NOTE: When you connect resistors in the following steps, align them as shown in the Pictorial. Space the resistors 1/2" from the capacitors as shown in the inset drawing. After fitting and soldering the resistors, cut off and discard any excess lead lengths. No resistor should be closer than 1/4" to any metallic object to which it is not intentionally connected.

( ) Refer to the Pictorial and place one of the 3/4" lengths of sleeving on one lead of a 30 kΩ resistor. Connect this lead to the positive (+ or red dot) lug of capacitor 1 (NS). Pass the other resistor lead through the positive lug of capacitor 2 (S-2) to the negative lug of capacitor 4 (NS).

( ) Place one of the 3/4" lengths of sleeving on one lead of a 30 kΩ resistor and connect this lead to the positive lug of capacitor 5 (NS). Pass the other lead through the positive lug of capacitor 6 (S-2) to the negative lug of capacitor 8 (NS).

( ) Pass the straight end of one of the 1-5/8" bare wires through the negative lug of capacitor 2 (NS). Place the bent end of the wire into the positive lug of capacitor 1 (S-2).

( ) Connect the black hookup wire coming from hole B on the circuit board to the negative lug of capacitor 1 (NS).

( ) Connect a 30 kΩ resistor from the negative lug of capacitor 1 (S-2) to the negative lug of capacitor 2 (S-2).

( ) Connect the bent end of one of the 1-5/8" bare wires to the negative lug of capacitor 3 (NS) and the straight end to the positive lug of capacitor 4 (NS).

( ) Place a 3/4" length of sleeving on one lead of a 30 kΩ resistor and connect this lead to the negative lug of capacitor 3 (S-2). Connect the other lead to the negative lug of capacitor 4 (S-2).

( ) Place the bent end of a 1-5/8" bare wire in the positive lug of capacitor 5 (S-2), and the straight end in the negative lug of capacitor 6 (NS).

( ) Connect a 30 kΩ resistor from the negative lug of capacitor 5 (NS) to the negative lug of capacitor 6 (S-2).

( ) Place the bent end of a 1-5/8" bare wire in the negative lug of capacitor 7 (NS) and the straight end in the positive lead of capacitor 8 (NS).

( ) Place a 3/4" length of sleeving on one lead of a 30 kΩ resistor and connect this lead to the negative lug of capacitor 7 (S-2). Connect the other lead to the negative lug of capacitor 8 (S-2).

( ) Connect the blue wire from hole H of the circuit board to the positive lug of capacitor 7 (NS).

( ) Connect one lead of a 30 kΩ resistor to the positive lug of capacitor 7 (S-2). Connect the other lead to the positive lug of capacitor 8 (S-2).

( ) Connect one lead of a 30 kΩ resistor to the positive lug of capacitor 3 (NS). Connect the other lead to the positive lug of capacitor 4 (S-2).

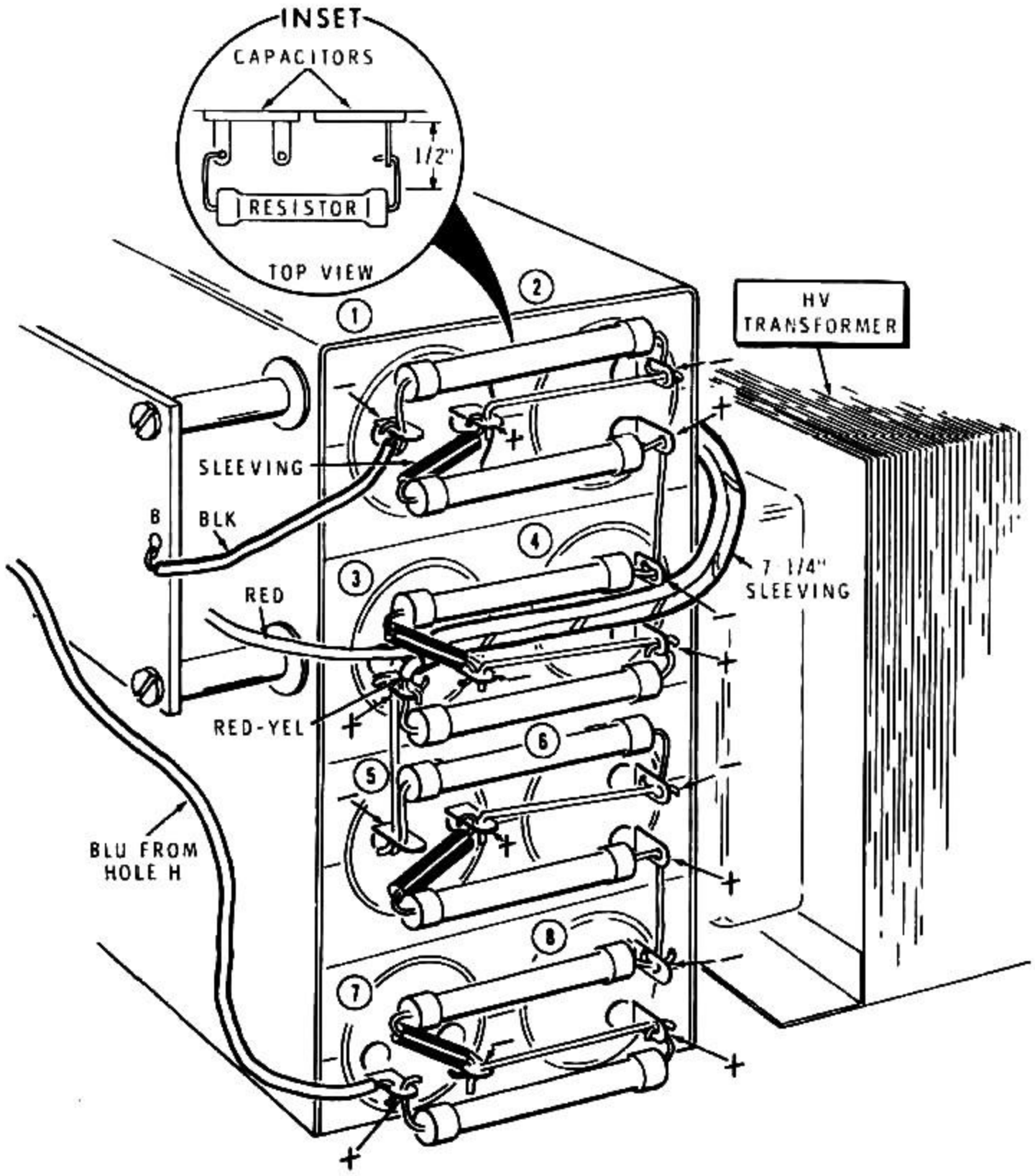
( ) Connect the bent end of the 1-3/8" length of bare wire to the positive lug of capacitor 3 (NS) and the straight end to the negative lug of capacitor 5 (S-2).

( ) Pass a 7-1/4" length of clear sleeving over the red and the red-yellow wires coming from the HV transformer. Slide the sleeving on the wires as far as it will go.

( ) Cut off the red-yellow wire 1/2" beyond the end of the sleeving. Remove 1/4" of insulation.

( ) Connect the red-yellow wire to the positive lug of capacitor 3 (S-3).

( ) Carefully compare your work in the foregoing steps to the Pictorial (and the Details) for wiring errors and for proper capacitor polarity. Incorrect connections in this high-voltage circuit area can cause serious damage.



PICTORIAL 4-7

Refer to Pictorial 4-8 for the following steps.

NOTE: In the following step, if solder on the bare end of the red wire prevents its entry into hole D, carefully cut off just enough of the soldered wire end to allow it to fit into the hole. Be careful not to cut the wire too short.

( ) Connect the red wire coming from the HV transformer to hole D on the circuit board (S-1). Reach in between the circuit board and the capacitor bracket to solder this connection. Make sure this connection is well soldered.

( ) Pass one lead of a .001 μF, 6 kV, capacitor through solder lug CF (S-2) to hole K in the circuit board (S-1). Connect the other lead of this capacitor to solder lug CK (NS).

Refer to the inset drawing of Pictorial 4-8 and Detail 4-8A for the next two steps.

( ) Connect the black cathode wire, coming from the solder lug of zener diode CW, to the foil side of the circuit board (S-1). Detail 4-8A shows the foil pattern.

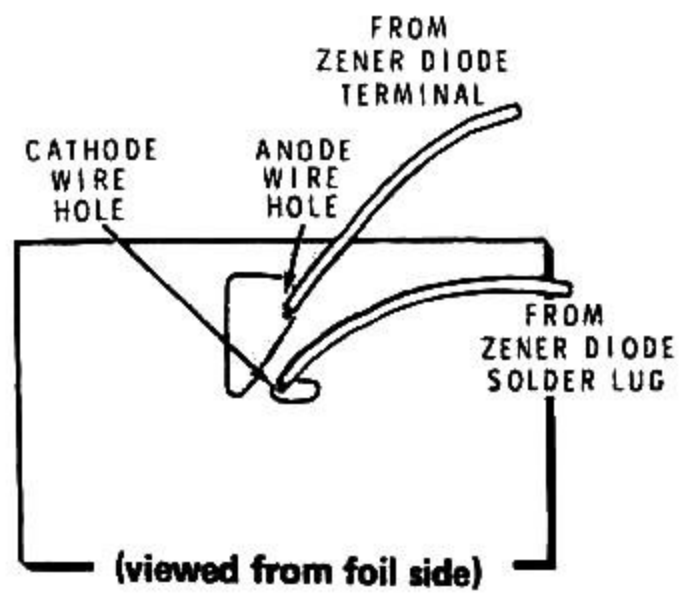
( ) Connect the other black wire, coming from the anode of zener diode CW, to the foil side of the circuit board (S-1). Refer to Detail 4-8A for the foil configuration.

Connect the wires coming from the component side of the circuit board as follows:

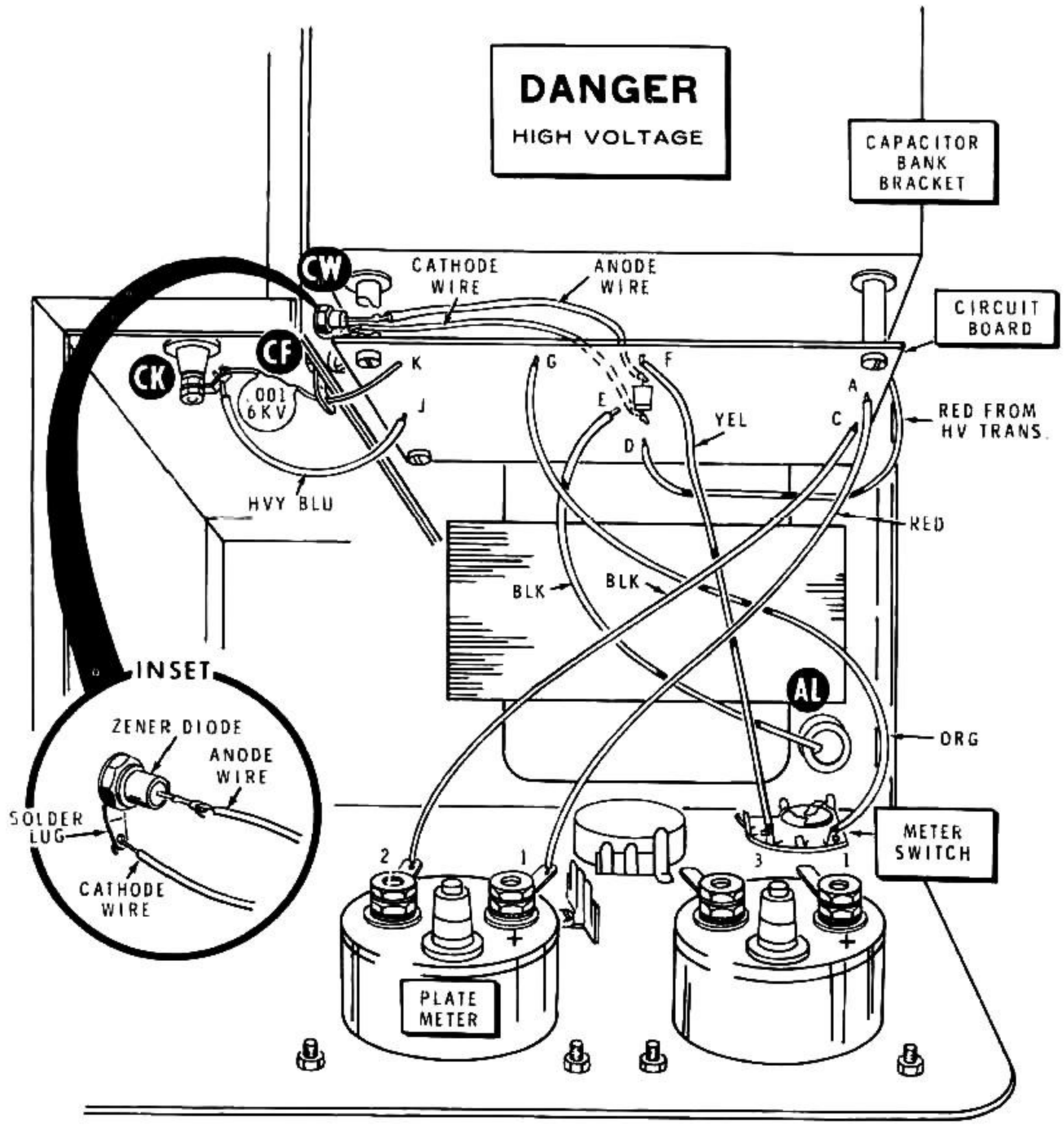
	Wire Color	From Hole	Connect to
( )	HVY Blue	J	Solder lug CK (S-2).
( )	Yellow	F	Lug 3 of meter switch (S-1).
( )	Orange	G	Lug 1 of meter switch (S-1).
( )	Black	C	Lug 2 of plate meter (S-2).
( )	Red	A	Lug 1 of plate meter (S-2).

( ) Insert the black stranded wire coming from hole E in the circuit board down through grommet AL.

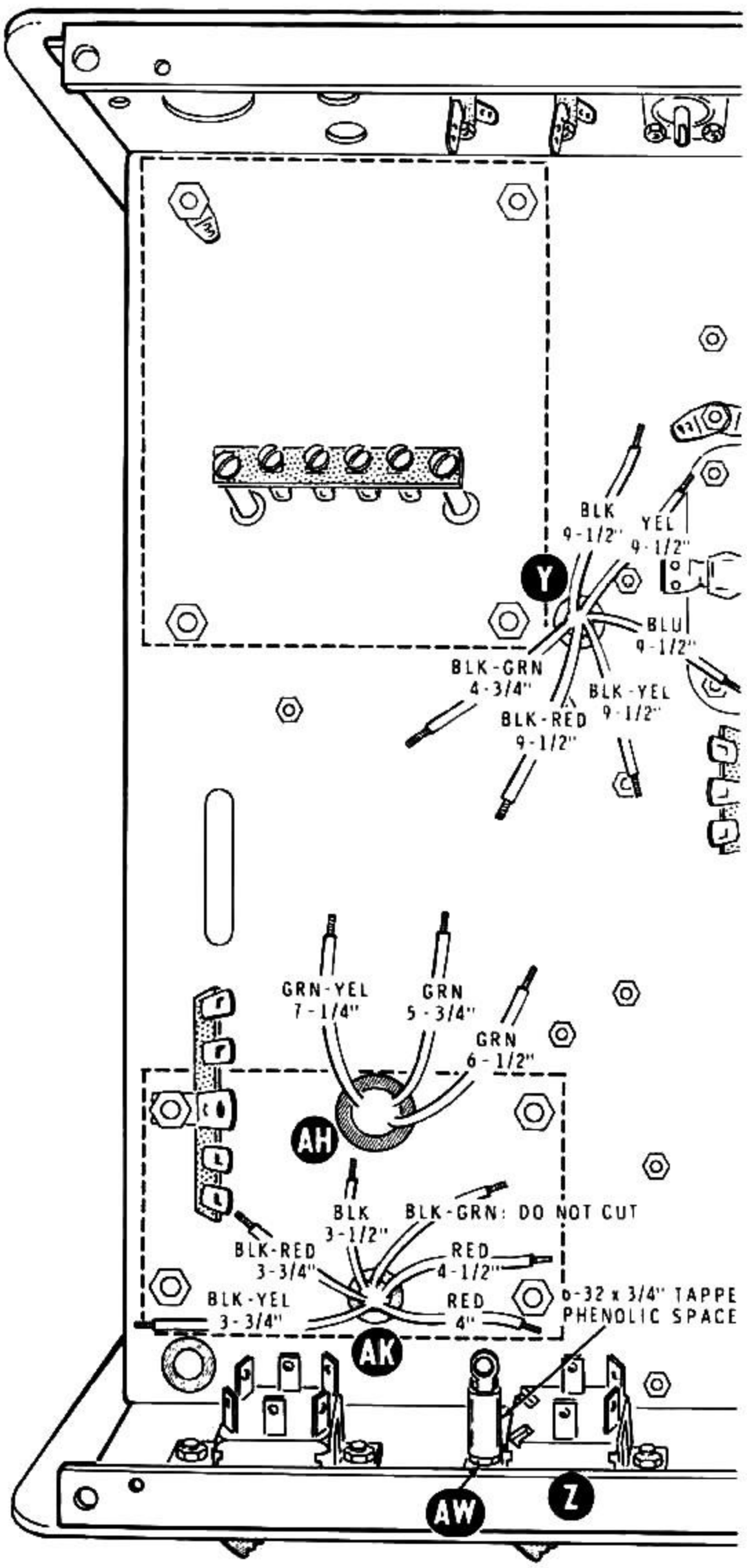
( ) Peel off the backing paper from the DANGER label and press it into place on the top of the capacitor bank bracket.



Detail 4-8A



PICTORIAL 4-8



PICTORIAL 4-9

UNDER-CHASSIS WIRING

Refer to Pictorial 4-9 and cut the transformer leads coming through the chassis at Y, AH and AK to the indicated lengths. Be sure you have selected the proper location before you cut. Measure the length of each lead from the chassis.

( ) At grommet Y, cut the transformer leads as follows:

Blue	9-1/2"
Yellow	9-1/2"
Black	9-1/2"
Black-red	9-1/2"
Black-Yellow	9-1/2"
Black-Green	4-3/4"

( ) At grommet AH, cut the transformer leads as follows:

Green	6-1/2"
Green-Yellow	7-1/4"
Green	5-3/4"

( ) At grommet AK, cut the transformer leads as follows:

One red	4-1/2"
Other red	4"
Black-Red	3-3/4"
Black-Yellow	3-3/4"
Black	3-1/2"
Black-Green	Do not cut

NOTE: When you remove insulation from transformer leads in the following steps, grasp the wires where they emerge from the chassis so no strain will be placed on the connections at the transformer end of the leads.

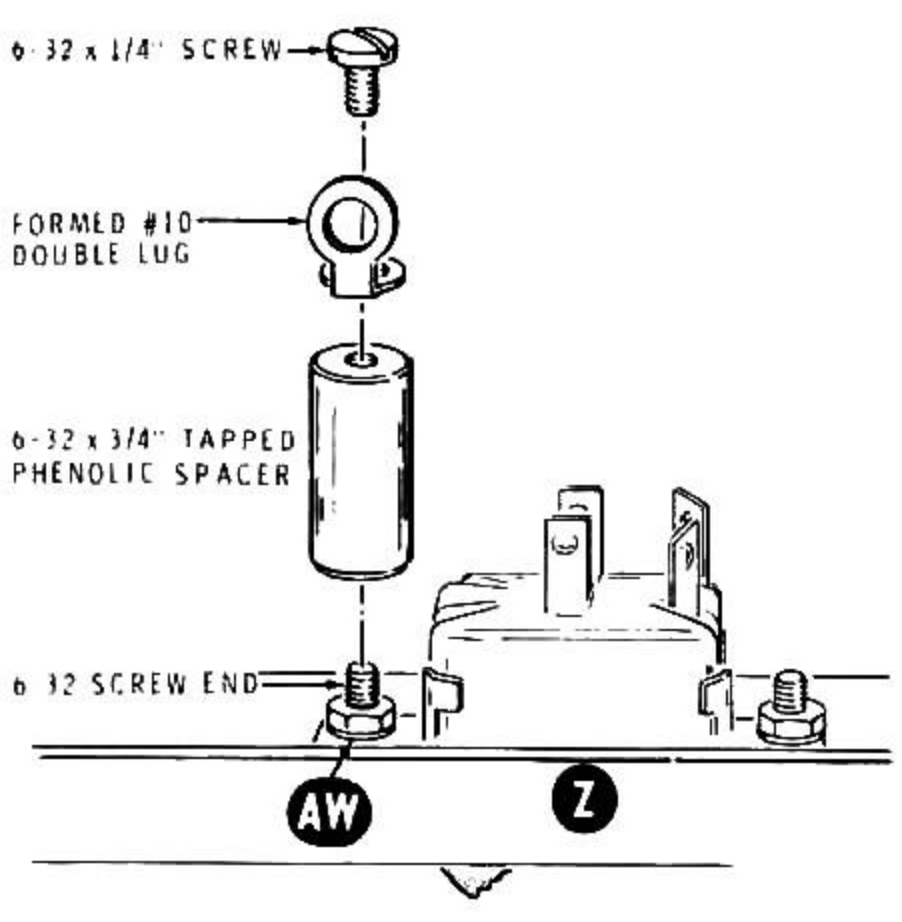
( ) Remove 1/4" of insulation from the cut ends of the two heavy green leads coming from AH. Melt a small amount of solder on the bared wire ends.

( ) Remove 1/4" of insulation from the end of each remaining transformer lead. Twist the fine wire strands together and melt a small amount of solder on each bared end.

Detail 4-9A

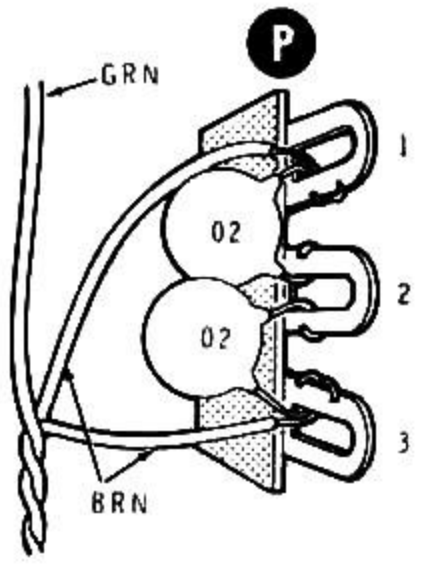
( ) Refer to Detail 4-9A and form a #10 double lug (#259-25) as shown.

( ) Refer to Detail 4-9B and screw a 6-32 x 3/4" tapped phenolic spacer onto screw AW. Then install the formed lug on the inner end of the phenolic spacer with a 6-32 x 1/4" screw. Position the lug as shown.



Detail 4-9B

NOTE: Before starting the wiring in the following steps, look ahead to the under-chassis photograph on Page 86. Observe how wires are routed down the center of the chassis and are then bound together by ties to form a cable. As an aid in forming a neat cable, you can mark the main wiring guide lines on the under side of the chassis with a magic marker or china marking pencil. Then follow these guide lines when routing the individual wires.



Detail 4-10A

Refer to Pictorial 4-10 (fold-out from Page 49) for the following steps.

( ) Route the twisted green and brown wires from grommet AL between grommet AH and grommet AK. Refer to Detail 4-10A and connect one of the brown wires to lug 1 (NS) and the other brown wire to lug 3 (NS) of terminal strip P.

( ) Connect a .02 μF disc capacitor from lug 1 (NS) to lug 2 (NS) of terminal strip P.

( ) Connect a .02 μF disc capacitor from lug 3 (NS) to lug 2 (S-2) of terminal strip P.

( ) Connect the green wire from grommet AL to lug 1 of terminal strip B (NS).

Connect the transformer leads from grommet AK as follows:

	Lead	Connect to
( )	4-1/2" Red	Terminal strip BT, lug 3 (NS).
( )	4" Red	Terminal strip BT, lug 4 (NS).
( )	Black-green	Terminal strip AE, lug 3 (NS).

Connect the following transformer leads coming from grommet Y to switch AN:

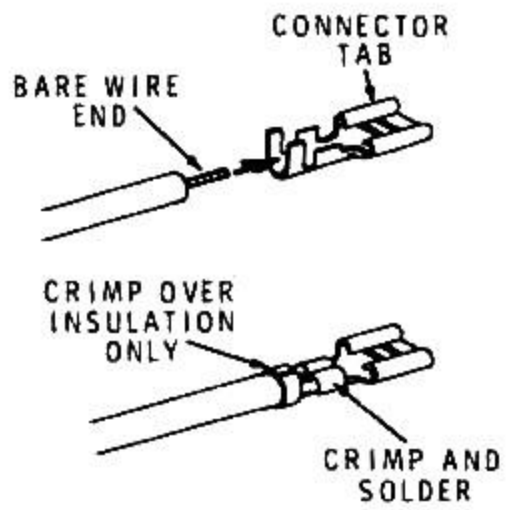
Lead	Lug of Switch AN
( ) Black-yellow	1 (S-1).
( ) Yellow	5 (S-1).
( ) Blue	6 (S-1).
( ) Black-red	2 (S-1).

( ) Connect a 2" black hookup wire from lug 3 (S-2) to lug 1 (NS) of terminal strip BT.

( ) Connect the yellow hookup wire from grommet T to lug 1 of phono socket U (NS).

( ) Connect the orange wire from grommet T to lug 2 of terminal strip BT (NS).

( ) Prepare a 4-1/4" length of large black stranded wire.



Detail 4-10B

Refer to Detail 4-10B for the next two steps.

( ) Locate the large connector tabs (#432-137). If these tabs are connected to one another, cut the strip of tabs into six individual tabs as shown.

( ) Install one of these large connector tabs (#432-137) on one end of the 4-1/4" wire (S-1).

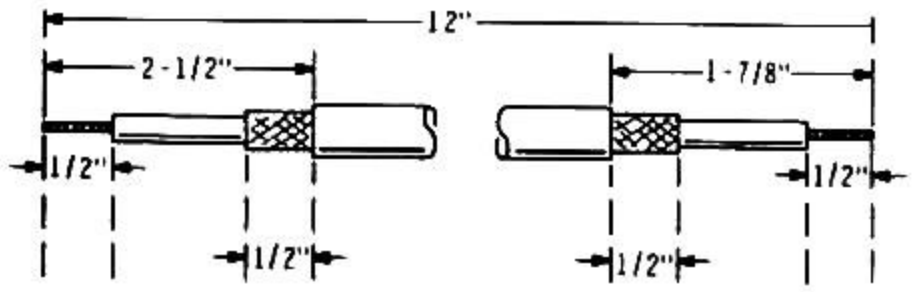
Refer to the Pictorial for the following steps.

( ) Push the connector tab from the preceding step onto lug 3 of switch Z. Connect the other end of this wire to double lug AW (NS).

( ) Connect the black lead from grommet AK to double lug AW (NS).

( ) Connect the black lead from grommet Y to double lug AW (NS).

( ) Connect the center conductor of the coaxial cable coming from lug 7 of switch CZ to lug 1 (NS) and the shield wires to lug 2 (S-1) of terminal strip AG.



Detail 4-10D

( ) Refer to Detail 4-10D and prepare a 12" length of RG-8/U coaxial cable. Tin the exposed braid at each end, being careful not to melt the inner insulation.

( ) Loosen the cable clamp at G, place the shield braid at the 2-1/2" end under the clamp, and connect the center conductor to lug 8 of relay F (S-1).

( ) Similarly, place the shield braid at the other end of the cable under cable clamp B and connect the center conductor to coaxial fitting A (S-1).

( ) Tighten both cable clamps and solder the shield braid at each end of its cable clamp. Be careful not to melt the inner insulation.

Refer to Pictorial 4-11 for the following steps.

( ) Prepare the following lengths of large black stranded wire:

4-1/2"

13-1/2"

13-1/2"

( ) Install a large connector tab (#432-137) on one end of each of the three wires.

( ) Push the tab on the 4-1/2" wire onto lug 4 of switch AN.

( ) Push the connector tab on one of the 13-1/2" wires onto lug 1 of switch Z, and the connector tab on the other 13-1/2" wire onto lug 2.

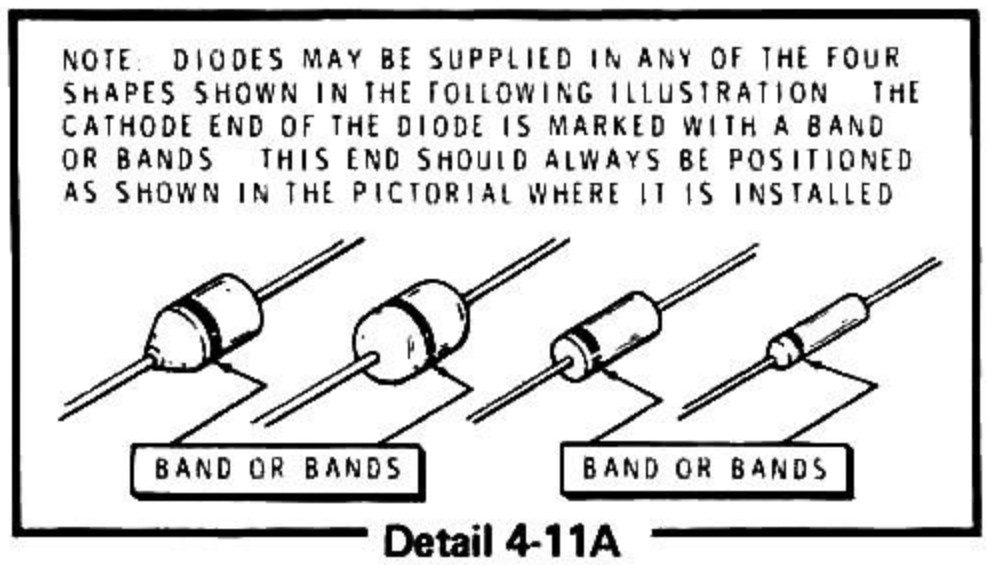
( ) Prepare a 12-1/2" length of large black stranded wire.

( ) Connect the free end of the black-yellow wire coming from grommet AK and one end of the 12-1/2" wire in the preceding step to one large tab connector (S-2). Then push this connector tab onto lug 3 of switch AN.

( ) Connect the free end of the black-red lead coming from grommet AK and the free end of the black wire coming from lug 4 of switch AN to one large tab connector (S-2). Push this tab onto lug 4 of switch Z.

The free ends of the "tabbed" wires in the preceding steps will be connected later.

( ) Refer to Detail 4-11A and connect the cathode lead of a silicon diode (#57-27) to lug 5 (NS) and the anode lead to lug 4 (S-2) of terminal strip BT.



Detail 4-11A

( ) Connect a 33 kΩ (orange-orange-orange) resistor from lug 1 (NS) to lug 2 (NS) of terminal strip BT.

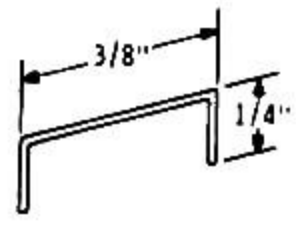
( ) Connect a 22 kΩ (red-red-orange) resistor from lug 2 (S-3) to lug 5 (NS) of terminal strip BT.

( ) Connect the positive lead (marked +) of a 20 μF electrolytic capacitor to lug 5 (NS) and the other lead to lug 1 (S-3) of terminal strip BT.

( ) Connect the black stranded wire coming from grommet AL to lug 6 of relay F (S-1).

( ) Connect a 2" red hookup wire from lug 3 (NS) to lug 11 (S-1) of the relay.

( ) Connect a 9-1/2" length of red hookup wire from lug 5 of terminal strip BT (S-4) to lug 3 of the relay (NS).

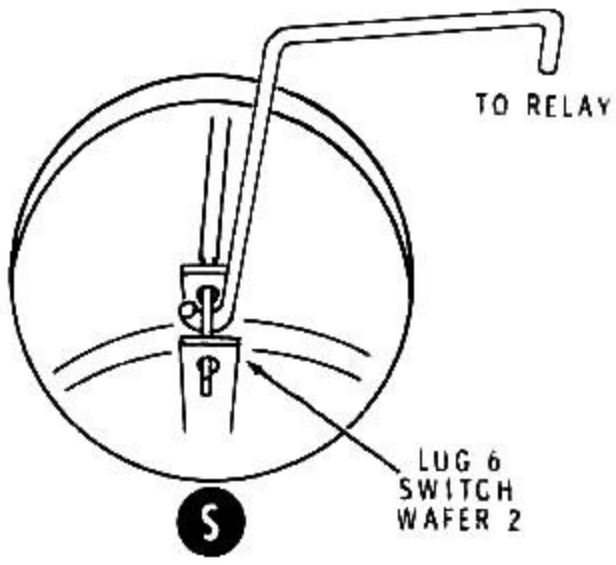


Detail 4-11B

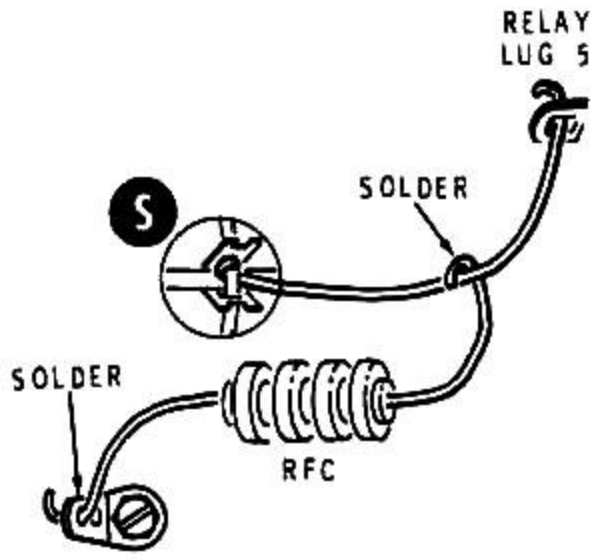
( ) Refer to Detail 4-11B and form a 7/8" length of bare wire as shown.

( ) Connect the bare wire from lug 1 (S-1) to lug 2 (S-1) of relay F.

( ) Connect the black-green transformer lead from grommet Y to lug 3 of terminal strip AE (S-2).



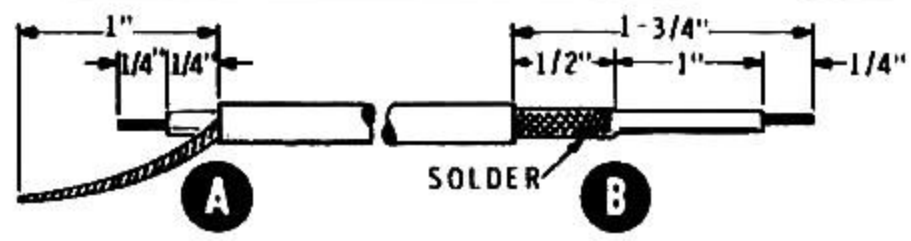
Detail 4-12B



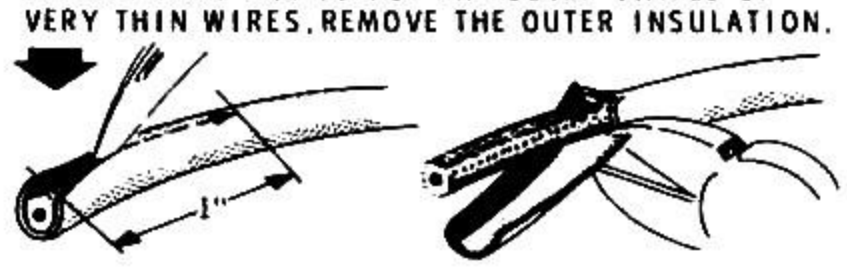
Detail 4-12C

( ) Refer to Detail 4-12B and connect the hook on the end of the formed wire through hole S to lug 6 of wafer 2 of switch CZ (S-4). Connect the other end of this wire to lug 5 of relay F (S-1) as shown in the Pictorial.

( ) Refer to Detail 4-12C and connect one lead of a 1 MH RF choke to solder lug CH (S-1). Wind the other lead around the bare wire coming from relay lug 5 (S-1). Position the choke parallel to the chassis with a clearance of approximately 1/2".

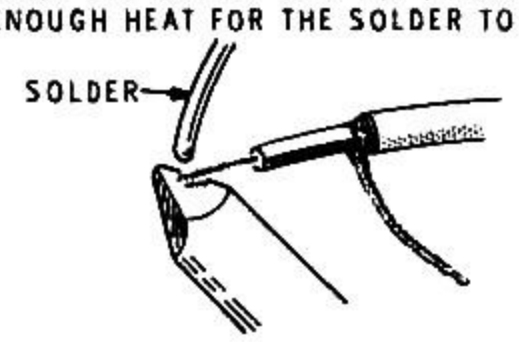


TAKING CARE NOT TO CUT THE OUTER SHIELD OF VERY THIN WIRES, REMOVE THE OUTER INSULATION.



PUSH BACK THE SHIELD. THEN MAKE AN OPENING IN THE SHIELD AND BEND OVER AS SHOWN. PICK OUT THE INNER LEAD.

REMOVE THE INNER INSULATION AND STRETCH OUT THE SHIELD. APPLY A SMALL AMOUNT OF SOLDER TO THE END OF THE SHIELD AND THE INNER LEAD. USE ONLY ENOUGH HEAT FOR THE SOLDER TO FLOW.



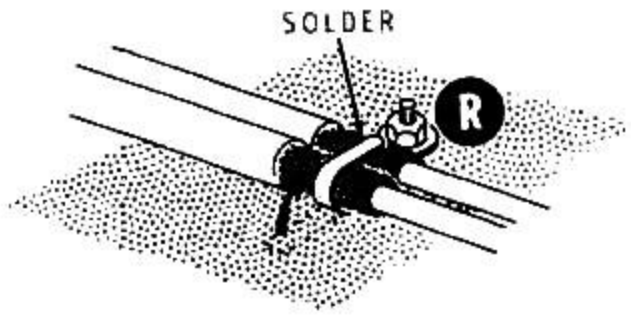
Detail 4-12D

( ) Refer to Detail 4-12D and prepare an 11-1/2" length of RG-58A/U coaxial cable. Note that 1" of outer insulation is first removed from end A, and that the center conductor and inner insulation are then cut back as shown.

( ) Tin the shield braid on end B. Use a minimum amount of heat and avoid melting the inner insulation.

( ) Connect the coaxial cable center conductor at end B to lug 7 of relay F (S-1).

( ) Connect the center conductor of the remaining coaxial cable coming from grommet T to lug 4 of relay F (S-1). Be sure this lead does not touch any other lug of the relay.



Detail 4-12E

( ) Refer to Detail 4-12E and position the exposed shields of the coaxial cables connected in the two preceding steps, over the long solder lug at R. Bend the solder lug back over both shield braids and solder. Use a minimum, but adequate, amount of heat.

( ) Connect the center conductor at the free end of the coaxial cable to the center conductor of the coaxial fitting at L (S-1). Connect the shield wires to lug 2 of phono socket U (S-1).

( ) Cut each lead of a 100 kΩ resistor (brown-black-yellow) to 1/2".

( ) Connect the 100 kΩ resistor from lug 9 (S-2) to lug 3 (S-3) of relay F as shown in inset drawing 2 of the Pictorial.

Refer to Pictorial 4-13 (fold-out from Page 50) for the following steps.

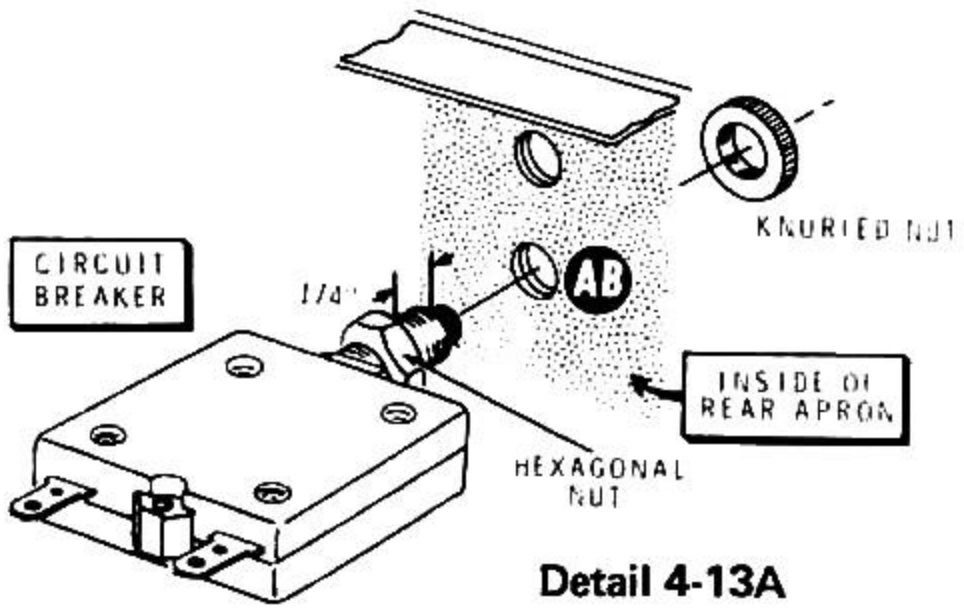
Refer to Detail 4-13A for the following three steps.

( ) Remove a knurled nut from each of the two circuit breakers (#65-28).

( ) Position the face of each hexagonal nut 1/4" from the end of the mounting bushing.

( ) Mount a circuit breaker on the chassis rear apron at AB. Use the knurled nut provided. NOTE: For convenience in wiring, position the solder lugs to provide the maximum distance between the chassis and the lugs.

( ) Similarly, mount the other circuit breaker at AA.



Detail 4-13A

NOTE: In the following steps, you will connect the fan motor. Be careful not to tear the motor leads out of their plastic frame.

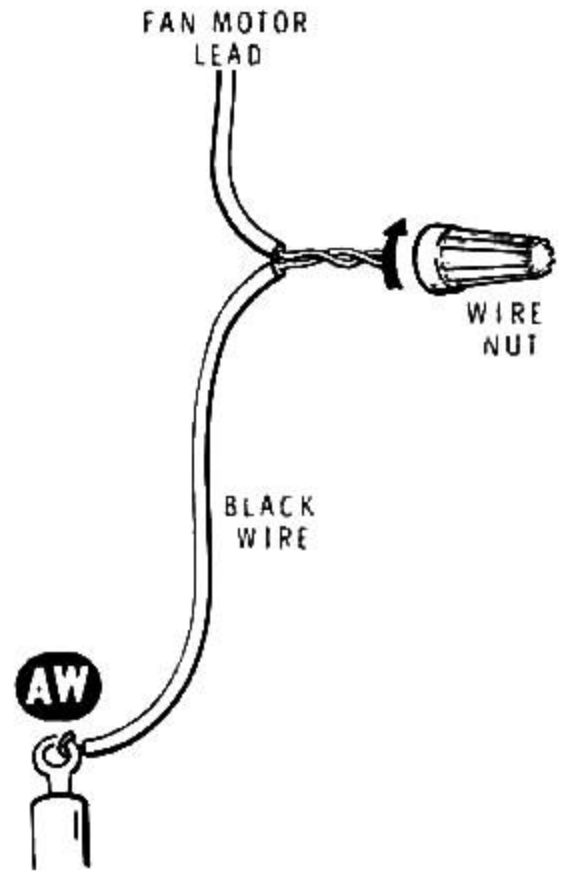
( ) Route one of the fan motor leads to terminal strip AE as shown. Cut off the excess lead lengths.

( ) Connect the prepared lead to lug 2 of terminal strip AE (NS).

( ) Remove 1/4" of insulation from the end of the other fan motor lead.

( ) Locate the remaining small black stranded wire, and remove 1/4" of insulation from one end.

( ) Twist together (clockwise) the bare end of the black wire and the bare end of the fan motor lead. Then twist the wire nut clockwise onto the wire ends until it is tight. Make sure there are no bare wires exposed around the wire nut.



( ) Route the black wire to lug AW (refer to Pictorial 4-13) then cut the wire to the proper length. Remove 1/4" of insulation from the end of the wire, and connect it to double lug AW (S-4).

Connect the wires from switches AN and Z as follows:

Wire Coming from	Connect to
Lug 3, switch AN	Lug 2, terminal strip AE (S-2).
Lug 1, switch Z	Lug 1, circuit breaker AB (S-1).
Lug 2, switch Z	Lug 1, circuit breaker AA (S-1).

( ) Prepare a 3" and 3-1/2" large black stranded wire by cutting to length and removing 1/4" of insulation from each end of each wire.

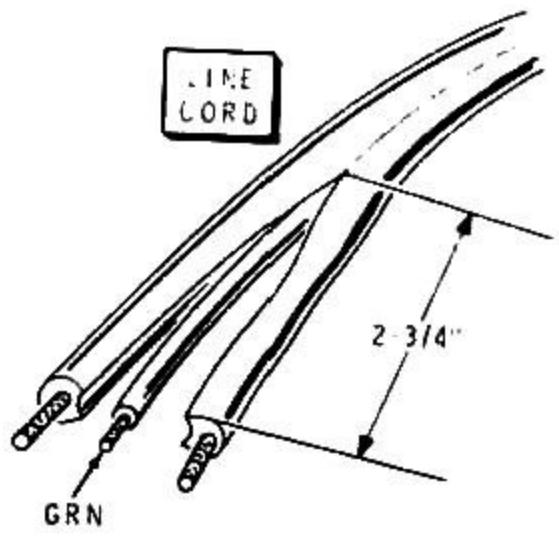
( ) Connect one end of the 3" wire to lug 4 of terminal strip AE (S-1). Connect the other end of this wire to lug 2 of circuit breaker AB (NS). Use the hole next to the circuit breaker body.

( ) Similarly, connect the 3-1/2" wire from lug 1 of terminal strip AE (S-1) to lug 2 of circuit breaker AA (NS).

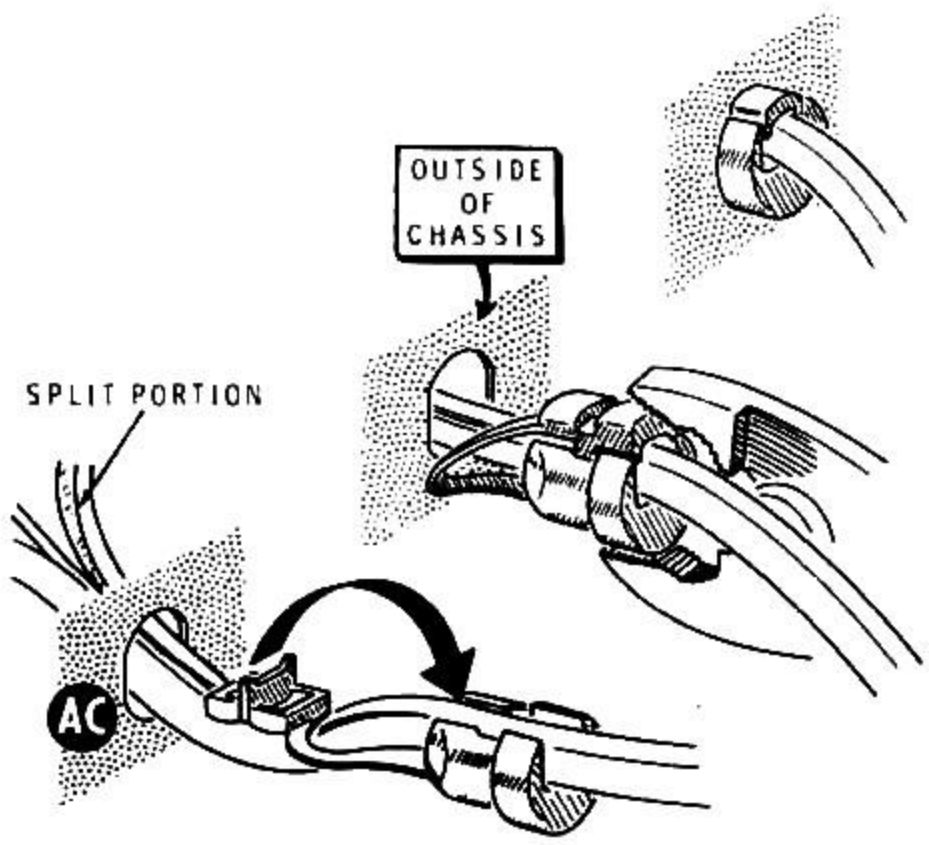
( ) Connect a .01 μF, 1.4 kV, disc capacitor from solder lug AD (NS) to lug 2 of circuit breaker AB (NS).

( ) Connect a .01 μF, 1.4 kV, disc capacitor from solder lug AD (NS) to lug 2 of circuit breaker AA (NS).

( ) Refer to Detail 4-13B and prepare the end of the line cord as shown. Remove 3/8" of insulation from the end of each of the three conductors. Melt a small amount of solder on the end of each.



Detail 4-13B



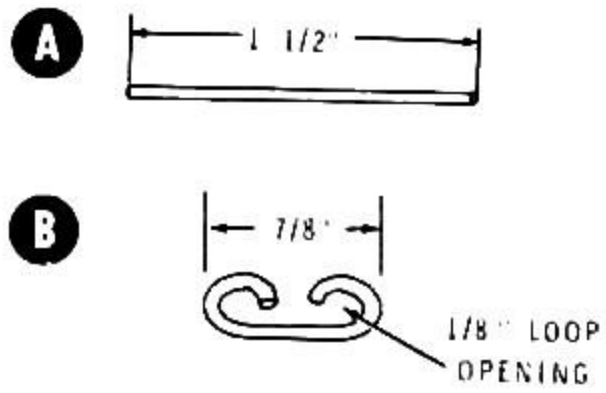
Detail 4-13C

( ) Refer to Detail 4-13C and place the strain relief on the line cord just beyond the split portion of the cord, as shown. Use a pair of gas pliers to compress the strain relief, and then insert it into hole AC from the outside of the chassis.

( ) Connect the green line cord wire to solder lug AD (S-3).

( ) Connect one line cord conductor to lug 2 of circuit breaker AB (S-3).

( ) Connect the other line cord conductor to lug 2 of circuit breaker AA (S-3).



Detail 4-13D

Refer to Detail 4-13D for the following steps.

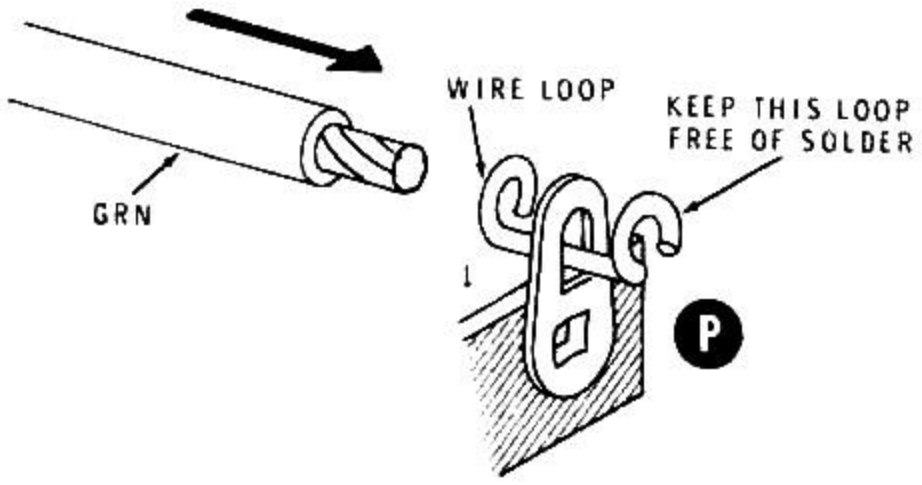
( ) Part A. Cut a 1-1/2" length of bare wire.

( ) Part B. On each end of the bare wire, form a loop having an inside diameter of approximately 1/8". Adjust the size of the loops so they will just slide onto the tinned end of one of the large green transformer leads from hole AH.

( ) Part C. Bend the two wire loops up as shown.

( ) Part D. Pass the formed wire through lug 1 of terminal strip P.

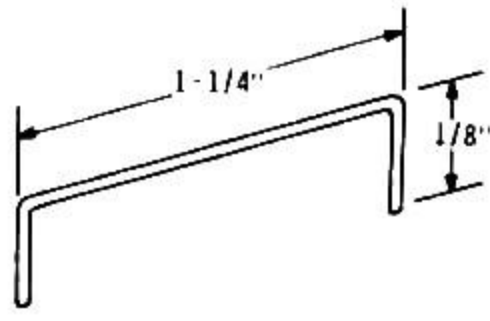
( ) Form another bare wire in the same manner, except pass this wire through lug 3 of terminal strip P.



Detail 4-13E

( ) Refer to Detail 4-13E and position the wire loops at lug 1 of the terminal strip so they point up away from the chassis. Then insert the end of the 6-1/2" green lead from hole AH all the way into the wire loop. Be careful to keep the two wire loops equally distant from the terminal strip solder lug. Then use pliers to compress the wire loop on the green wire. Solder the green lead to the wire loop and the wire loop to the solder lug, but be sure to keep the other wire loop free of solder. Also solder the lead from the .02 μF disc capacitor and the brown wire to lug 1 at this time.

( ) Repeat the preceding step at lug 3 of terminal strip P for the 5-3/4" green lead.



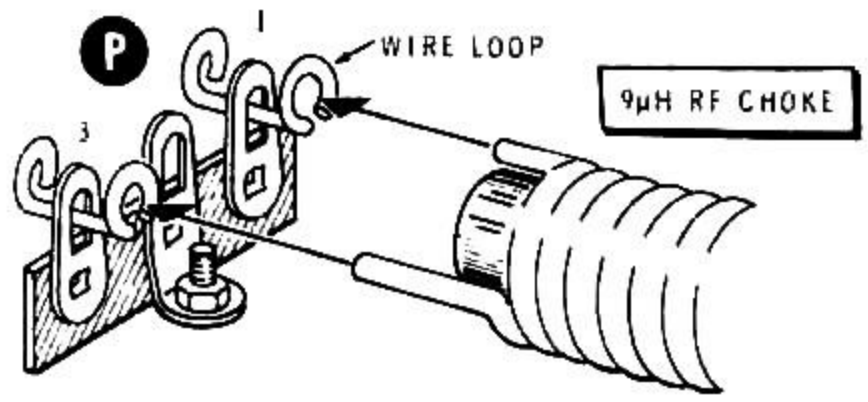
Detail 4-13F

( ) Refer to Detail 4-13F and form two 1-1/2" lengths of bare wire. Then, fit one wire from lug 1 of tube socket D (S-1) to lug 5 of tube socket N (NS).

( ) Fit the other 1-1/2" wire from lug 5 of tube socket D (S-1) to lug 1 of tube socket N (NS).

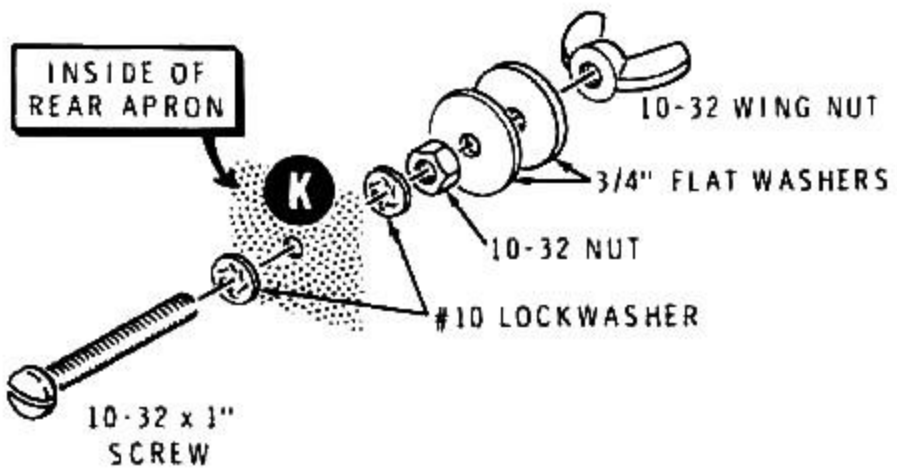
( ) Connect a .02 μF disc capacitor from lug 5 (S-2) to lug 1 (NS) of tube socket N.

( ) Connect a .01 μF, 1.4 kV, disc capacitor from lug 1 of tube socket N (S-3) to lug 1 of terminal strip AG (S-2).



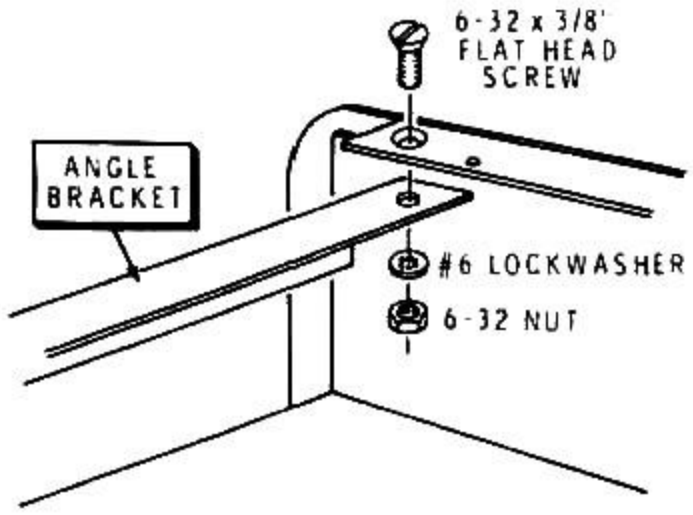
Detail 4-13G

( ) Refer to Detail 4-13G and fit the 9 μH RF choke (#45-78) so the two short leads at one end fit into the two wire loops on terminal strip P. At the other end of the choke, form the two leads so they loop around the bare wire filament leads between the two tubes as shown. Make sure the RF choke leads clear the chassis by at least 1/8". Solder the four RF choke leads carefully as these leads carry heavy current.



Detail 4-13H

( ) Refer to Detail 4-13H and install the ground post at K on the chassis rear apron. Use a 10-32 x 1" screw, two #10 lockwashers, a 10-32 nut, two 3/4" flat washers, and a 10-32 wing nut.

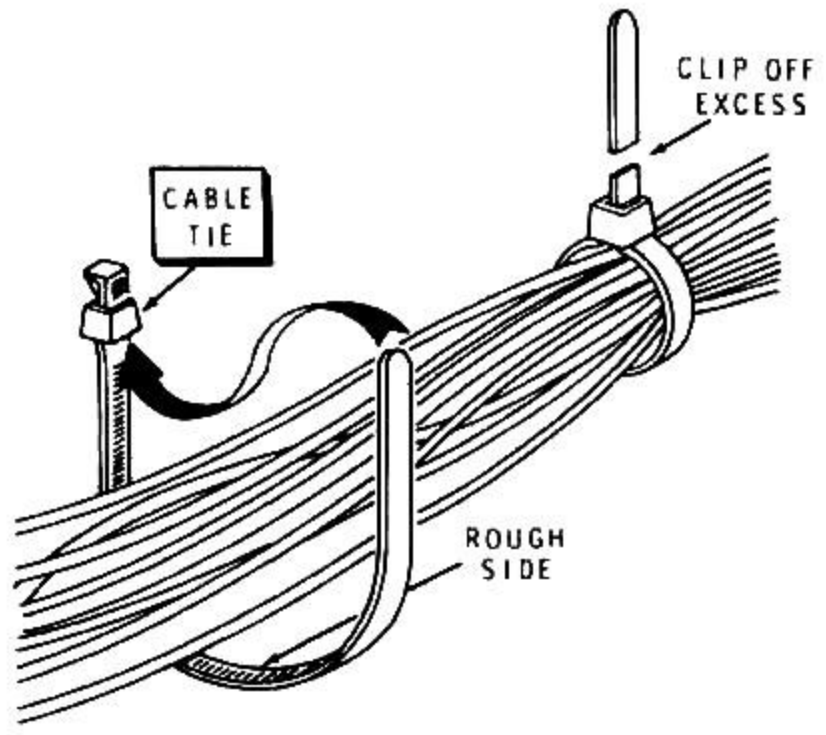


Detail 4-14A

Refer to Pictorial 4-14 for the following steps.

( ) Refer to Detail 4-14A and install an angle bracket (#204-1041) on the chassis at AS and AT. Use 6-32 x 3/8" flat head hardware.

( ) Similarly, install the other angle bracket between AP and AR.



Detail 4-14B

( ) Refer to Detail 4-14B and pass a cable tie (#354-5) around all of the wires at each of the six points shown in the Pictorial to form a neat cable. Equalize any slack in each wire between the ends of the wire. Then pull each cable tie snug and clip off the excess length of the tie.

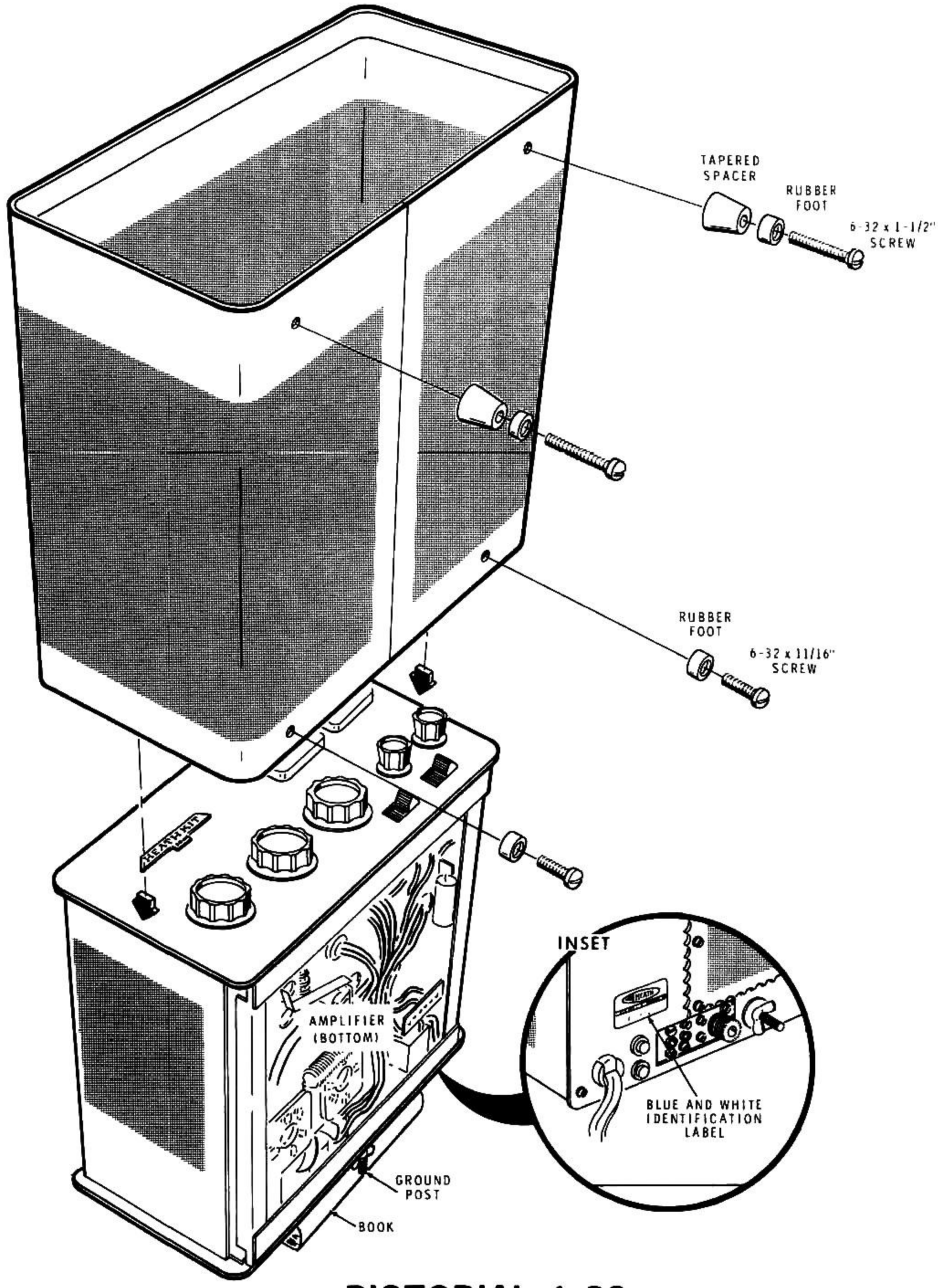
120-240 VOLT WIRING

This amplifier can be operated from 120 or 240 volts, 50/60 Hertz, alternating current.

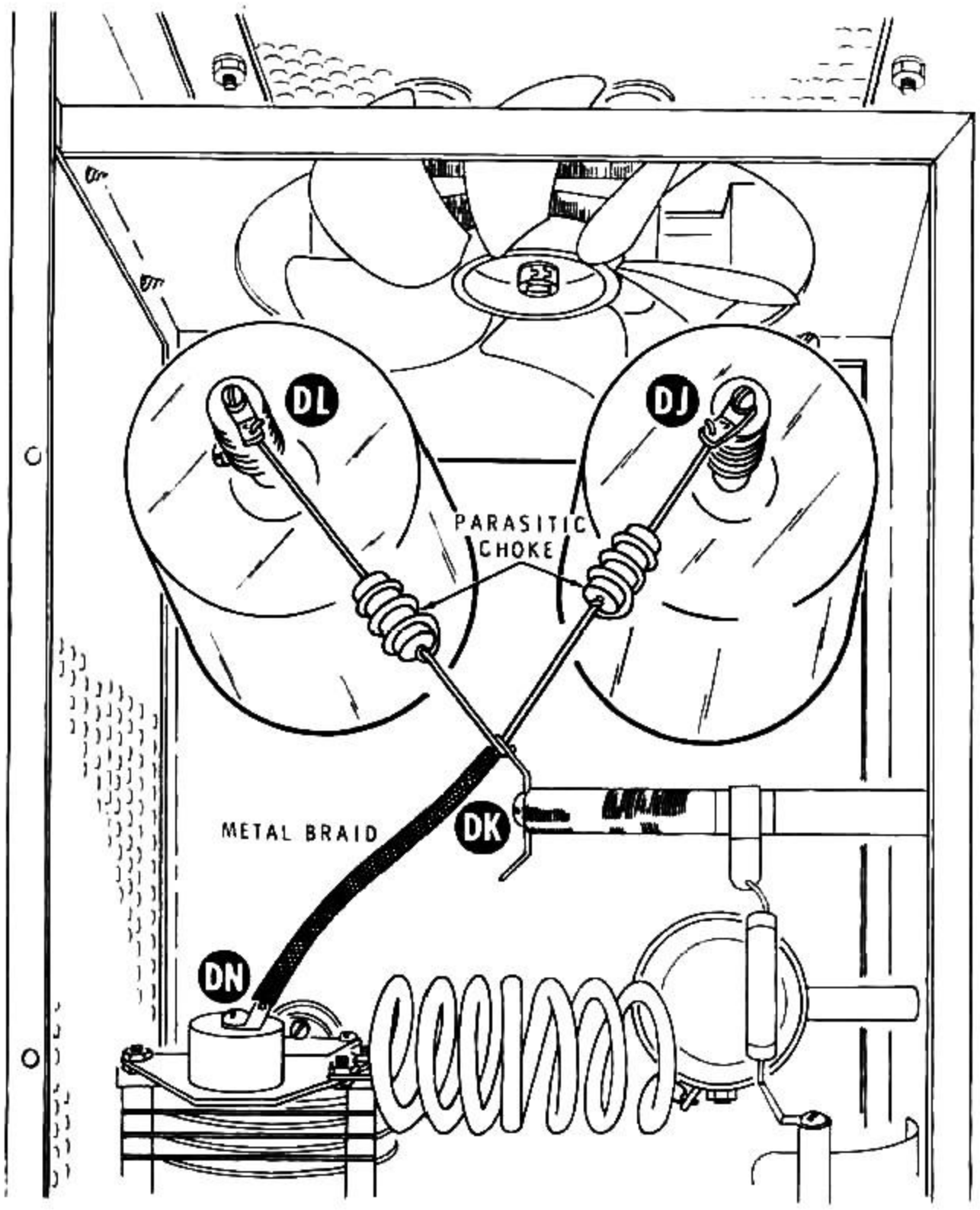
Make the proper connections on terminal strip AE for the supply voltage you will use. Refer to the inset drawing of Pictorial 4-14 and perform one of the following steps, depending on the line voltage to be used.

( ) For 120 VAC operation, connect a bare wire between terminals 1 and 2 and another bare wire between terminals 3 and 4 of terminal strip AE.

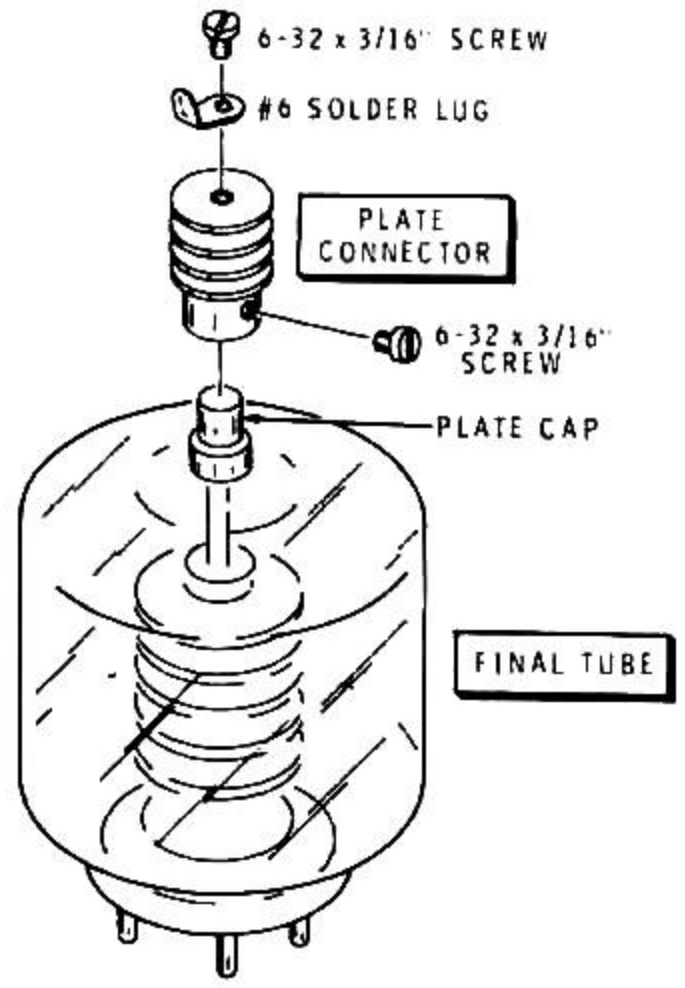
( ) For 240 VAC operation, connect a bare wire between terminals 2 and 3 of terminal strip AE.



PICTORIAL 4-20



PICTORIAL 4-15



Detail 4-15A

FINAL TOP-CHASSIS WIRING

Refer to Pictorial 4-15 for the following steps.

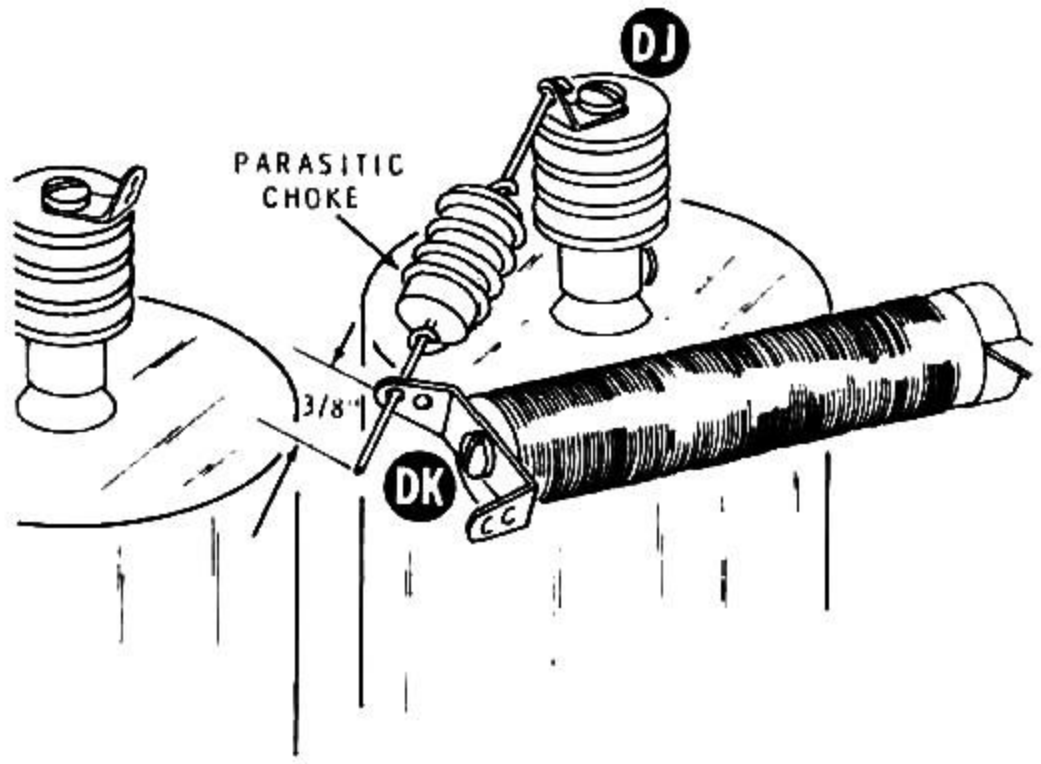
Refer to Detail 4-15A for the following three steps.

( ) Install a #6 solder lug on the top end of each plate connector (#260-12). Use a 6-32 x 3/16" screw, but leave it loose.

( ) Start a 6-32 x 3/16" screw into the side of each plate connector.

( ) Place each plate connector on the plate cap of a final tube (3-500Z) and tighten the screw on the side of each connector.

( ) Place a final tube in each tube socket. CAUTION: Use extreme care when you install a final tube (3-500Z). Without rocking, gently push the tube into its socket. Too much pressure or lateral force (from rocking) may crack the glass beads around the socket pins, and damage the tube. Heath Company cannot be held responsible for any damage sustained through improper installation.



Detail 4-15B

NOTE: When you install parasitic chokes in the following steps, center the chokes between the solder lugs.

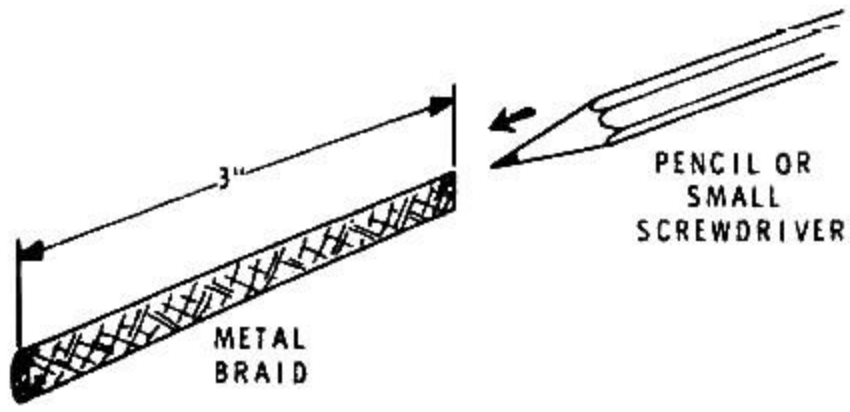
( ) Cut each lead of the two parasitic chokes (#45-53) to a length of 7/8".

( ) Refer to Detail 4-15B and install a parasitic choke from solder lug DJ (S-1) to solder lug DK (NS). Note that the lead of the parasitic choke extends through solder lug DK for approximately 3/8". Leave this lead straight as shown in the Detail.

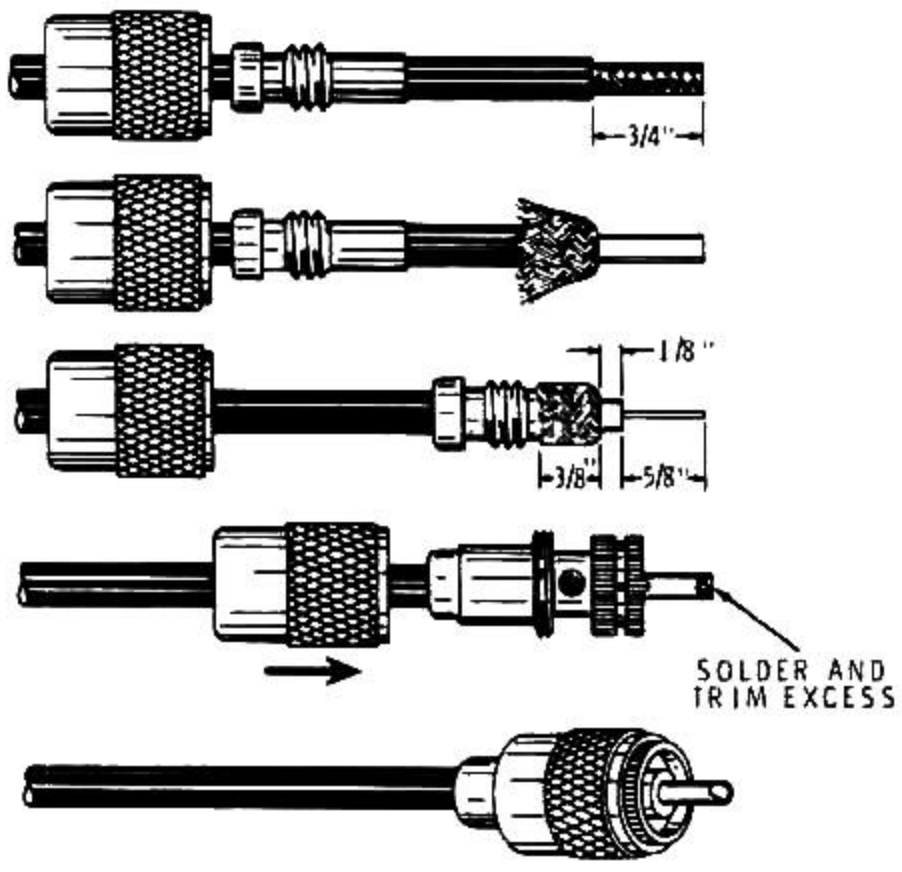
( ) Install the other parasitic choke from solder lug DL (S-1) to solder lug DK (NS).

( ) Tighten the screws in the tops of the two plate connectors.

( ) Refer to Detail 4-15C and open up the ends of a 3" length of metal braid with a pencil. (Note that the metal braid is actually flattened tubular braid.) Push one end onto the 3/8" projecting end of the parasitic choke at DK (S-3). Push the other end over the solder lug on the capacitor at DN (S-1).



Detail 4-15C



PICTORIAL 4-16

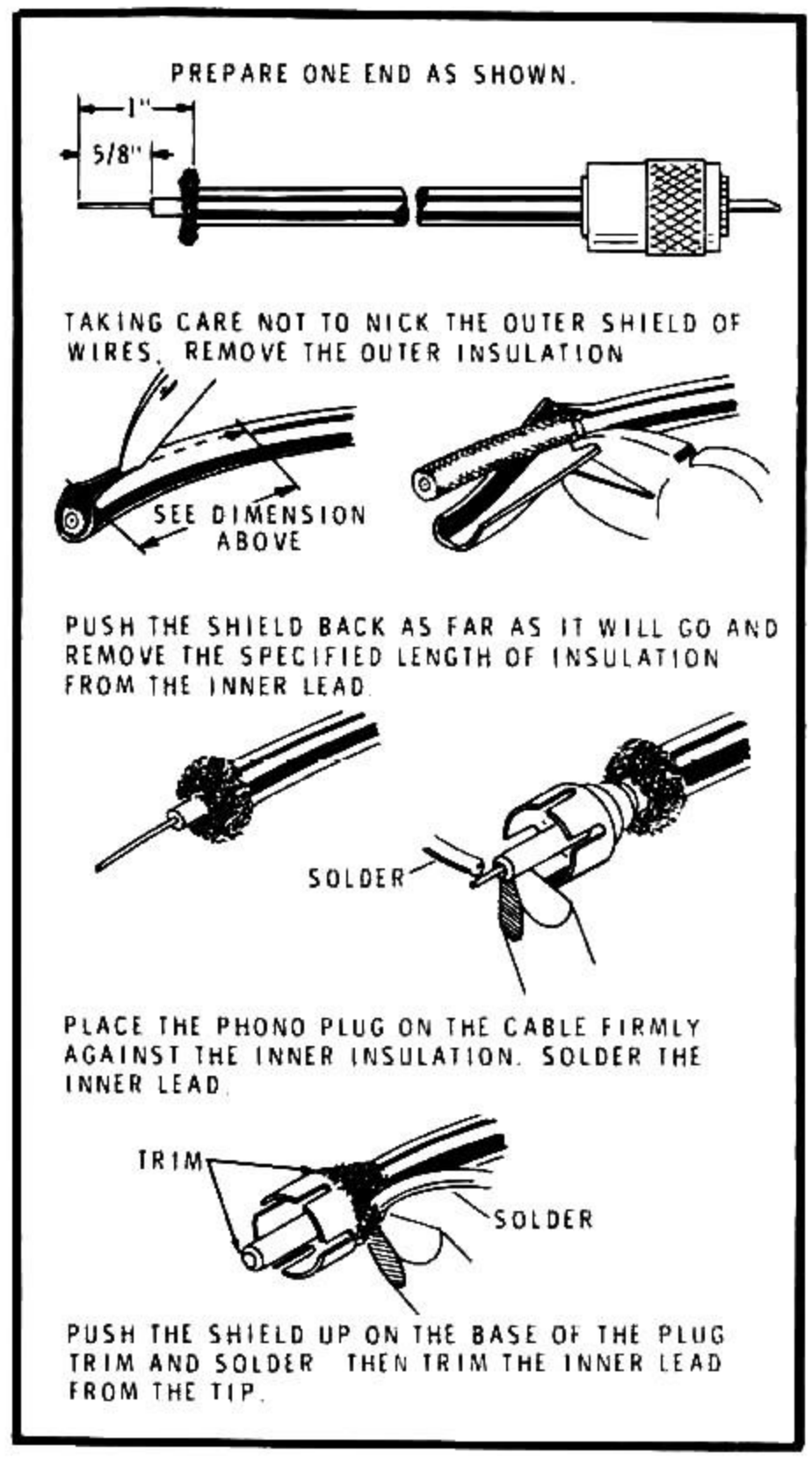
CABLE PREPARATION

( ) Cut a length of RG-58A/U coaxial cable which will conveniently reach from the output of your exciter to the RF Input connector on the rear panel of the Amplifier (4' maximum recommended).

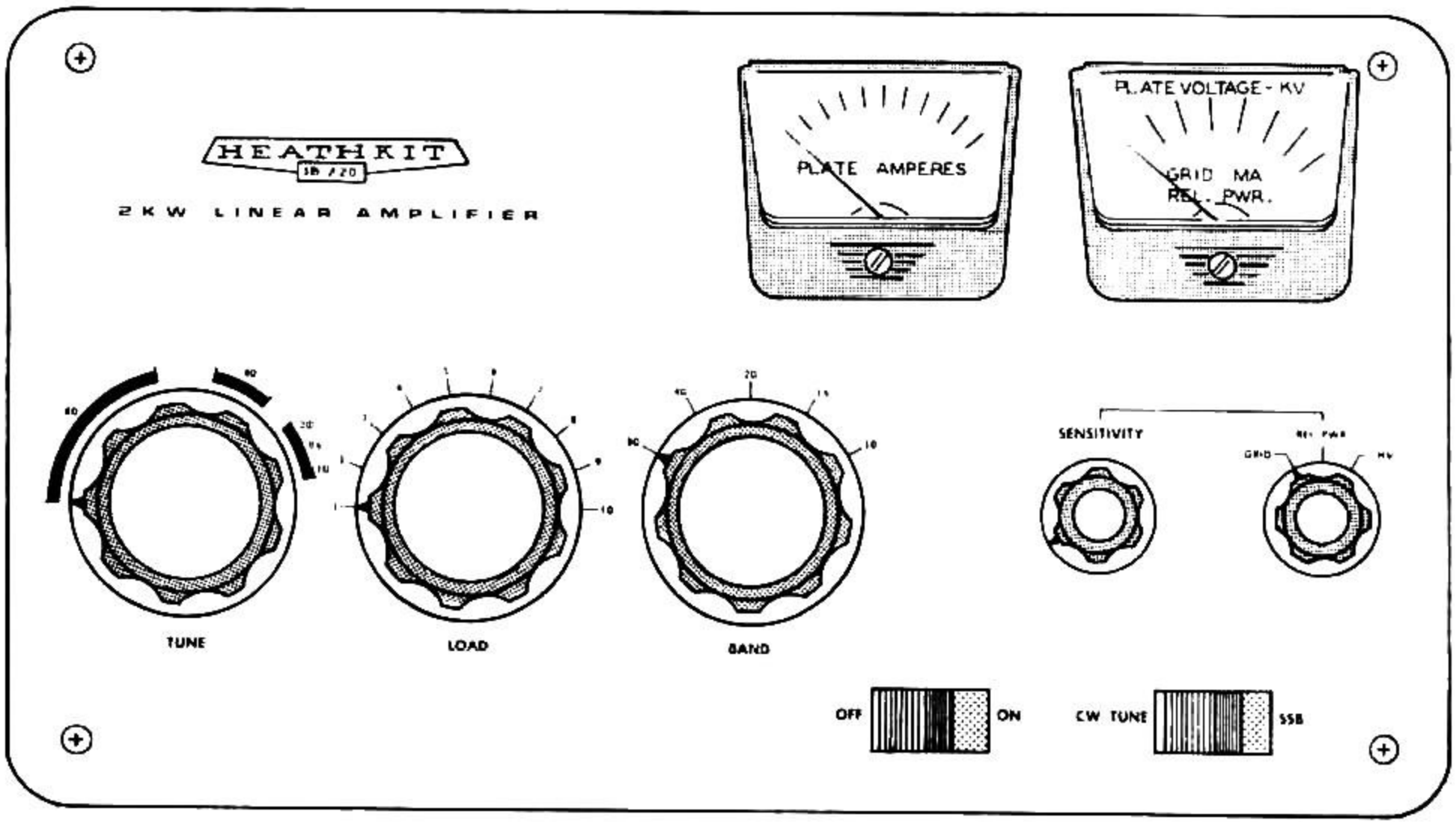
( ) Refer to Pictorial 4-16 and install a coaxial plug (#438-9) and a coaxial plug insert (#438-12) on one end of the coaxial cable.

( ) On the other end of the coaxial cable, install a connector (not furnished) which will mate with the output connector of your exciter. Refer to Pictorial 4-16 or Pictorial 4-17, as appropriate.

Lay the cable aside for use later.



PICTORIAL 4-17



PICTORIAL 4-18

KNOB INSTALLATION

Refer to Pictorial 4-18 for the following steps.

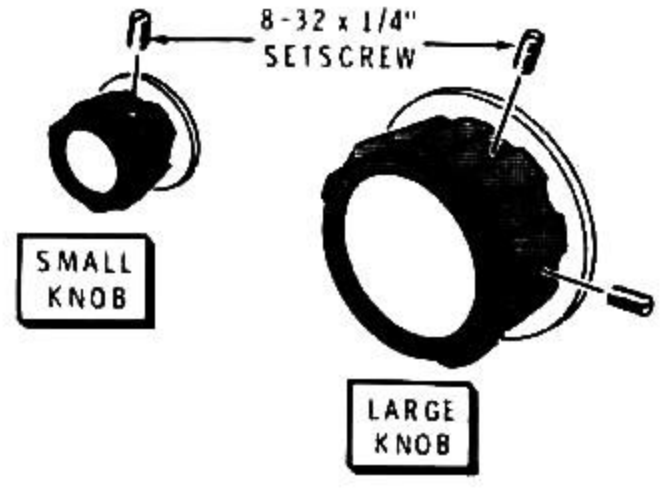
( ) Refer to Detail 4-18A and start two 8-32 x 1/4" setscrews into each of the three large knobs. Start a single setscrew into each of the two small knobs.

( ) Turn the shafts of the Tune and Load capacitors so the plates of each are fully meshed.

( ) Turn the three other shafts fully counterclockwise.

( ) Install the knobs on the shafts so the index marks are positioned as shown in the Pictorial, and tighten the setscrews.

Proceed to "Test and Final Assembly."



Detail 4-18A

TEST AND FINAL ASSEMBLY

The input coils are factory adjusted and do not require any further alignment.

The brass spring and the metal spacer form a safety "interlock" which grounds the high voltage power supply and removes the high voltage from points which are exposed when the perforated cover is removed.

Refer to the chassis photographs for the location of the interlock and the resistance test points.

RESISTANCE CHECK

( ) IMPORTANT: Refer to Figure 1, push down the brass spring of the interlock, and temporarily insert a rubber foot between the brass spring and the metal spacer. If you fail to do this, the high voltage circuit will be short-circuited, you will be unable to obtain a plate connector resistance reading, and damage will result if power is applied.

( ) The resistance between the plate connectors and the chassis should measure approximately 200 kΩ after the meter stabilizes.

( ) The resistance between lug 3 of each tube socket and the chassis (Pictorial 4-14) should measure approximately 20 Ω.

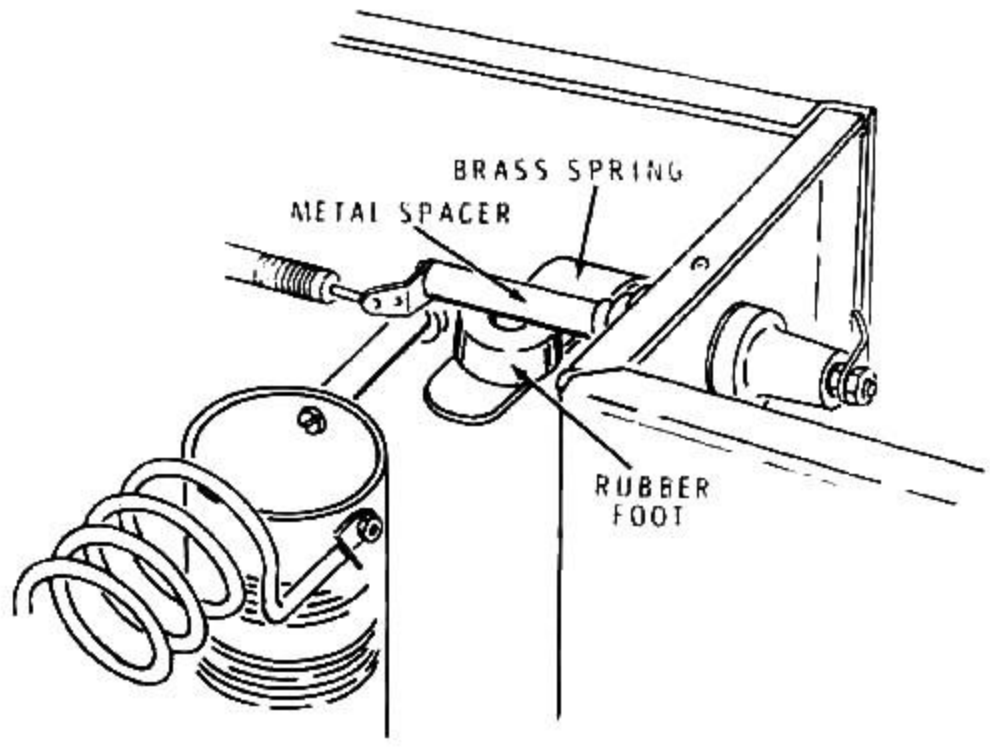
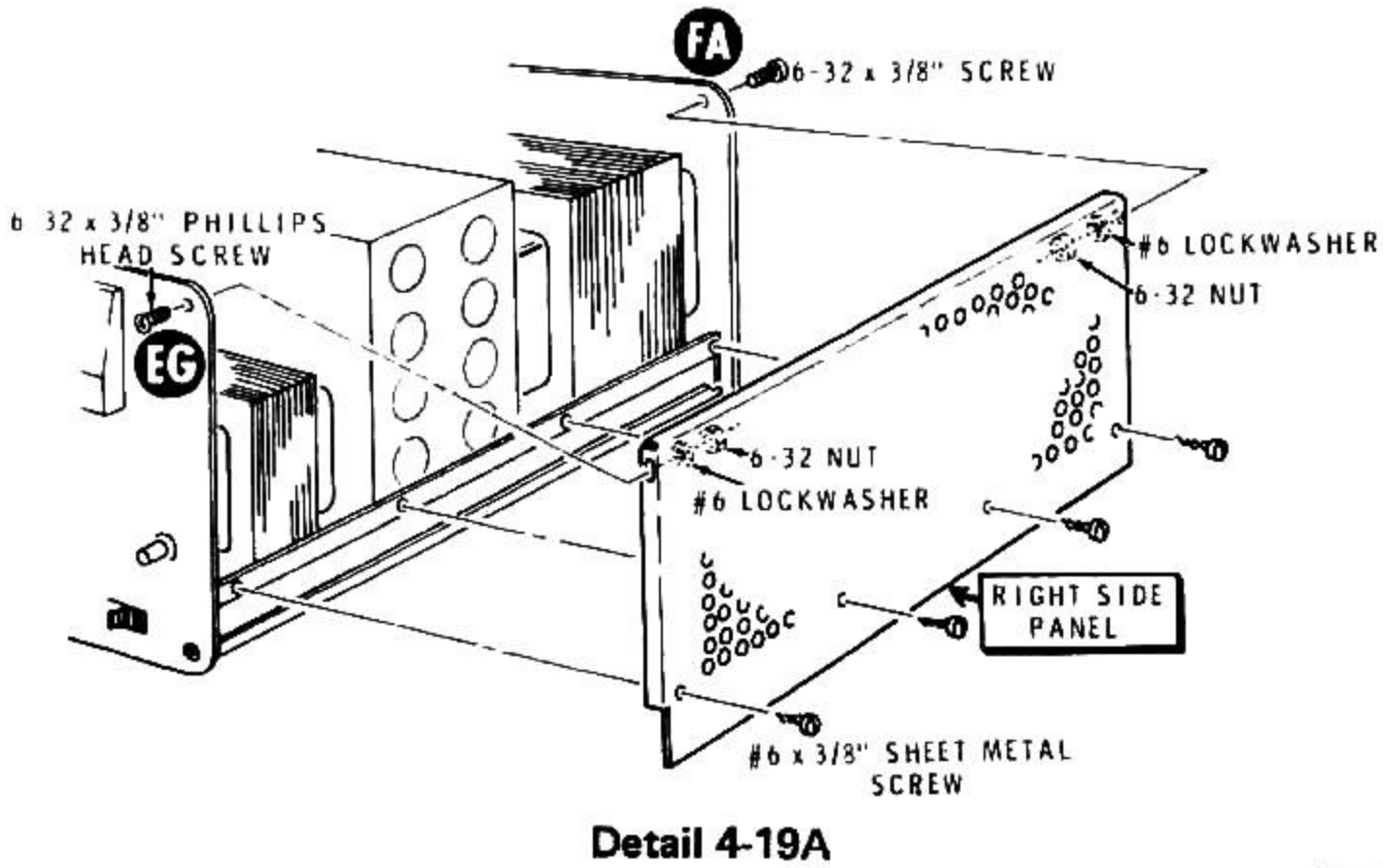


Figure 1

If any difficulty is encountered in obtaining either of these resistance readings, refer to the "In Case of Difficulty" section of the Manual on Page 75.

( ) Remove the rubber foot from the interlock.



Detail 4-19A

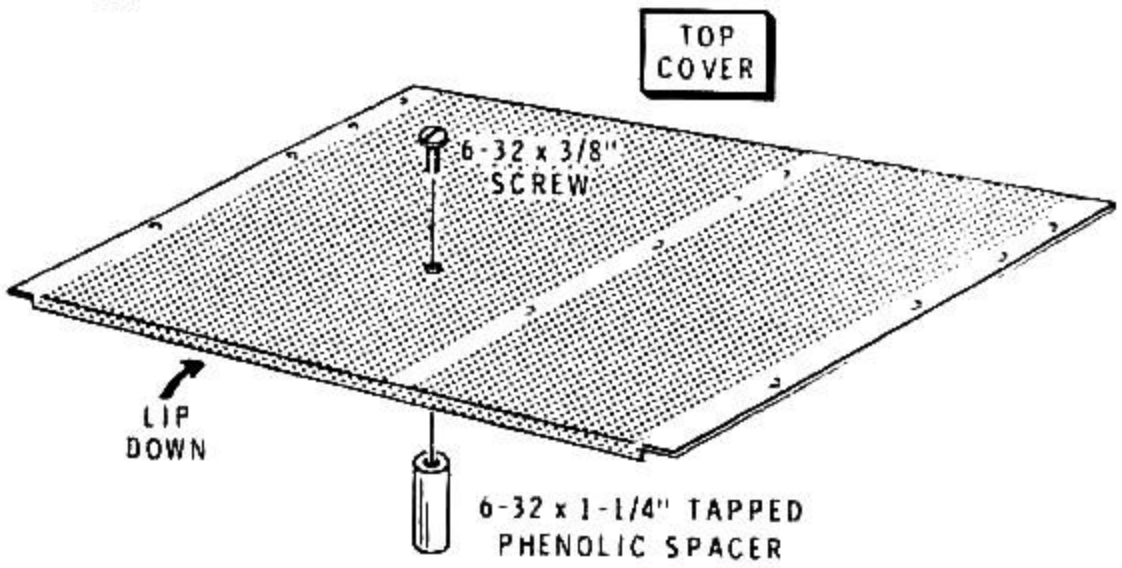
Refer to Pictorial 4-19 for the following steps.

( ) Refer to Detail 4-19A and install the right side panel. Use #6 x 3/8" sheet metal screws along the lower edge, 6-32 x 3/8" hardware at FA, and 6-32 x 3/8" phillips head hardware at EG. CAUTION: After the panel is installed, check to make sure there is at least 1/4" clearance between the point of the sheet metal screw and any connections to the positive (+) lug of filter capacitor #7. (See Pictorial 4-7, fold-out from Page 43.)

( ) As shown in the Pictorial, place the perforated top cover (#205-724) on the top of the Amplifier with the lip against the front panel pointing down. Align the mounting screw holes. Then mark the hole in the cover which is directly over that portion of the brass spring which protrudes beyond the metal spacer.

( ) Refer to Detail 4-19B and install a 6-32 x 1-1/4" tapped phenolic spacer (#255-39) on the underside of the perforated cover at the marked hole. Use a 6-32 x 3/8" screw.

( ) Install the perforated top cover and the top rear plate cover (#205-723) on the top of the amplifier. Use #6 x 3/8" sheet metal screws. First, install a screw near each corner of the top cover and then check visually to make sure that the phenolic spacer on the under side of the top cover pushes the interlock spring down away from the metal spacer mounted on the feedthrough insulator. Any required repositioning of the phenolic spacer should be accomplished before completing the top cover installation. Then install the rest of the sheet metal screws.



Detail 4-19B

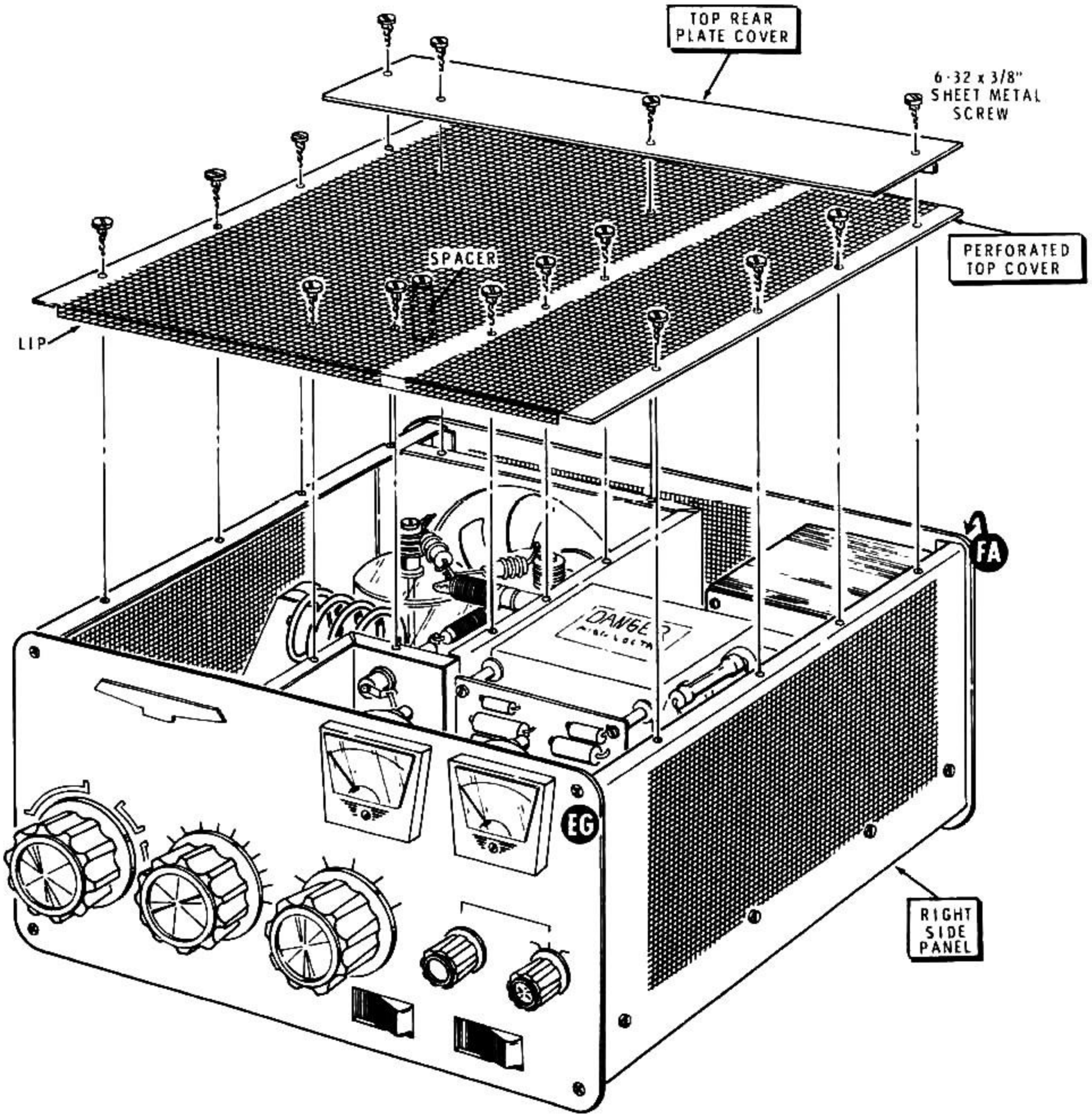
( ) If necessary, adjust each meter pointer to "0" with the meter adjusting screw (see Figure 3-1 fold-out from Page 68).

NOTE: If at any time during the testing and operation the Linear Amplifier does not perform as described, unplug the Linear Amplifier line cord and refer to the "In Case of Difficulty" section of the Manual.

Position the switches and controls as follows:

TUNE	9 o'clock
LOAD	9 o'clock
BAND	Any
SENSITIVITY	12 o'clock
METER SWITCH	HV
POWER SWITCH	OFF
MODE SWITCH	CW/TUNE

( ) Plug the line cord into the power source for which the unit is wired, either 120 volts or 240 volts AC.



PICTORIAL 4-19

CAUTION: *LETHAL VOLTAGES ARE PRESENT IN THIS UNIT. USE EXTREME CARE WHEN MAKING ANY TESTS.*

( ) Push the POWER switch to ON.

( ) Check to see that the tube filaments and meter pilot lamps light, and that the fan operates. The right-hand meter should read approximately 2500 volts.

( ) Push the MODE switch to SSB. The meter should read approximately 3000 volts.

NOTE: There should be no indication on either panel meter except when the METER SWITCH is at the HV position.

( ) Push the POWER switch to OFF and unplug the line cord.

NOTE: Read through the following steps and decide whether you want your amplifier to sit level, or whether you wish the front of the chassis elevated. Then select the feet and mounting hardware so the parts will be immediately available as you install the cabinet. The screws for the mounting feet will be inserted through the four holes in the cabinet bottom and screwed into the captive nuts in the flange of the chassis.

Refer to Pictorial 4-20 (fold-out from Page 56) for the following steps.

( ) Place a book on a flat surface and balance the amplifier chassis on the book, front panel uppermost.

( ) Lower the cabinet onto the chassis so the captive nuts in the chassis bottom flange are aligned with the four holes in the cabinet.

Perform only <u>one</u> of the following two steps, depending upon how you wish the amplifier cabinet positioned.

( ) If you wish to have the amplifier cabinet sit level, install a rubber foot at each corner of the cabinet. Use 6-32 x 11/16" screws.

( ) If you wish the front of the cabinet to be elevated, install a rubber foot on each rear corner with 6-32 x 11/16" screws. Then, install a tapered spacer and a rubber foot at each front corner of the cabinet with 6-32 x 1-1/2" screws.

NOTE: The blue and white identification label shows the Model Number of your kit. Refer to these numbers in any communications with the Heath Company.

( ) Install the identification label in the following manner.

1. Select a location for the label where it can easily be seen when needed, but will not show when the unit is in operation, such as on the rear panel (see the inset drawing in Pictorial 4-20).
2. Carefully peel away the backing paper. Then press the label into position. You will avoid smearing the numbers on the label if you will put the piece of waxed backing paper on top of the label and then rub on it instead of directly on the label.

This completes the assembly of your Linear Amplifier. Proceed to "Installation."

INSTALLATION

LOCATION

The amplifier should not be operated in excessively warm locations or near heating vents or radiators. Free air circulation around and through the amplifier cabinet, and an unobstructed air inlet for the blower should be provided. No books, magazines, or equipment should be placed on top of the cabinet to impede the free flow of air.

POWER CONSIDERATIONS

Because of the power involved, this Amplifier should preferably be served by its own 240 VAC electric service line, having three 12 gauge conductors and fused in each "hot" wire for 10 amperes. However, if a single 240 VAC line must serve the entire station, make an effort to connect your equipment so the load will be balanced between the two "hot" wires as nearly as possible.

If only 120 VAC can be provided, use a separate line having 10 gauge conductors and 20 ampere fuses.

DO NOT use this Amplifier at its full ratings on a regular house wiring circuit, as the ratings of the wire will almost certainly be exceeded.

Avoid excessively long runs of wire from your service entrance. A heavy flow of current in such a line results in a voltage drop which can affect the performance of your equipment.

The plug on the power cord for this kit is for standard 120 VAC outlets. For 240 VAC operation in the U.S.A., cut off and replace this plug with a permanent plug that matches your 240 VAC receptacle in a manner such that your power connection conforms with section 210-21 (b) of the National Electric Code, which reads, in part:

> "Receptacles connected to circuits having different voltages, frequencies, or types of current (AC or DC) on the same premises shall be of such design that attachment plugs used on such circuits are not interchangeable."

When you install the new plug, make sure it is connected according to your local electrical code. Keep in mind that the green line cord wire is connected to the amplifier chassis.

For your convenience in identifying conductors, one edge of the heavy line cord is beaded. The other edge is smooth.

ANTENNA

The output circuit of the Amplifier is designed for connection to an unbalanced transmission line of 50 Ω characteristic impedance. Lines of other characteristic impedance may be used providing the SWR (standing wave ratio) does not exceed 2:1.

The antenna connector is a UHF type SO-239. A mating PL-259 plug is furnished for your transmission line. See "Equipment Interconnections" for information on how to install this plug.

Coaxial cables RG-8/U, RG-11/U, or similar types, should be used for the transmission line. The smaller types RG-58/U and RG-59/U are not recommended because of the power level.

The "A.R.R.L. Antenna Book" is commonly available and includes comprehensive reference work on transmission lines and antennas. Other similar handbooks for the amateur are offered for sale and can often be found in a public library.

GROUNDING

A good earth or water pipe ground should be connected to the ground post on the rear apron of the Amplifier. Use the heaviest and shortest connection possible.

Before using a water pipe ground, inspect the connections around your water meter and make sure that no plastic or rubber hose connections are used which interrupt electrical continuity to the water supply line. Install a jumper around any insulating water connectors found. Use heavy copper wire and pipe clamps. It is best to ground all equipment to one point at the operating position and then ground this point as discussed above.

EQUIPMENT INTERCONNECTIONS

Interconnections between this Amplifier and other Heath equipment are shown in the Figure 2 series of illustrations. Other makes of equipment will usually follow the same general pattern.

CABLES FURNISHED

Two phono cables are furnished. These are shielded cables which have a phono plug molded at each end. Use one cable to connect the amplifier ALC output to the exciter ALC input. Use the second cable to connect the amplifier antenna relay socket to the exciter antenna relay socket.

An RG-58A/U coaxial cable was made up earlier. This cable is used to connect the exciter RF output to the amplifier RF input.

Antenna Relay

OPERATION

The antenna relay circuit in the Amplifier must be grounded in the transmit mode. Heath exciters contain a provision to accomplish this action. If a relay terminal, or other switching provision is not available, this function must be provided by other means. If a separate coaxial send-receive relay is used in your station, it may have external contacts available. A separate switch can also be used.

HEATH TRANSCEIVERS WITH 11-PIN POWER PLUGS

If you will use your Amplifier with a Heath transceiver which has an 11-pin power plug on the rear panel, refer to Pictorial 5 and perform the following steps to accomplish the Antenna Relay connection.

However, if you have previously changed the interior wiring of the transceiver to use one of the spare phono sockets to bring out the exterior antenna relay connection, disregard the following steps and proceed to the "Operations" section.

( ) Cut off and discard the phono plug from one end only of one of the phono cables furnished.

( ) Remove 3/4" of the gray outer insulation of the cable.

( ) Unwind the shield wires from the inner insulation. Then twist the shield wires tightly together and melt a small amount of solder on the ends of the wires.

( ) Remove 1/4" of insulation from the inner conductor, twist the exposed bare wires tightly, and melt a small amount of solder on the wire ends.

( ) Remove the transceiver power cable socket cap and slide it back on the power cable. Then push the prepared end of the phono cable through the socket cap as shown in the Pictorial.

NOTE: When soldering the power socket in the following steps, be very careful that you do not get the hot soldering iron against the clear sleeving already installed on the adjacent lugs.

( ) Connect the center conductor of the phono cable to lug 11 (S-1), and the shield wires to lug 5 (S-1) of the power socket.

( ) Snap the power socket cap back into place.

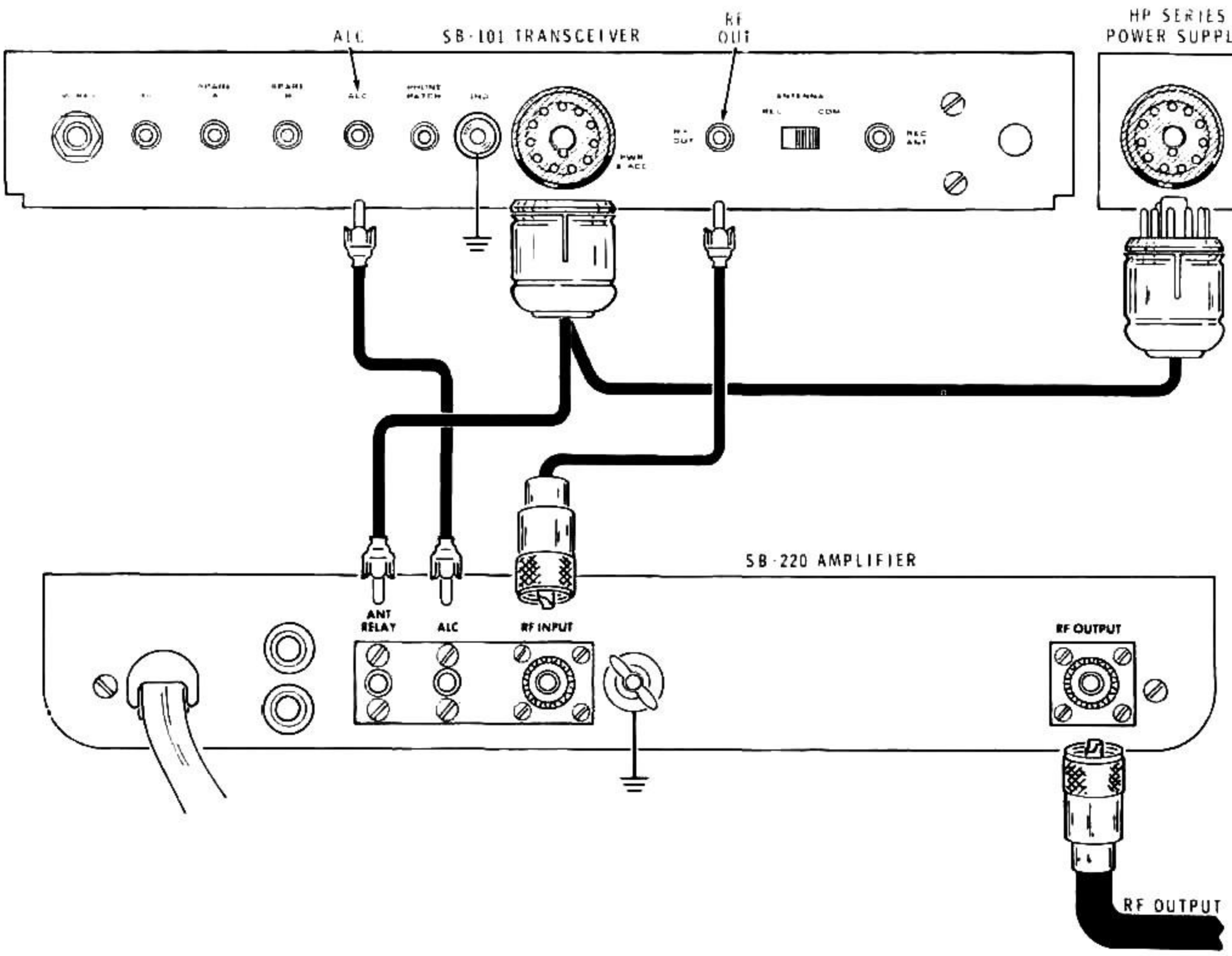
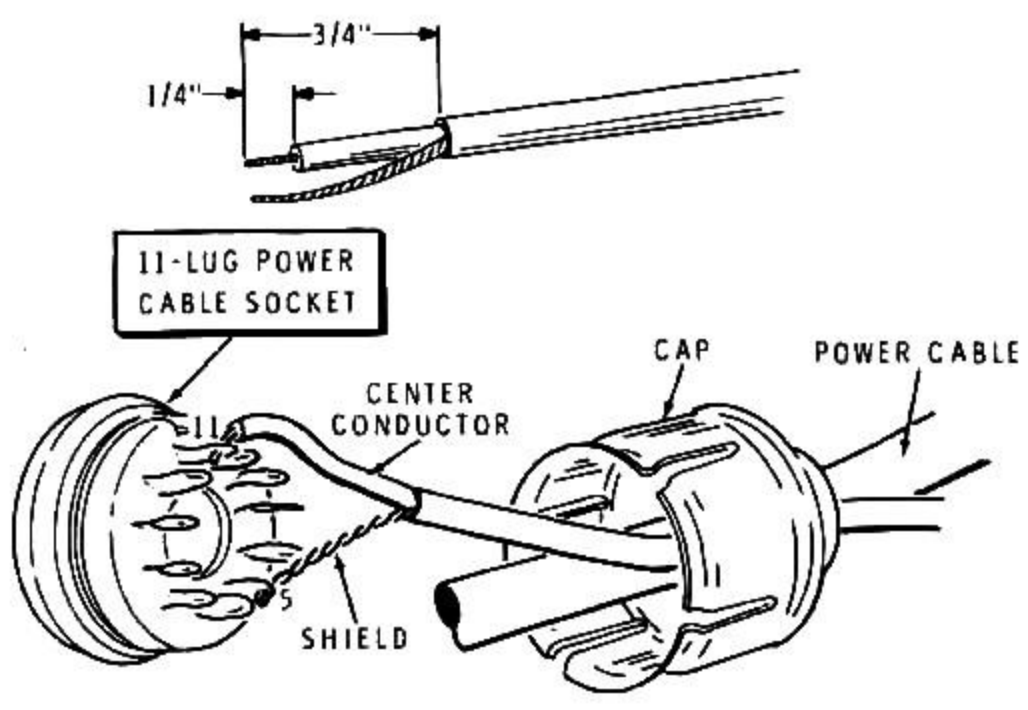


Figure 2-1



PICTORIAL 5

OPERATION

CONTROLS, CONNECTORS, AND METERS

Refer to Figure 3-1 (fold-out from Page 68) for identification of the front panel controls and a concise description of the functions of each.

Refer to Figure 3-2 for rear panel connections.

READING THE METER

Refer to Figure 3-3 for illustrations of the two panel meters.

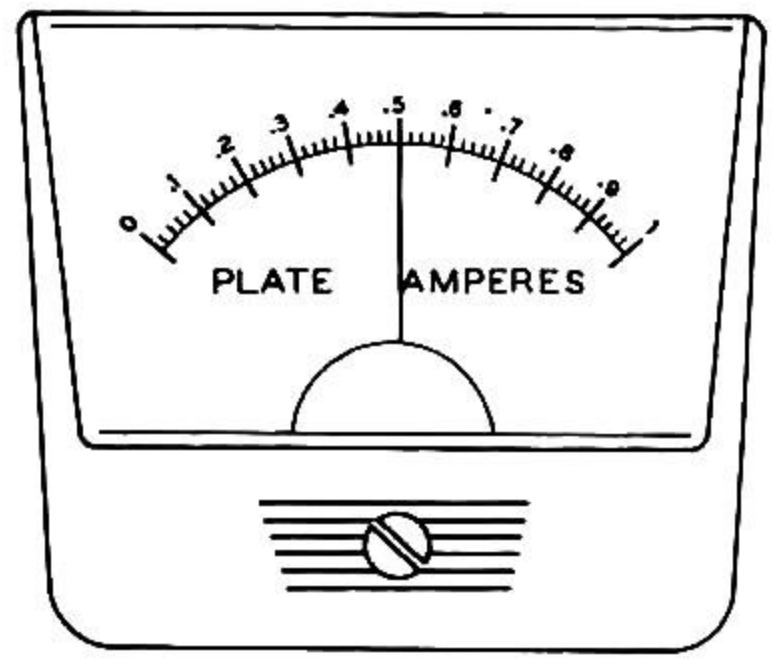
Plate Meter

The Plate Meter is calibrated from 0 to 1 ampere. Note that by adding the proper number of zeros and dropping the decimal point, each scale number may be read as milliamperes. Thus .5 amperes would become 500 milliamperes.

Multi-Meter

Read the Multi-Meter scale which corresponds to the setting of the METER SWITCH:

METER SWITCH POSITION	MEASURES	SCALE READING
GRID	Grid current	0-350 milliamperes (lower scale)
REL PWR	Relative power output	0-350 (lower scale) (Adjust needle deflection to full scale with SENSITIVITY control after tune-up)
HV	High voltage	0-3.5 kilovolts (upper scale)



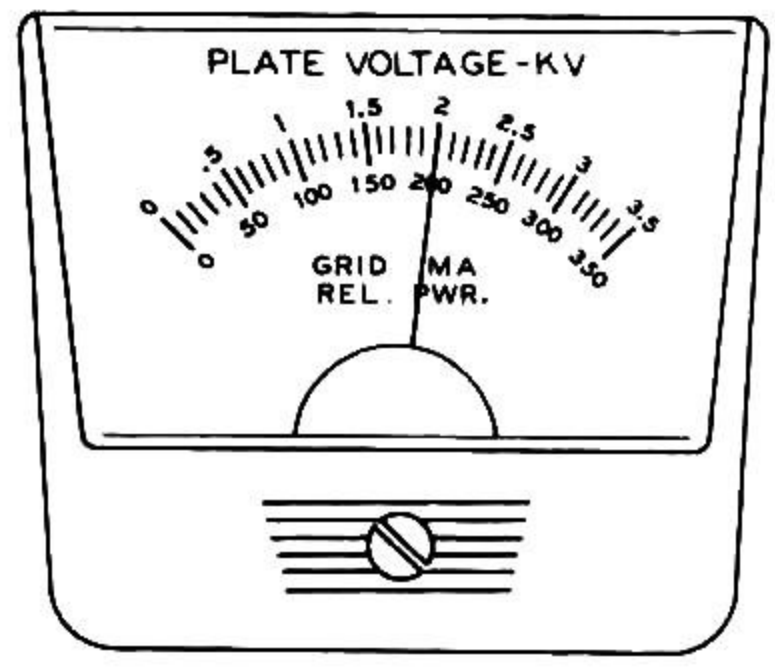


Figure 3-3

GENERAL

SAFETY INTERLOCK

Refer to the Chassis Photograph (Page 87) for the location of the interlock. When the amplifier top cover is in place, the insulator on the underside of the cover opens the interlock, and the high voltage circuit is operational. When the top cover is removed, the interlock closes and connects the high voltage circuit to chassis. This connection will discharge the filter capacitor bank and eliminate a shock hazard.

WARNING: *If the Amplifier is turned ON when the amplifier cover is removed, the high voltage power supply will be short circuited and may be damaged. If this occurs, DO NOT touch any part of the high voltage supply with your hands until all possible high voltage points have been checked with a separate voltmeter.*

CIRCUIT BREAKERS

Push in the red buttons on the two circuit breakers and note their position. When a circuit breaker opens, the red buttons will protrude farther and will be easily noticed.

If one or both circuit breakers open during operation of the Amplifier, turn the amplifier POWER switch OFF; then push the red buttons in to their former position, wait a few seconds, and push the POWER switch to ON. If the breakers will not stay closed, push the POWER switch OFF and locate the reason for the overload.

TUBES

The Amplifier uses "instant heating" type tubes. Therefore, after tune-up, you can use the Amplifier immediately after it is turned on.

It is not abnormal for the tube plates to show a dull red color. If the plates show a bright orange or yellow color, tuning and drive conditions should be investigated immediately, and necessary corrections should be made.

After prolonged usage, let the Amplifier run for several minutes without excitation, so the fan will cool the tubes before the Amplifier is turned off.

DC INPUT POWER

In grounded grid amplifier operation, a considerable portion of the driving power is fed through the amplifier tube. The Amplifier output is the approximate sum of the driver output and the power added by the Amplifier. Both the driver and amplifier input powers must therefore be considered when calculating DC input power.

DRIVING POWER

This Amplifier is designed to operate at full ratings (see Specifications) when driven by an exciter delivering approximately 100 watts of RF output. An exciter of lower power output may be used as a driver, but the Amplifier's output will be less. If you use an exciter that delivers more than 100 watts, carefully adjust the driving power to avoid "over-drive" and the creation of spurious signals which create needless interference to others. The use of the Heathkit Model 610 Monitor Scope is highly recommended for continuous output monitoring. The display on an oscilloscope is the best readily available way of determining the amplitude of the voice peaks which, if excessive, can cause "flat topping" and the radiation of distortion products.

IMPORTANT: In no case should the MIC/CW Level of your exciter be advanced beyond the point where the Amplifier REL. PWR. indication ceases to increase. If the level control is turned past this point, nonlinear operation may be produced.

ALC (Automatic Level Control)

When the Amplifier is overdriven, the ALC circuitry creates a negative voltage which is fed back to the exciter to reduce its gain and help prevent "flat topping."

Protective circuitry of this nature is a valuable circuit element, but it is not a substitute for proper adjustment of the exciter drive.

TUNE-UP

The current and voltage figures given in this section are approximations. Actual readings will vary at each installation with such factors as line voltage, exciter drive, and load impedance.

The following procedure for tuning the Amplifier should take only a few seconds after you go through it a few times. Note the LOAD control position so it can be preset the next time a particular band is used.

CW AND RTTY PROCEDURE

Make sure the Amplifier has been installed as described and illustrated in the "Installation" section. IMPORTANT: Before proceeding, make sure you have a dummy load (such as the Heathkit Cantenna) or an appropriate antenna connected to the Amplifier output.

( ) Set the Amplifier controls as follows:

SWITCH OR CONTROL	POSITION	COMMENTS
TUNE	Desired band segment	
LOAD	1 (80 and 40 bands) 4 (20, 15, and 10 bands)	After tune-up, note position so control can be preset in the future.
BAND	Desired band	
SENSITIVITY	12 o'clock	Keep needle on scale with SENSITIVITY control. After tune-up, adjust as desired.
METER	REL. PWR.	
POWER	OFF	
MODE	CW/TUNE	

( ) Tune your exciter for full CW output at the desired frequency. The MULTI-METER on the Amplfiier, when switched to indicate REL. PWR., will show the relative power output of the exciter and may be used even though the Amplifier is off.

( ) Reduče the exciter output to 0 by placing its controls in the receive mode; also turn its MIC/CW Level control fully counterclockwise.

( ) Turn the Amplifier on.

( ) Place the exciter in the tune mode. The amplifier plate meter should read approximately .12 ampere resting plate current. Then advance the Level control until the PLATE METER shows .3 ampere.

( ) Peak (adjust) the amplifier TUNE and LOAD controls for maximum REL. PWR. meter indication.

( ) Advance the drive to .4 ampere plate current and repeak the TUNE and LOAD controls. The Meter readings should then be approximately:

Plate amperes = .35
High voltage = 2100
Grid mA = 110

( ) Alternately adjust the TUNE, LOAD, and exciter drive controls for the desired input. Refer to Figure 3-4. The meter readings at 1 kw input will be approximately:

Plate amperes = .5
High voltage = 2000
Grid mA = 100-200

( ) Advance the SENSITIVITY control for the desired REL. PWR. meter reading.

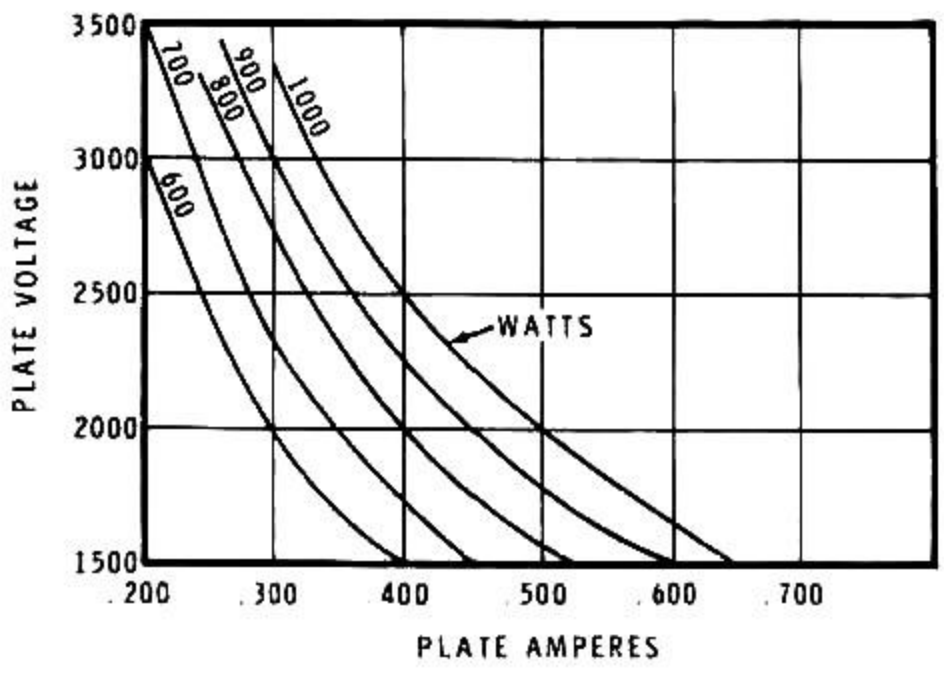


Figure 3-4

( ) Turn the exciter Mode switch to Standby or the desired transmission mode.

The Linear Amplifier is now loaded for operation on CW or RTTY. If an oscilloscope is being used for monitoring, a display similar to that shown in Figure 3-5 should be obtained. If you have a Heathkit Model 610 Monitor Scope, you may find that its optional trapezoid display pattern is more easily interpreted for voice patterns.

CAUTION: While actually transmitting, DO NOT switch between CW/TUNE and SSB modes.

SSB PROCEDURE

( ) Tune up the exciter and Amplifier as for CW operation. NOTE: In the absence of the recommended oscilloscope monitor, either the PLATE METER or the REL. PWR. indication can be used to monitor SSB transmission. The PLATE METER indications are easier to follow.

Low Power SSB

( ) For 1000 watts P.E.P. operation, switch the exciter only to the SSB mode. Leave the amplifier MODE switch at CW/TUNE.

( ) Adjust the exciter drive control so the PLATE METER will indicate between .12 and .2 ampere with average speech. Hard voice peaks should not exceed .250 ampere.

High Power SSB

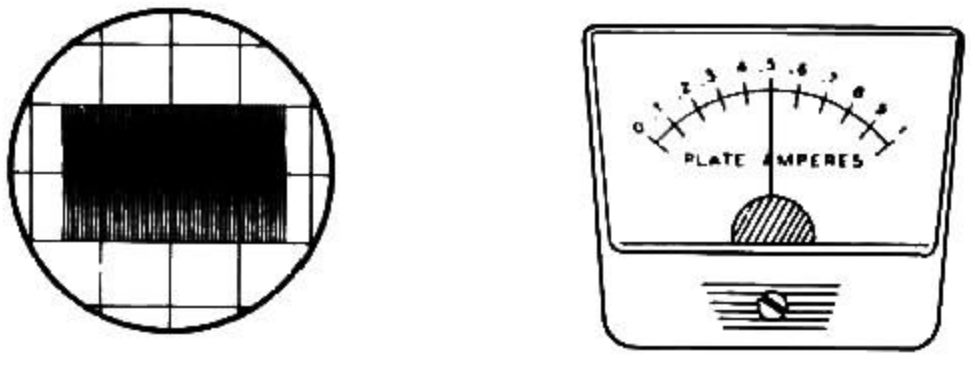
( ) For 2000 watts P.E.P. operation, switch both the exciter and the amplifier MODE switch to SSB.

( ) Advance the exciter drive level until the PLATE METER reads from .2 to .3 ampere with average speech and no higher than .33 ampere on hard voice peaks. A higher drive level will cause "flat topping."

An example of a proper SSB oscilloscope pattern is shown in Figure 3-6. Note that there are sharp, distinct peaks. The number of patterns or "christmas trees" will depend upon the operator's voice characteristics and the scope sweep speed. Set the scope for approximately 30 Hz sweep.

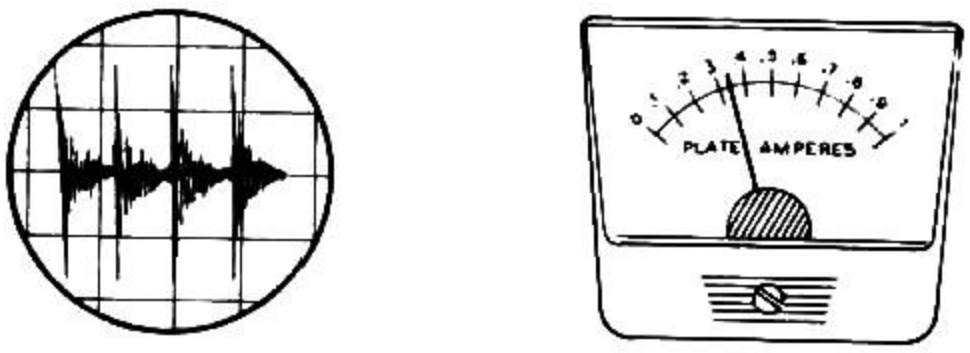
Note that the meter reading on voice peaks will not be high, due to meter inertia and voice characteristics; however, the height of the oscilloscope pattern is greater than that shown in Figure 3-5.

Figure 3-7 shows the same voice pattern but with extreme "flat topping." The oscilloscope shows that no more useful power is being developed. When the drive level is too high the meter reads higher, but only distortion is developed.



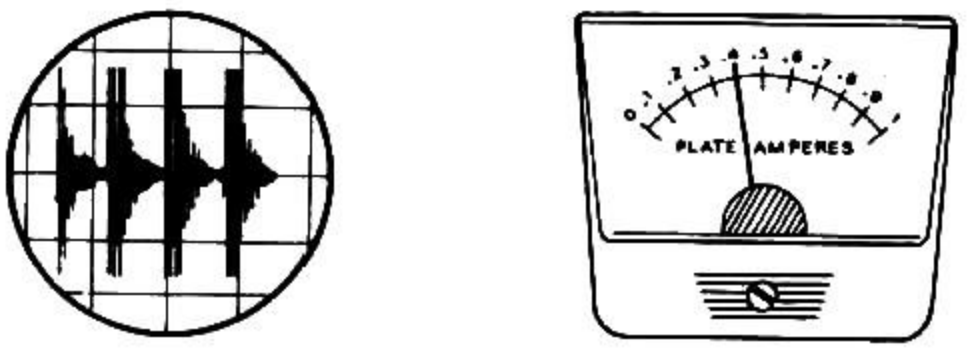
Oscilloscope pattern and plate meter reading resulting from carrier or "single tone" modulation. The meter indicates CW plate current input.

Figure 3-5



Oscilloscope pattern and plate meter reading in 2000 watt SSB mode. Notice the peaks on the oscilloscope pattern. They are sharp, indicating a clean signal, and they will attain a height greater than the "single tone" pattern of Figure 3-5, indicating maximum power input.

Figure 3-6



Oscilloscope pattern and plate meter reading resulting from overdrive. The meter reads higher, but the scope indicates peak flattening. Operation in this manner causes distortion and severe interference to adjacent frequencies.

Figure 3-7

PERIODIC MAINTENANCE

Remove the top cover of the Amplifier and remove the dust at least once a year. This can be done by using the blower connection on a vacuum cleaner, or by a soft bristle brush.

While the top cover is removed, add one drop of light machine oil to each fan bearing.

IN CASE OF DIFFICULTY

Refer to the Kit Builders Guide for Service and Warranty information.

NOTE: Operating the Amplifier outside the specified power or frequency range (or both) may damage components. Such damage is not covered by the Heath warranty.

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.

2. The majority of the kits that are returned for repair, do not function properly due to poor connections and soldering. Many troubles can be eliminated by carefully reheating all connections to make sure that they are soldered as described in the Proper Soldering Techniques section of the "Kit Builders Guide."

3. Make sure that the tubes light up properly. If they do not, remove the tubes from their sockets and check for continuity between pins 1 and 5 with an ohmmeter. An infinite resistance will indicate a faulty tube filament.

4. Check the values of the parts. Be sure that the proper part has been wired into the circuit as shown in the Pictorial Diagrams and as called out in the wiring instructions.

5. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.

6. A review of the Circuit Description will prove helpful in indicating where to look for trouble.

TROUBLESHOOTING CHART

DIFFICULTY	POSSIBLE CAUSE
1. No AC power	A. Circuit breakers open. B. Jumpers missing on terminal strip AE. C. Terminal strip AE wired wrong.
2. Meter inoperative in one position: A. GRID. B. REL. PWR. C. HV.	A. Resistor R1, R3. B. D17, R25, R24, C54, R26. C. R6, R7, R8, R9. D. Meter switch.
3. Meter circuits inoperative	A. Meter jumper wire not removed. B. R2, C3, C8. C. Meter switch.
4. Idle current over .15A in CW/TUNE position.	A. ZD1.
5. No idle current	A. Relay. B. ZD1. C. V1 - V2.
6. No high voltage	A. D1 - D14. B. C10 - C17. C. R12 - R19. D. T1. E. R1 or R3. F. C29. G. Top cover off (interlock).
7. Relay will not activate	A. D16. B. C4. C. Ant-Relay jack. D. T2. E. RL-1.
8. Final tune has no effect	A. Bandswitch wafer #2 180 degrees out of position. B. L7 installed wrong. C. Improper load on the Linear Amplifier. D. V1, V2.

DIFFICULTY	POSSIBLE CAUSE
9. No RF output	A. Relay wired wrong. B. L7 installed wrong. C. Coax shorted. D. C29.
10. ALC inoperative	A. Wiring error or component failure on terminal strip BE. B. ALC jack.
11. Amplifier hard to drive.	A. Coaxial leads to the input bandswitch reversed.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

SPECIAL SHIPPING INSTRUCTIONS FOR U.S. AND CANADA

DO NOT ship an assembled Model SB-220 amplifier unless it is packed in the Model 220 Service Pack. Due to the weight of the transformers, shipment without special packaging will almost certainly result in damage.

OVERSEAS SHIPMENT NOTE: Shipment from overseas sources with the transformers mounted is not recommended.

SPECIFICATIONS

Band Coverage	80, 40, 20, 15 and 10 meter amateur bands.
Driving Power Required	100 watts.
Maximum Power Input	SSB: 2000 watts P.E.P. CW:1000 watts. RTTY: 1000 watts.
Duty Cycle	SSB: continuous voice modulation. CW: Continuous (maximum key-down 10 minutes). RTTY: 50% (maximum transmit time 10 minutes).
Third Order Distortion	-30 dB or better.
Input Impedance	52 Ω unbalanced.
Output Impedance	50 Ω unbalanced; SWR 2:1 or less.
Front Panel	Tune. Load. Bandswitch. Sensitivity. Meter switch. Power. CW/Tune – SSB. Plate meter. Multi-meter (Grid mA, Relative Power, and High Voltage).
Rear Panel	Line cord. Circuit breakers (two 10 A). Antenna Relay (phono). ALC (phono). RF Input (SO-239). Ground post. RF output (SO-239).

Tubes	Two 3-500Z.
Power Required	120 VAC, 50/60 Hz, at 20 amperes maximum. 240 VAC, 50/60 Hz, at 10 amperes maximum.
Cabinet Size	14-7/8" wide, 8-1/4" high, 14-1/2" deep.
Net Weight	50 lbs.

The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

CIRCUIT DESCRIPTION

Refer to the Schematic (fold-out from Page 87) to identify the circuit components while reading this section.

POWER SUPPLY

The power supply uses high voltage transformer, T1, and a filament and bias transformer, T2. Each transformer has dual primary windings which are connected in parallel for 120 VAC operation, or in series for 240 VAC electric service. The transformers are protected by two 10 ampere circuit breakers, wired so they provide appropriate overload protection for either primary voltage.

The fan motor is connected across one of the primary windings on the high voltage transformer and always operates on 120 VAC.

The AC input line is by-passed for RF by capacitors C1 and C2.

HIGH VOLTAGE SUPPLY

The primary windings of the high voltage transformer, T1, are tapped, and the six leads are connected to the Mode and Power switches.

When the Mode switch is in the CW/Tune position, the entire portion of each primary winding is connected to the power line. When this switch is in the SSB position, only the tapped portion of each primary winding is connected to the power line.

When the tapped windings (fewer turns) are connected to the power source, a higher secondary-to-primary turns ratio is being used and a higher secondary voltage for SSB operation results.

The transformer secondary is connected in a full-wave, voltage-doubling circuit. The AC voltage is rectified by diodes, D1 through D14, and it is filtered by series-connected electrolytic capacitors C10 through C17. Resistors R12 through R19 parallel the filter capacitors and equalize the voltage drop across each capacitor in the series. They also act to discharge the filter capacitors after the power switch is turned off.

The red-yellow transformer lead is connected to the junction of capacitors C13 and C14. During the half-cycle when this lead is positive, capacitors C14 through C17 are charged. During the other half-cycle, the red lead is positive and capacitors C10 through C13 are charged. These two capacitor strings are in series across the load, and the voltages of each group add together.

Resistors R1 and R3 are discussed under "Metering Circuits."

Chokes RFC 1 and RFC 2 and bypass capacitors C6 and C7 are used to keep RF energy out of the power supply circuits.

The interlock grounds the output of the high voltage supply when the top cover of the Amplifier is removed. This feature protects the user against a shock from undischarged filter capacitors. The Amplifier must not be turned on while the top cover is removed as the high voltage supply is short-circuited under these circumstances.

FILAMENT AND BIAS SUPPLY

Transformer T2 has two secondary windings. One winding furnishes 5 VAC at 30 amperes for the amplifier tube filaments. The two #47 pilot lamps for meter illumination are also connected across the filament line.

Filament supply is fed to the two tubes through RFC 3, a coil which is bifilar wound on a ferrite core. This coil forms a choke to raise the tube filaments above RF ground so the driving voltage will not be short-circuited.

The second winding on transformer T2 is used in a half-wave rectifier circuit for the bias supply voltage, to operate relay RL1, and to furnish ALC threshold voltage. The AC voltage from this winding is rectified by D16 and filtered by C4. This DC voltage is connected to lugs 3 and 11 of relay RL1. In the receive mode, this voltage is applied through lug 9 to the center-tap of the filament winding. This positive voltage increases the voltage difference between the tube grids (which are grounded for DC) and the tube filaments, which now carry the positive DC voltage in addition to the AC filament voltage. The tube grids are consequently biased beyond cutoff and no plate current flows.

In the transmit mode, the center-tap of the filament winding is connected to ground through lugs 9 and 6 of the relay, the 5.1 volt zener diode ZD1, and R3. The plate current through the zener develops 5.1 VDC operating bias for the tubes and limits the idling plate current.

RELAY

The relay has three sets of single-pole, double-throw contacts. When the relay coil circuit is open the contacts are in the receive mode.

Approximately 120 VDC is connected to one side of the relay coil at lug 11. Lug 10 connects the other side of the relay coil to the Antenna Relay jack on the rear panel. This jack is usually connected to normally open relay contacts in the exciter (such as a VOX or PTT relay). When these relay contacts close, they must connect the amplifier relay coil circuit to ground. The amplifier relay will then close and its contacts will be in the transmit mode.

The function of amplifier relay contacts 3, 6, and 9 was discussed in the "Bias Supply" section.

Relay contact 7 is connected to the RF INPUT connector. In the receive mode the incoming signal is transferred directly to the RF Input through relay contacts 8, 2, 1, and 7. In the transmit mode, the RF Input voltage is connected through relay contacts 7 and 4 to lug 1 of Band-switch wafer 1F.

In the transmit mode, the RF Output is connected through relay contacts 5 and 8 to the pi network output circuit of the Amplifier.

RF CIRCUITS

INPUT CIRCUIT

An input impedance-matching pi network circuit for each band is connected by Band-switch wafer 1. After passing through the matching circuit, the RF driving power is coupled to the tube filaments by C32. Capacitor C21 equalizes any RF voltage difference between the filament leads.

TUBES

The amplifier tubes are connected in parallel in a class B grounded grid· circuit. RF driving power is applied to the filaments in the normal cathode-driven configuration. As mentioned in "Power Supply" section, RFC 3 holds the filaments above RF ground.

Pins 2, 3, and 4 of each tube are connected together internally. Each of the three grid pins is bypassed to ground. This combination of RF chokes and capacitors provides a predetermined level of negative feedback at the tube grids to further reduce intermodulation distortion.

PC-1 and PC-2 are parasitic chokes in each tube plate lead to suppress any VHF parasitic oscillations.

The positive side of the power supply is connected in parallel to the tubes through RFC 1.

Cooling air is circulated around the tubes by the fan.

OUTPUT CIRCUIT

The tuned output circuit of the Amplifier is a pi network composed of plate tuning capacitor C55, loading capacitors C56 and C57, and coils L6 and L7.

Band-switch wafer 2 progressively shorts out the unused portions of coils L6 and L7. The coil turns in use are tuned to resonance by Tune capacitor C55. Load capacitor C57 is tuned to complete the impedance match between the tubes and the load connected to the RF OUTPUT. On the 80 meter band, fixed capacitor C56 is switched in parallel with C57 to provide the additional capacitance required on this band.

If a DC voltage is unintentionally applied to the plate output circuit, RFC 6 will provide a DC path to ground, thus short-circuiting the high voltage supply and opening the circuit breakers.

ALC CIRCUIT

Approximately 60 VDC ALC threshold voltage is available at the junction of resistors R4 and R5, which form a voltage divider across the bias supply winding of transformer T2. C5 is an RF bypass, and R11 is an isolation resistor.

C47 couples some RF driving voltage to voltage divider R21-R22. C48 and C49 are frequency compensating capacitors for R21 and R22, respectively.

When the RF driving voltage at the junction of R21-R22 exceeds the ALC threshold voltage, D18 will rectify the negative half-cycles. C51 and C53 act as filters and RF bypasses: R23 is an isolation resistor.

The negative voltage appearing at the ALC connector may be coupled back to the exciter to reduce its gain and help reduce "flat-topping" of voice peaks due to overdrive.

METERING CIRCUITS

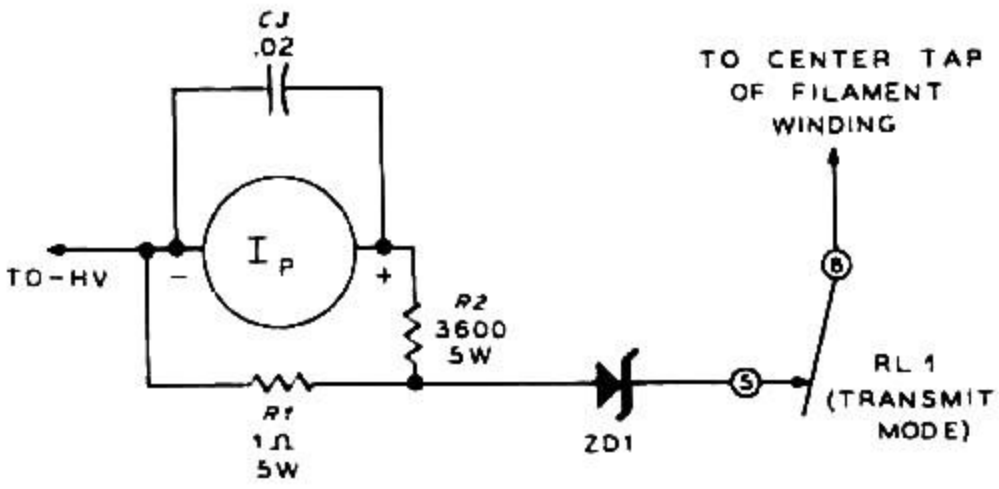


Figure 4-1

PLATE METER (Figure 4-1)

The Plate Meter reads the total plate current drawn by both tubes from 0 to 1 ampere. It is placed in series with a multiplier resistor, R2, and it measures the voltage drop across shunt resistor R1 through which the plate current passes.

MULTI-METER

Grid Current (Figure 4-2)

To read grid current, the Multi-Meter is switched in parallel with shunt resistor R3. The grid circuit return is to the center tap of the filament winding of transformer T2. Note that grid current only passes through R3, as the return for the high voltage circuit is through R1, R2, and the Plate Meter.

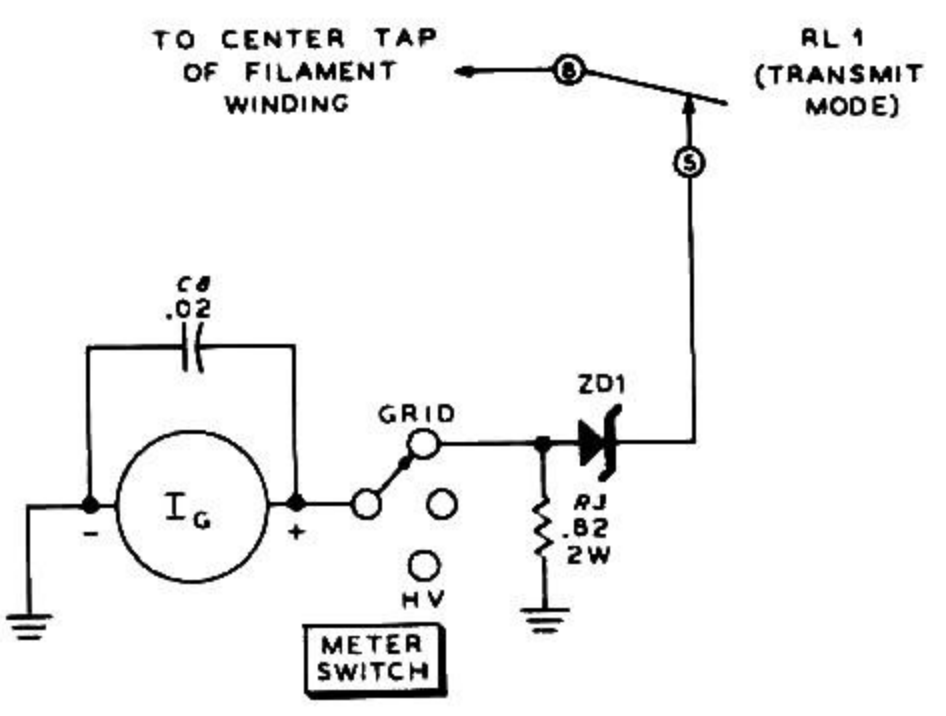


Figure 4-2

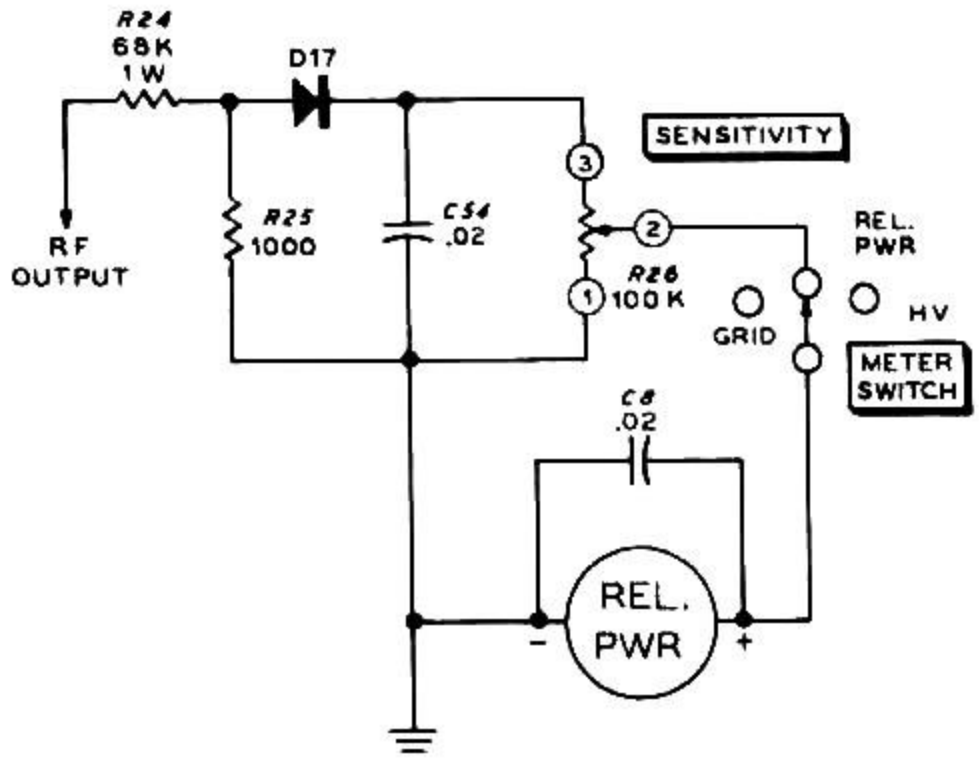


Figure 4-3

Relative Power (Figure 4-3)

Voltage divider R24 and R25 is connected across the RF OUTPUT. The voltage at the junction of these resistors is rectified by diode D17, filtered by C54, and applied through Sensitivity control R26 to the Multi-Meter. The Sensitivity control adjusts the Multi-Meter for the desired reading.

High Voltage (Figure 4-4)

High voltage is measured by switching the Multi-Meter to the junction of the multiplier resistors (R6, R7, and R8) and the shunt resistor R9. The meter scale is calibrated to indicate voltage, based upon the current flowing through the meter and R9 in parallel, the combination being in series with the multiplier resistors R8, R7 and R6.

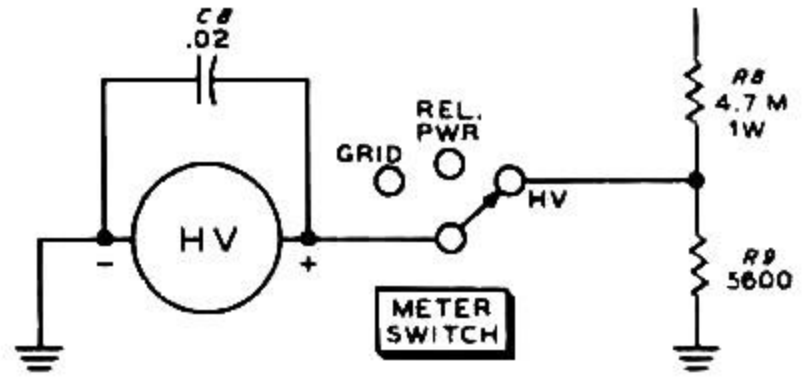
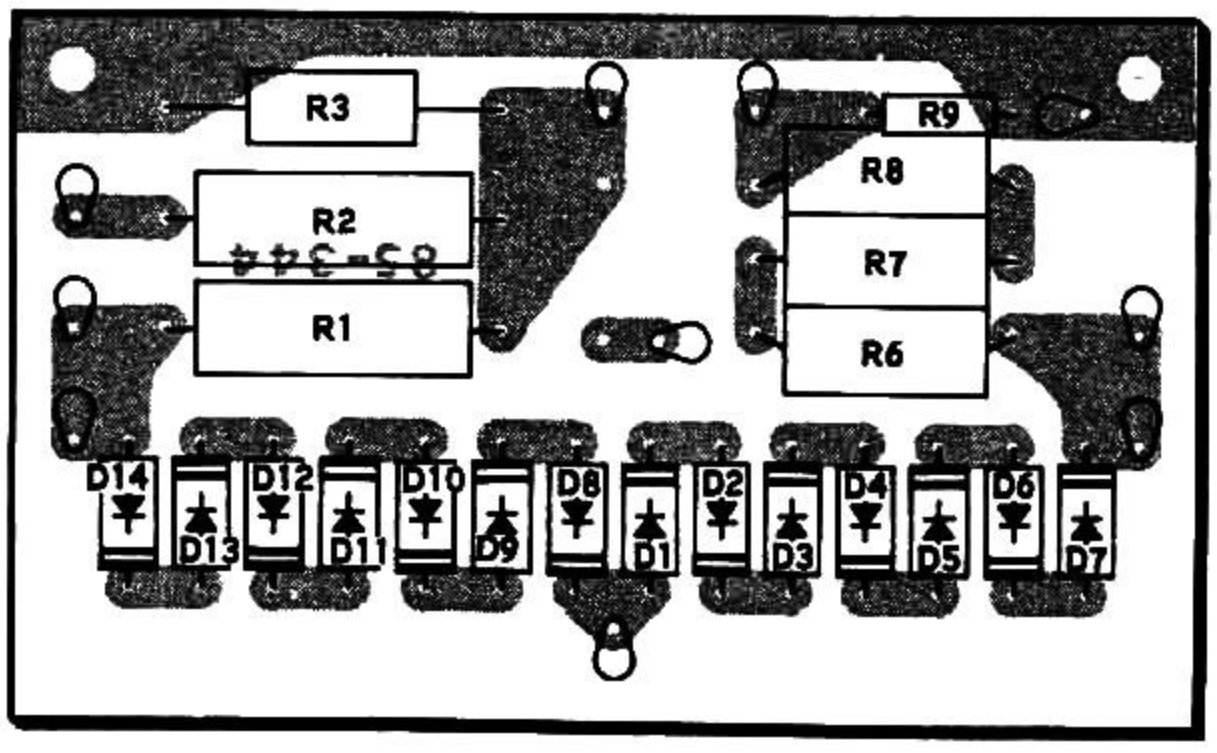


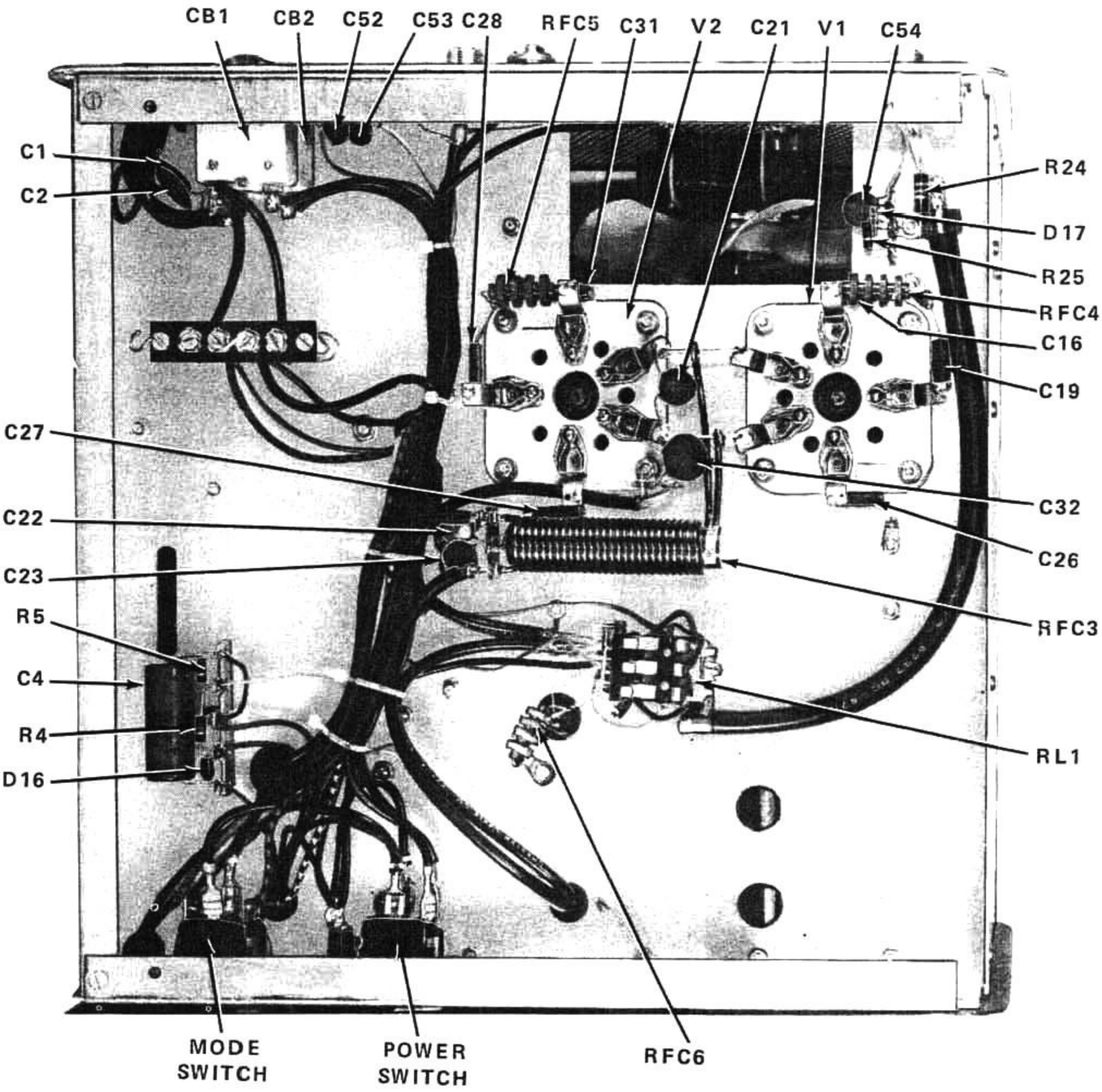
Figure 4-4

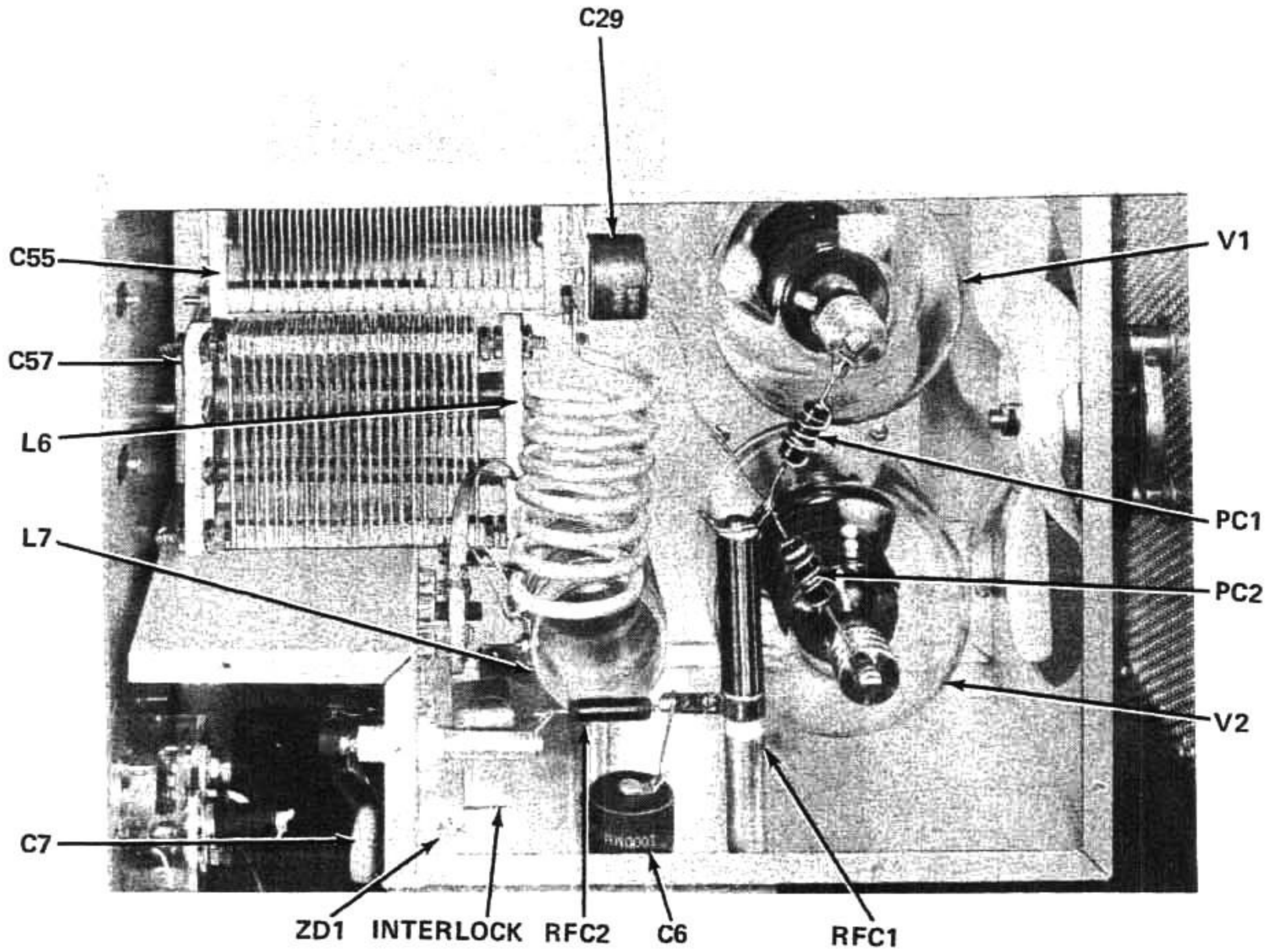
CIRCUIT BOARD
X-RAY VIEW

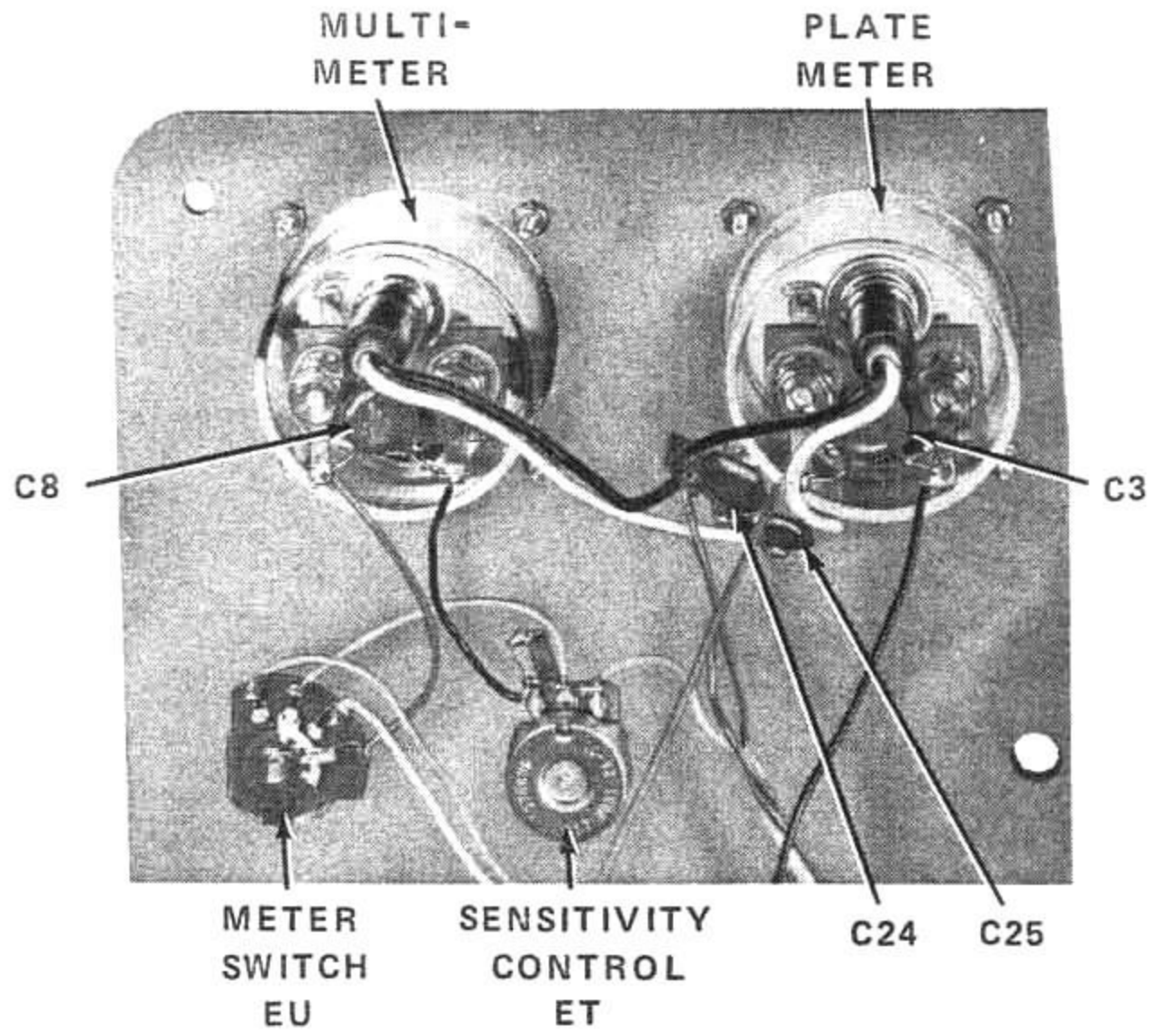


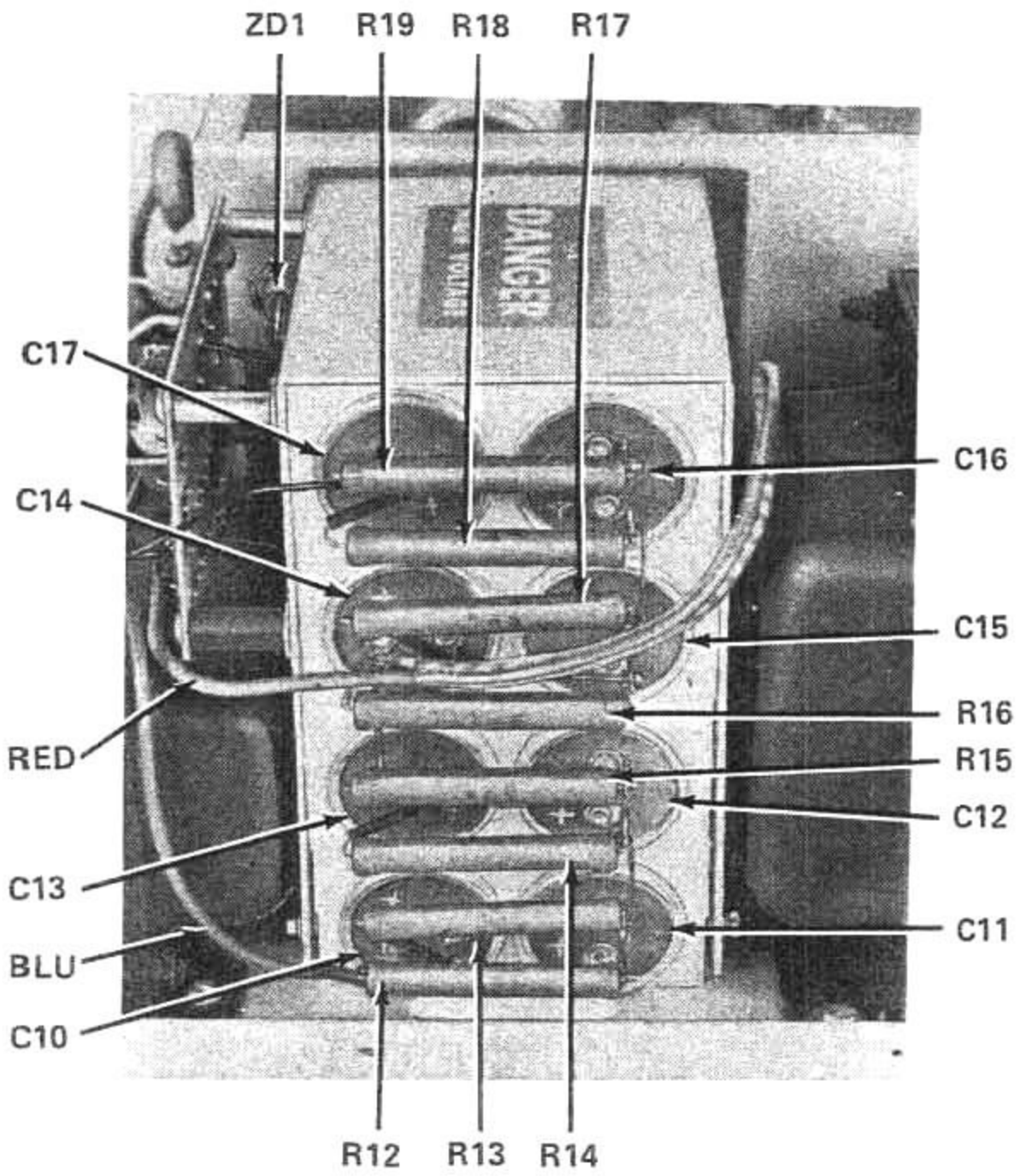
(VIEWED FROM FOIL SIDE)

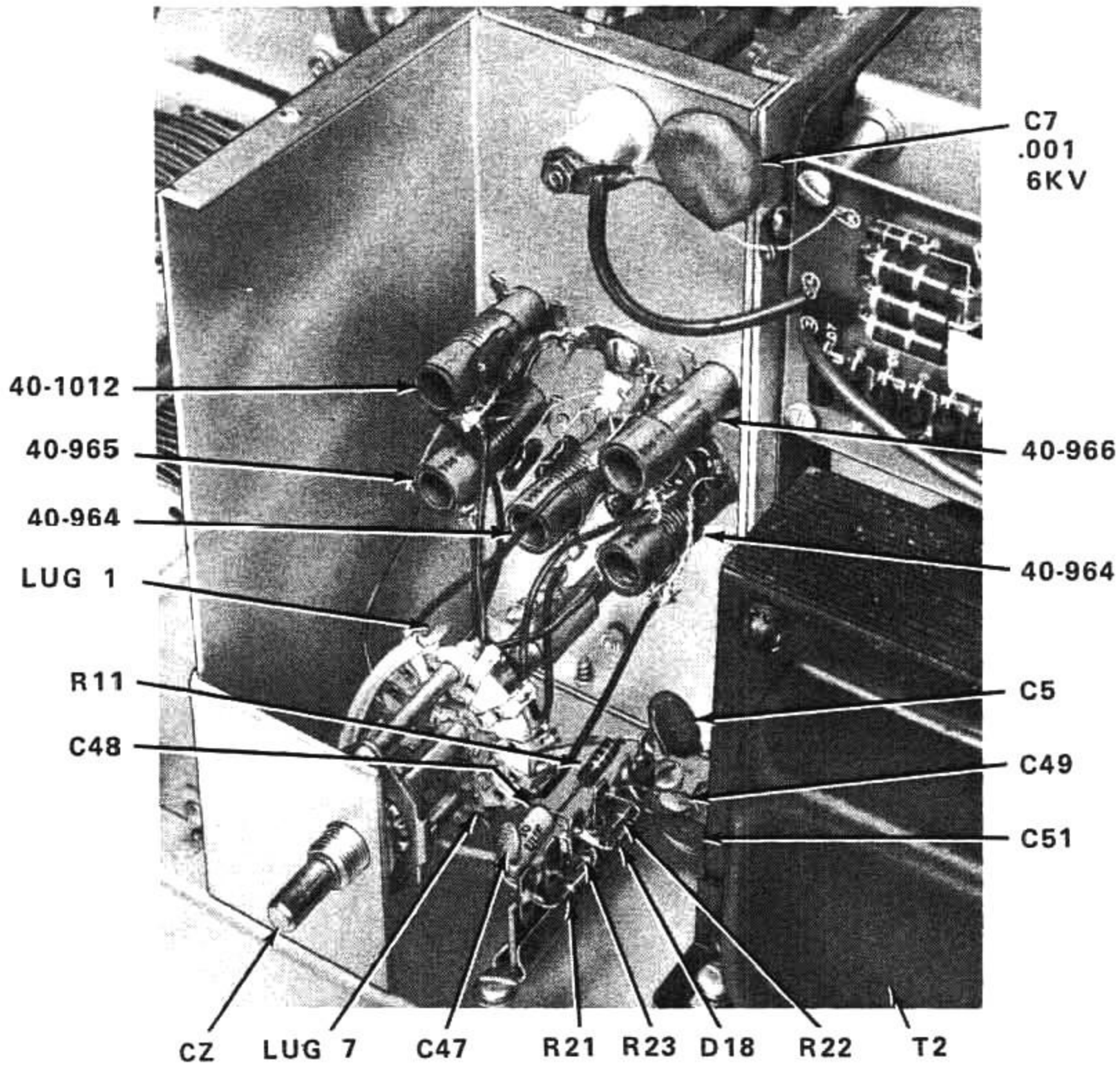
CHASSIS PHOTOGRAPHS




C29
C55
V1
C57
L6
PC1
L7
PC2
V2
C7
ZD1
INTERLOCK
RFC2
C6
RFC1


MULTI-
METER
PLATE
METER
C8
C3
METER
SWITCH
EU
SENSITIVITY
CONTROL
ET
C24
C25


ZD1
R19
R18
R17
C17
C16
C14
C15
R16
RED
R15
C12
C13
C11
BLU
C10
R12
R13
R14


C7
.001
6KV
40-1012
40-965
40-964
LUG 1
R11
C48
40-966
40-964
C5
C49
C51
CZ
LUG 7
C47
R21
R23
D18
R22
T2

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

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