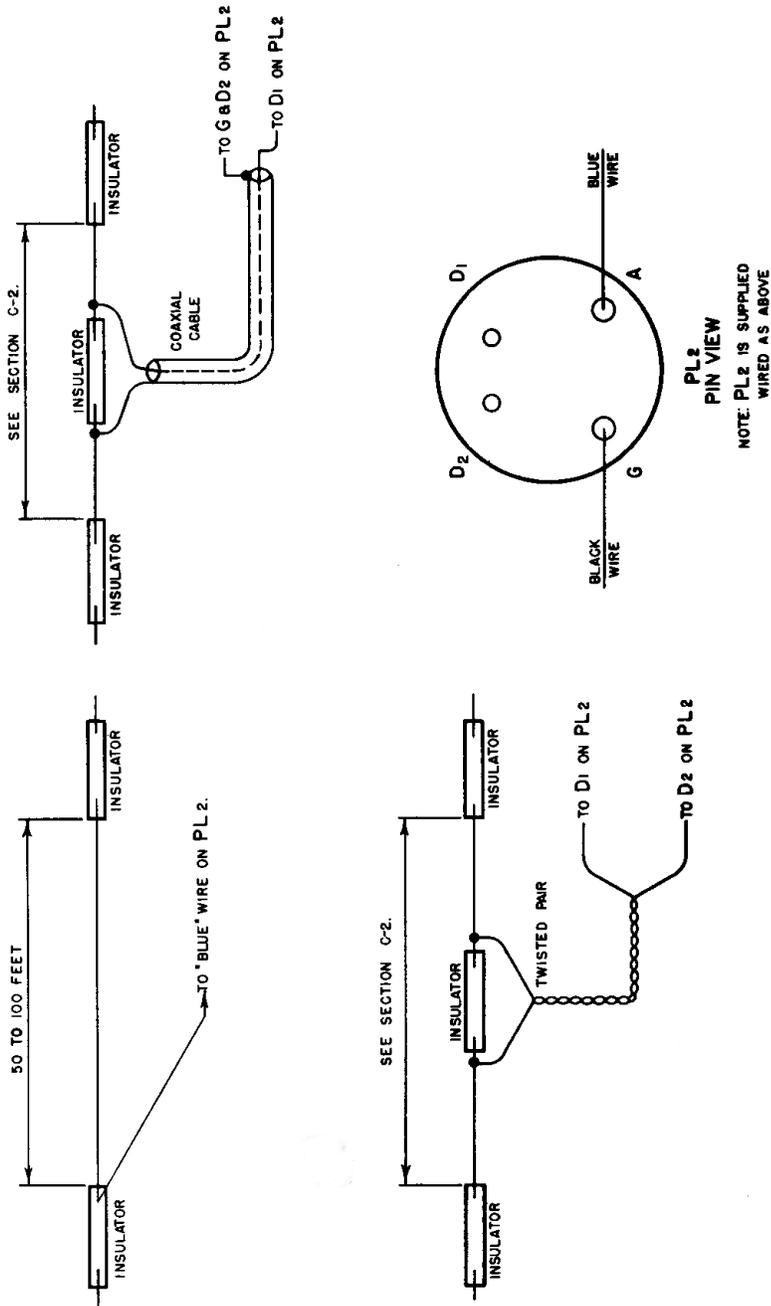
The 1H5GT beat frequency oscillator and automatic noise limiter tube (V_8) serves a dual purpose. Its triode section functions as an oscillator to provide a beat note for the reception of c-w telegraph signals. This triode section of tube V_8 is referred to as the B-F-O (beat frequency oscillator). Transformer T_{17} and condenser C_{32} form the oscillatory circuit, which is tuned by the slug in the secondary of transformer T_{17} , to produce the desired audio pitch in the speaker or phones when combined through capacitor C_{30} with the 455 KC. intermediate frequency signal in tube V_5 .

The beat frequency oscillator is disconnected by the BFO switch (SW_3) for the reception of phone signals.

The diode section of tube V_8 acts as an automatic noise limiter (A-N-L) by clipping off the excessive voltage peaks caused by noise and allowing the normal audio voltage to proceed to the audio amplifier tube V_6 unaltered.

B-2. POWER CIRCUITS - Refer to figure 2 for the circuit of the power supplies. The two separate and independent power supplies are controlled by POWER SWITCH SW_{7A} , B . When the POWER SWITCH is set at OFF neither supply is functioning.

With the POWER SWITCH set at BAT the entire receiver obtains its filament and plate voltages from the 6-volt "A" battery (BA_1) and the two 45-volt "B" batteries (BA_2 and BA_3) respectively. The filaments of tubes V_1 , V_2 , V_3 and half of V_6 are connected in series and the filaments of tubes V_4 , V_5 and V_8 and the remaining half of V_6 are connected in series. These two series circuits are in turn connected in parallel to the 6-volt "A" battery (BA_1) through section A of the STAND BY switch SW_1 . The plate and screen circuits are connected to the "B" batteries through section B of the STAND BY switch SW_1 . Note that both filament and plate voltages are disconnected from the receiver during stand-by periods when operating from the battery supply to conserve battery life. This feature is



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FIG. 3. RECOMMENDED ANTENNA INSTALLATIONS.

possible through the use of quick heating filament type tubes.

With the POWER SWITCH set at AC/DC the set will operate from a commercial power line supplying 110-to 117-volts of either alternating current or direct current power. The rectifier tubes V_7 and V_9 (type 35Z5GT) are operated in parallel to furnish a pulsating direct current when operating from an a-c line or pass the direct current when operating from a d-c line.

When operating from a d-c line it may be necessary to turn the line cord plug around to get the positive terminal connected to the plates of the rectifier tubes so that current will flow.

The filaments of the rectifier tubes are connected in series and operate from the line voltage with the voltage dropping resistor R_{25} .

The D-C from the rectifiers is fed to the filament circuit of the receiver through R_{40} when operating from a 110-volt line or through R_{40} and R_{41} in series when operating from a 117-volt line. The filament network consists of voltage divider resis-

tors R_{33} and R_{34} which supply the filaments of tubes V_4 , V_5 , V_6 and V_8 in series and voltage divider resistors R_{32} and R_{35} which supply the filaments of tubes V_1 , V_2 and V_3 in series.

The D-C supplied by the rectifier tubes for the plate and screen current requirements of the receiver is filtered by the pi-section network consisting of choke L_2 and capacitors C_{35} and C_{37} . Note that the STAND BY switch (SW_{1B}) now disconnects only the plate and screen voltage of the receiver leaving the filaments heated since the rectifier tube filaments take a relatively long time to reach their operating temperature.

The neon lamp (LM_1) located in the dial escutcheon operates from the high voltage supplied either by the batteries or the AC/DC supply to indicate that either is supplying power. An RC oscillator circuit composed of R_{19} and C_{28} excites this lamp, hence very little power is drained from the supply for this indicator. The indicator will always glow as long as the POWER SWITCH is set at either its BAT or AC/DC position.

C. INSTALLATION

C-1. UNPACKING - Remove the receiver and accessories from the carton and inspect them carefully for any damages or shortages. Claims for damage should be made immediately to the transportation company. Claims for shortages should be made immediately to the Hallicrafters Co., Chicago 16, Ill., U.S.A.

C-2. ANTENNA - A built-in telescoping antenna that can be extended to approximately 26 inches is permanently installed in the receiver and will generally give good reception over the entire tuning range. When the receiver is to be used in a permanent or semi-permanent location, it is sometimes desirable to install a long wire antenna to provide increased sensitivity. This is especially true if the set is operated in a steel framed or metal lathed building as such construction tends to shield the receiver.

For general all-around use the simplest form of antenna is a piece of copper wire 50 to 100 feet long, erected as high and as free from surrounding objects as possible and well insulated from ground. When using this type of antenna the telescoping antenna should be fully collapsed and covered with the metal cap. This helps to reduce

the noise level from local electrical disturbances. To connect this antenna to the receiver use plug PL_2 supplied as an accessory. Attach the antenna lead to the "Blue" wire of this plug and a ground wire to the "Black" lead and insert it into socket SO_1 located on the right hand side of the cabinet. Refer to figure 3 for additional details.

If maximum sensitivity on one frequency or small band of frequencies is desired full advantage of the inherent possibilities of the S-39 can best be realized by erecting a simple half-wave doublet antenna that is resonate at the desired frequency. The length of an antenna for a particular frequency can be found by using the formula:-

$$\text{Length of a half wave antenna in feet} = \frac{468}{\text{Desired resonate frequency in megacycles.}}$$

For example: The length of a half wave antenna for operation on 23.5 MC. would be, $\frac{468}{23.5}$ or 19.5 feet. This is the total length between the end insulators, as shown in figure 3. To convert this length of wire to a half wave doublet cut the wire in the middle and insert an insulator. On either side of this insulator, i.e., to each quar-

ter wave section of the antenna, attach one terminal of the lead-in, be it twisted pair or coaxial cable.

Connection from the feeders to the receiver is made by means of plug PL₂. Figure 3 shows how this plug is to be wired for different types of feed lines.

Every half-wave doublet antenna has directional characteristics broadside of its length - i.e. it receives signals better from the sides than it does from the ends and so should, if at all possible, be erected at right angles to the direction from which reception is desired.

All connections and joints in the antenna system and ground circuit must be soldered to guard against corrosion and high-resistance joints which will materially reduce the incoming signal strength and give noisy reception generally.

C-3. PORTABLE USE - The Model S-39 receiver can generally be operated in any location because of its self-contained power supply and antenna. However, some locations may

require the use of an external wire antenna to overcome shielding effects of surrounding objects and reduce interference from nearby electrical equipment.

Battery life is limited and since the receiver works equally well on battery or power line supply it is highly advisable to make use of the latter whenever possible.

C-4. POWER LINE USE - The S-39 receiver will operate from any a-c or d-c power line delivering 110-or 117-volts. NOTE:- As shipped the S-39 is wired for 117-volt operation. For 110-volt operation see Section D-5 for change in wiring.

The power cord with plug PL₁ is located in the rear compartment of the cabinet and is reached by opening the cover plate on the back. (See figure 6). For A-C operation this plug may be connected to the outlet without regard to polarity, but for D-C operation if the receiver refuses to work after a reasonable "warm-up" period reverse the position of plug PL₁ in the outlet socket.

D. ADJUSTMENT AND OPERATION

D-1. CONTROLS - Reading from left to right the front panel controls and their function are as follows:

- (1) ANL, automatic noise limiter switch SW₂ controls the 1H5GT (V₈) circuit which is used to minimize "static" and other electrical disturbances by clipping off the peaks of noise pulses that are in excess of the normal audio voltage. It will be found most useful on the short waves (high frequencies) and should be ON only when needed.
- (2) AVC, automatic volume control switch SW₅, is used to maintain a more nearly constant audio output level. It tends to decrease the effects of fading and limits the overall volume of the receiver automatically. It should be ON when receiving phone signals and OFF when receiving c-w telegraph signals.
- (3) STAND BY switch SW₁ controls both the filament and plate power when operating on batteries and only the plate voltage when operating on AC/DC. It is used to silence the receiver for short intervals, without turning the POWER SWITCH OFF. This switch will be found most useful when the S-39 is used as a communications receiver in conjunction with a transmitter.
- (4) BFO, beat-frequency oscillator, switch SW₃, provides the beat note of an audio frequency of approximately 1000 cycles. This is made use of in two ways, when receiving c-w telegraph (code) signals and to locate weak phone signals. On weak phone signals it produces a beat note with the carrier for tuning and then the BFO should be turned OFF to eliminate the whistle and allow reception of the phone signal.
- (5) A.F. GAIN, audio frequency gain (volume), control R₁₄ determines the level of the audio output of both the speaker and phones. This control should be used at all times to increase or decrease volume.
- (6) R.F. GAIN, radio frequency gain control R₄, controls the sensitivity of the receiver. The control should be kept full on or in the extreme right hand position under ordinary circumstances. The receiver is most sensitive with

this setting and maximum A-V-C action is obtained for phone reception. In some instances when receiving local stations it may be necessary to reduce the sensitivity to prevent overloading the tubes and consequent distortion.

- (7) BAND SWITCH, SW₆ (A to H) selects the correct capacitor and inductance to tune one of the four frequency ranges available.
- (8) POWER SWITCH, SW₇ (A & B) controls both filament and plate power of the receiver. With the switch set at BAT., the receiver power is supplied from the self-contained "A" and "B" batteries. With the switch set at AC/DC the receiver may be operated from either a 110-volt or 117-volt A-C or D-C source. With the switch set at OFF the receiver is inoperative, being disconnected from the battery source and the power line source. CAUTION! Be sure the POWER SWITCH is at OFF when the receiver is not in use - the neon lamp (LM₁) will glow whenever the POWER SWITCH is set at BAT. or AC/DC.
- (9) MAIN TUNING control which turns the three sections of condenser C₁, is used for setting the receiver to the desired frequency. The bands marked 1, 2, 3 and 4 on the main tuning dial correspond to the numbered positions of the BAND SWITCH.
- (10) BANDSPREAD TUNING control, which turns the three sections of C₂, is used for fine adjustment of the received signal and for logging purposes. For accurate frequency reading of the MAIN TUNING dial the BANDSPREAD dial should be set at "0".

D-2. STANDARD BROADCAST RECEPTION - For reception of standard broadcast signals the S-39 controls should be set and operated as follows:

ANL	at OFF
AVC	at ON
STAND BY	at ON
BFO	at OFF
BAND SWITCH	at #1 position
POWER SWITCH	at BAT. or AC/DC

Extend the telescoping antenna to full height. If an external antenna is used, collapse the built-in antenna and cover with cap. Connect the external antenna to plug PL₂ (See Section C-2 for wiring details) and insert in socket SO₁.

Set the BANDSPREAD dial at "0". Turn the R.F. GAIN control full on, i.e. to extreme right. Set the A.F. GAIN control about half on, or to a setting determined by experience. Tune in the station by setting the MAIN TUNING dial at the frequency of the station.

Frequencies being tuned in on Band 1 are read on scale number 1. Adjust the volume to the desired level by use of the AF GAIN control. If a powerful nearby station is being received and the signal is distorted, the RF GAIN control should be reduced by turning the control to the left just enough to clean up the signal.

If static or other electrical disturbances are present with the signal, the ANL switch should be turned ON. This will cut off noise peaks above the normal signal level.

Note: When operating the S-39 on BAT. the set will start to function as soon as the POWER SWITCH is set at BAT. This is possible because of the quick heating of the tubes. On AC/DC however it is necessary to wait a short period before the receiver will start functioning after the POWER SWITCH is set at AC/DC. This is to give the two 35Z5GT rectifier tubes V₇ and V₉ time to heat-up.

D-3. SHORT WAVE RECEPTION - For reception of short wave signals set the controls exactly as for Standard Broadcast (See Section D-2) with the exception of the BAND SWITCH. Set the switch to the number corresponding to the frequency range desired.

On the higher frequency bands, it will be found advantageous to set the MAIN TUNING dial near the frequency of the desired station and complete the tuning with the BANDSPREAD TUNING. In tuning the BANDSPREAD for weak short wave stations, extreme care should be exercised to avoid passing over them as the incoming signal is quite sharp.

D-4. C-W TELEGRAPH RECEPTION - To receive c-w telegraph signals (code) the controls should be set and operated as follows:

ANL at OFF
 AVC at OFF
 STAND BY at ON
 BFO at ON

BAND SWITCH - On number corresponding to frequency range desired.

POWER SWITCH at either BAT or AC/DC.

R.F. GAIN - To extreme right unless strong nearby stations are being received in which case it will be necessary to reduce the gain to prevent overloading the tubes.

A.F. GAIN - Adjusted to give desired volume.

MAIN TUNING - Dial set on frequency of the desired station.

BANDSPREAD TUNING - Use for precise tuning to the exact frequency of the incoming signal and for logging purposes.

D-5. 110-VOLT SOURCE OPERATION - The receiver, as delivered, is wired for 117-Volt A-C/D-C operation. If the supply voltage is 110-volts, it will be necessary to make one change in the wiring. Resistor R₄₀ - R₄₁ located on the top of the chassis, between the main tuning condenser and the speaker has a wire soldered to the "117" lug. This wire must be unsoldered and soldered to the "110" lug. This is the only change necessary.

Note: It is well to leave the set wired for 117-volt operation unless the power source definitely operates at 110-volts or erratic operation of the receiver due to low line voltage requires that the wiring changes be made.

E. ALIGNMENT AND SERVICE

E-1. RECEIVER ALIGNMENT -

- (a) Equipment needed to align the receiver -
 Signal generator to cover 455 KC to 30 MC
 Non-metallic screwdriver
 Output meter with a phone plug connector
 .1 mfd. condenser
 6.5 mmfd. condenser. (Dummy antenna)
- (b) Setting of controls for I-F alignment -
 ANL, AVC and BFO switches at OFF
 STAND BY switch at ON
 A.F. and R.F. GAIN controls set at maximum gain
 BAND SWITCH at #1 Band
 POWER SWITCH at BAT. (power cord removed from wall socket)
 BANDSPREAD TUNING at "0"
 Telescoping antenna completely collapsed.
- (c) I-F alignment (455 KC) -
 Remove top and bottom cover for access to internal components
 Have external antenna plug PL₂ out of socket SO₁
 Connect "hot" lead of signal generator through the .1 mfd condenser to the lug on rear stator section of main tuning condenser (C₁).

Connect "ground" lead of signal generator to chassis
 Plug output meter plug in the phone jack (J₁)
 Set MAIN TUNING dial at 1500 KC - Band #1
 Tune signal generator to 455 KC. Adjust slugs S₁ to S₆ inclusive for maximum output. Refer to figures 4 and 5 for location of the adjusting screws on transformers T₁, T₂, and T₃.

Repeat adjustments of slugs S₁ to S₆ to peak all the i-f transformers for maximum output.

- (d) B-F-0 adjustment -
 Without disconnecting the signal generator, after completing the i-f transformer alignment, adjust the BFO transformer as follows:

Set BFO switch at ON
 Remove modulation from the signal generator
 Adjust tuning slug S₇ to desired pitch (Approx. 1000 cycles). Slug S₇ is located under the chassis just in back of the coil shield plate.

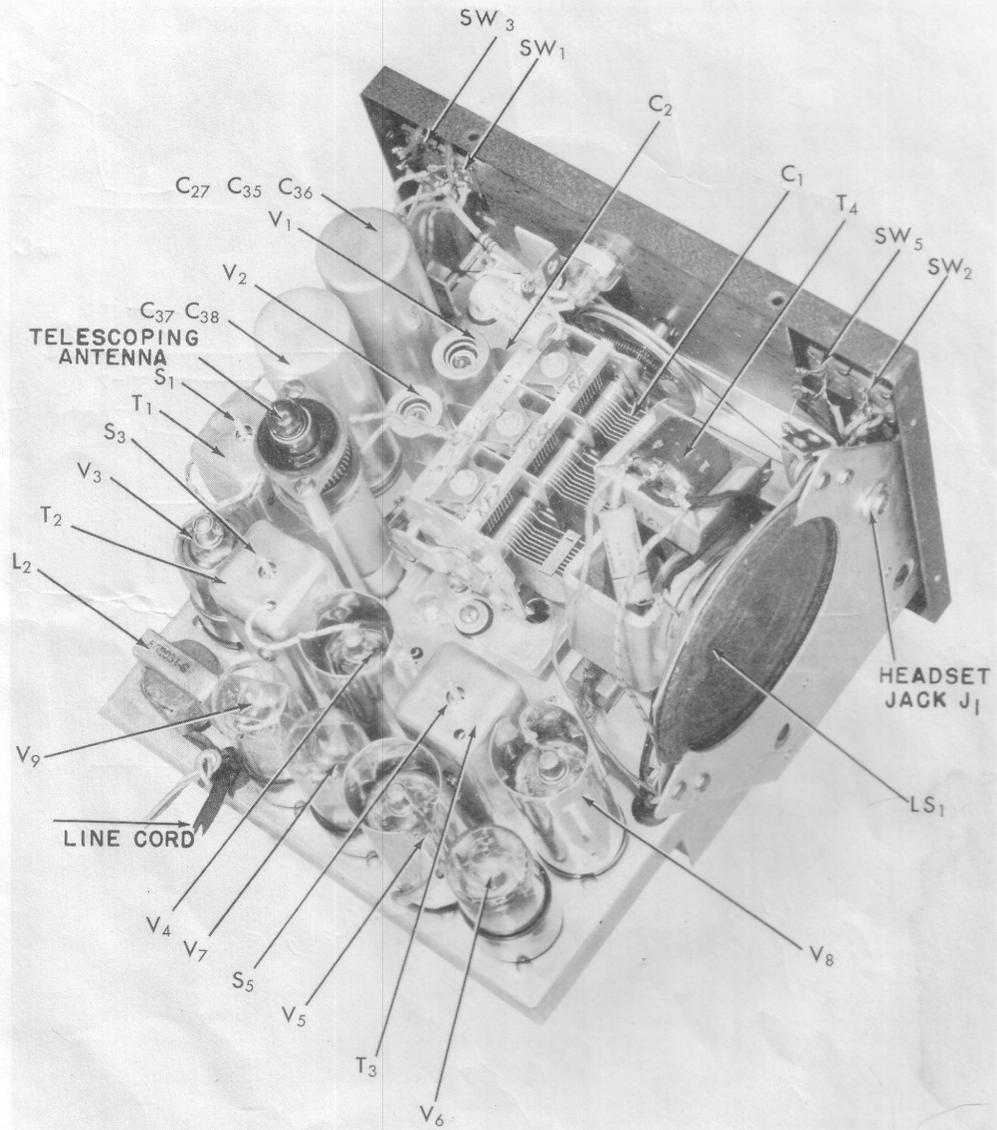


Fig. 4. Model S-39 Receiver, Top View.

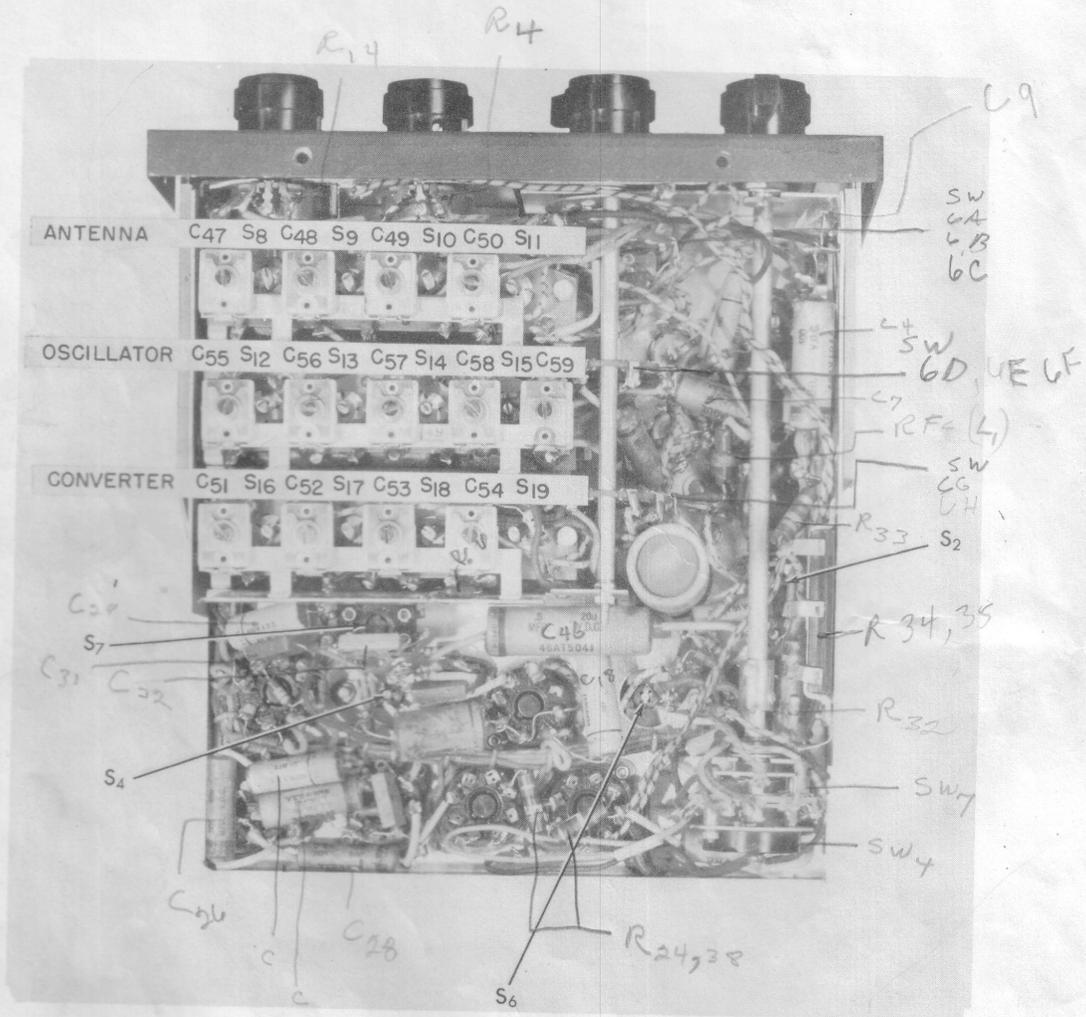


Fig. 5. Model S-39 Receiver, Bottom View of Chassis

Note: It is possible to adjust the B-F-0 pitch without the use of the signal generator. Tune in a c-w signal to exact resonance with the BFO switch set at OFF. Set BFO switch at ON and adjust pitch to the tone desired by turning slug S₇. Replace top cover after aligning the I-F and B-F-0 transformers.

(e) Setting of controls for R-F alignment -

ANL, AVC and BFO switches at OFF
STAND BY switch at ON
A.F. and R.F. GAIN controls set at maximum gain
BAND SWITCH at Band to be aligned (See alignment chart)
POWER SWITCH at BAT. (power cord removed from wall socket)
BANDSPREAD TUNING at "0"
Telescoping antenna is collapsed except for bottom section

Note: Only one section of the telescoping antenna shall extend above the top cover of the receiver. (This procedure is necessary to obtain an accurate calibration for the receiver when aligning with the dummy antenna of 6.5 mmfd.) The receiver's top cover must be fastened down for the following adjustments.

(f) R-F alignment -

Leave output meter plug in phone jack (J₁)

Connect "Hot" lead of signal generator to extended section of the telescoping antenna through the 6.5 mmfd dummy antenna condenser.

Connect ground side of generator to chassis

Have external antenna plug PL₂ out of socket S₀₁

Set MAIN TUNING dial of receiver and signal generator frequency as shown in the alignment chart.

Adjust trimmers (C₄₇ to C₅₈) and slugs (S₈ to S₁₉) in the order shown on the alignment chart. (See figure 5 for location of adjustment screws).

Note: When aligning bands 3 and 4 "rock" the MAIN TUNING control slightly to peak the adjustment.

When aligning the low frequency end of band 4 by adjusting slug S₁₅, the oscillator may cease to function. A slight adjustment of condenser C₅₉ will bring it back into oscillation.

E-2. MAINTENANCE - To ensure the maximum in dependability and usefulness from the Model S-39 receiver a few precautions should be observed.

- (a) Remove run down batteries from the cabinet at once. DO NOT leave batteries in the receiver if it is to be out of service for a considerable period of time. A chemical reaction takes place in old batteries which will corrode the other components of the receiver.

ALIGNMENT CHART

BAND	SIGNAL GENERATOR FREQUENCY AND "MAIN TUNING" DIAL SETTING	ADJUST FOR MAXIMUM OUTPUT		OSCILLATOR FREQUENCY RELATIVE TO SIGNAL FREQUENCY
		OSCILLATOR SECTION	ANTENNA AND CONVERTER SECTIONS	
1	1.4 MC	C ₅₅	C ₄₇ and C ₅₁	455 KC Above
	.6 MC	S ₁₂	S ₈ and S ₁₆	
2	4.0 MC	C ₅₆	C ₄₈ and C ₅₂	455 KC Above
	2.0 MC	S ₁₃	S ₉ and S ₁₇	
3	10.0 MC	C ₅₇	C ₄₉ and C ₅₃	455 KC Above
	5.0 MC	S ₁₄	S ₁₀ and S ₁₈	
4	28.0 MC	C ₅₈	C ₅₀ and C ₅₄	455 KC Below
	14.0 MC	S ₁₅ C ₅₉	S ₁₁ and S ₁₉	

- (b) Protect the set from the weather. The loud speaker opening, phone jack, external antenna socket and etc. provide access to the interior of the receiver proper. Excessive moisture can cause serious damage.
- (c) Guard the set against extreme heat and cold. High and low temperatures will affect the life of the batteries.
- (d) Dust and dirt are detrimental to efficient operation. Keep the chassis and parts clean. If dust collects in the condenser plates it should be blown out with dry air.
- (e) When replacing run down "A" and "B" batteries, the middle one must be removed first and the others slide toward the center cabinet "cut-out" in order to remove them. The "A" batteries may be replaced by Burgess #2F4 or Eveready #718. The "B" batteries by Burgess #B-30 or Eveready #762. Any other makes of the same size and voltage may be substituted provided they accommodate the standard battery plugs with which the receiver is equipped.

E-3. SERVICE - The Model S-39 receiver will continue to give satisfactory service over many years if it is given proper attention. It should be checked at least once a year by a competent service man so that failing tubes and other parts can be replaced before they effect associated equipment. The

F. SUPPLEMENTARY DATA

F-1. POWER REQUIREMENTS - When operating on 117 Volts A-C or D-C, the power drain is approximately 40 watts.

The two "B" batteries and the one "A" battery should give approximately 100 hours of intermittent service.

Note: To remove the batteries from the rear compartment it is necessary to take out the middle one first, then slide the others toward the middle of the cabinet.

alignment should be checked at the same time to ensure peak performance.

Whenever tubes are to be removed for testing or replacing, BE SURE the power cord is removed from the wall outlet in addition to having the POWER SWITCH set at OFF.

Extreme care must be used when removing or inserting the small 1T4 and 1R5 tubes as the glass envelope of these tubes are delicate. The metal shields are removed by pressing down and turning in a counterclockwise direction to release the shield's lock.

The neon lamp LM₁, should operate indefinitely. If it must be replaced it can be removed from the circuit by unsoldering the leads.

Note: As wired in the circuit the neon lamp LM₁ operates as a relaxation oscillator at a frequency determined by the time constant of resistor R₁₉ and condenser C₂₈. Under these conditions it draws far less current from the "B" batteries than it would if operating as a simple glow lamp.

E-4. CAUTION - The carrying-case cabinet is electrically insulated from the chassis and is therefore perfectly safe against shock. Reference to the schematic diagram, figure 2, will show that the chassis is grounded to the power line when operating on A-C or D-C. Serious shocks can be received from various points on and in the chassis therefore be extremely careful when removing the covers or when necessary servicing is being performed. SAFETY FIRST, remove the power cord before working on the receiver whenever possible. Note: The cabinet is electrically grounded to the chassis through condenser C₄.

F-2. WEIGHT - Weight of complete unit with batteries ready for portable operation is 28 pounds.

F-3. DIMENSIONS - Measurements, overall, including handle, knobs and etc.

Height - 9 inches.
Width - 9 inches.
Depth - 15 inches.

Overall height from table to top of telescoping antenna fully extended is 39.5 inches.

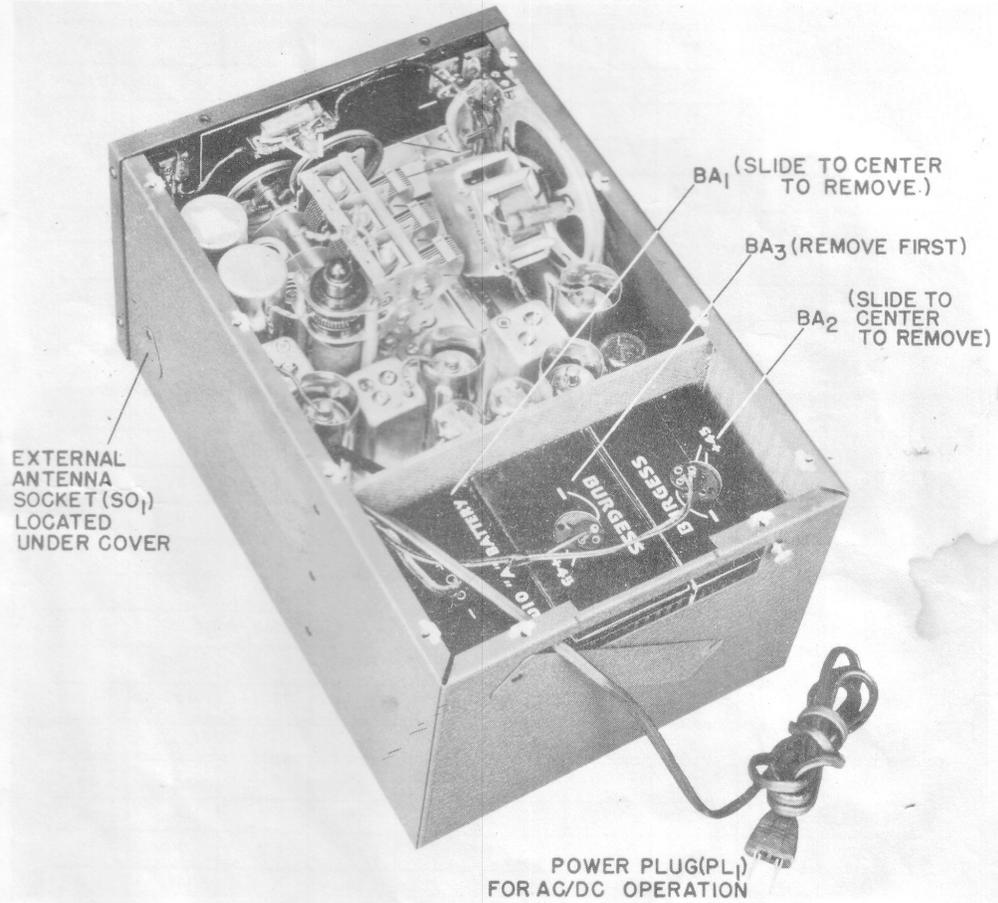


Fig. 6. Model S-39 Receiver, Rear View, Cover Removed, Showing Power Cord Compartment And Battery Compartment.

F-4. TABLE OF TUBE SOCKET VOLTAGES
 Measured from socket pin to ground with 1000 ohm-per-volt meter
 All voltages are D-C unless otherwise specified.

Tube	Pin Number									Cap.
	1	2	3	4	5	6	7	8		
Battery Supply										
V ₁ 1T4	2.62	87	84	NC	2.62	0	4.1	X	X	
V ₂ 1R5	0	65	65	0	0	0	1.5	X	X	
V ₃ 1P5GT	+0	2.7	87	▲85 ●30	+0	+1.5	1.5	NC	0	
V ₄ 1P5GT	+0	2.8	88	#88	NC	+0	1.4	+0	0	
V ₅ 1H5GT	+0	1.45	62	NC	0	+0	0	+0	0	
V ₆ 3Q5GT	+0	4.4	84	88	0	+0	4.4	5.9	X	
V ₇ 35Z5GT	NC	0	NC	NC	0	NC	0	0	X	
V ₈ 1H5GT	NC	4.4	*70	+3.2	0	*+86	2.8	NC	3.5	
V ₉ 35Z5GT	+0	0	NC	NC	0	+0	0	0	0	
117 Volts AC										
V ₁ 1T4	3.0	110	100	-14	3.2	0	4.8	X	X	
V ₂ 1R5	0	86	86	0	0	0	1.5	X	X	
V ₃ 1P5GT	+0	3.0	110	▲110 ●44	+0	+1.7	1.7	NC	X	
V ₄ 1P5GT	+0	3.2	110	110	NC	+0	1.7	+0	0	
V ₅ 1H5GT	+0	1.5	70	NC	0	+0	0	+0	0	
V ₆ 3Q5GT	+0	8.6	100	110	0	+0	5	6.8	X	
V ₇ 35Z5GT	NC	0	NC	NC	117 A-C	NC	35 A-C	120	X	
V ₈ 1H5GT	NC	5	*94	4	2.7	*100	3.2	NC	4	
V ₉ 35Z5GT	+117	35 A-C	NC	NC	117 A-C	+117 A-C	72 A-C	120	X	
120 Volts DC										
V ₁ 1T4	3.5	107	80	NC	3.5	0	5.5	X	X	
V ₂ 1R5	0	75	75	0	0	0	2	X	X	
V ₃ 1P5GT	+0	3.5	103	▲110 ●44	+0	+2	2	NC	0	
V ₄ 1P5GT	+0	3	102	102	NC	+0	1.6	+0	0	
V ₅ 1H5GT	+0	1.6	40	NC	0	+0	0	+0	0	
V ₆ 3Q5GT	+0	7.7	100	103	0	+0	4.8	6.3	X	
V ₇ 35Z5GT	NC	0	NC	NC	118	NC	40	110	X	
V ₈ 1H5GT	NC	4.8	*85	+2	0	*+105	3.2	NC	2	
V ₉ 35Z5GT	120	35	NC	NC	118	120	75	115	X	

NC - No Connection.

X - No Pin.

* - With BFO switch at ON.

† - Tie Lug.

▲ - Band switch at 2, 3, or 4.

● - Band switch at 1.

- R.F. GAIN control at maximum.



PARTS LIST

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F-5. LIST OF REPLACEABLE PARTS

Ref. Symbol	Name of Part and Description	Function	Mfr Code and Type No.	Hallcrafters Part No.
R ₁	Resistor, 2.2 megohm \pm 10%, $\frac{1}{2}$ watt, carbon	A-V-C decoupling for tube V ₁	ASA	RC10AE225K
R ₂	Same as R ₁	Grid return for tube V ₁		
R ₃	Resistor, 8,200 ohm \pm 10%, $\frac{1}{2}$ watt, carbon	Voltage drop for screen of tube V ₁	ASA	RC21AE822K
R ₄	Resistor, variable, $\frac{1}{2}$ megohm \pm 20%, carbon	R.F. GAIN control	CT	25A527
R ₅	Resistor, 4700 ohm \pm 10%, $\frac{1}{2}$ watt, carbon	Plate decoupling for oscillator section of tube V ₂	ASA	RC10AE472K
R ₆	Same as R ₁	Grid return for tube V ₂		
R ₇	Resistor, 100,000 ohm \pm 10%, $\frac{1}{2}$ watt, carbon	Grid bias for oscillator section of tube V ₂	ASA	RC10AE104K
R ₈	Resistor, 1.0 megohm \pm 10%, $\frac{1}{2}$ watt, carbon	A-V-C decoupling for tube V ₃	ASA	RC10AE105K
R ₉	Same as R ₁	Grid return for tubes V ₁ and V ₃ with A-V-C switch set at OFF		
R ₁₀	Resistor, 51,000 ohm \pm 5%, $\frac{1}{2}$ watt, carbon	Primary loading on transformer T ₂	ASA	RC21AE513J
R ₁₁	Same as R ₁	A-V-C decoupling at diode load of tube V ₅		
R ₁₂	Same as R ₈	Diode load for A-N-L section of tube V ₈		
R ₁₃	Same as R ₇	Diode load for tube V ₅		
R ₁₄	Resistor, variable, $\frac{1}{2}$ megohm \pm 20%, carbon	A.F. GAIN control	CT	25A526
R ₁₅	Resistor, 10 megohm \pm 20%, $\frac{1}{2}$ watt, carbon	Grid return for tube V ₅	ASA	RC10AE106M
R ₁₆	Same as R ₇	Plate decoupling for tube V ₅		
R ₁₇	Resistor, 470,000 ohm \pm 20%, $\frac{1}{2}$ watt, carbon	Plate load for tube V ₅	ASA	RC10AE474M

R ₁₈ R ₁₉	Same as R ₁₇ Same as R ₁₇	Grid return for tube V ₆ Part of RC oscillator for pilot light LM ₁	ASA ASA	RC10AE473M RC10AE224K
R ₂₀ R ₂₁	Resistor, 47,000 ohm ± 20%, ½ watt, carbon Resistor, 220,000 ohm ± 10%, ½ watt, carbon	Plate load for tube V ₆ Grid bias for oscillator section of tube V ₈		
R ₂₂ R ₂₃ R ₂₄	Not used Not used Resistor, 24 ohm ± 5%, 1 watt, carbon	Current limiter for tube V ₉	ASA	RC31AE340J
R ₂₅	Resistor, 330 ohm ± 5%, 9 watt, wire wound, candohm, type FH	Line voltage drop for filaments of tubes V ₇ and V ₈	MT	24A829
R ₂₆ R ₂₇	Not used Resistor, 1000 ohm ± 10%, ½ watt, carbon	Shunt for filaments of tubes V ₄ , V ₅ and V ₈	ASA	RC10AE102K
R ₂₈ R ₂₉ R ₃₀	Not used Resistor, 560 ohm ± 10%, ½ watt, carbon Same as R ₂₉	Shunt for tubes V ₂ and V ₃ Filament current shunt for tubes V ₁ , V ₂ and V ₃	ASA	RC10AE561K
R ₃₁ R ₃₂	Not used Same as R ₂₇	Part of filament voltage divider for tubes V ₁ , V ₂ and V ₃		
R ₃₃	Resistor, 820 ohm ± 10%, 1 watt, carbon	Part of filament voltage divider for tubes V ₄ , V ₅ , V ₆ and V ₈	ASA	RC31AE321K
R ₃₄ R ₃₅	Resistor, 1645 ohm ± 10%, tapped at 800 ohm, 7.4 watt, 2 unit, wire wound, unit #1 800 ohm (R ₃₄), unit #2 845 ohm (R ₃₅), candohm, type MW-2	Part of filament voltage divider for tubes V ₄ , V ₅ , V ₆ , and V ₈ Part of filament voltage divider for tubes V ₁ , V ₂ and V ₃	IHC	24A044

LIST OF REPLACEABLE PARTS - (Cont'd.)

Ref. Symbol	Name of Part and Description	Function	Mfr Code and Type No.	Hallcrafters Part No.
R ₃₆	Resistor, 820 ohm ± 10%, ½ watt, carbon	Cathode bias for tube V ₆	ASA	RC10AE821K
R ₃₇	Not used			
R ₃₈	Same as R ₂₄	Current limiter for tube V ₇		
R ₃₉	Resistor, 1.5 megohm ± 20%, ½ watt, carbon	Voltage drop for screen of tube V ₃ , in band #1 only	ASA	RC10AE155M
R ₄₀	Resistor, 450 ohm tapped at 87 ohm, 7 watt, 2 unit, wire wound, unit #1 363 ohm (R ₄₀), unit #2 87 ohm (R ₄₁)	Adjustable voltage drop for filament of tubes V ₁ , V ₂ , V ₃ , V ₄ , V ₅ , V ₆ , and V ₈	MT	24A819
R ₄₁	Same as R ₄₀			
R ₄₂	Same as R ₄₀	Diode load for tube V ₅		
R ₄₃	Capacitor, variable, 3 section, 2 unit, unit #1-(C ₁), max. cap. per section 352 mmfd., air dielectric, unit #2-(C ₂) max. cap. per section 22 mmfd. air dielectric, each unit has separate drive shaft to which pulleys are fixed, special	Receiver main tuning capacitor		
C ₁		Receiver bandspread tuning capacitor	OM	48C132
C ₂				
C ₃	Capacitor, 51 mmfd. ± 5%, 500 V. D-C working, low loss mica dielectric	External antenna coupling #2	ASA	CM20C510J
C ₄	Capacitor, 0.1 mfd. -10 + 40%, 400 V. D-C working, paper dielectric, type 484	D-C blocking capacitor between electrical ground and cabinet	A	46AV104J
C ₅	Capacitor, 15 mmfd. ± 20%, 500 V. D-C working, temp. coeff., -.00075 mmfd./mmfd./degree Cent., ceramic dielectric, type 809-047	External antenna coupling for band #1	CRL	47A027

C ₆	Capacitor, 10 mmfd. \pm 20%, 500 V. D-C working, temp. coeff., -.00075 mmfd./mmfd./degree Cent., ceramic dielectric, type 811-013	Coupling between whip antenna and grid of tube V ₁	CRL	47A028
C ₇	Capacitor, 0.05 mfd. -10 + 40%, 200 V. D-C working, paper dielectric, type AB	Filament by-pass for tube V ₁	SP	46AU503J
C ₈	Capacitor, 0.01 mfd. -10 + 40%, 400 V. D-C working, paper dielectric, type AB	Screen grid by-pass for tube V ₁	SP	46AW103J
C ₉	Same as C ₈	D-C blocking capacitor between GND terminal of socket 80 ₁ and chassis		
C ₁₀	Capacitor, fixed, cap. 5 to 6.5 mmfd., 500 V. D-C working, temp. coeff. -.00075 mmfd./mmfd./degree Cent., ceramic dielectric, type 807-004	Coupling between plate of tube V ₁ and grid of tube V ₂	CRL	47A005
C ₁₁	Same as C ₁₀	Coupling between plate of tube V ₁ and grid of tube V ₂ on band #4		
C ₁₂	Same as C ₇	Plate return by-pass for tube V ₁		
C ₁₃	Same as C ₇	Grid bias by-pass for converter section of tube V ₂		
C ₁₄	Capacitor, 3 mmfd., twisted wire leads	Additional coupling between oscillator and converter on band #4		
C ₁₅	Capacitor, 2 mmfd., twisted wire leads	Coupling between oscillator and converter		
C ₁₆	Same as C ₃	Grid coupling for oscillator section of tube V ₂		
C ₁₇	Same as C ₇	A-V-C by-pass for tube V ₃		

LIST OF REPLACEABLE PARTS - (Cont'd.)

Ref. Symbol	Name of Part and Description	Function	Mfr Code and Type No.	Hallcrafters Part No.
C18	Same as C8	Screen by-pass for tube V ₃		
C19	Not used			
C20	Same as C7	Screen by-pass for tube V ₄		
C21	Capacitor, 100 mfd. ± 20%, 500 V. D-C working, mica dielectric	R-F by-pass for diode load of tube V ₅	ASA	CM20A101M
C22	Capacitor, 0.004 mfd. - 10 + 40%, 600 V. D-C working, paper dielectric, type 684	Audio coupling for triode section of tube V ₅	A	46A7402J
C23	Capacitor, 0.1 mfd. - 10 + 40%, 200 V. D-C working, paper dielectric, type 284	Plate decoupling for tube V ₅	A	46AU104J
C24	Same as C8	Audio coupling between tube V ₅ and tube V ₆		
C25	Capacitor, 0.005 mfd. - 10 + 40%, 400 V. D-C working, paper dielectric, type 484	R-F by-pass on plate of tube V ₆	A	46AW502J
C26	Capacitor, 0.02 mfd. - 10 + 40%, 400 V. D-C working, paper dielectric, type AB	Audio coupling between plate of tube V ₆ and the headset	SP	46AW203J
C27	Capacitor, 60 mfd. - 10 + 50%, 150 V. D-C working, electrolytic, one section of 3 section unit, 6 prong plug-in assembly, type 10B336	Filter by-pass	IC	45A065
C28	Capacitor, 0.02 mfd. - 10 + 40%, 400 V. D-C working, paper dielectric, type AB	Part of RC oscillator for pilot light LM ₁	SP	46AW203J

C29	Same as C28		D-C blocking capacitor for oscillator section of tube V ₈	ASA	CM20A511J
C30	Capacitor, 3 turn twisted wire leads		B-F-0 coupling in oscillator section of tube V ₈		
C31	Same as C21		Resonating capacitor for transformer T ₁₇		
C32	Capacitor, 510 mmfd. ± 5%, 500 V. D-C working, mica dielectric		A-M-L coupling between tube V ₈ and V ₆		
C33	Same as C7		Line filter by-pass	A	46AW580J
C34	Capacitor, 0.05 mfd. - 10 + 40%, 400 V. D-C working, paper dielectric, type 484		Input filter capacitor		
C35	Capacitor, 30 mfd. - 10 + 50%, 150 V. D-C working, electrolytic, one part of triple unit - refer to C ₂₇		Filament circuit by-pass		
C36	Capacitor, 100 mfd. - 10 + 65%, 5 V. D-C working, electrolytic, one part of triple unit - refer to C ₂₇		Filament circuit by-pass Filament circuit by-pass Filament circuit by-pass	IC	45A066
C37	Capacitor, dual, 120 mfd. - 10 + 50%, 150 V. D-C working (C ₃₈), 60 mfd. - 10 ± 65%, 5 V. D-C working (C ₃₇), unit hermetically sealed, 4 prong plug-in assembly, type 10B335			Oscillator pad for band #4	ASA
C38			Resonating capacitor for high impedance primary section of T ₁₂	ASA	CM20A121K
C39	Capacitor, 4300 mmfd. ± 5%, 500 V. D-C working, mica dielectric		Oscillator pad for band #3	ASA	CM30A202J
C40	Capacitor, 120 mmfd. ± 10%, 500 V. D-C working, mica dielectric				
C41	Capacitor, 2000 mmfd. ± 10%, 500 V. D-C working, mica dielectric				

LIST OF REPLACEABLE PARTS - (Cont'd.)

Ref. Symbol	Name of Part and Description	Function	Mfr Code and Type No.	Hallcrafters Part No.
C ₄₂	Capacitor, 910 mmfd. ± 5%, 500 V. D-C working, mica dielectric	Oscillator pad for band #2	ASA	CM30A911J
C ₄₃	Capacitor, 390 mmfd. ± 5%, 500 V. D-C working, mica dielectric	Oscillator pad for band #1	ASA	CM20A391J
C ₄₄	Same as C ₈ . 01 <i>h.c.</i>	D-C blocking for oscillator section of tube V ₂ A-V-C by-pass for tube V ₁ Filament circuit by-pass		46AT504J
C ₄₅ C ₄₆	Same as C ₇ Capacitor, 0.5 mfd. - 10 + 40%, 200 V. D-C working, paper dielectric			
C ₄₇ C ₄₈ C ₄₉ C ₅₀	Capacitor, 4 unit assembly, mica dielectric, compression type adjustment, trimmers mounted on a single metal strip, 3 units with min. cap. 2.7 mmfd., max. cap. 35 mmfd. (C ₄₇ , C ₄₉ , C ₅₀) 1 unit with min. cap. 1.5 mmfd., max. cap. 10 mmfd. (C ₄₈) special	Antenna stage trimmer for band #1 Antenna stage trimmer for band #2 Antenna stage trimmer for band #3 Antenna stage trimmer for band #4	AE	44A064
C ₅₁ C ₅₂ C ₅₃ C ₅₄	Same as C ₄₇ , C ₄₈ , C ₄₉ , C ₅₀ , assembly. C ₅₁ , C ₅₃ , C ₅₄ , same as C ₄₇ , C ₄₈ , C ₅₀ ; and C ₅₂ same as C ₄₈	Converter stage trimmer for band #1 Converter stage trimmer for band #2 Converter stage trimmer for band #3 Converter stage trimmer for band #4		

C55	Capacitor, 5 unit assembly, mica dielectric, compression type adjustment, trimmers mounted on a single metal strip, 2 units with min. cap. 1.5 mmfd., max. cap. 10 mmfd. (C57 and C58), 2 units with min. cap. 2.7 mmfd., max. cap. 35 mmfd. (C55 and C56), 1 unit with min. cap. 25 mmfd., MAX. 140 mmfd. (C59), special	Oscillator stage trimmer for band #1	UE	44A082
C56		Oscillator stage trimmer for band #2		
C57		Oscillator stage trimmer for band #3		
C58		Oscillator stage trimmer for band #4		
C59		Excitation adjustment for oscillator stage		
C60	Not used	R-F by-pass in audio circuit	ASA	CM20A241J
C61	Capacitor, 240 mmfd. \pm 5%, 500 V. D-C working, mica dielectric	R-F by-pass in A-N-L circuit	ASA	CM20A270K
C62	Same as C21	Primary shunt for transformer T13		
C63	Capacitor, 27 mmfd. \pm 10%, 500 V. D-C working, mica dielectric	Fixed trimmer for transformer T12	CRL	47A006
C64	Capacitor, 10 mmfd. \pm 10%, 500 V. D-C working, temp. coeff. -.00055 mmfd./mmfd./degree Cent., ceramic dielectric	<i>Filter</i> Coupling between tubes V2 and V3	ASA	NONE
C65	Transformer, I-F, 455 KC., fixed primary trimmer 155 mmfd., fixed secondary trimmer 80 mmfd., primary and secondary are tuned by adjustable iron cores, special	Coupling between tubes V3 and V4	SI	50A086
T1	Same as T1 except for length of leads	Coupling between tubes V4 and V5	SI	50B157
T2	Same as T1 except for length of leads	Coupling between tube V5 and speaker IS1	SI	50B158
T3	Transformer, A-F, primary to match the output of the type 3Q5GT tube, part of speaker assembly IS1. Shown for reference only			

LIST OF REPLACEABLE PARTS - (Cont'd.)

Ref. Symbol	Name of Part and Description	Function	Mfr Code and Type No.	Hallcrafters Part No.
T ₅ T ₆ T ₇ T ₈	Transformer, R-F, 4 unit assembly, tunes from .55 MC. to 30 MC. in 4 bands with condensers C ₁ and C ₂ , inductance adjusted by movable iron cores; impregnated with fungicide lacquer	Couples antenna to tube V ₁ on band #1 Couples antenna to tube V ₁ on band #2 Couples antenna to tube V ₁ on band #3 Couples antenna to tube V ₁ on band #4	SWI	51B301
T ₉ T ₁₀ T ₁₁ T ₁₂	Transformer, R-F, 4 unit assembly, tunes from .55 MC. to 30 MC. in 4 bands with condensers C ₁ and C ₂ , inductance adjusted by movable iron cores; impregnated with #86A Maas-Walstein fungicide lacquer	Oscillator transformer on band #1 Oscillator transformer on band #2 Oscillator transformer on band #3 Oscillator transformer on band #4	SWI	51B303
T ₁₃ T ₁₄ T ₁₅ T ₁₆	Transformer, R-F, 4 unit assembly, tunes from .55 MC to 30 MC. in 4 bands with condensers C ₁ and C ₂ , inductance adjusted by movable iron cores; impregnated with fungicide lacquer	Couples tube V ₁ to V ₂ on band #1 Couples tube V ₁ to V ₂ on band #2 Couples tube V ₁ to V ₂ on band #3 Couples tube V ₁ to V ₂ on band #4	SWI	51B302
T ₁₇	Transformer, R-F, 455 MC., air core primary winding, secondary winding tuned by adjustable iron core, special	B-F-O transformer	SWI	54A022

L ₁	Reactor, R-F, inductance 165 microhenries, air core, type 760	Plate decoupling for oscillator section of tube V ₂	SWI	53A013
L ₂	Reactor, filter, d-c resistance 225 ohms, max. load current 17 milliamperes, iron core, type S-2882	Plate supply filter	OT	56B031
SW _{1A} SW _{1B}	Switch, DPST, slide action, bakelite insulation, steel mtg. plate with 2 holes having 1-1/8" mtg. centers, type 70	STAND-BY switch	OM	60A062
SW ₂	Switch, DPST, slide action, bakelite insulation, steel mtg. plate with 2 holes having 1-1/8" mtg. centers, type 71	ANL switch	OM	60A061
SW ₃ SW ₄	Same as SW ₂ Switch, SPST, toggle action, refer to SW ₇	BFO switch Controls power for A-C/D-C operation	OM	60A130
SW ₅	Switch, SPDT, slide, bakelite insulation, brass solder lugs, steel mtg. plate with 2 holes having 1-1/8" mtg. centers, type 77	AVC switch	OM	60A130
SW ₆	Switch, rotary selector, 4 position, 3 section, shorting type contacts, bushing 1/4" long, type RM	BAND SWITCH	MA	60B160
SW ₇	Switch, rotary selector, 3 position, single section, non-shorting type contacts, has a type 6030-K4 toggle action, SPST A-C switch ganged on rear of assembly "ON" position full clockwise, type H	POWER SWITCH	OM	60A162
SO ₁	Socket, female, 4 contacts, bakelite insulation, wafer type, brass contacts, 2 mtg. holes with 1 1/4" mtg. centers, type 2642	External antenna connection	CN	10A060
PL ₁	Plug with line cord, 2 conductor, rubber insulation, #18 ga. stranded copper wire, length 6 feet, 2 prong spring type molded on plug, special	Line cord for AC/DC operation	E	87A078

LIST OF REPLACEABLE PARTS - (Cont'd.)

Ref. Symbol	Name of Part and Description	Function	Mfr Code and Type No.	Hallicrafter's Part No.
BA ₁	Battery, 6 V. D-C, 2 holes socket, 3-7/8" x 2-15/16" x 5 1/2", type P688A ✓	"A" supply	ROV	27A010
BA ₂	Battery, 45 V. D-C, combination "B" socket, 4-1/8" x 2-9/16" x 5-5/16", type P6303 ✓ ✓	"B" supply	ROV	27A009
BA ₃	Same as BA ₂	"B" supply		
J ₁	Jack, single circuit, normally closed, brass mechanism, bakelite insulation, type 1J102	Headset connection	U	36A002
LS ₁	Loudspeaker; 4 inch O.D. permanent magnet dynamic, includes transformer T ₄ in the assembly, type 4-0M-11A	Loudspeaker	OT	85B009
LM ₁	Lamp, indicator, 1-1/8" leads, clear glass bulb type 4 1/2, type NE-7	Indicates set in operation	GE	39A007
V ₁	Tube, pentode, type 1T4	R-F amplifier stage	RCA	90X1T4
V ₂	Tube, pentagrid converter, type 1R5	Converter and oscillator stage	RCA	90X1R5
V ₃	Tube, type, 1P5GT	1st I-F amplifier stage	RCA	90X1P5GT
V ₄	Same as V ₃	2nd I-F amplifier stage		
V ₅	Tube, diode triode, type 1H5GT	2nd detector and 1st audio amplifier stage	RCA	90X1H5GT
V ₆	Tube, beam power amplifier, type 3Q5GT	Audio amplifier stage	RCA	90X3Q5GT
V ₇	Tube, half-wave high-vacuum rectifier, type 35Z5GT	Rectifier	RCA	90X35Z5GT
V ₈	Same as V ₇	B-F-O and A-N-L stage		
V ₉	Same as V ₇	Rectifier		

FOR TROPICAL RECEIVERS USE THE ABOVE PARTS LIST EXCEPT FOR THE FOLLOWING ITEMS:

T ₁	Transformer, I-F, 455 KC., fixed primary trimmer 155 mmfd., fixed secondary trimmer 85 mmfd., primary and secondary are tuned by adjustable iron cores, vacuum impregnated with zophar #1340 and flash dipped in Hollowax #2012, special (Note: T ₁ differs from T ₂ and T ₃ in the length of the wire leads)	Coupling between tubes V ₂ and V ₃	SI	50A150
T ₂	Transformer, I-F, 455 KC., fixed primary trimmer 155 mmfd., fixed secondary trimmer 85 mmfd., primary and secondary are tuned by adjustable iron cores, vacuum impregnated with zophar #1340 and flash dipped in Hollowax #2012, special (Note: T ₂ differs from T ₁ and T ₃ in the length of the wire leads)	Coupling between tubes V ₃ and V ₄	SI	50A159
T ₃	Transformer, I-F, 455 KC., fixed primary trimmer 155 mmfd., fixed secondary trimmer 85 mmfd., primary and secondary are tuned by adjustable iron cores, vacuum impregnated with zophar #1340 and flash dipped in Hollowax #2012, special (Note: T ₃ differs from T ₁ and T ₂ in the length of the wire leads)	Coupling between tubes V ₄	SI	50A151
L ₁	Reactor, R-F, inductance 170 microhenries, air core, vacuum impregnated with zophar #1340 and flash dipped in Hollowax #2012, type 3485	Plate decoupling for oscillator section of tube V ₂	SWI	53A057
L ₂	Reactor, filter, d-c resistance 250 ohms ± 20%, max. load current 30 milliamperes, inductance 3.6 henrys at 30 milliamperes, vacuum wax impregnated and flash dipped in Hollowax #2012, type 1A1251 modified	Plate supply filter	GT	56B051
SW ₆	Switch, rotary selector, 4 position, 3 section, shorting type contacts, bushing 3" long, terminal 6 of section 2 front and rear are electrically connected, type RM	BAND SWITCH	MA	60H179

LIST OF REPLACEABLE PARTS - (Cont'd.)

Ref. Symbol	Name of Part and Description	Function	Mfr Code and Type No.	Helicopter's Part No.
IS ₁	Loudspeaker; 4 inch O.D. permanent magnet dynamic, includes transformer T ₄ in the assembly, fungacide treated, type 4-OM-11A tropicalized.	Loudspeaker	OT	85C029