

h
**COMMUNICATIONS
EQUIPMENT**

ENG. DEPT.

MODEL HT-33A
Linear Power Amplifier

the **hallicrafters** co.
4401 W. FIFTH AVENUE • CHICAGO 24, ILLINOIS



Figure 1. Hallicrafter's Model HT-33A Linear Amplifier

SECTION I

GENERAL

1-1. GENERAL DESCRIPTION.

The Hallicrafters Model HT-33A is a precision built, ultra compact linear amplifier employing a Penta-Lab PL-172 pentodetype tube having 1000 watts plate dissipation. It is designed as the ideal companion unit for The Hallicrafters HT-32 or FPM-200, and may be used with any 100 watt exciter without the need of any external pad or matching network.

The circuit employs a single PL-172 operating class AB1 or AB2. The input circuit is designed for either 50 or 75 ohm matching and requires no grid tuning or neutralization at any time. The power supply is completely self-contained and uses two 3B28 tubes connected in a full wave rectifier circuit having excellent regulation. Screen voltage is controlled by four OA2 regulator tubes. A variable bias supply with front panel control is included to maintain proper idling plate current. Provision has been made to apply cut off bias by proper connections to an octal plug on rear of chassis. 115 VAC is also available at this plug for switching operations.

Overload protection is provided by a 5 ampere fuse F1 which protects the filament, bias and blower circuits, a 1/16 ampere fuse F2 which protects the PL-172 screen, and a 20 ampere circuit breaker, which in addition to being the high voltage "ON-OFF" switch, protects the high voltage supply.

An interlock safety switch removes the primary voltage from the plate supply transformer when the

cabinet cover is opened. (Do not attempt to defeat its purpose as lethal voltages are present.)

1-2. TVI SUPPRESSION.

Every consideration has been given to possible local TVI problems in the design of the HT-33A. Circuitry has been used that discourages harmonic generation. A low pass filter has been included in series with the AC power leads. The enclosed metal cabinet greatly aids in shielding. A ground lug has been provided at the rear of the chassis for an external ground connection. It is recommended that all station components be bonded together with heavy copper wire or strap and to an earth ground. Ground leads, which are equal to 1/4 wave length at your favorite operating frequencies, should be avoided.

1-3. ADDITIONAL FEATURES.

Many additional features have been included for reliability and ease of operation. All important circuits are metered and easily read on a large illuminated meter. In addition to grid current, screen current, cathode current and plate voltage ranges, an RF output volt meter is included for easier tuning. In this position (keeping in mind the maximum current ratings for the tube as given later), both plate tuning and plate loading controls are adjusted for maximum deflection on the volt meter. A red jewel on the front panel indicates that the high voltage supply is on. All band-switching is accomplished by a single selector knob.

SECTION II INSTALLATION

2-1. UNPACKING.

Check all shipping tags and labels for further instructions before removing or destroying. All tubes will be shipped in a separate carton to prevent damage to the tubes and sockets.

Remove PL-172 tube from carton and install in socket. The tube must be oriented so that the large cathode pin is in line with the large hole in the socket. Lower tube into chimney carefully, rotating tube slightly back and forth until tube pins engage in socket holes. **DO NOT FORCE.** As tube engages socket, press down lightly until tube is firmly seated in socket. After tube is installed, loosen screw at point where parasitic choke is connected to the coupling capacitor. Swing parasitic choke and anode connector around to proper position and snap anode connector on to the plate of the PL-172. Tighten screw at point where the parasitic choke connects to the coupling capacitor (**FIRM BUT WITHOUT FORCE**). (See Figure 3 for exact location.) Install four OA2 regulator tubes. Install two 3B28 tubes. Connect rectifier plate caps.

2-2. LOCATION.

It is very important that the HT-33A be placed in such a manner that complete air circulation will be had on all sides as well as the top and bottom. The air intake for the fan is through the bottom of the cabinet and air space must be maintained. The HT-33A must rest on cabinet feet at all times. Under no circumstances should any object be placed on top of this unit.

2-3. POWER REQUIREMENTS.

The HT-33A is designed for 117V 50/60 cycle AC operation. The source should be capable of supplying 2350 watts with good regulation at the specified line voltage if the maximum capabilities of this unit are to be realized.

2-4. RACK MOUNTING.

The HT-33A may be rack mounted if desired. In order to accomplish this, the unit must first be removed from the cabinet by following the procedure given below:

1. Remove bottom perforated panel from cabinet.
2. Remove short AC fan cord from receptacle.
3. Remove three screws which hold fan support bracket to chassis.
4. Remove fan assembly from unit.
5. Remove three chassis mounting screws at bottom rear of cabinet.
6. Remove top and bottom screw on each side of front panel (Four screws only).
7. Open cabinet cover to disengage interlock switch. (**BE SURE ALL CABLES ARE DISCONNECTED FROM CHASSIS.**)

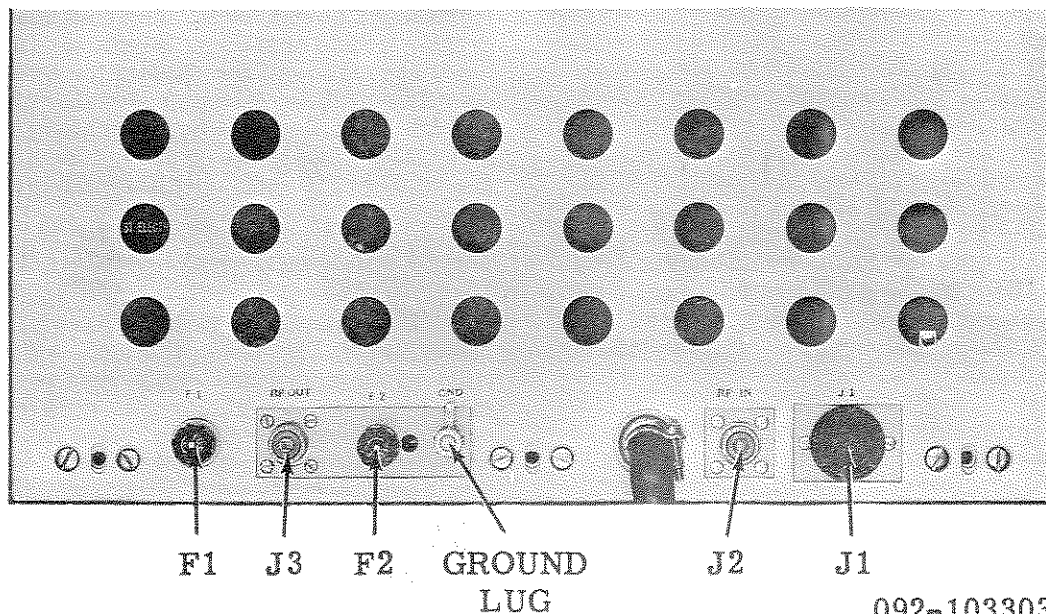


Figure 2. Chassis, Rear View

8. Slide chassis out from front of cabinet.
9. Fan must be replaced in original position after unit is installed in rack. Never operate unit without fan.

The slots at the edges of the front panel are properly spaced to accommodate mounting screws in a standard 19 inch rack.

The HT-33A should never be placed directly above another unit which radiates heat as the fan will blow this warm air through the tube and impair its cooling capabilities. Also, the area above the chassis must not be constricted, so that the warm air may be freely exhausted into the room.

2-5. BIAS AND ANTENNA RELAY CONNECTIONS.

It is recommended that coaxial type antenna changeover relays be used with the HT-33A.

It is also recommended that cut off bias be used in all modes of operation. (See figures 4, 5, and 6 for antenna relay connections.)

NOTE

The bias control relay may be connected in parallel with any 117 V. A. C. antenna changeover relay.

The HT-33A is shipped with a jumper between pins 3 and 4, and another jumper between pins 1 and 8 in the plug at rear of chassis, marked J1. This allows the HT-33A bias relay to close when the "FILAMENT" switch is turned "ON". If either jumper is

removed, the bias relay will remain open and cut-off bias will be applied to the PL-172.

2-6. INPUT AND OUTPUT CONNECTIONS.

A. Input Connection. The input connector, located at the rear of the chassis, will mate with a type PL-259 coaxial connector (Amphenol type 83-1SP) (not supplied). Excitation from the exciter unit should be applied through this connector. The input is designed for 50 to 75 ohms and any reasonable length of RG-58/U cable will suffice.

CAUTION

Care must be used in applying excitation. See tuning instructions.

B. Output Connection. The output connector, located at the rear of the chassis will mate with a type PL259 coaxial connector (Amphenol type 83-1SP) (not supplied). Use only RG-8/U coaxial cable in the feed line. Although the output impedance is variable, it is strongly recommended that the load be 50 ohms with the lowest possible VSWR. Never attempt to feed an antenna of unknown characteristics, as serious damage to the HT-33A may result. For further information on this subject, consult the A. R. R. L. handbook.

AC voltage (117V, not to exceed 50 watts) is available at this plug (J1) when the "FILAMENT" switch is turned "ON".

Another AC circuit is available (117V, not to exceed 50 watts) when the "HIGH VOLTAGE" switch is turned "ON".

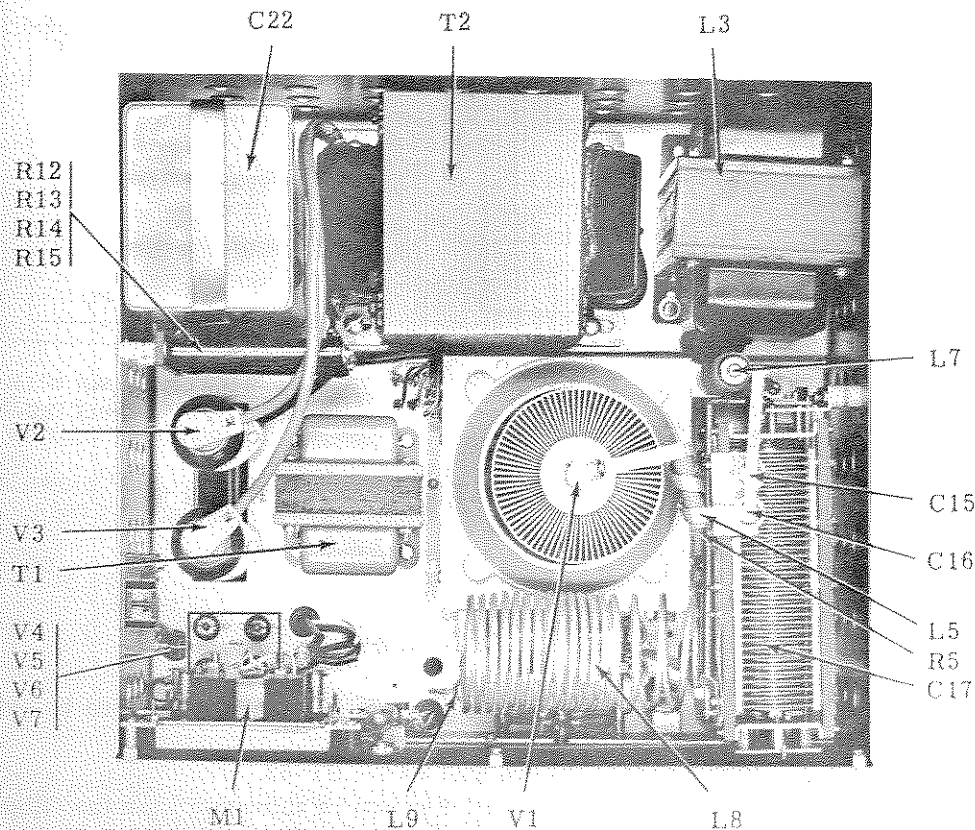


Figure 3. Chassis, Top View

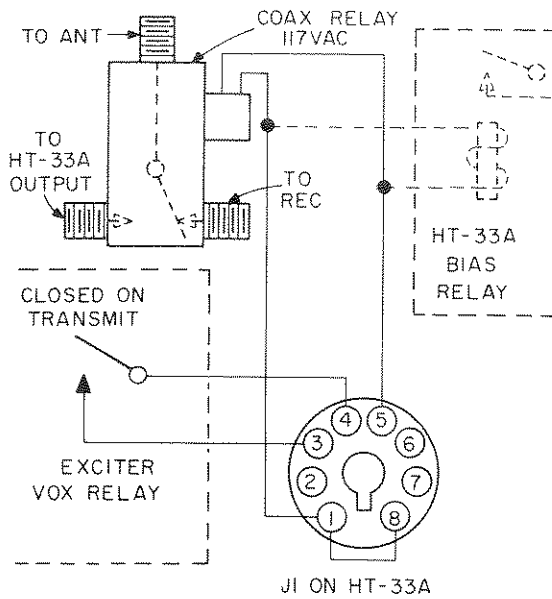


Figure 4. Antenna and Bias Switching Circuit

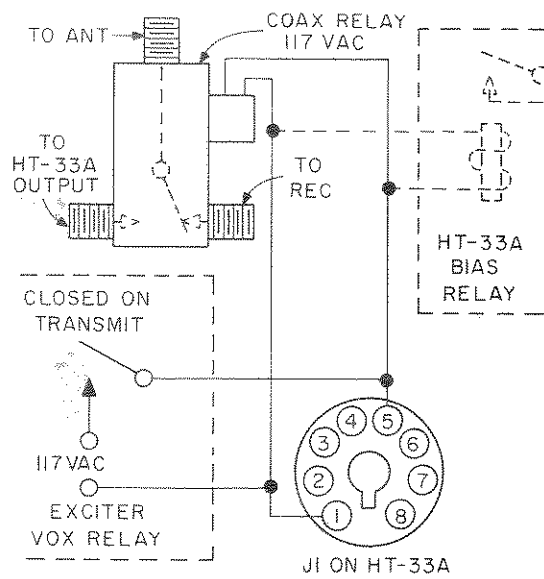


Figure 5. Antenna and Bias Switching Circuit

Suggested antenna and bias switching circuits where 117V AC is supplied by the HT-33A.

For use with exciters such as HT-32

(Note - Contacts used in exciter VOX relay must have no internal connections).

Suggested antenna and bias switching circuits where 117V AC is supplied through VOX relay contacts in exciter.

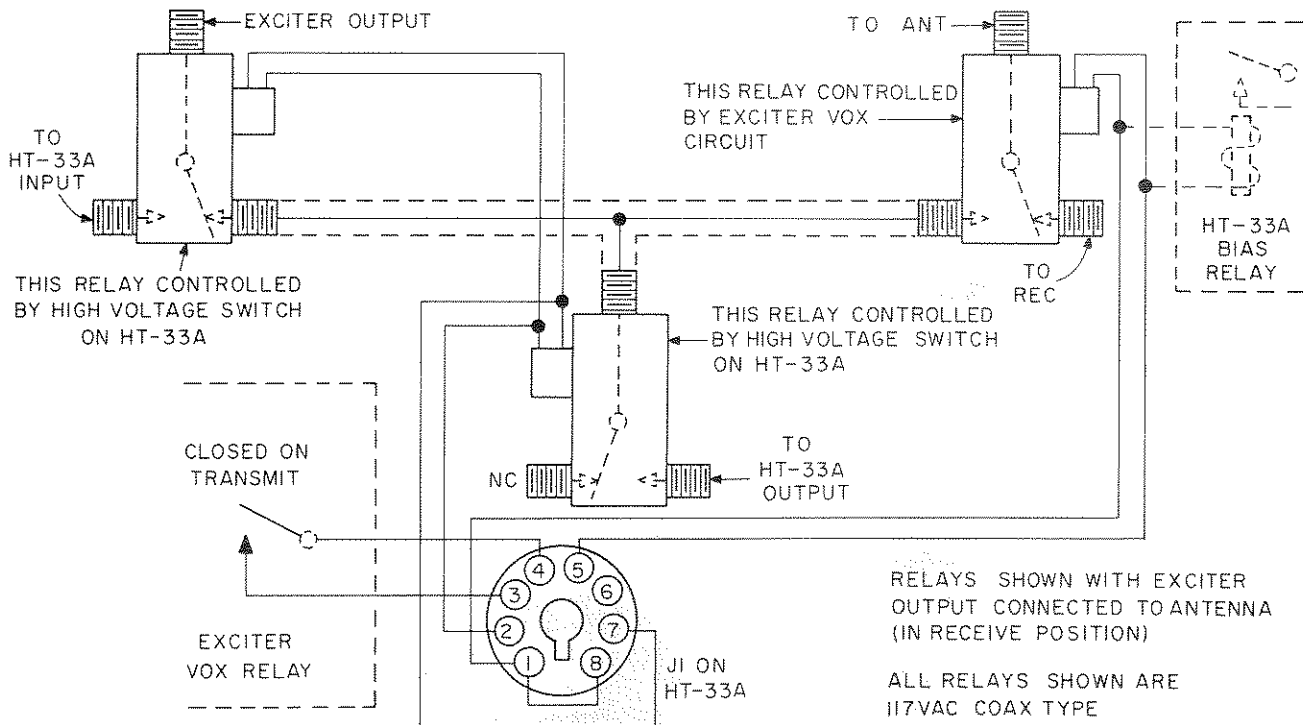


Figure 6. Antenna and Bias Switching Circuit

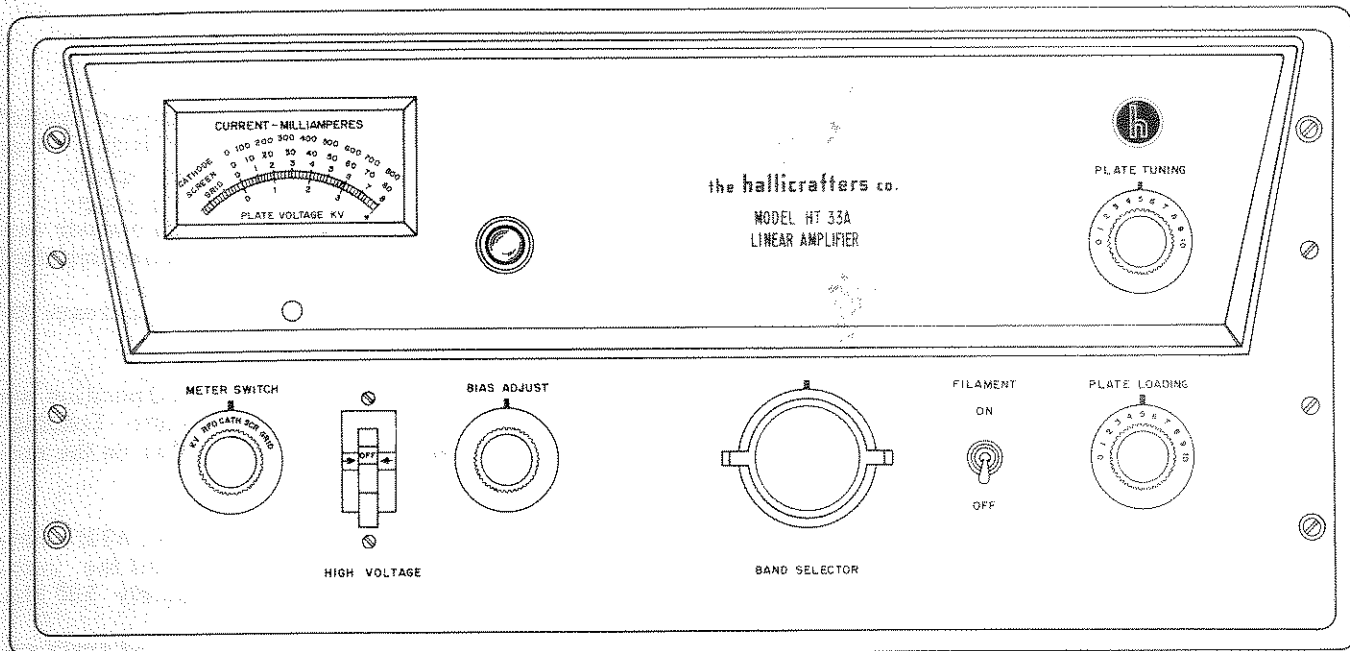
Suggested antenna and bias switching circuits where 117V AC is supplied by the HT-33A.

For use with exciters such as the HT-32.

Antenna switching from the HT-33A to the exciter will be automatic when the "High Voltage" Switch is turned "OFF".

SECTION III

FUNCTION OF OPERATING CONTROLS



092-403359

Figure 7. Front Panel Controls

NAME OF CONTROL	TYPE	DESCRIPTION
FILAMENT	Toggle	Connected in series with power line. Used to energize all filaments, bias supply, and fan, or to disable entire unit.
HIGH VOLTAGE	Circuit Breaker (20 Amp.)	Used to energize primary of high voltage transformer and turn on red indicator light. Also protects high voltage supply.
METER SWITCH	Rotary (5 position)	Connects the meter to read grid, screen, cathode current, RF output voltage, and plate voltage. The setting of the switch automatically switches in the correct shunt or divider network.
BIAS ADJUST	Potentiometer	Used to adjust the cathode current to the correct operating point.
BAND SELECTOR	Rotary Switch (5 position)	Selects proper plate tank coil tap. Shorts out unused portion of coil. Switches in additional loading capacity on 40 and 80 meters.
PLATE TUNING	* Variable Capacitor	Resonates plate circuit to operating frequency. (Never attempt to use the HT-33A as a frequency multiplier.)
PLATE LOADING	* Variable Capacitor	Used to adjust output impedance to match the antenna load impedance. (40-80 Ohms.)

*Note: 0 on dial indicates maximum capacity and 10 indicates minimum capacity.

SECTION IV

TUNING PROCEDURE

4-1. GENERAL.

In all cases, both the "Plate Tuning" and "Plate Loading" controls are adjusted for maximum RF output as indicated on the RF output voltmeter. Never control power input by the loading adjustment alone. Power input should always be a direct function of the applied excitation. All tuning adjustments must be made at the maximum peak input level that you desire to use. Note that the idling plate current may be changed to give increased efficiency for CW.

4-2. TUNING PROCEDURE.

The following steps apply to all types of operation:

1. Set "Filament" switch to "OFF" position.
2. Set "High Voltage" switch to "OFF" position.
3. Set "Meter" switch to "CATH" position.
4. Set "Band Selector" to desired band.
5. Connect transmission line to coax output receptacle.
6. Connect exciter output to HT-33A input receptacle.
7. Plug HT-33A line cord into a receptacle capable of delivering 2350 watts @ 117V 50/60 cycles.
8. Place the "Filament" switch in "ON" position. Three to four minutes for filament warm-up will suffice.

Never leave filament power on unless the blower fan is operating.

Never apply "High Voltage" unless filament power has been applied for three minutes.

NOTE

The cathode current indicated on the meter will be the combined plate, screen, and control grid current. To determine the plate current, it will be necessary to subtract the combined total of the screen current reading plus the grid current reading from the cathode current.

4-3. TUNE UP FOR CW OPERATION.

1. Set the "Bias Adjust" control in maximum

counterclockwise position.

2. Assuming filament voltage has been applied for the required time, place "High Voltage" switch in "ON" position.
3. Adjust bias control so that the cathode current is 100 MA or less (without excitation).
4. Apply enough CW excitation to increase the cathode current to 200 MA.
5. Rotate "Meter" switch to RFO position and adjust "Plate Tuning" and "Plate Loading" for maximum upward deflection on the meter.
6. Rotate "Meter" switch back to CATH position and increase excitation until the cathode current reads approximately 300 MA.
7. Rotate "Meter" switch to RFO and again adjust "Plate Tuning" and "Plate Loading" for maximum upward deflection on the meter.
8. Increase excitation and adjust tuning until the cathode current is approximately 390 MA after tuning. Always make the final adjustment with the "Plate Tuning" capacitor. One kilowatt CW input will be had when the plate voltage multiplied by the plate current equals 1000.

Example: $2700 \text{ V} \times 370 \text{ MA} = 999 \text{ watts, or}$
 $999\text{W} \div 2700 \text{ V} = 370 \text{ MA}$

4-4. TUNE UP FOR SSB OPERATION.

1. Adjust bias control until 180 MA cathode current is indicated without excitation.
2. Place exciter in CW position and increase excitation to the HT-33A until the cathode current reads approximately 250 MA.
3. Rotate "Meter" switch to RFO and adjust both "Plate Tuning" and "Plate Loading" for maximum upward deflection.
4. Rotate "Meter" switch to CATH position and again increase excitation until the cathode current is 350 MA.
5. Repeat tuning procedure as described above.
6. Increase excitation until 520 MA cathode current is indicated after tuning adjustment as previously described. Always make the final adjustment with the "Plate Tuning" capacitor.

7. Switch exciter to SSB and bring up audio control gradually while talking into the microphone. One kilowatt average input will be had when the plate current is approximately 370 MA (depending on line voltage) on voice peaks. This will usually be about 390 MA total cathode current. Under these conditions, grid current will be approximately 2 MA on voice peaks.

4-5. TUNE UP FOR DOUBLE SIDE BAND WITH CARRIER (AM).

1. Proceed as described in 4-3 for CW tuneup, except bias is adjusted for 180 MA idling current.
2. Final adjustment will be made at 1 kilowatt

CW input (370 MA plate current).

3. Remove CW excitation and place exciter in AM position.
4. Gradually increase audio gain control on exciter until HT-33A plate current is 370 MA on voice peaks. (Approximately 390 MA total cathode current).

It is strongly recommended that a monitor scope be used for both SSB and DSB operation. Although a 1/4 second meter is used in your HT-33A as prescribed by the F. C. C. ; no meter will follow voice peaks and, of course, in no way indicates true peak power input under voice conditions. A monitor scope will be invaluable in getting the most out of your HT-33A.

SECTION V SERVICE DATA

5-1. SERVICE OR OPERATING QUESTIONS.

For further information regarding operation or servicing of any Hallicrafters equipment, contact your Hallicrafters dealer. The Hallicrafters Company maintains an extensive system of Authorized Service Centers where any required service will be performed promptly and efficiently at a nominal charge. All Hallicrafters Authorized Service Centers display the sign shown below. For the location of the one nearest you, consult your dealer or telephone directory. Make no service shipments to the factory, as The Hallicrafters Company will not accept the responsibility for unauthorized shipments.

The Hallicrafters Company reserves the privilege of making revisions in current production of equipment and assumes no obligation to incorporate these revisions in earlier models.

5-2. WARNING - HIGH VOLTAGE.

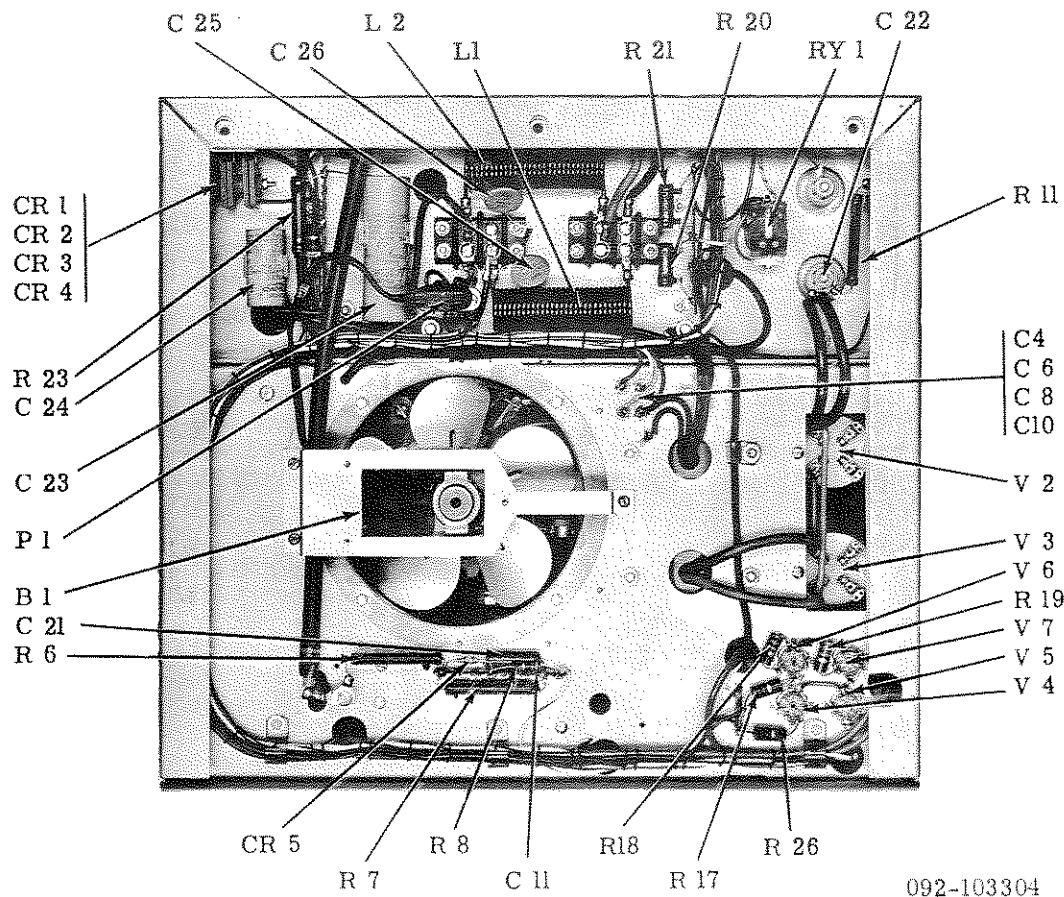
DC voltage in excess of 2700 volts is present in this equipment.

Do not attempt to measure voltages with hand held test leads nor attempt to service this unit with the high voltage supply on. In addition to the danger of serious injury, or death, from the high voltage supply, serious radio frequency burns can be caused by coming in contact with, or close proximity to, the plate and output circuits.

An AC interlock switch is installed on the cover for your protection. Do not attempt to defeat its purpose. Also, a bleeder circuit is provided to discharge the high voltage filter capacitor. However, we strongly recommend the use of a grounding rod to short the high voltage circuit to the chassis before any servicing is attempted.

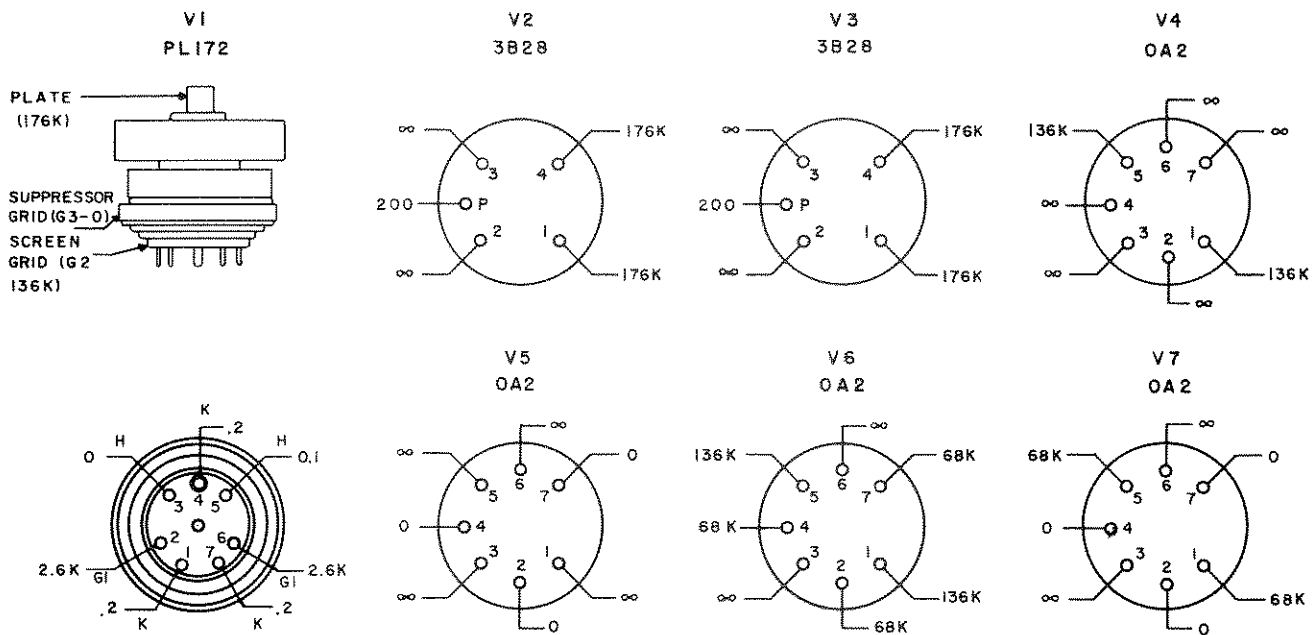
USE EXTREME CAUTION WHEN WORKING WITH THIS EQUIPMENT.





092-103304

Figure 8. Chassis, Bottom View



092-303370

Figure 9. Resistance Chart

SECTION VI

GENERAL SPECIFICATIONS

Dimensions, Overall	20" W x 10 1/2" H x 17" D.
Dimensions, Front Panel.....	Standard Rack Mtg. 8 3/4" H x 19" W.
Mode of Operation.....	AB1 or AB2 linear power amplifier.
Power Consumption.....	2350 watts, 117 VAC, 50/60 cycles at maximum input.
Input Impedance.....	50 - 75 Ohms.
Output Impedance.....	40-80 Ohms.
Plate Power Input SSB.....	1000 watts average
Plate Power Input AM.....	1000 watts (100% Mod. voice peaks).
Plate Power Input CW.....	1000 watts
Power Output SSB @ 1 KW Input.....	800 WPEP (Min.)
Drive Power SSB (180 MA Idling Plate Current).....	50 WPEP
Drive Power AM (180 MA Idling Plate Current).....	12.5 watts
Drive Power CW (50 MA Idling Plate Current).....	60 watts
Weight, Net.....	114 pounds
Weight, Shipping.....	120.5 pounds

6-1. NEUTRALIZATION.

No neutralization is necessary at any time. A low impedance input circuit, in conjunction with excellent shielding and by-passing, assures complete stability at all times.

6-2. GRID CURRENT.

It is recommended that the control grid current be kept below 5 MA, and under no circumstances be allowed to exceed 8 MA.

It is normal for the PL-172 to indicate negative (reverse) control grid current, and in some cases, may read off scale when the meter is switched to the "Grid" position. This will in no way indicate a defective tube and no allowances are to be made when reading "Grid" current.

6-3. IDLING PLATE CURRENT.

CW - The idling current (plate current without excitation) may be set at 100 MA or less. Maximum efficiency will be realized when the idling current is low. Less excitation will be required when the idling current is increased.

SSB - The idling plate current (plate current without excitation) may be set at any point between 180 MA and 220 MA. Maximum efficiency will be realized at 180 MA (AB2 operation); however, lowest distortion and lowest drive requirements will be realized with 220 MA idling current (class AB1 operation).

AM - The idling plate current (plate current without excitation) should be maintained at 180 MA (for Double Side Band with Carrier).

6-4. PLATE CURRENT.

The indicated plate current on the 1/4 second meter will be approximately 370 MA for 1 KW plate input (legal limit for amateur use).

The maximum plate current that may be drawn on SSB voice peaks or keyed CW will be 500 MA. This may be used for short test periods not to exceed 5 minutes under steady state carrier conditions to allow tuning and loading adjustments to be made (AM 400 MA on 100% mod. voice peaks).

6-5. SCREEN CURRENT.

The screen current will be approximately 10-15

MA @ 1 KW input, SSB voice peaks. Under key down CW conditions, the screen current will be 20-25 MA @ 1 KW input. The screen grid current should never exceed 40 MA.

6-6. PLATE VOLTAGE.

The plate voltage should be approximately 2700 volts with 117 VAC line voltage @ 1 KW CW input.

6-7. RF OUTPUT VOLTMETER (RFO).

This voltmeter is connected across the output coax and indicates maximum output voltage across the coax. It is not calibrated and is to be used as a tuning indicator (always tune for maximum upward deflection for a given power input). As this is not a peak reading meter, voice peaks will deflect meter approximately 1/3 the equivalent CW output.

6-8. CLEANING.

Equipment that is power cooled may tend to collect dust within the unit depending on the content of the air being circulated. Also the 2700 V circuitry has a tendency to attract dust particles. The circuitry should be kept clean, as any accumulation of dust

in the high voltage or RF areas may cause arcing and consequent damage. This applies to both the top, side and underside of the chassis. Both "Plate Tuning" and "Plate Loading" capacitors should be cleaned frequently to prevent arcing between plates.

CAUTION

Do not nick or bend capacitor plates.

The preferred method of cleaning is the use of a vacuum cleaner while dusting with flexible bristle clean brush. Be sure to remove and clean fan and area around the PL-172 tube socket.

Never use solvents for cleaning.

6-9. LUBRICATION.

Both upper and lower fan bearings should be lubricated with one or two drops of SAE #30 oil once a year.

6-10. CHASSIS REMOVAL.

(See RACK MOUNTING, 2-3).

SERVICE PARTS LIST

Schematic Symbol	Description	Hallicrafters Part Number	Schematic Symbol	Description	Hallicrafters Part Number
CAPACITORS			COILS AND TRANSFORMERS		
C1...	.005 mfd, 500V, Ceramic disc.	.047-100442	L1, 2...	Choke, AC line.....	053-200512
C2...	.001 mfd, 3000V, Ceramic disc.	.047-100397	L3...	Choke, Filter.....	056-200337
C3, 4,			L4...	Choke, Parasitic Grid (Inc. R4)....	053-100421
5, 6, 7,			L5...	Choke, Assembly, Parasitic	
8, 9, 10.	1500 mmfd, 500V, Ceramic			Plate (Inc. R5).....	041-250388
	Feed - thru.....	.047-100602	L6...	Choke, RF, 2.5 uh.....	053-200335
C11,			L7...	Choke, Plate RF.....	053-100508
12, 13, 28	.01 mfd, 500V, Ceramic disc. ....	.047-100354	L8...	Coil, Tank.....	051-202494
C14...	.002 mfd, 6000V, Ceramic disc. ....	.047-101085	L9...	Choke, RF Safety.....	053-200444
C15,			T1...	Transformer, Filament	
16	1000 mmfd, 5000V, Ceramic HV..	047-200556		and Bias.....	052-300652
C17...	Variable (Plate tuning).....	.048-100431	T2...	Transformer, Plate.....	052-200653
C18					
19, 27	500 mmfd, 5000V Ceramic HV... ..	.047-201084	LAMPS AND TUBES		
C20..	Variable (Plate load) .....	.048-100430	DS1, 2	Lamp, Pilot	039-100003
C21...	0.1 mfd, 200V, Paper.....	499-014104	DS3...	Lamp, Pilot (117V).....	039-200002
C22...	8 mfd, 3000V, Paper.....	046-200890	V1...	PL-172 (Power Amplifier).....	090-201295
C22			V2, 3..	3B28 (High Voltage Rectifier)....	090-900414
(alternate)	10 mfd, 3000V, Paper	046-100889	V4, 5		
C23...	60 mfd, 450V, Electrolytic	045-100417	6, 7..	OA2 (Voltage Regulator).....	090-900001
C24...	16 mfd, 450V, Electrolytic	045-100418			
C25,					
26..	.01 mfd, 1400V, Ceramic disc. ....	.047-200752			

SERVICE PARTS LIST CONT'D

Schematic Symbol	Description	Hallicrafters Part Number	Schematic Symbol	Description	Hallicrafters Part Number
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RESISTORS

R1,		
2, 3	200 ohm, 10W	.023-100167
R4	47 ohm, 1W (Part of L4)	
R5	50 ohm, 10W, 5%, WW (Part of L5)	
R6	47K ohm, 2W, 1%	452-003473
R7	2200 ohm, 2W, 1%	452-003222
R8	4700 ohm, 2W, 10%	451-652472
R9	1000 ohm, 2W, 10%	451-652102
R10	1.5 megohm, 2W, 1%	452-003155
R11	2 megohm, 2W, 1%	452-003205
R12, 13,		
14, 15	10K ohm, 50W, WW	.024-101232
R16,		
17	220 ohm, 2W, 10%	451-652221
R18,		
19	68K ohm, 2W, 10%	451-652683
R20	1500 ohm, 5W, WW	024-101234
R21	1100 ohm, 5W, WW	024-101248
R22	1 K ohm, 4W, Variable (Bias Adjust)	.025-101654
R23	2500 ohm, 10W, WW	.024-101235
R24	47 ohm, 2W, 10%	451-652470
R25	800 MA shunt (Part of M1)	
R26	80 MA shunt (Part of M1)	
R27	8 MA shunt (Part of M1)	

CONNECTORS AND SOCKETS

J1	Socket, Octal (Antenna Relay)	.006-200296
J2, 3	Connector, Coaxial	010-100056
J4	AC Receptacle (Fan)	010-200015
P1	Cord and Plug (Fan)	087-204833
P2	Cord, AC line	087-204978
	Cap (Rectifier Plate)	076-100191
	Cap (PL-173 Plate) (Part of L5)	
	Fuse post	006-200837
	Socket (PL-172) (V1)	006-400835
	Socket (3B28) (V2, V3)	006-100316
	Socket (OA2) (V4, 5, 6, 7)	006-100645
	Socket (DS1, 2)	086-100031
	Socket (DS3) (with Jewel)	086-100448
	Plug, Octal (Antenna Relay Connections)	035-100003

SWITCHES

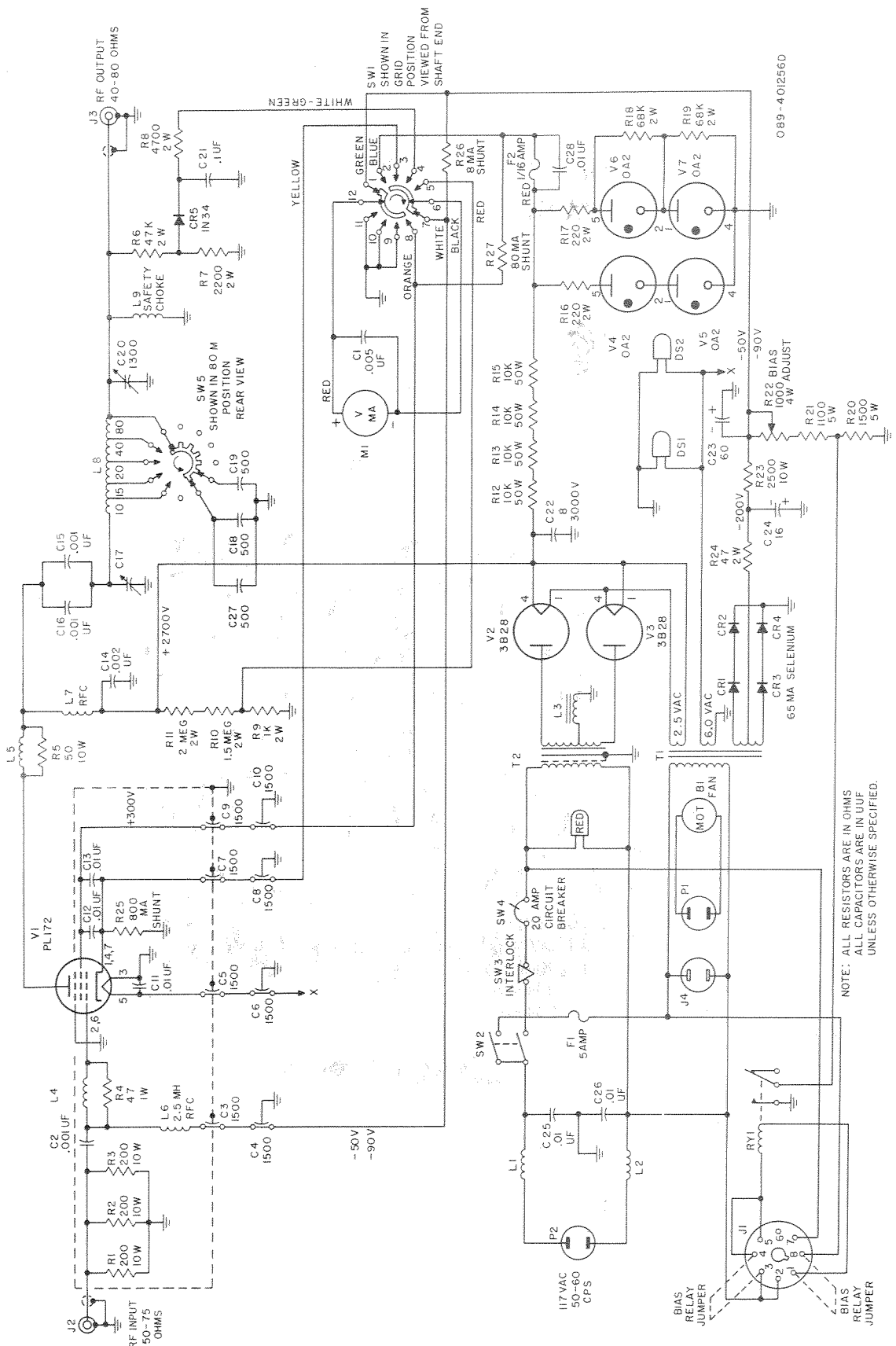
SW1	Rotary (Meter)	060-302008
SW2	Toggle (DPST) (Power)	060-200908
SW3	AC Interlock	060-200450
SW4	Circuit Breaker (HV)	060-100987
SW5	Rotary (Band Selector)	060-300991

MISCELLANEOUS

B1	Motor (Fan)	020-200218
CR1, 2,		
3, 4	Rectifier, Selenium (65MA)	027-100243
CR5	Diode, IN34A	112-100028
F1	Fuse (5 Amp 250V)	039-100460
F2	Fuse (1/16 Amp)	039-100504
M1	Meter	082-400400
RY1	Relay (Bias)	021-200433
	Cabinet	066-402251
	Feet (Rubber)	016-100029
	Panel, Front	068-400798
	Cover, Cabinet Top	066-401487
	Plate, Bottom (Perforated)	063-303710
	Blade, Fan	080-100540
	Insulator, Stand Off (11)	008-100999
	Insulator, Stand Off (5)	008-101016
	Insulator, Stand Off (1)	008-105499
	Instruction Manual	094-901929
	Blade, Fan (small)	080-200547

KNOBS AND ESCUTCHEONS

	Knob, Band Selector	015-101293
	Knob, Plate Tuning and Loading (2)	015-101291
	Knob, Meter SW	015-101292
	Knob, Bias Adjust	015-101294
	Escutcheon, Panel	007-500732
	"h" Medallion	007-100669



089-4012560

Figure 10. Schematic Diagram, HT-33A Linear Power Amplifier