



METROAMP 50 WATT PLEXI KIT

ASSEMBLY INSTRUCTIONS

V. 1.2 SEPTEMBER , 2009

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Thank you for your purchase of our 50 watt plexi kit. I hope you will enjoy building and playing your new amp. These instructions will take you step by step through the assembly and testing process. New to this kit is our inclusion of technical notes with several steps. These notes point out details and component values relevant to vintage Marshalls and tube amps in general.

These instructions are in Acrobat .pdf format. Allowing you to view, zoom and print pages and individual images. You can download a free copy of Adobe Acrobat Reader at: <http://www.adobe.com/products/acrobat/readstep2.html>

Only basic hand tools are required to assemble the kit:

screw drivers- standard and Philips
needle nose pliers
diagonal cutters
wire strippers
5/64" Allen wrench (for set screw knobs)
soldering iron- 15-40 watts
solder
multimeter- AC/DC at least 500 volts, resistance
round file

We also suggest these optional tools:

nut drivers- 1/4", 5/16", 11/32", 3/8" and 1/2"
heat gun- for shrink tubing
drill and several small bits
masking tape

The steps are best followed in order. And you'll find extra diagrams, schematics and alternate wiring layout files in the appendix. For example, a diagram for 220V AC operation of the power transformer.

Tech support is available online at our forum: <http://forum.metroamp.com>

Thanks,

George Metropoulos

!!! DISCLAIMER !!!

THIS AMP KIT OPERATES AT UP TO 500 VOLTS DC. THIS VOLTAGE IS POTENTIALLY LETHAL !!! PLEASE USE EXTREME CAUTION WHILE ASSEMBLING AND TESTING THIS KIT. METROAMP AND METROPOULOS AMPLIFICATION INC ACCEPT NO LIABILITY FOR DAMAGE OR INJURY INCURRED FROM OR WHILE USING THIS KIT.

50 WATT PLEXI KIT

<u>QTY</u>	<u>DESCRIPTION</u>	<u>QTY</u>	<u>DESCRIPTION</u>
1	SMALLBOX HEAD CASE	2	CE 50 X 50 FILTER CAP
1	STEEL CHASSIS	2	FILTER CAP MOUNT
4	CAGE NUTS	1	F&T DUAL 33UF AXIAL CAP
4	CHASSIS BOLTS	2	CARLING SP/ST TOGGLE
2	1/2" GROMMET	2	CHROME RING FOR TOGGLE
1	3/8" GROMMET	2	PANEL MOUNT FUSE HOLDER
1	PLEXI PANELS (FRONT/REAR)	1	120V INDICATOR LAMP
1	1202-118 POWER TRANSFORMER	1	MARSHALL IMPEDANCE SWITCH
1	784-139 OUTPUT TRANSFORMER	3	CGE 1M AUDIO TAPER POT
1	C1999 CHOKE	1	CGE 250K AUDIO TAPER POT
<u>OPTIONAL TRANSFORMERS</u>		1	CGE 25K AUDIO TAPER POT
1	MM P4550JT-G2	1	CGE 5K LINEAR TAPER POT
1	O50JM	6	MARSHALL SET SCREW KNOB
1	JJ E34L MATCHED PAIR	6	CLIFF OLD STYLE JACK
3	JJ 12AX7	1	PTP BOARD 10 1/8" X 3" RED
<u>OPTIONAL TUBES</u>		1	MP2510 BRIDGE RECTIFIER
1	MULLARD RI EL34 MATCHED PAIR	2	XICON 1K 5 WATT
3	TUNG SOL RI 12AX7	2	FUSE AGC 3A
6	#10 BRASS SCREW, FW, LW, LN	2	FUSE AGC 500mA
1	#10 BRASS 5/8", LW, LN	12	3" BLACK CABLE TIE
8	#6 SCREW, LW, NUT	6"	1/4" BLACK SHRINK TUBE
8	#4 SCREW, LW, NUT	1	50 WATT WIRE KIT (SEE PAGE 2)
5	#4 BOARD MOUNT BOLTS	1	50 WATT COMPONENTS KIT (SEE PAGE 2)
6	LOCK WASHER FOR POTS	1	8' POWER CABLE
6	2 HOLE GROUND LUG	1	STRAIN RELIEF
2	MICALEX OCTAL SOCKET	<u>OPTIONAL RESISTORS</u>	
3	MICALEX 9 PIN SOCKET & SHIELD	1	ALLEN BRADLEY NOS CC KIT (PAGE 2)
2	EL34 TUBE RETAINER		
<u>SOZO CAPS - LEAD SPECS</u>		<u>SOZO CAPS - BASS SPECS</u>	
7	SOZO .022UF @ 400V	5	SOZO .022UF @ 400V
2	SOZO .1UF @ 400V	4	SOZO .1UF @ 400V
2	SOZO .68UF @ 400V		

50 WATT PLEXI KIT (page 2)

50 WATT COMPONENTS KIT

CAPACITORS

- 2 10UF @ 160V
- 1 220UF @ 50V
- 1 330UF @ 25V
- 3 500PF SILVER MICA
- 2 250PF SILVER MICA
- 1 100PF SILVER MICA
- 1 47PF SILVER MICA

RESISTORS

- 2 1 OHM 1% METAL FILM
- 1 8.2K 2 WATT METAL OXIDE
- 3 10K 2 WATT METAL OXIDE
- 2 100K 2 WATT METAL OXIDE
- 1 47K 2 WATT METAL OXIDE

- 1 470 1 WATT CARBON FILM
- 2 820 1 WATT CARBON FILM
- 1 2.7K 1 WATT CARBON FILM
- 2 5.6K 1 WATT CARBON FILM
- 1 10K 1 WATT CARBON FILM
- 1 15K 1 WATT CARBON FILM
- 1 33K 1 WATT CARBON FILM
- 1 47K 1 WATT CARBON FILM
- 1 56K 1 WATT CARBON FILM
- 4 68K 1 WATT CARBON FILM
- 1 82K 1 WATT CARBON FILM
- 5 100K 1 WATT CARBON FILM
- 1 150K 1 WATT CARBON FILM
- 2 220K 1 WATT CARBON FILM
- 2 470K 1 WATT CARBON FILM
- 4 1M 1 WATT CARBON FILM

- 1 1N4007 DIODE
- 1 25K HORIZONTAL BIAS POT

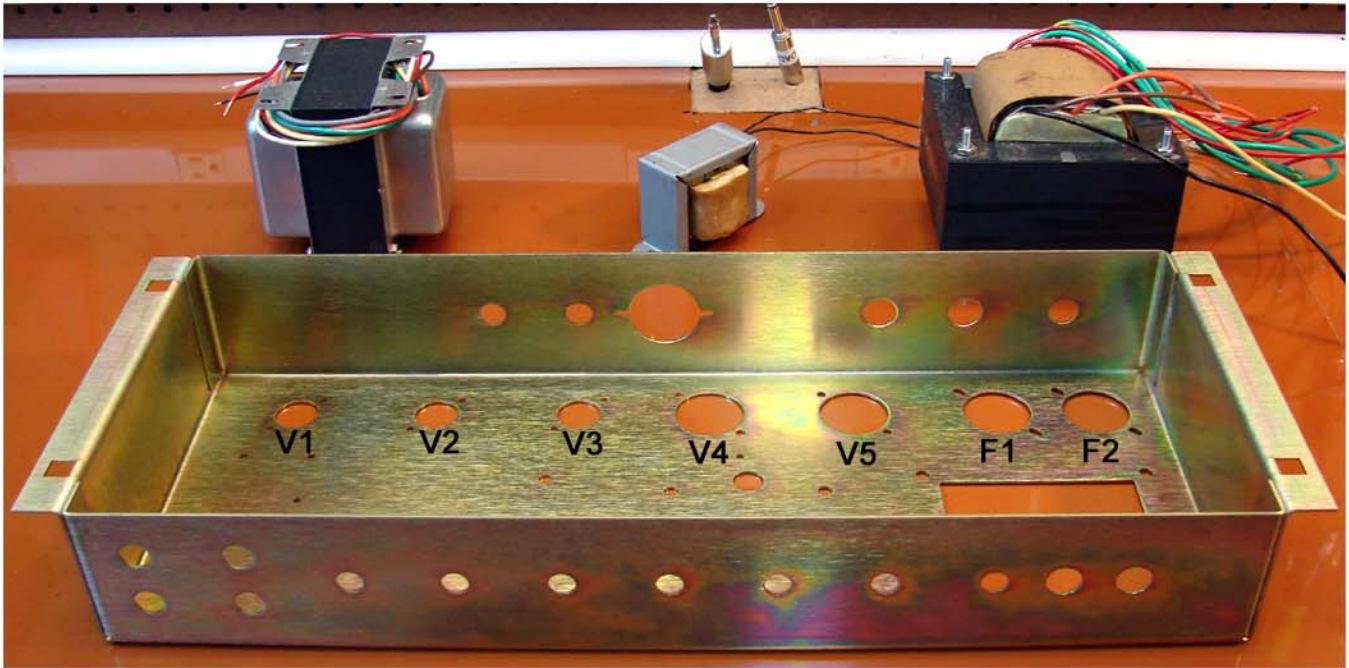
50 WATT WIRE KIT

- 3' 18 GAUGE BUSS
- 3' 22 GAUGE BUSS
- 2' 18 GAUGE BLACK INSULATION
- 10' RED 22 GAUGE 600V TOPCOAT
- 10' BLACK 22 GAUGE 600V TOPCOAT
- 6' BLUE 22 GAUGE 600V TOPCOAT
- 6' YELLOW 22 GAUGE 600V TOPCOAT
- 6' GREEN 22 GAUGE 600V TOPCOAT
- 6' PURPLE 22 GAUGE 600V TOPCOAT
- 6' WHITE 22 GAUGE 600V TOPCOAT
- 6' ORANGE 22 GAUGE 600V TOPCOAT
- 6' BROWN 22 GAUGE 600V TOPCOAT

OPTIONAL ALLEN BRADLEY NOS CC KIT

- 2 820 1/2 WATT CARBON COMP
- 1 33K 1/2 WATT CARBON COMP
- 1 47K 1/2 WATT CARBON COMP
- 1 56K 1/2 WATT CARBON COMP
- 4 68K 1/2 WATT CARBON COMP
- 2 100K 1/2 WATT CARBON COMP
- 2 470K 1/2 WATT CARBON COMP
- 4 1M 1/2 WATT CARBON COMP

STEP 1: BEFORE YOU BEGIN



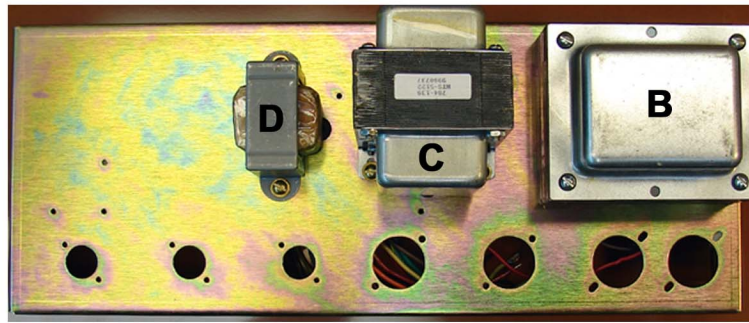
Before starting the assembly, we suggest looking over the parts and getting familiar with the kit. The preceding parts list can be used as a check sheet.

For best results, assemble your kit in a clean area with good lighting. We suggest working for 2-3 hours per sitting. The steps in this manual are divided into specific tasks. You should be able to complete several steps in each session.

Throughout this manual we will refer to particular tube sockets and filter caps as indicated in the photo. Looking inside the chassis, with the front panel facing you, the tube sockets are labeled left to right: **V1** (V stands for “valve”) through **V5**. Likewise, filter cap cans are designated **F1** and **F2**.

The power transformer is abbreviated as “**PT**” and the output transformer is abbreviated as “**OT**”.

STEP 2: INSTALLING THE TRANSFORMERS AND CHOKE.



A. Install (2) **1/2"** **grommets** in the output transformer wire holes in the chassis. And (1) **3/8"** **grommet** in the choke wire hole.

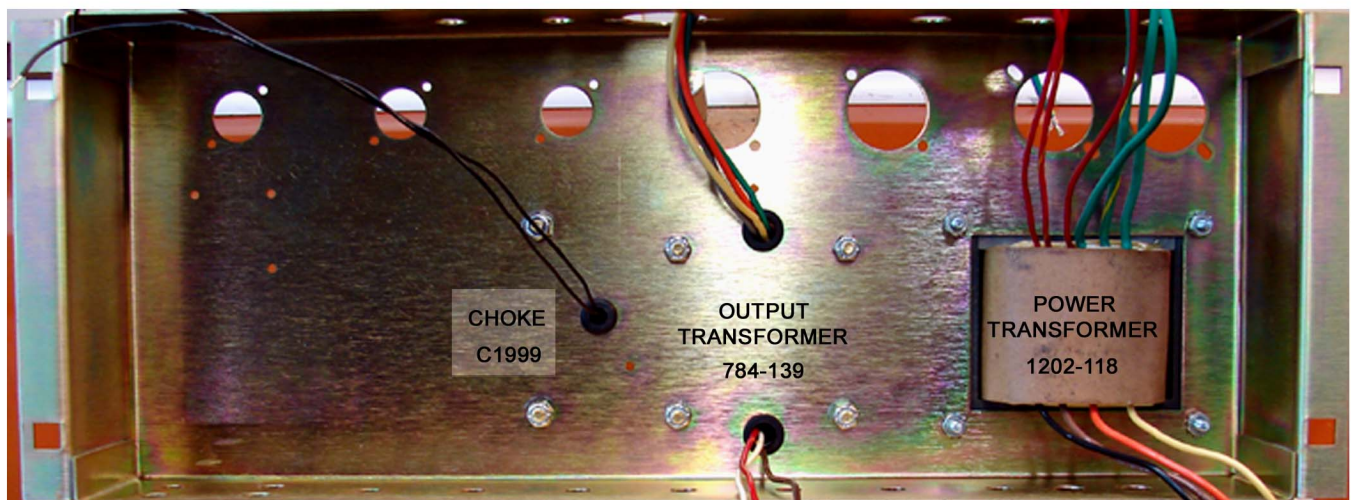
B. Install the power transformer, **1202-118** on the chassis with the wires oriented as in the picture below.
Use a lock washer between the nut and chassis. Tighten the nuts using an **11/64"** socket or nut driver.

C. Install the output transformer, **784-139** with wires routed as pictured. Mount using (4) **#10 brass bolts**. From the top, your hardware sequence is:

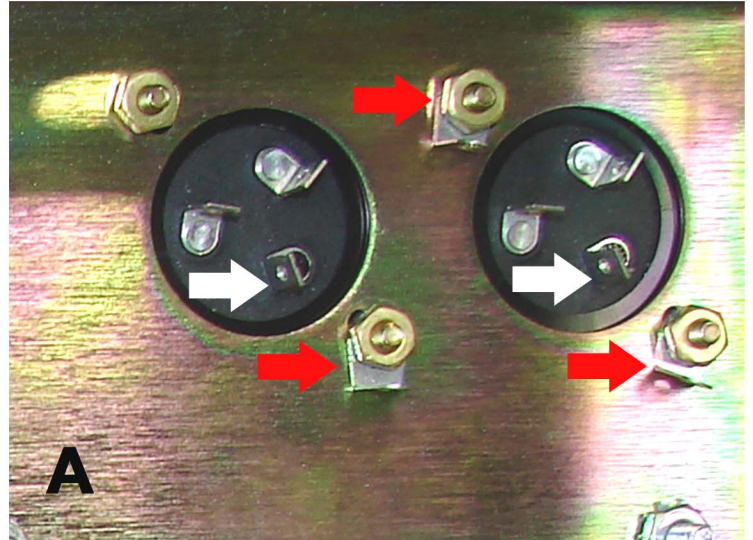
Bolt - flat washer - OT bracket - chassis - lock nut.

The lock nut requires a **3/8"** socket or nut driver.

D. Install the choke, **C1999** using (2) **#10 brass bolts**, flat washer and lock nuts.



STEP 3: INSTALLING FILTER CANS AND PREAMP TUBE SOCKETS.



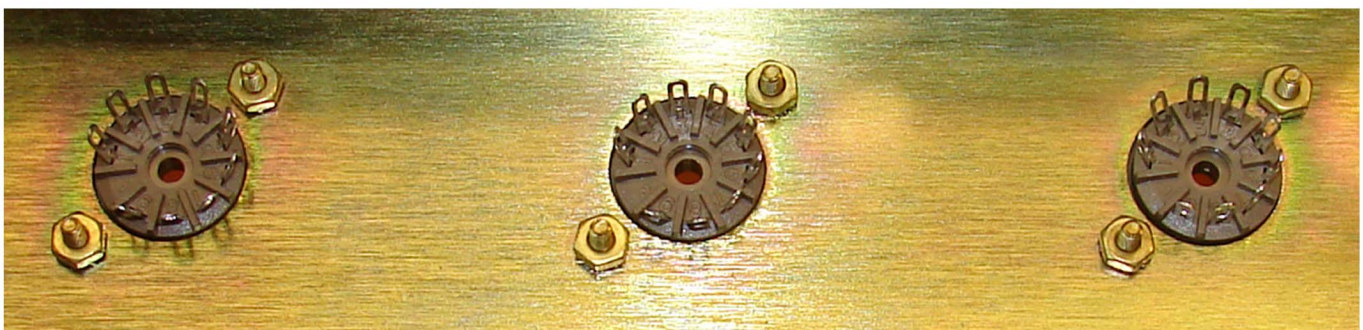
- A.** Install (2) **CE 50 x 50uF** filter cap cans using can cap mounts and #6 brass bolts. Be sure to orient the ground terminal (white arrows) as in the photo above. (3) of (4) mounting bolts require a **2 hole ground lug**, indicated by red arrows. The hardware sequence is:

Bolt - Cap Mount - Chassis - Ground Lug - Lock Washer - Nut

#6 brass nuts require a 5/16" socket or nut driver.

-
- B.** Install the (3) **9 Pin Preamp Sockets** using (6) #4 brass bolts, lock washers and nuts. Be sure to orient the space between terminals 1 and 9 as indicated in the picture below.

#4 nuts require a 1/4" socket or nut driver.



STEP 4: INSTALLING THE OUTPUT TUBE SOCKETS

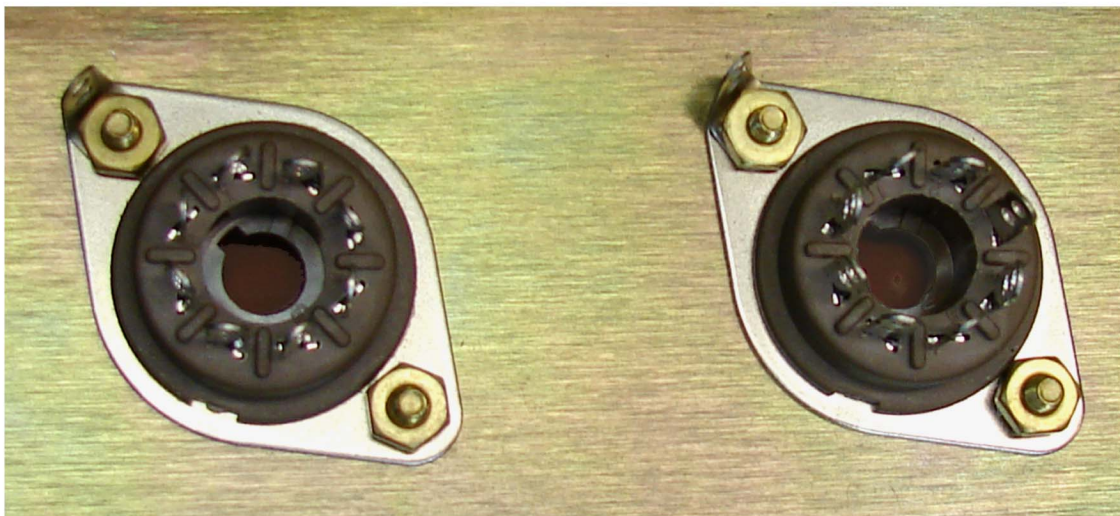
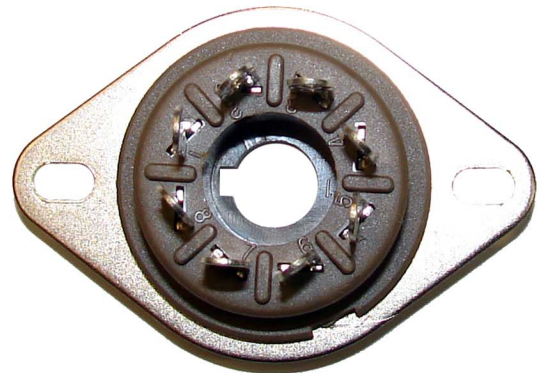
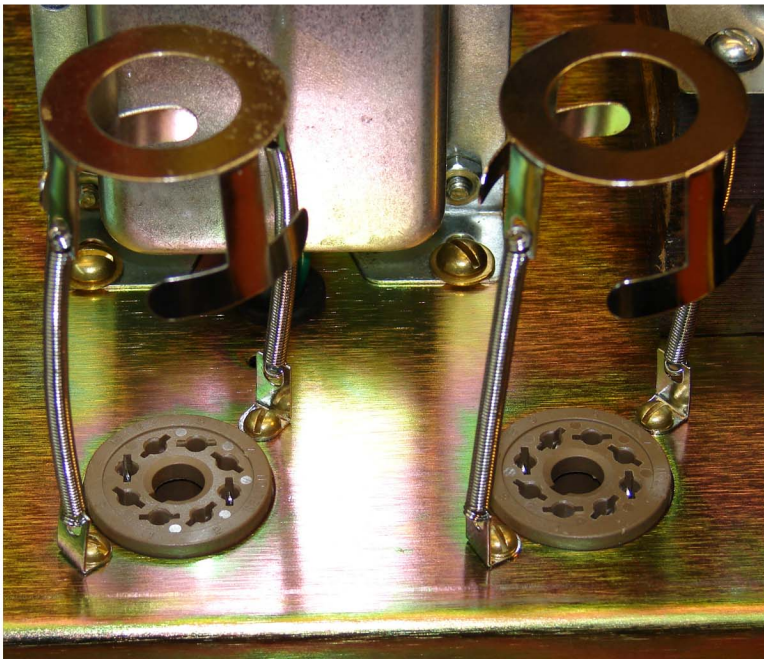
- A. Install (2) Micalex Octal Sockets and (2) EL34 Tube Retainers** using (4) #6 brass bolts, lock washers and nuts. Be sure to orient the notch in each socket towards the rear of the chassis, as in the picture below.

(2) bolts also require ground lugs, as shown.

The hardware sequence is:

**Bolt - Tube Retainer - Chassis - Tube Socket - Ground Lug -
Lock Washer - Nut**

#6 brass nuts require a 5/16" socket or nut driver.



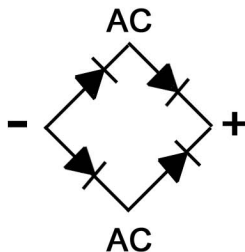
STEP 5: INSTALLING THE BRIDGE RECTIFIER AND PANELS.

- A.** Install the **Bridge Rectifier** to the chassis using a #10 brass bolt, lock washer and lock nut. Be sure to orient the flat corner (indicating positive) as in the picture.

The hardware sequence is very important on this part, to prevent the bridge from moving:

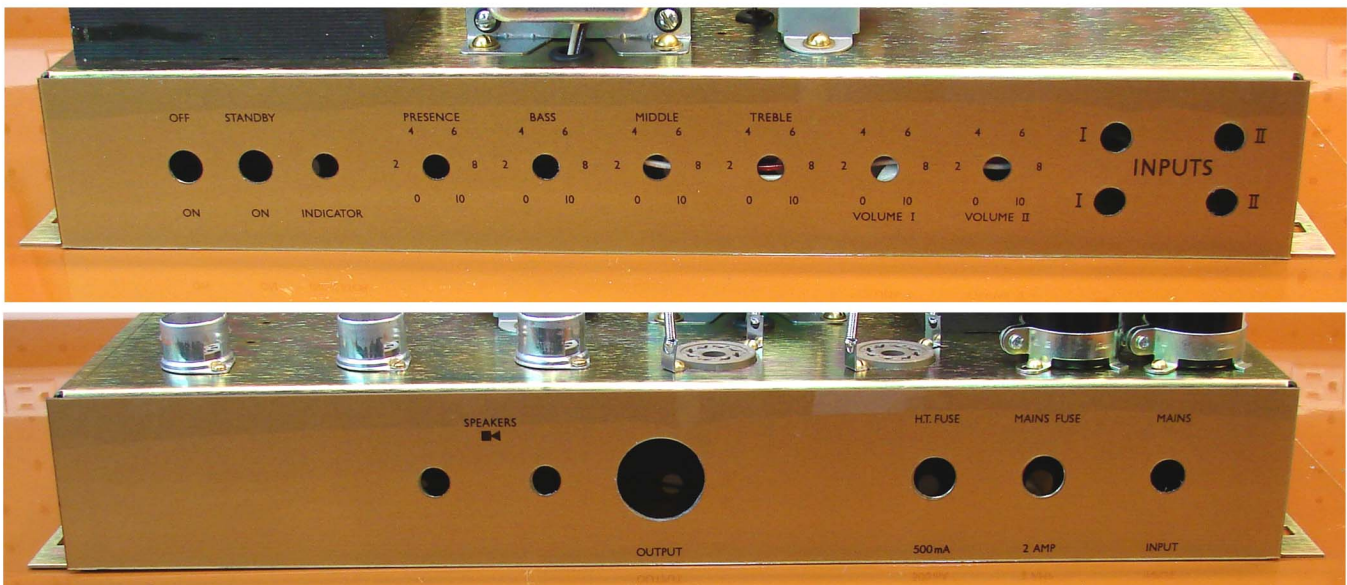
Bolt - Lock Washer - Bridge Rectifier - Chassis - Lock Nut

TECH NOTE: a bridge rectifier consists of (4) discrete diodes wired in parallel pairs with all cathodes facing the same way. In this application, we are using only (2) of the internal diodes. As illustrated in the 50 watt Lead schematic.



- B.** Peel away the backing and press the **Plexi Panels** into place on the front and rear of the chassis. Make sure each panel remains flush with the edge of the chassis.

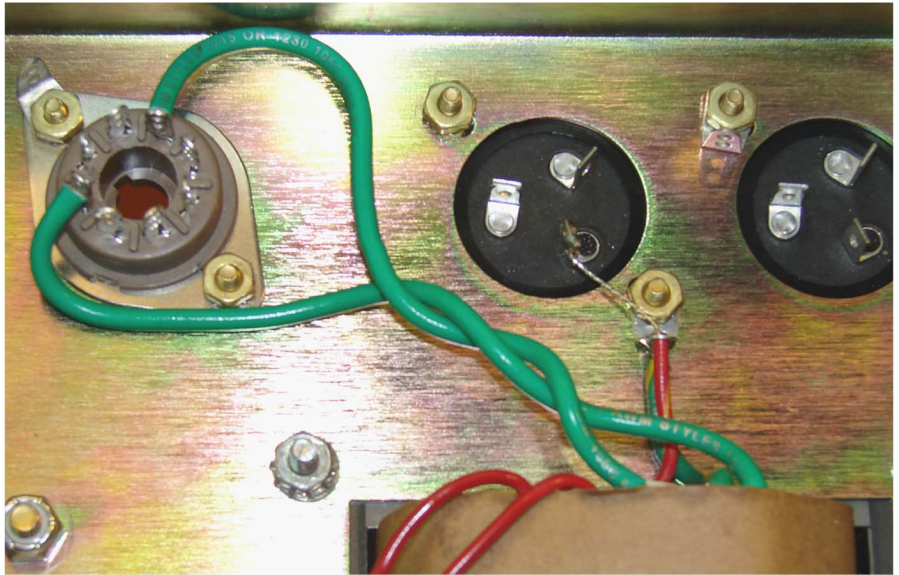
Inspect the holes and remove any excess panel material with a round file.



STEP 6: WIRING THE HEATERS

- A.** Solder the **PT** heater CT (center tap), Green with Yellow stripe, to the ground lug on F1.

Cut the **PT** high voltage secondary CT, Red with Yellow, to 3". Strip 1.5" and route it through the ground lug, then on to F1 negative terminal.



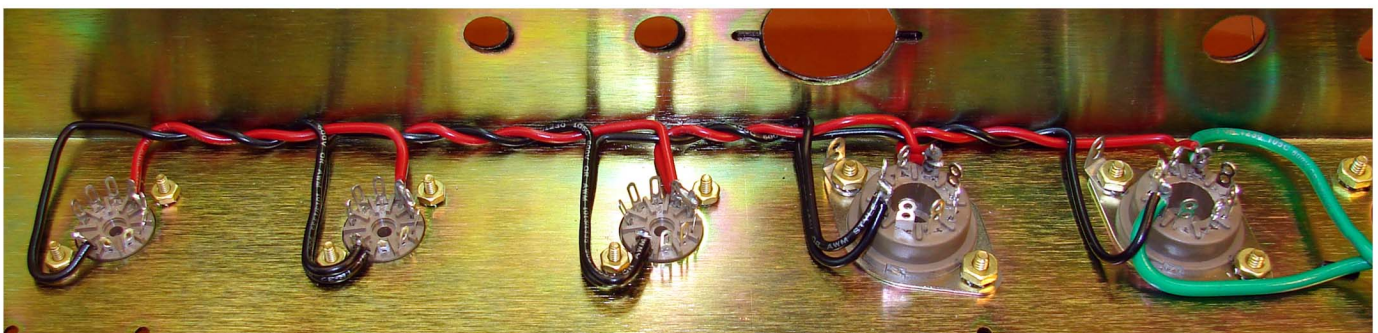
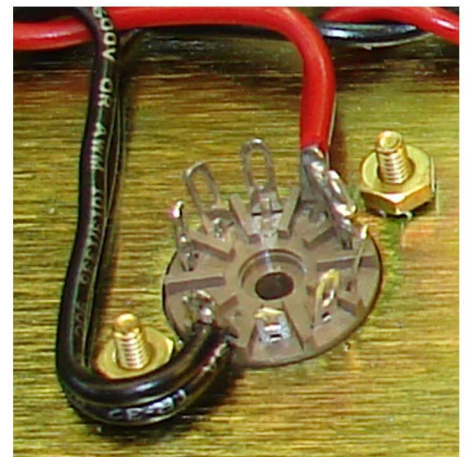
Twist and route the **PT** heater wires, Green, to V5 pins 2 and 7. As shown.

- B.** Using 22 gauge red and black wire, solder, twist and route heater wires across each of the tube sockets. This step can not be rushed. Starting from **V5** and working from right to left, solder a 6" red wire to pin 2 and a 10" black wire to pin 7. Route these to the rear of the chassis, twist and wire to pins 2 and 7 of **V4**.

Continue on to the preamp sockets and note that red attaches to both pins 4 and 5. While black attaches to pin 9.

Be sure to include (3) full twists of wire between the preamp tube sockets, where AC hum is more of a concern.

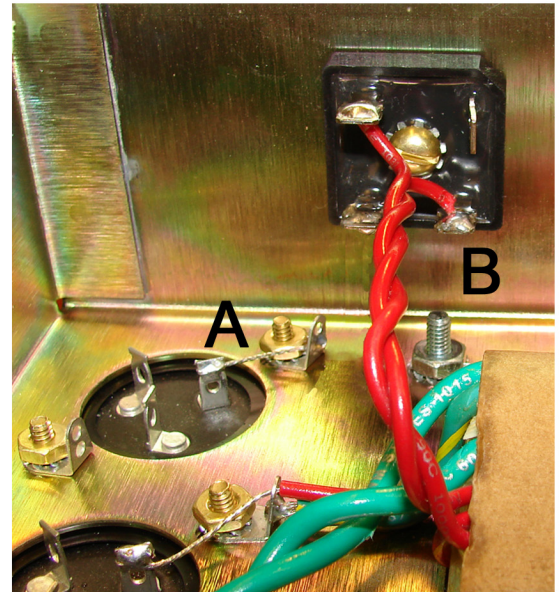
TECH NOTE: Twisting wires that carry AC voltage can prevent hum due to phase cancellation. In this case the AC voltages are out of phase due to the center tapped heater wind in the power transformer.



STEP 7: WIRING THE RECTIFIER AND PT PRIMARY

- A. Use 1.5" of 18 gauge buss wire to connect the **F2** negative terminal to the ground lug.

- B. Twist 4" of the **PT** high voltage secondary wires (red) and route them to the bridge rectifier. Strip 1/2" from each and wrap around the rectifier terminals labelled "AC", as shown.



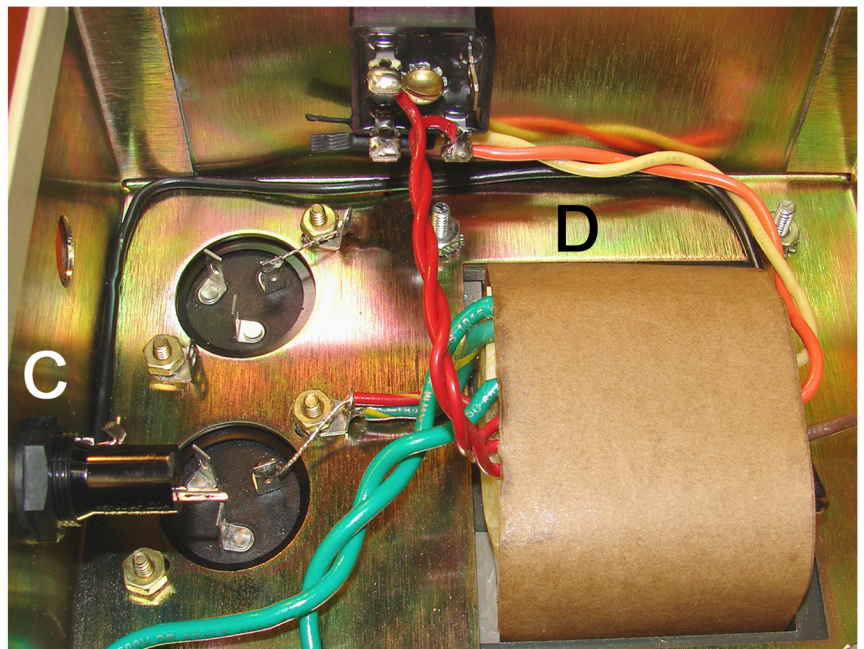
- C. Install the **fuse holder** closest to the **PT**. The large white washer is installed between the fuse holder and the plexi panel. It has a small notch that accommodates a locating pin on the fuse holder.

Route the **PT** common (black) wire to the fuse holder and solder to the side terminal.

- D. The **1202-118** PT includes primary taps for use with 120, 220 or 240V AC supply. For use with 120V AC (brown) you'll need to cut and shrink tube the ends of the 220,240 taps (yellow, orange).

Cut the unused wires to 4-6" and cover the end with **1/8"** **shrink tube**. Route these wires along the chassis edge, as shown. They will later be cable tied.

NOTE: for 220, 240V AC operation, please refer to the appropriate diagram in the **Appendix**.



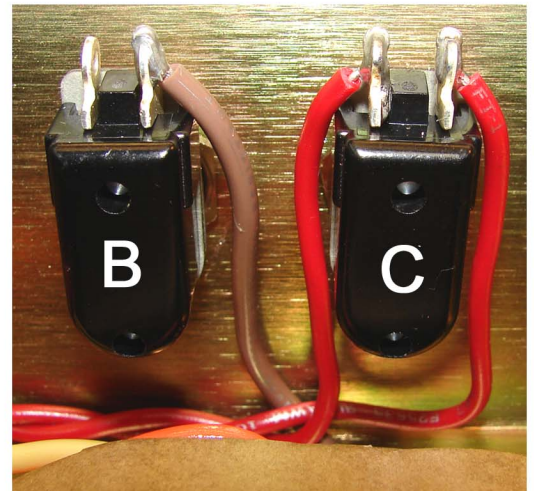
STEP 8: INSTALLING THE SWITCHES AND WIRING STANDBY

A. Install (2) Carling SP/ST switches and Chrome Rings.



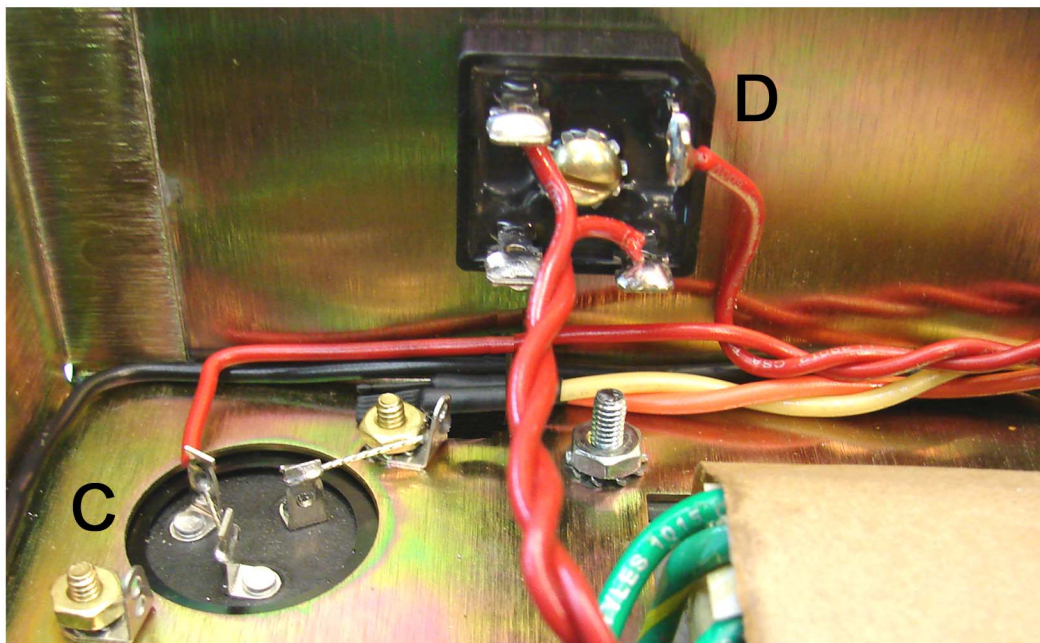
B. Wire the PT primary wire (brown for 120V) to the POWER switch, as shown.

C. Attach red wires (one 10" and one 14") to each terminal on the STANDBY switch. Twist and route these to the rectifier bridge and F2 filter cap.



D. Cut the 10" red wire to length and attach to the positive (+) terminal.

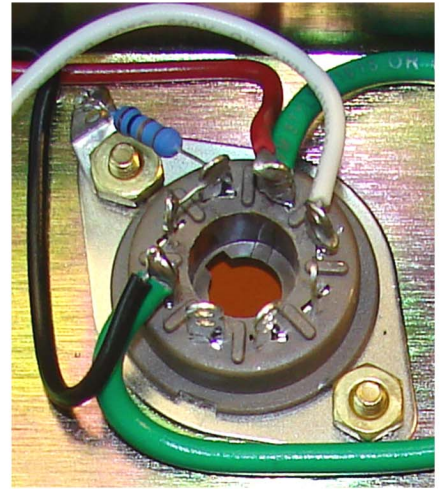
E. Strip 1.5" from the end of the 14" red wire and attach to both F2 positive terminals.



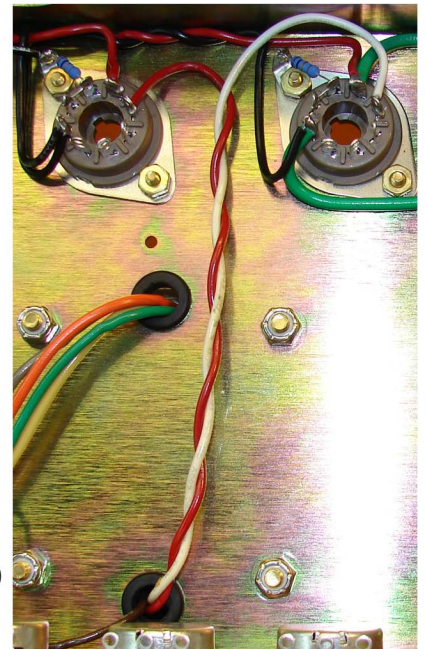
STEP 9: WIRING OT PRIMARY AND INSTALL OUTPUT JACKS

- A.** Install (2) **1 ohm 1 watt** resistors (brown-black-gold) on V4 and V5. Connect pins 1 and 8 with one resistor lead, as shown. Then attach the opposite end to the ground lug.

TECH NOTE: On previous kits, the 1 ohm bias resistor was installed between pins 1 and 8. Technically speaking, this new method provides a slightly more accurate bias reading. On the order of a few milliamps. Fortunately, biasing doesn't require operating the output tubes at a static setting. Either method provides useable results. More on this in the testing section.

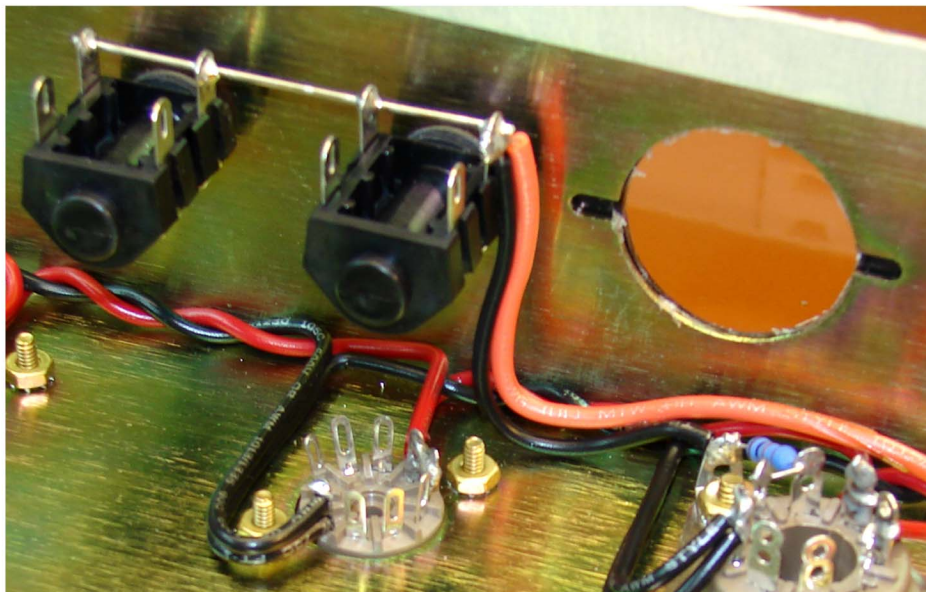


- B.** Twist the OT primary wires (red and white) as shown and attach: Red to V4, pin 3 White to V5, pin 3



- C.** Install (2) **Cliff Old Style Jacks** in the speaker jack positions. Route the OT secondary, common wire (orange) to the near jack and attach as shown. Also, attach a 3" section black wire. Bridge all four of the negative terminals (closest to the chassis) with 18 gauge buss wire and solder each connection.

Attach the black wire to the ground lug on V4.



STEP 10: WIRING OUTPUT JACKS AND IMP SWITCH

- A. Route the OT secondary wires (yellow, green, gray) to the Impedance Selector switch and cut to length.**

Attach as shown. Yellow to pin 1, green to pin 2 and gray to pin 3. It is easiest to solder these in place before mounting the impedance switch to the chassis.

Wires attached, place the switch in the chassis hole and drill the panel for mounting bolts using a 7/64" (or 3mm) bit.

Mount using (2) #4 bolts, lock washers and nuts.
Hardware sequence:

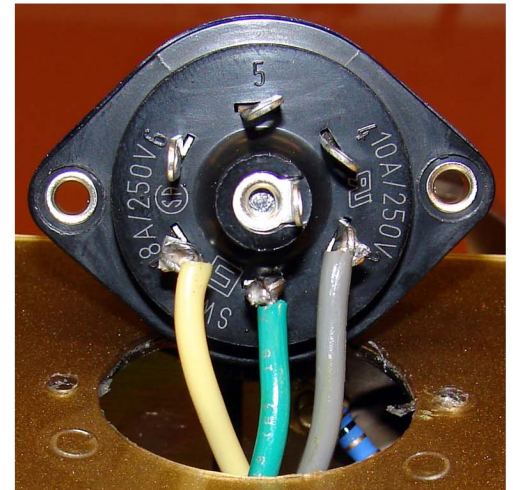
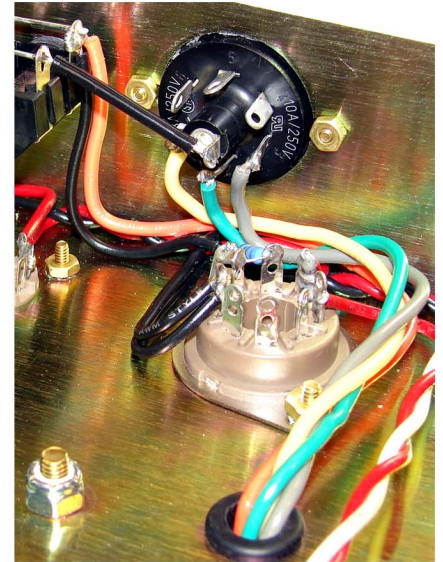
Bolt - Switch - Chassis - Lock Washer - Nut

NOTE: OT SECONDARY

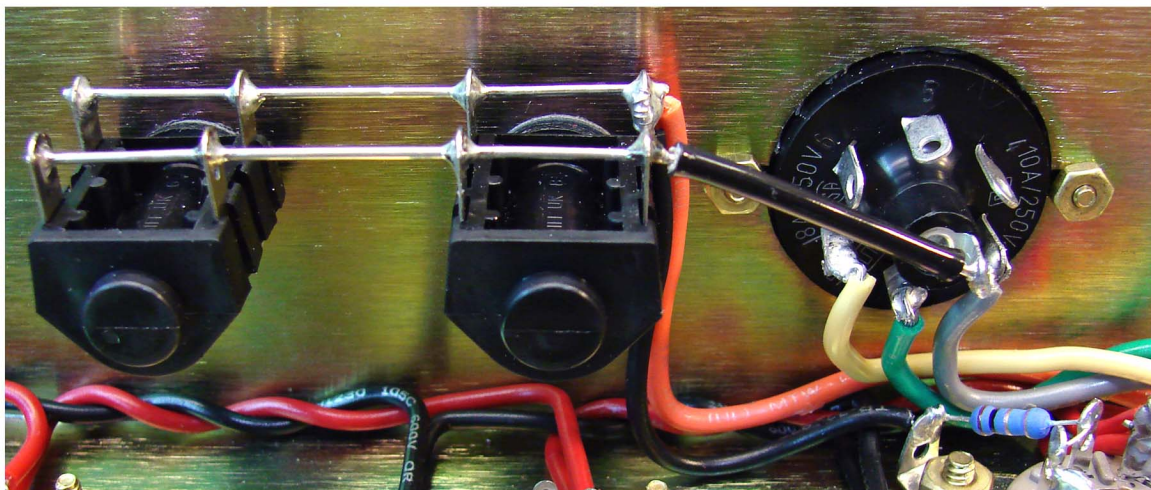
YELLOW = 4 OHMS

GREEN = 8 OHMS

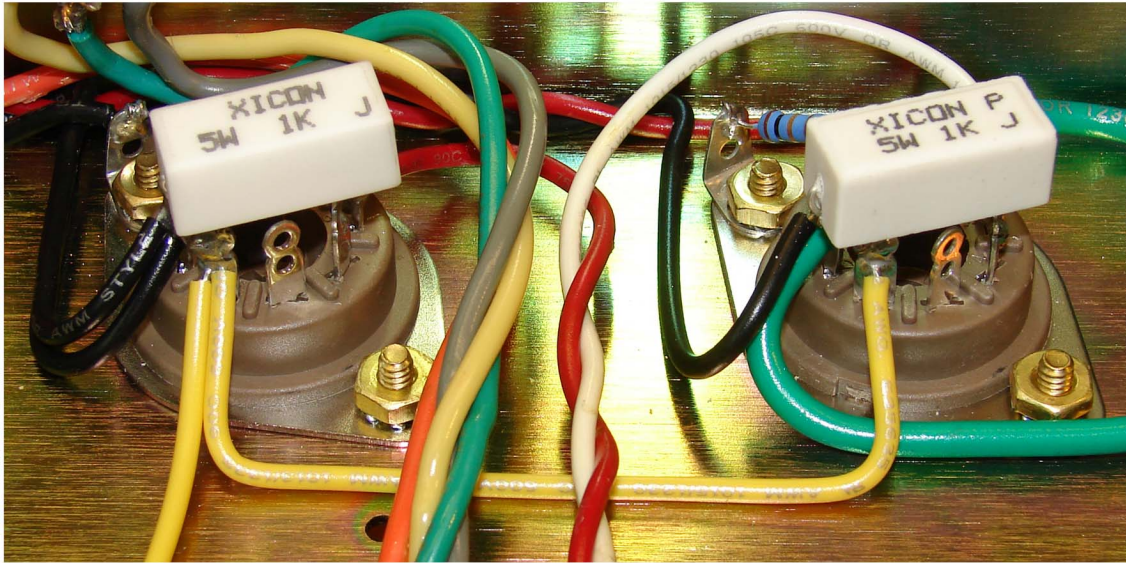
GRAY = 16 OHMS



- B. Using 18 gauge buss wire, bridge the four positive terminals on the output jacks and the impedance switch center terminal. Insulate the buss between the jacks and switch using 1.5" of 18 gauge insulation.**



STEP 11: INSTALL SCREEN RESISTORS AND INDICATOR



- A.** Cut (2) 5" lengths of yellow wire. Bend one wire as shown and bridge between **V4** and **V5**, pin 6. Attach the other wire at **V4**, pin 6. Later, this wire will connect to the board. Be sure to use the lower holes in the tube socket terminals, as the large screen grid resistor will attach here as well.
- B.** Install (2) **Xicon 1K 5 watt** resistors on **V4** and **V5**. Bend the resistor leads under the component and space them at 1/2". Cut to length and solder between pins 4 and 6.

TECH NOTE: Early 50 watts did not include these screen grid resistors, since Mullard EL34's could handle full screen current draw. Modern tubes, however, require these resistors to limit the current flowing in the screen grids.

-
- C.** Install the **120V Indicator lamp**. Attach a 4" red wire and a 14" black wire. Route the red wire to the power switch terminal shared by the **PT** primary wire (STEP 8, part B). Route the black wire to the fuse holder terminal shared by the **PT** primary black wire (STEP 7, part C).

NOTE: For 220/240V operation, refer to the appropriate wiring diagram in the **Appendix**.



STEP 12: INSTALLING THE POTS AND KNOBS



PRESENCE

BASS

MIDDLE

TREBLE

VOLUME I

VOLUME II

- A. Install (6) **CGE pots**. Pay close attention to the values, as above. The hardware sequence is:

Pot - Lock Washer - Lock Washer - Chassis - Flat Washer - Nut

The pot nuts require a 1/2" socket or nut driver.

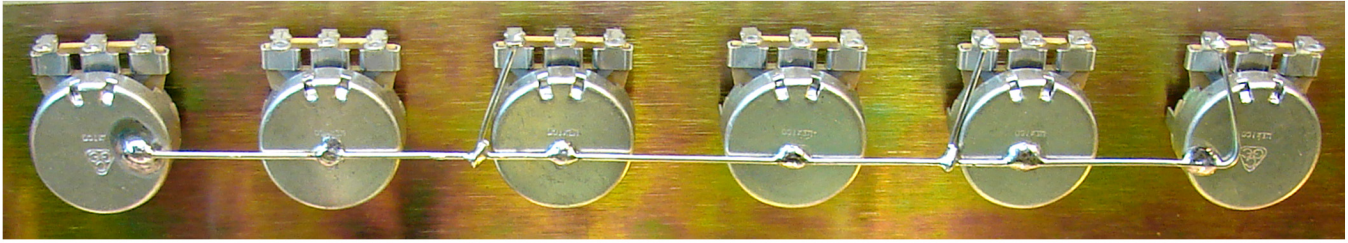
-
- B. Install (6) **Marshall Set Screw Knobs** using a 5/64" Allen wrench.

NOTE: a 2mm Allen wrench will work as well.

The Marshall knobs often have excess material that must be cleared away before they will fit the pot shaft. In this case, a 1/4" drill bit serves the purpose.



STEP 13: INSTALL BUSS AND INPUT JACKS



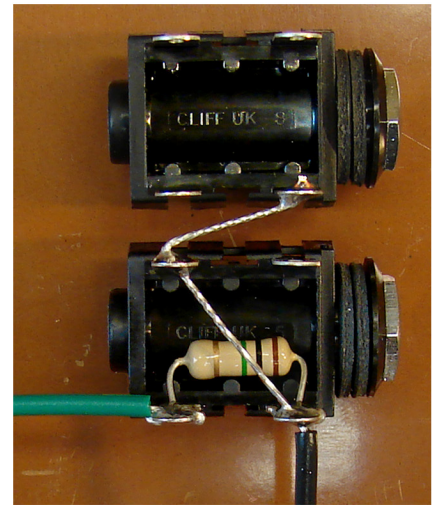
- A.** Install 18 gauge buss wire across the pots, as shown. Be sure to route the buss from the **VOLUME II** pot up to pin 3.

Install buss between the main buss and pin 3 of both the **VOLUME I** and **MIDDLE** pots.

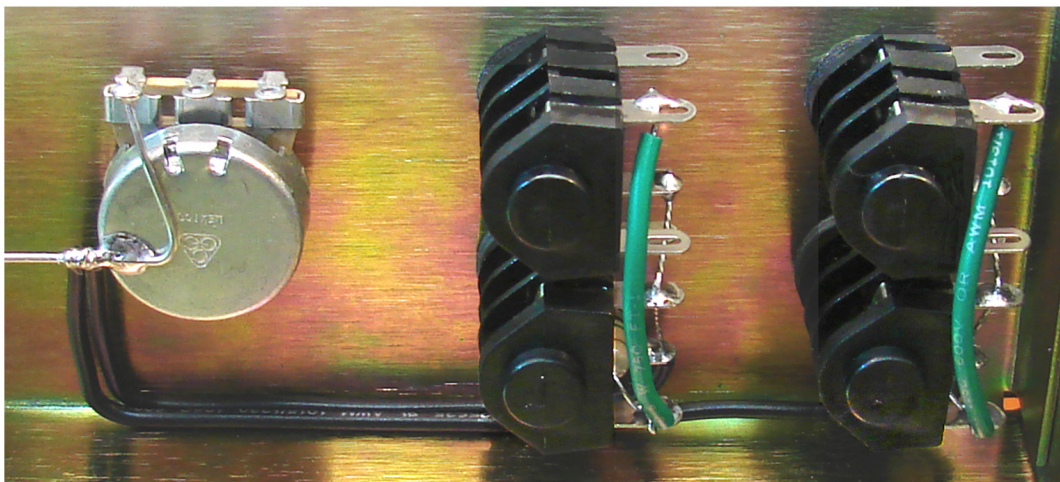
- B.** Prepare (2) Input Jack Assemblies using (2) **Cliff Jacks**, (1) **1M 1 watt resistor** (brown-black-green), (1) 10" black wire and (1) 2" green wire each, as shown.

First bend the leads and attach the resistor. Next, strip 2" from the end of the black wire and route diagonally through the lower jack terminals and on to the top jack. Solder in place. Finally, attach the 2" green wire, as shown.

NOTE: If you opted for Allen Bradley NOS CC resistors, use the (2) 1M 1/2 watts for this step.

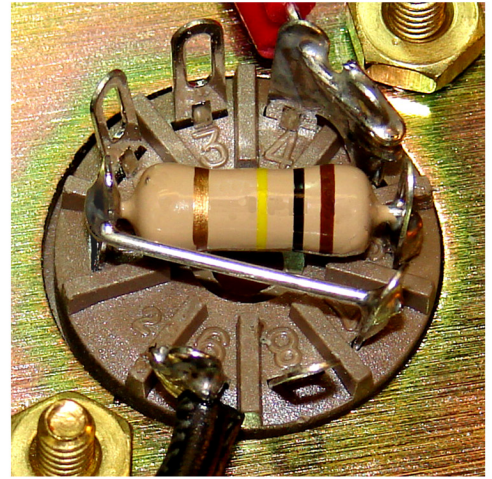


- C.** Mount the jack assemblies to the chassis and route the black wire to the pot buss. Attach each by stripping 1/4" and bending the bare wire into a small hook. Place the hook over the buss, pinch it tight and solder in place.
- D.** Attach the green wires to the top jacks, as shown, and solder in place. Leave room on the terminal for the wire which will attach here later.



STEP 14: INSTALL V2 PLATE RESISTOR AND BOARD MOUNTS

- A.** Install a **100K 1 Watt** (brown-black-yellow) on the **V2** tube socket, as shown. One lead attaches to pin 6, the opposite lead bridges pins 1 and 7.



- B.** Install (5) **#4 Board Mounting Bolts** in the positions indicated below. Hardware sequence:

Bolt - Flat Washer - Chassis - Lock Washer - Aluminum Spacer - Lock Washer - Nut - Nut

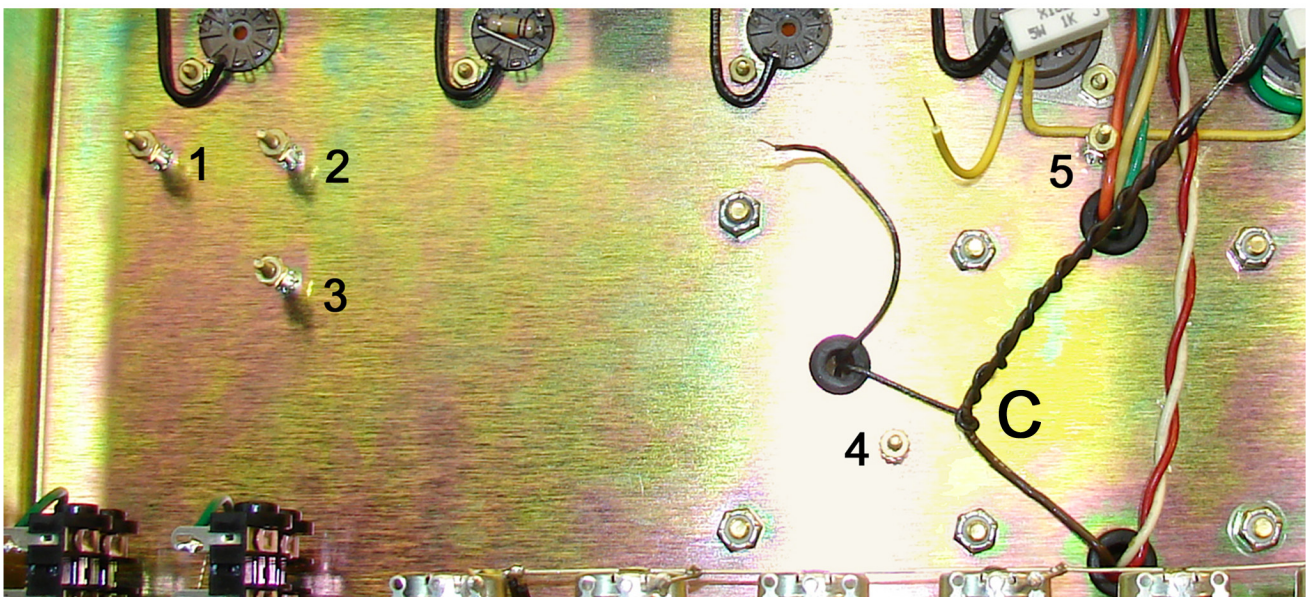
#4 nuts require a 1/4" socket or nut driver.

- C.** Twist the **OT primary CT** (brown) and one choke lead together for 6" length, as shown. These will attach to the board.

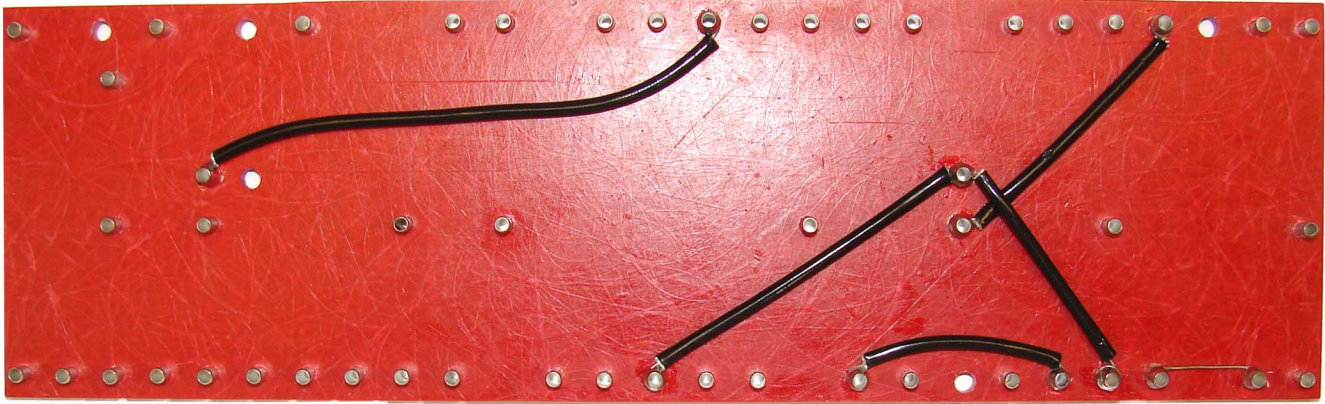
Cut the remaining choke wire to 5" length.



Your chassis is now ready for the point to point board, which will be prepared for installation in the following steps.



STEP 15: INSTALL BUSS WIRES ON BOARD



- A.** Using 22 gauge buss wire and 18 gauge insulation, connect terminals on the PTP board, as indicated.

Be sure each terminal has a full wrap of buss wire and that the solder flows evenly across the terminal and buss.

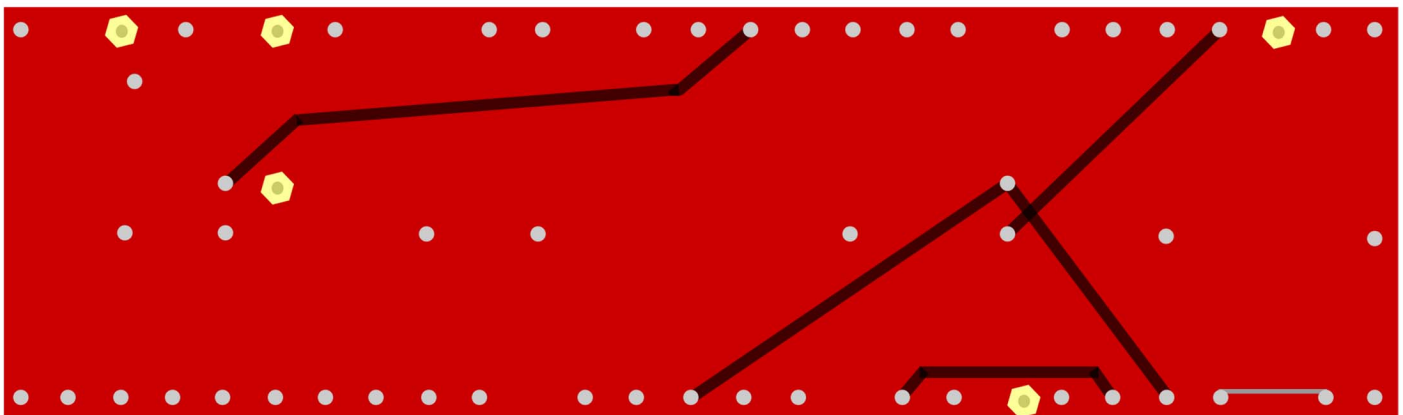
Note that there is no connection between the buss wires which cross.



- B.** Install a bare buss wire, with no insulation, between terminals in the lower, right corner of the board.

TECH NOTE: Early Marshalls, JTM 45, 50 watt and 100 watts, typically used normal wire on the underside of the board for these connections. In general, by mid 1968 the buss wires appear on top of the board.

You can wire your buss wire on the bottom, early style. But it does make troubleshooting issues with buss wires more difficult.



STEP 16: INSTALLING THE PTP BOARD WIRES

- A. This step is very important to get right, since once the board is wired into the chassis, it's difficult to troubleshoot wiring issues underneath.

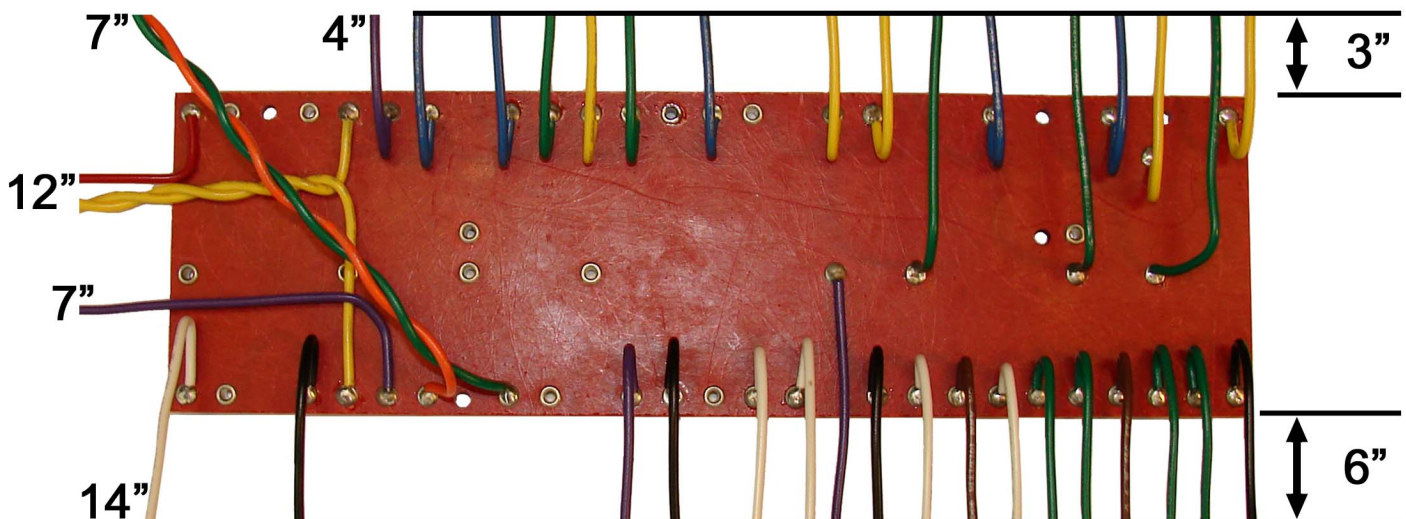
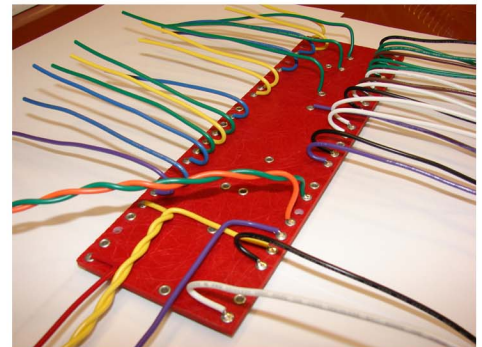
Solid solder connections are also paramount.



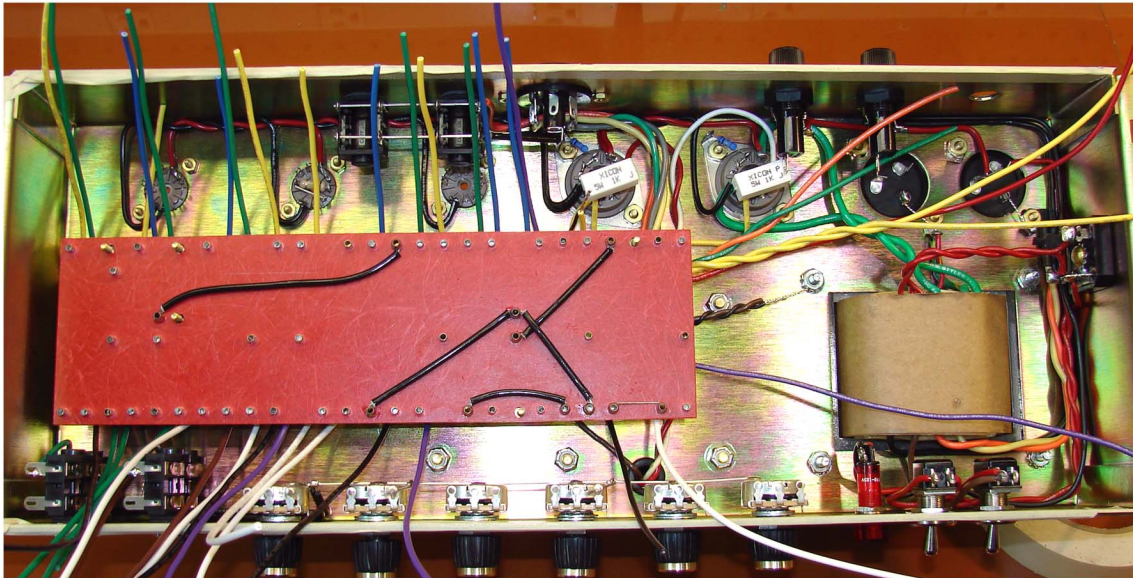
- B. For each wire, start by stripping 1/4" from the end. Fold the bare wire over to form a "U" shape. Press this into the terminal and solder in place. Be sure not to fill the terminal with solder. Component leads will be inserted from the top of the board later.

- C. Working from left to right, cut the appropriate wire color to length and solder in place. Note that the 3" and 6" lengths listed below indicate the wire needed from the board edge to the chassis termination. 4", 7", 12" and 14" wires are actual, overall length from board terminal to chassis termination.

NOTE: a curve in the wire under the board will direct the wire down to the chassis when the board is installed.



STEP 17: WIRING THE BOARD INTO THE CHASSIS



A. Lower the board on to the mounting bolts and locate the wires in the general location where they will attach inside the chassis.

B. (4) wires in the chassis attach to board terminals. The twisted pair of OT primary and choke wire (brown and black) both connect at the top, right corner terminal, as shown. The screen grid (yellow) and remaining choke wire (black) attach to the board, as well.



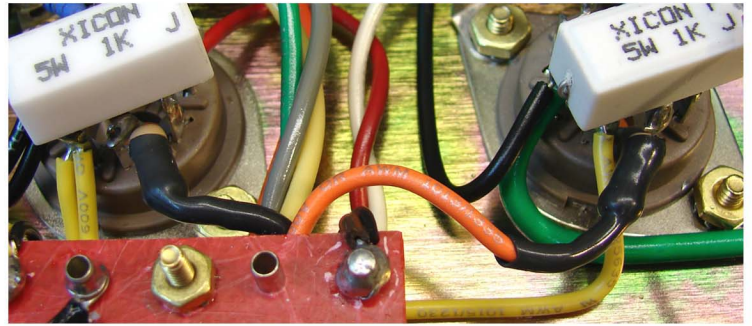
C. Reference the full chassis wiring diagram in the Appendix titled "**Metroamp 50 Watt Plexi Kit**" to systematically cut to length and attach board wires inside the chassis. For optimal wire routing, refer to the photo titled "**50 Watt Chassis Inside**" and images in the next step "**Board Wiring Details**".

TECH NOTE: Sloppy wire routing can cause noise and hum in the amp. Wires should be kept as short as possible in most positions. Especially green wires on the input jacks and preamp tube grids.

In general, any wire carrying signal should be isolated from wires carrying high DC voltage (such as blue plate wires) or AC voltage, as in the heater wiring.

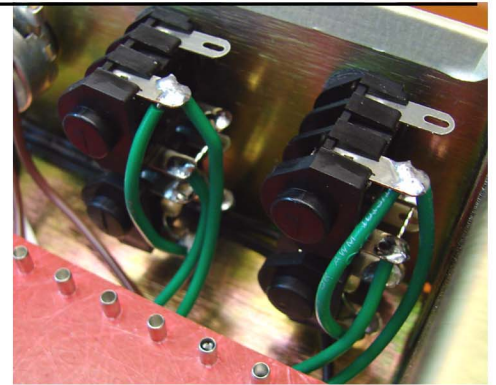
STEP 18: BOARD WIRING DETAILS

- A.** Install **5.6K 1 watt** resistors (green-blue-red) between the orange and green wires and the output tube socket grids, pin 5.
1/4" diameter shrink tubing over the wire and resistor will prevent it from shorting.

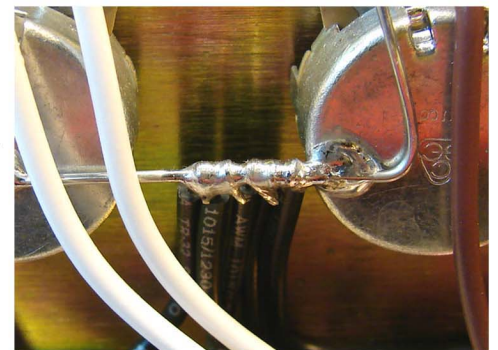


TECH NOTE: Many early 50 watts did not include output grid resistors. These components stabilize the output section by creating a low pass filter, which prevents high frequency oscillation. The value of the resistor, and to a lesser degree the internal properties of the tube grid, determine the cut off frequency. Increasing the resistor value, lowers the cutoff frequency.

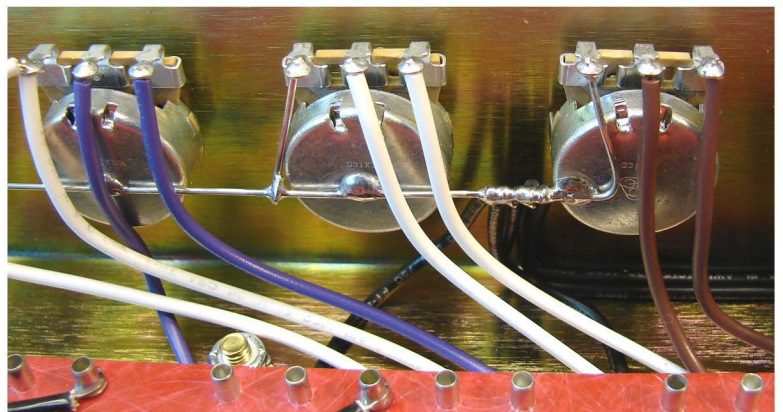
- B.** Attach green input wires to the input jacks, as shown. Keeping these wires as short as possible will help prevent noise and hum.



- C.** Solid grounding is important on the buss. Be sure to make clean connections and not to use too much solder here.



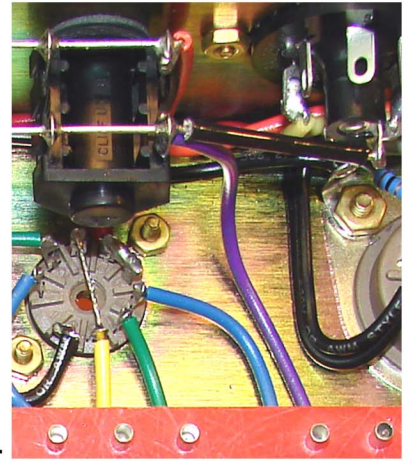
- D.** Short, clean wiring is also important for the board to pot wires.



STEP 19: BOARD WIRING DETAILS (CONTINUED)

- A. Attach the negative feedback wire (purple) to the output jack positive terminal.

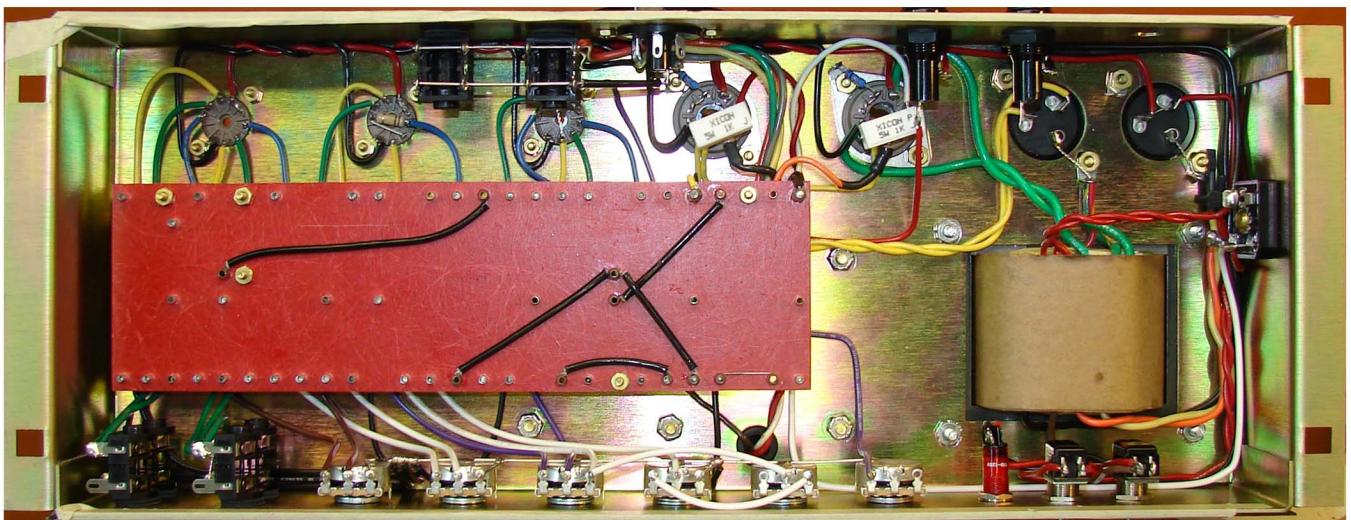
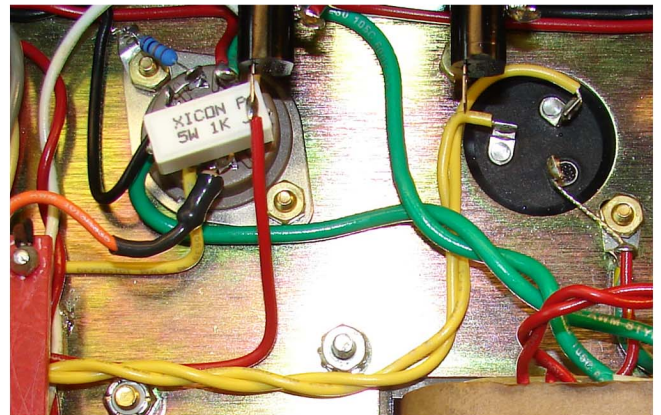
TECH NOTE: Negative feedback refers to a small portion of the amplifier output signal being fed back into the phase inverter circuit. This opposite phase signal tends to stabilize and dampen the circuit. It also affects gain in the output section. More negative feedback yields less output gain. For more NF attach the wire to the 16 ohm tap. For less, use the 8 or 4 ohm taps. With the wire on the jack, NF depends on the impedance setting.



- B. Install short jumper wires on the **TREBLE**, **MIDDLE** and **BASS** pots and shown.



- C. Complete the board wiring as shown (right and below). Attention to detail in this step makes a huge difference in the overall results and performance of your amp build. So take time to do it right.

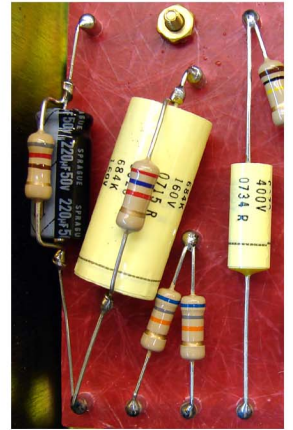


STEP 20: POPULATING THE BOARD

- A. Refer to the appropriate board diagram in the **Appendix** for the specs you are building.

Install components on the board, as shown in the images. A lead bender such as Mouser part **#5166-801** and **5166-901** work well for resistors. Great results can also be achieved by holding the part in place over the terminals, bending the leads with small pliers, test fitting and adjusting as necessary.

A resistor and capacitor code sheet is the **Appendix**.



- B. For the bias pot, first install the bias caps (**10uF @ 160V**) then prep the pot (**25K horizontal mount**) by bending the rounded side tabs flush. Straighten the right, pointed terminal and angle the left, pointed terminal. Solder the pot in place, as shown.

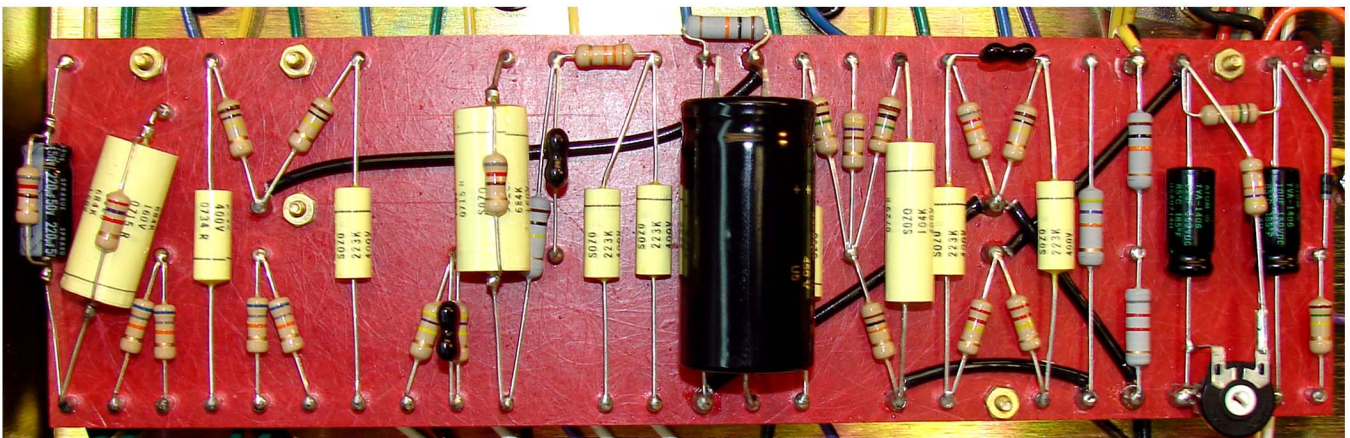


NOTE: Adjusting the pot full clockwise produces the highest bias voltage. Adjusting the value of the series resistor (**47K**) changes the bias range. Higher resistor value produces higher bias voltage, and vice versa.

- C. Install the **10K 2 Watt Metal Oxide** resistor between the positive terminals of the **Dual 33uF Axial** cap by bending the leads around the terminals and soldering in place.



- D. Populate the board with your desired specs, including **Allen Bradley NOS carbon comp** resistors (if you opted for the optional kit). Remember that Acrobat Reader allows full zooming on all images, if you need a close up.

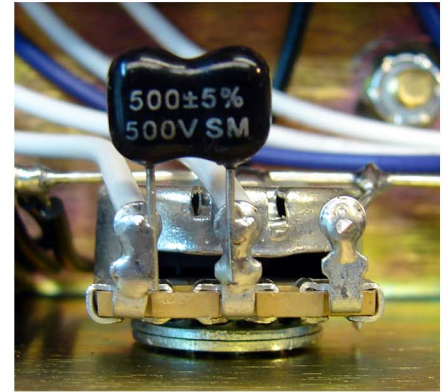


STEP 21: FINISHING THE CHASSIS ASSEMBLY

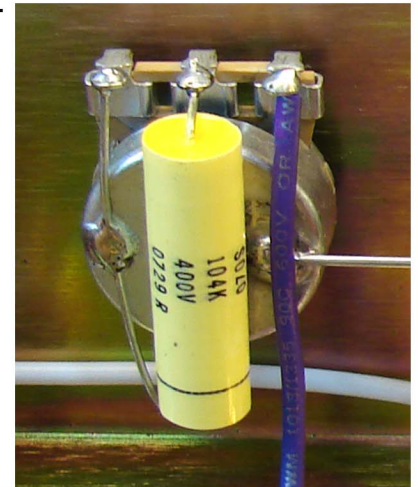
- A. Install a **Silver Mica** “bright cap” on the **VOLUME I** pot, left and center terminals. Stock value is **500pF**.

TECH NOTE: The bright cap works by allowing higher frequencies to bypass the pot. The frequency cut off is determined by the cap value and pot setting.

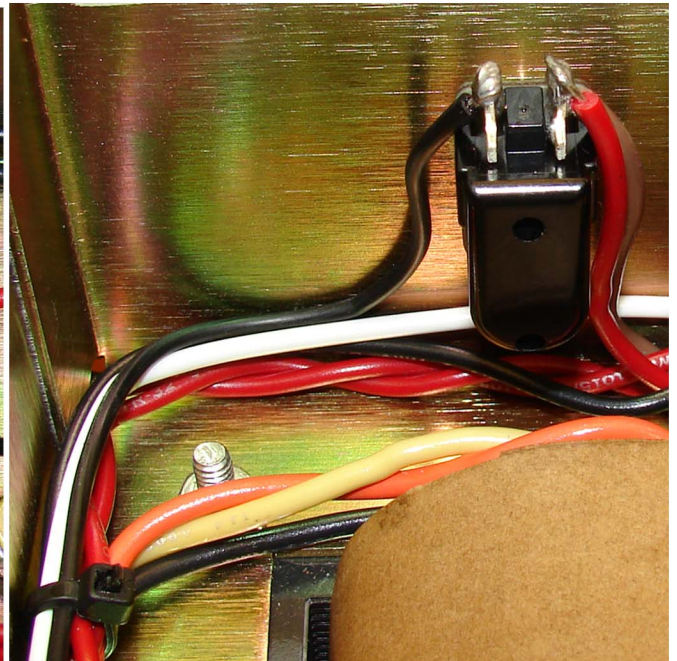
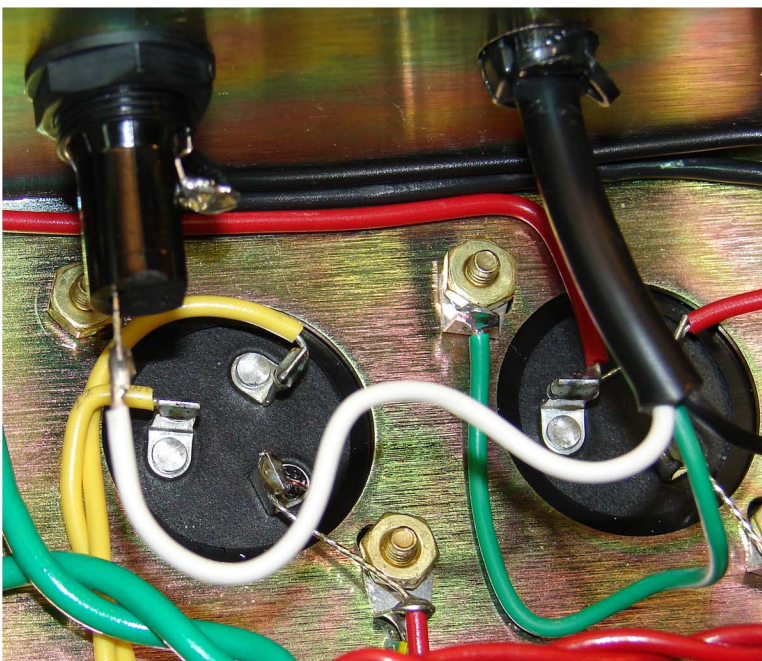
Typical values are: **100pF**, **250pF**, **500pF**, **560pF**, **5,600pF** or no cap at all.



- B. Install a **.1uF 400V Sozo** cap on the **PRESENCE** pot, as shown. Solder one lead to the center terminal. Route the opposite lead across the body of the pot and attach as pictured. Be sure to solder the lead to the pot for proper grounding.



- C. Strip 10” of insulation from the power cord (you may need to remove the IEC plug). Install the **AC Power Cable** and **Strain Relief** into the chassis using pliers. Attach the white **Neutral** wire to the Mains fuse holder. Attach the green **Ground (Earth)** to the **F2** ground lug, as shown. Route the black **Live** wire to the Power switch and attach to the open terminal. Cable ties can now be installed on the wires routed in the chassis end, under the rectifier block.



TESTING PART 1: POWERING UP

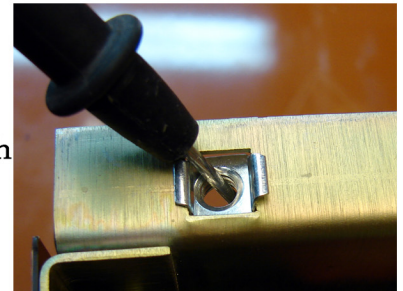
HIGH VOLTAGE WARNING!!!!

THIS AMP OPERATES AT UP TO 500 VOLTS DC. IT CAN KILL YOU. PLEASE USE EXTREME CAUTION WHILE TESTING, BIASING, MODIFYING ETC. AS A RULE, ONLY USE ONE HAND INSIDE THE CHASSIS AT A TIME AND ALWAYS BE SURE TO UNPLUG THE POWER CORD AND DRAIN THE FILTER CAPS BEFORE WORKING INSIDE.

- A.** Install the fuses, **500mA** for the **H.T. Fuse** and **3A** for the **Mains** for 120V AC. **2A** for 220V or 240V operation.

Set your multimeter to AC 500 volts range. Ground your meter negative lead in a chassis mounting hole (installing the cage nuts will help hold the lead in place).

- B.** Plug the AC cord in, but **don't** turn the power on. Instead, measure the AC on the "Hot" terminal of the power switch. It should read approx **120V AC**. If so, turn the power switch ON, the indicator lamp should light.



- C.** Next, test for heater voltage (**3.15V AC**) on the tube socket terminals, as indicated below.

- D.** Switch meter to DC 100 volts range and test for negative bias voltage on **V4** and **V5**, pin 5. You should read between **-20** and **-50V DC**. The bias pot should adjust this voltage reading.

- E.** Switch meter to DC 500 volts ranges and carefully measure the positive (+) terminal of the bridge rectifier. You should read approx **350V DC**. This reading will increase to approx. 450V DC when the **STANDBY** switch is turned to the **ON** position.

50 WATT PLEXI KIT VOLTAGE CHART

	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V1 12AX7	148	SIGNAL	0.85	3.15 AC	3.15 AC	188	SIGNAL	1.7	3.15 AC
V2 12AX7	150	SIGNAL	1	3.15 AC	3.15 AC	270	150	152	3.15 AC
V3 12AX7	208	SIGNAL	35	3.15 AC	3.15 AC	200	SIGNAL	35	3.15 AC
V4 EL34	GROUND	3.15 AC	440	435	-36	440	3.15 AC	GROUND	
V5 EL34	GROUND	3.15 AC	440	435	-36	440	3.15 AC	GROUND	

	(+)	AC	(-)	AC
RECTIFIER	440	335AC	N/A	335AC

NOTE: ALL MEASUREMENTS TAKEN WITH METER NEGATIVE LEAD GROUNDED IN CHASSIS MOUNTING HOLE. STANDBY switch in ON position.

TESTING PART 2: INSTALLING TUBES

- A.** Assuming all went well in **Testing Part 1**, flip the standby switch to ON. On the DC 500V range, check for approx **450V** on each terminal of the **HT Fuse** holder. Confirm this, then power down and unplug the AC power cord.

- B.** Next we need to stress the fact that capacitors store electricity and **WILL SHOCK YOU IF NOT PROPERLY DRAINED!** In most tube amps this can be accomplished using a simple test lead.

In the picture, the amp is powered off and a jumper has been clipped to the chassis and also to a **100k V1 plate resistor**. This will **drain all filter caps** in the B+ line through the 100k resistor. Which prevents a large arc. This method will take from 30 seconds to 2 minutes, typically. And **MUST** be repeated any time the filter caps are charged.

Always measure to confirm that the stored voltage has been fully drained. As shown on our meter.

Equally as important, ALWAYS REMEMBER TO REMOVE THE JUMPER BEFORE POWERING UP.



- C.** With the caps properly discharged, turn the bias pot fully clockwise for maximum bias voltage. Install (3) **12AX7** preamp tubes. Power on and look to see that the tubes are heating up. Using the DC 500V range, test each preamp tube cathode and plate voltage. These should read approx 5% higher than the voltages listed in the voltage chart.



- D.** Power off and install (2) **EL34** output tubes. Attach a speaker and power the amp on. Set all tone controls to **"5"** and volumes to **"0"**. Raise the **VOLUME I** control until you hear a hiss in your speaker. If you hear a loud hum, lower the **Volume I** control and raise **VOLUME II** to see if both channels exhibit the noise. If so, begin troubleshooting by swapping the preamp tube locations. Determine if one particular tube causes more hum than the others. If all tubes exhibit the same level of hum, power the amp with no tube in the V1 position. Assuming the noise ceases, examine the wiring and grounding in the V1 portion of the circuit.

If the amp powered up with normal hiss in the speaker, take voltage readings again. The readings should now reflect the voltages listed in the chart +/- **5%**. Note that the chart lists typical readings. AC line voltage, bias setting and output tube variations will combine to vary the actual measurements.

TESTING PART 3: BIASING

- A.** Extremely important and often misunderstood, biasing is simply setting the operating parameters for a tube. In our case, adjusting current flow in the tube, at idle, using a fixed bias voltage. For **Class A/B fixed bias** output stages like in our 50 watt, a **fixed negative DC voltage** is applied to each output tube grid (**pin 5**).
- B.** To determine where to set the bias, we use a simple formula. Based on EL34 maximum plate dissipation and B+ voltage in the amp: **$(25 \times .7) / B+ = \text{Cathode Current}$**

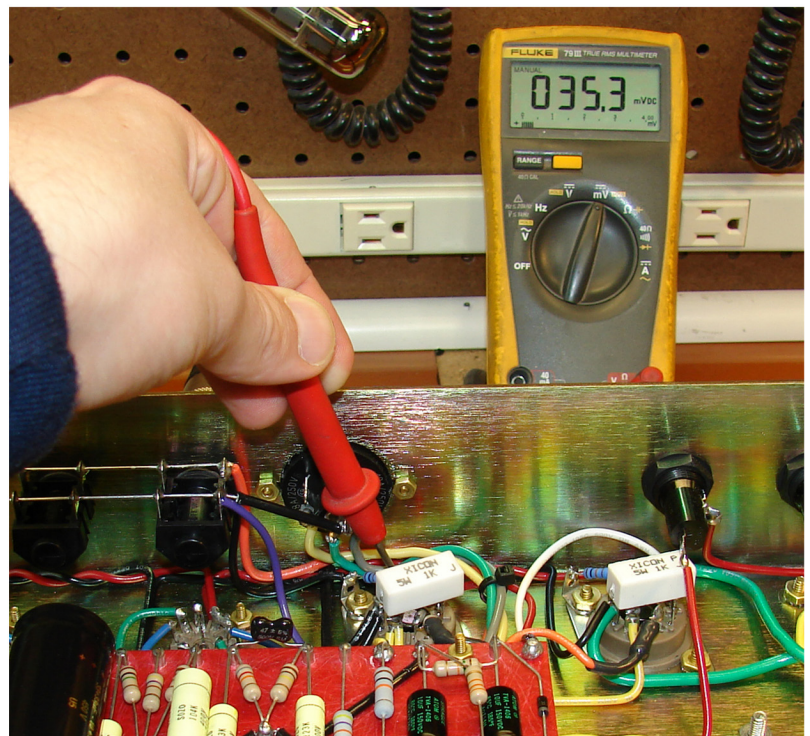
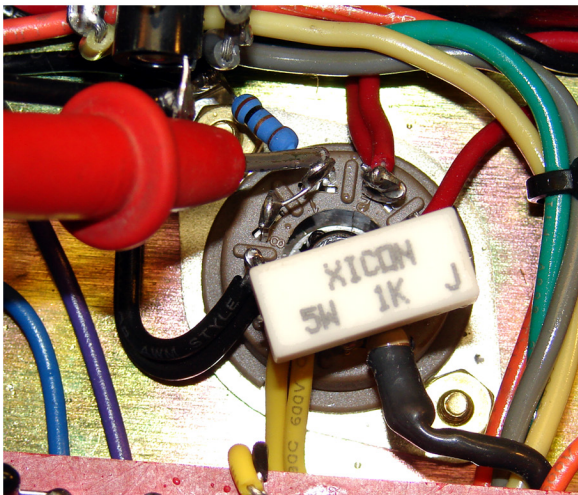
Here, **25 Watts** is the specified maximum plate dissipation for an EL34. We multiply this by **(.7)** to assure a safe rating of **70%** of the maximum spec. Or **17.5 Watts**. We get our **B+** value by measuring at the **H.T.** fuse in the amp. Here we have **440V DC**.

The adjusted formula is: **$17.5W / 440V = 40mA$** . So we want to adjust our output tubes to maximum **40mA** of cathode current at idle.

- C.** Thanks to **OHMS LAW** we can determine cathode current by measuring millivolts across a **1 ohm** resistor between the cathode and ground. As installed in **STEP 9, PART A**. Our reading in millivolts (**mV**) is equal to cathode current in milliamps (**mA**).
- D.** With a speaker or load attached and **VOLUME**s at **"0"**, power the amp on, turn **STANDBY ON** as well. Using the millivolt setting, ground your negative meter lead and measure the reading at **pin 1** of each output tube, as shown below. These measurements should be similar, but not identical.

Slowly adjust the bias pot counter-clockwise and remeasure until you get in the desired range. In this case, between **35** and **40mA** is safe operating range. Corresponding to **60-70%** of maximum plate dissipation. So adjust until both output tubes are biased within this range.

NOTE: Bias will drift a bit as tubes break in. You should check bias after a few hours of use.



FINISH

Congratulations! You can now bolt your chassis into the head case. I hope you have enjoyed building this kit. And that you will love the tone and satisfaction of knowing that you have assembled a boutique quality amplifier.

As you play your amp, you should hear some “break in” taking place during the first several hours. This is normal. The most obvious tonal changes occur in over the initial 20 hours. The tubes, capacitors and output transformer will all be fully settled after approx 100 hours.

If you require tech support, are interested in tweaks and mods or just want to show off your work, please visit our forum. Online at:

<http://forum.metroamp.com>



APPENDIX

50 WATT CHASSIS INSIDE

METROAMP 50 WATT PLEXI KIT

220/240V AC WIRING

50 WATT BOARD – LEAD SPECS

50 WATT BOARD – BASS SPECS

50 WATT BOARD – '70 SPECS

ALLEN BRADLEY NOS CC'S

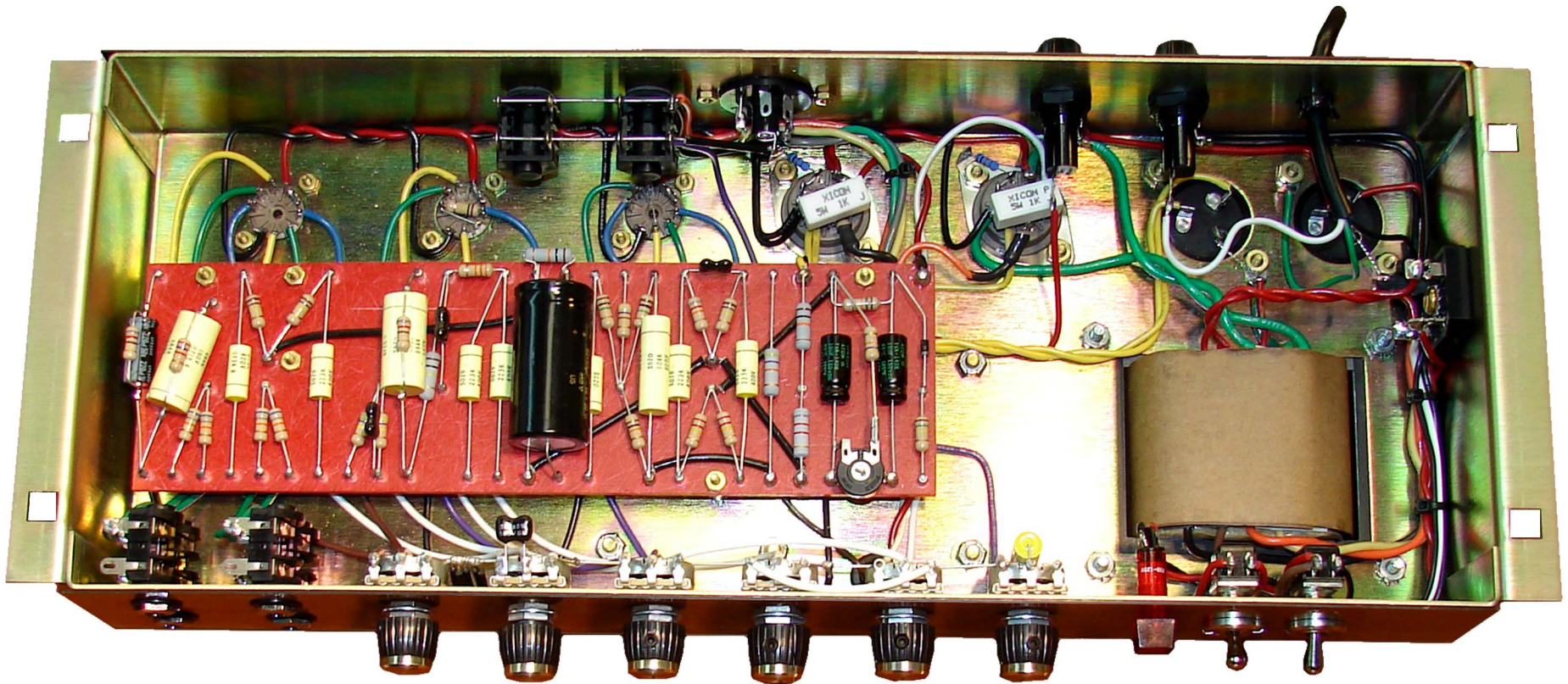
1987 LEAD SCHEMATIC

1986 BASS SCHEMATIC

TRANSFORMER DIAGRAMS

RESISTOR/CAPACITOR CODES

50 WATT CHASSIS INSIDE

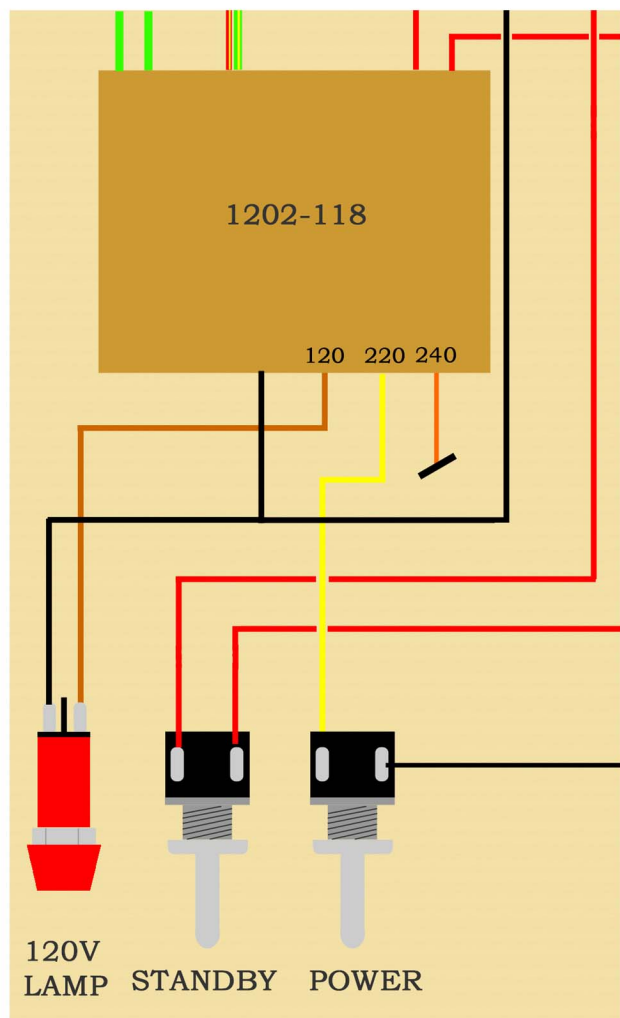


 = GROUND BUSS ON POTS

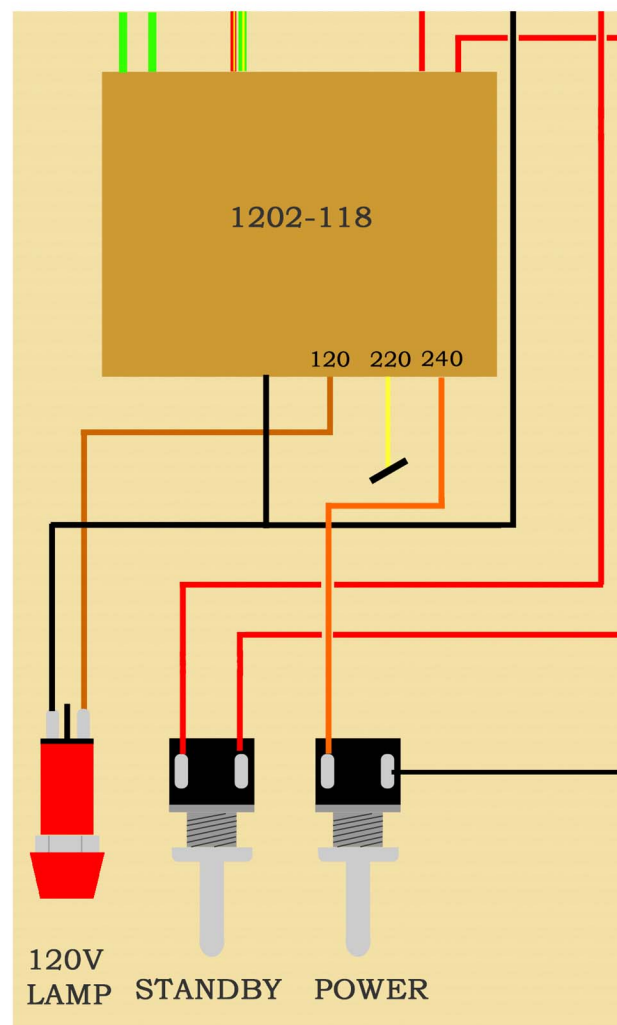
[illegible]

220/240V AC WIRING

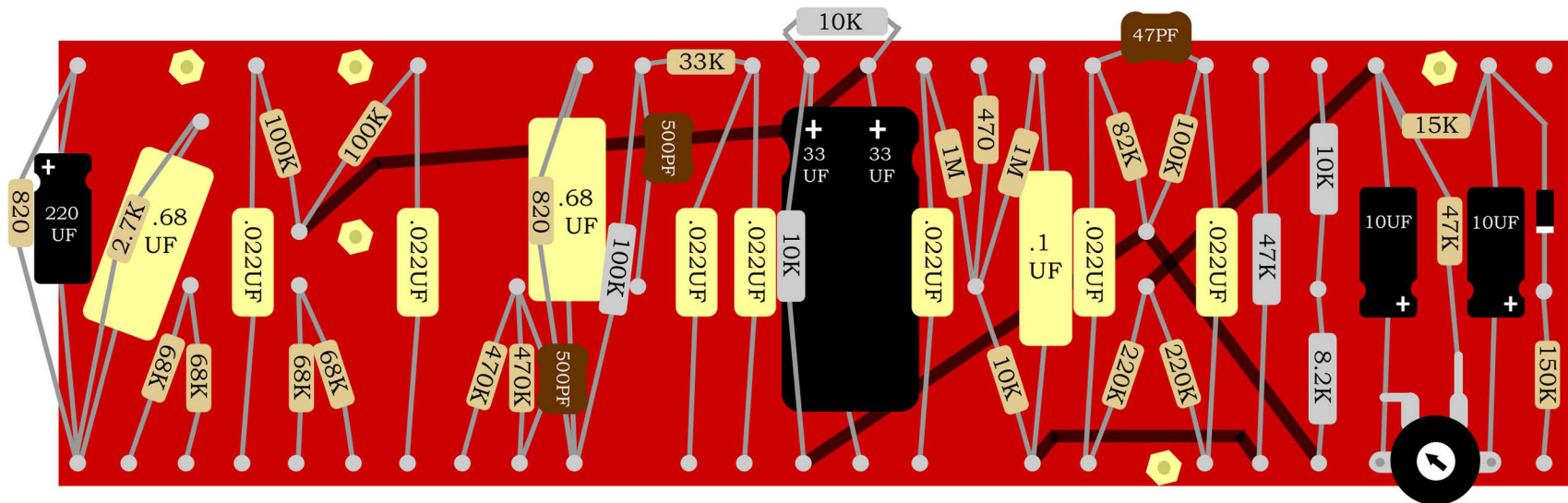
220V AC



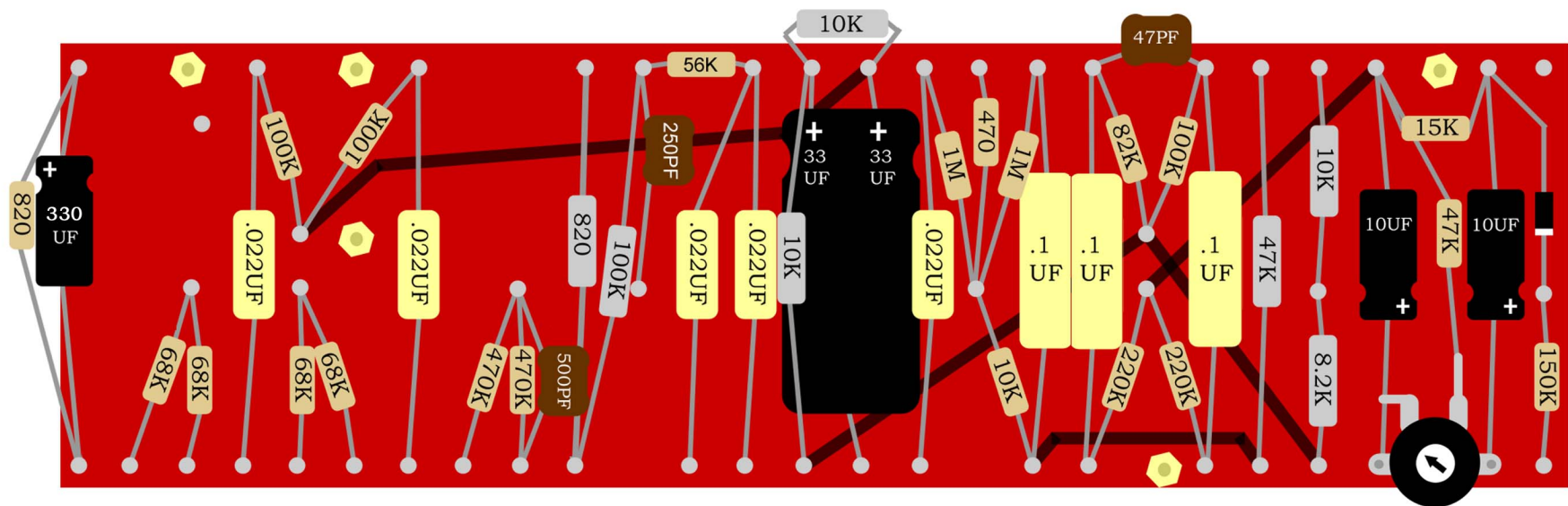
240V AC



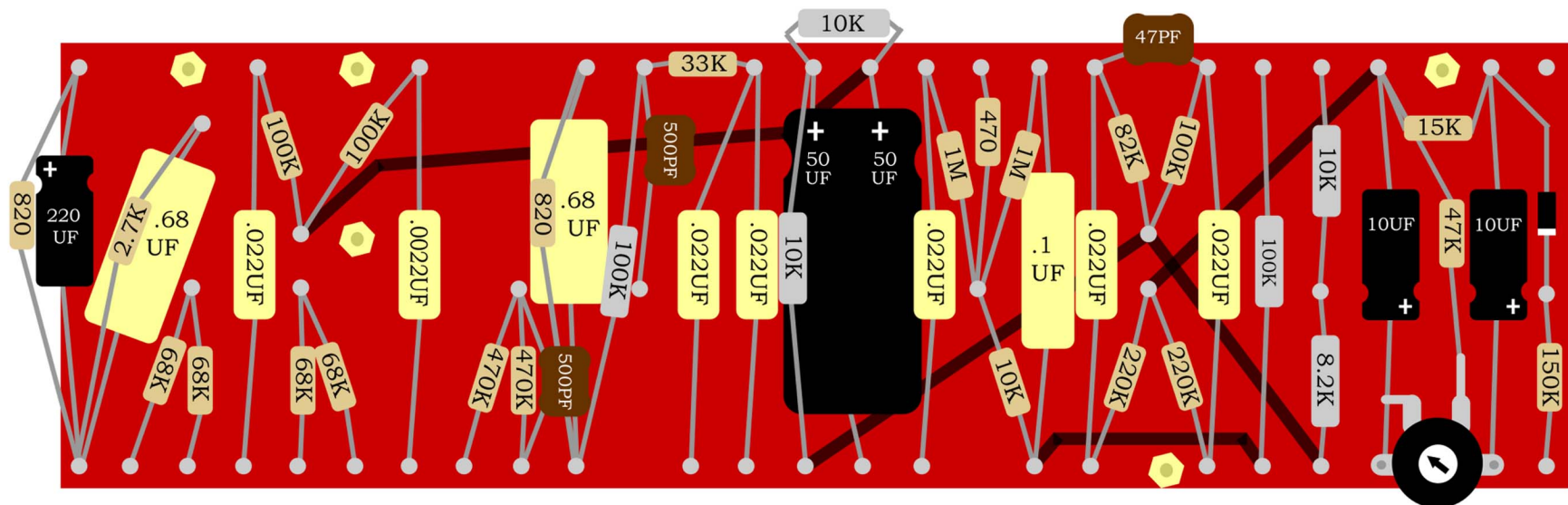
50 WATT BOARD - LEAD SPECS



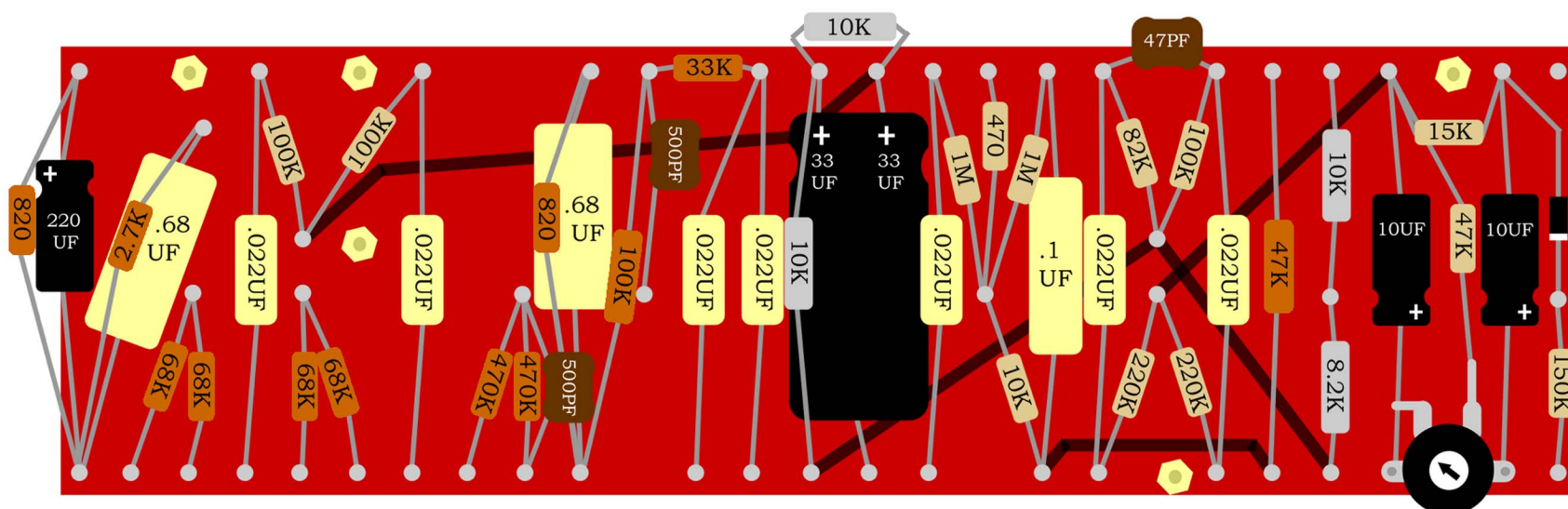
50 WATT BOARD - BASS SPECS



50 WATT BOARD - '70 AND UP LEAD SPECS

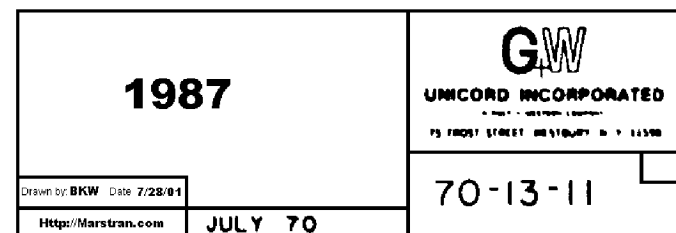


ALLEN BRADLEY N.O.S. CARBON COMPS

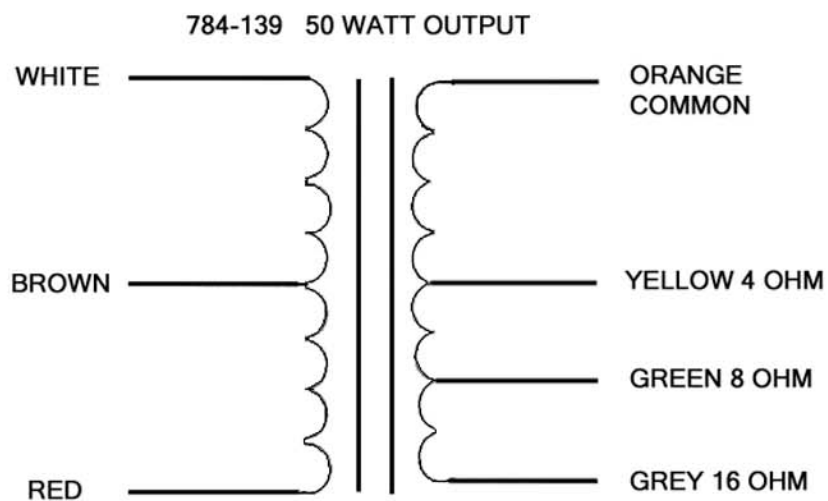
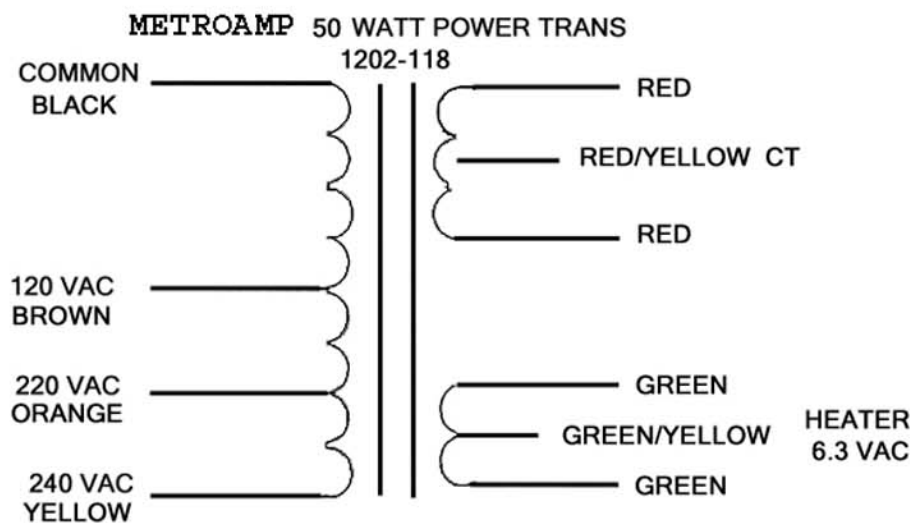


INSTALL OPTIONAL ALLEN BRADLEY NEW OLD STOCK CARBON COMP RESISTORS AS INDICATED IN BROWN.

OLD STOCK COMPONENTS SHOULD ALWAYS BE PREPPED BY STEEL WOOLING THE LEADS AND MEASURING FOR TOLERANCE.



50 WATT TRANSFORMER DIAGRAMS



RESISTOR COLOR CODES-

1 ohm	brown-black-gold
470	yellow-violet-brown
820	grey-red-brown
1k	brown-black-red
1.5k	brown-green-red
2.7k	red-violet-red
5.6k	green-blue-red
8.2k	grey-red-red
10k	brown-black-orange
15k	brown-green-orange
27k	red-violet-orange
33k	orange-orange-orange
47k	yellow-violet-orange
56k	green-blue-orange
68k	blue-grey-orange
82k	grey-red-orange
100k	brown-black-yellow
150k	brown-green-yellow
220k	red-red-yellow
470k	yellow-violet-yellow
1M	brown-black-green

CAPACITOR CODES

.0022uf	222K
.01uf	103K
.022uf	223K
.047uf	473k
.1uf	104k
.68uf	684k