METROPOULOS
AMPLIFICATION

METROAMP JTM 45
AMP KIT

ASSEMBLY INSTRUCTIONS

V. 2.1 OCTOBER 2008

Thank you for your purchase of our JTM 45 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.

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
mutilmeter- 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 220/240V 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.

JTM 45 AMP KIT

QTY		DESCRIPTION	QTY		DESCRIPTION
1		SMALLBOX HEAD CASE	2		OHMITE 470 OHM 5 WATT RESISTOR
1		ALUMINUM JTM 45 CHASSIS			
1		METRIC CAGE 4 NUT KIT	1		6" LENGTH OF 1/8" SHRINK TUBING
1		CHASSIS MOUNTING 4 BOLTS KIT	1		AMBER 120V LAMP
					BOLTS
1		METROAMP REFERENCE CD	1		LARGE BRASS BOLTS QTY 12
1		JTM 45 PANEL SET (FRONT AND REAR)	1		MEDIUM BRASS BOLTS QTY 12
			1		SMALL BRASS BOLTS QTY 12
		BOARDS	1		CIRCUIT BOARD MOUNTING BOLTS QTY 6
1		PTP BOARD - JTM 45 KIT			
					SWITCHES
		TRANSFORMERS/CHOKE	1		MARSHALL NEW STYLE IMPEDANCE SELECTOR
1		METRO JTM 45 POWER TRANSFORMER 1202-55	2		CARLING SP/ST
1		METRO JTM 45 OUTPUT TRANSFORMER 784-103	2		MARSHALL CHROME RING FOR TOGGLE SWITCHES
1		MERCURY MAGNETICS 7H CHOKE JT45C-7H			
					HARDWARE
		OPTIONAL TRANSFORMERS	1		3" 12 BLACK CABLE TIE KIT
1		MERCURY MAGNETICS P. T. P4550JT-G2	1		STRAIN RELIEF
1		MERCURY MAGNETICS O. T. 045JT-16	2		GROMET 1/2"
			1		GROMET 3/8"
		TUBES	1		CHASSIS MOUNT FUSE HOLDER
1		VALVE ART KT66 MATCHED PAIR	1		FLUSH MOUNT FUSE HOLDER
1		VALVE ART GZ34 RECTIFIER	1		GROUND LUG 2 HOLES QTY 12
3		JJ 12AX7			
					FUSES
		TUBE SOCKETS	2		AGC FUSE 3AMP **NOTE: 2A FOR 220/240V OPERATION**
3		8 PIN OCTAL MICALEX SOCKET	2		AGC FUSE 500mA
3		9 PIN SOCKET WITH SHIELD			
					POWER CORD
		KITS (SEE PAGE 2)	1		8' IEC POWER CABLE
1		ALPHA POT KIT			
1		MARSHALL BOARD COMPONENTS KIT			**JACKS**
1		FULL AMP WIRE KIT	4		CLIFF OLD STYLE INPUT JACKS
1		2 CAN CAPACITOR MOUNTING CLAMP KIT	2		CLIFF NEW STYLE OUTPUT JACKS
		CAPACITORS			**KNOBS**
1		F&T DUAL 32UF CAN	6		MARSHALL SET SCREW KNOBS
1		F&T DUAL 16UF CAN			
1		TAD 16UF @ 475V AXIAL			**OPTIONAL CAPACITORS**
4		.1UF @ 400V MALLORY 150	4		.1UF @ 400V SOZO
5		.022UF @ 400V MALLORY 150	5		.022UF @ 400V SOZO

JTM 45 KIT PARTS 2

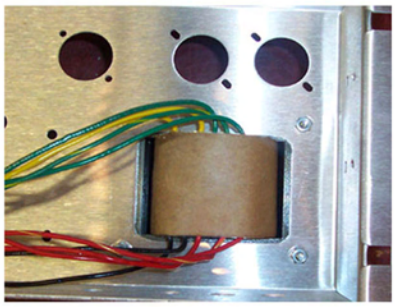
		MARSHALL BOARD COMPONENTS KIT			ALPHA POT SET
QTY				QTY	
		1 WATT CARBON FILM RESISTOR			
1		470 OHM		3	1 MEG AUDIO TAPER
2		820 OHM		1	250K LINEAR TAPER
1		1K		1	25K AUDIO TAPER
4		1.5K		1	5K LINEAR TAPER
1		2.7K			
4		5.6K			
1		10K			
1		15K			
1		27K			**FULL AMP WIRE KIT**
1		33K			
1		47K		10	BLUE 22 GAUGE 600V TOPCOAT
1		56K		10	YELLOW 22 GAUGE 600V TOPCOAT
5		68K		10	WHITE 22 GAUGE 600V TOPCOAT
1		82K		10	BROWN 22 GAUGE 600V TOPCOAT
4		100K		10	PURPLE 22 GAUGE 600V TOPCOAT
1		150K		10	ORANGE 22 GAUGE 600V TOPCOAT
3		220K		10	GREEN 22 GAUGE 600V TOPCOAT
2		270K		15	RED 22 GAUGE 600V TOPCOAT
3		470K		15	BLACK 22 GAUGE 600V TOPCOAT
4		1M			
				4	22 GAUGE BUSS WIRE
		1 WATT METAL OXIDE RESISTOR		4	18 GAUGE BUSS WIRE
4		1 OHM (COLOR MAY VARY)		4	BLACK INSULATION
		2 WATT METAL OXIDE RESISTOR			
2		820 OHM			**OPTIONAL ALLEN BRADLEY CC'S**
1		8.2K			
3		10K		2	820 OHM AB NOS CC 1/2W 5%
1		27K		1	27K OHM AB NOS CC 1/2W 5%
1		47K		1	56K OHM AB NOS CC 1/2W 5%
2		100K		4	68K OHM AB NOS CC 1/2W 5%
				2	100K OHM AB NOS CC 1/2W 5%
		SILVER MICA CAPACITOR		2	270K OHM AB NOS CC 1/2W 5%
1		47PF		2	1M OHM AB NOS CC 1/2W 5%
1		100PF			
1		250PF			
3		500PF			
		ELECTROLYTIC CAPACITOR			
2		10UF @ 15OV			
1		220UF @ 50V			
1		330UF @ 25V			
		DIODES			
5		1N4007 (ALTERNATE PART # UF4007)			
		BIAS POTS			
1		25K VERTICAL MOUNT			
1		25K HORIZONTAL MOUNT			

NOTE: THE MARSHALL BOARD COMPONENTS KIT INCLUDES MORE PARTS THAN REQUIRED FOR THIS KIT. THE EXTRA VALUES ARE SUITABLE FOR TWEAKING AND COMMON MODS.

JTM 45 AMP KIT INSTRUCTIONS: STEP # 1

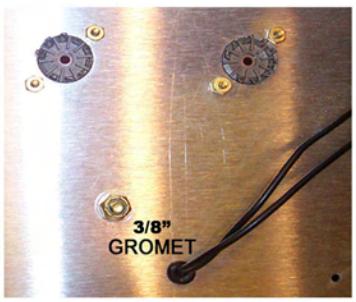
Installing the transformers and choke.

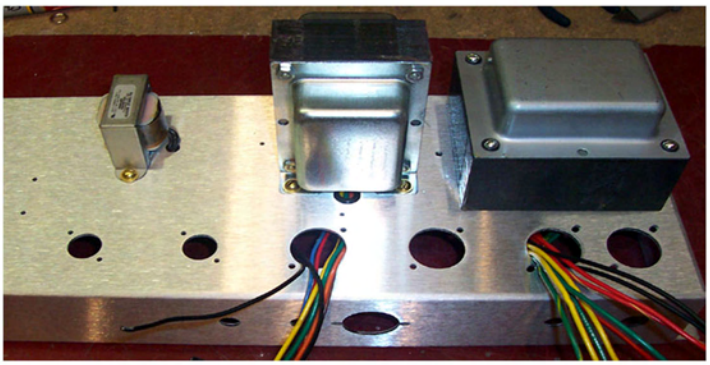
Install the **1202-55** power transformer on the chassis and tighten the **11/32"** nuts. Be sure the wires are oriented as in the picture.



Install **(2) 1/2" rubber grommets** and the **784-103** output transformer using large brass bolts. The lock nuts require a **3/8"** nut driver.

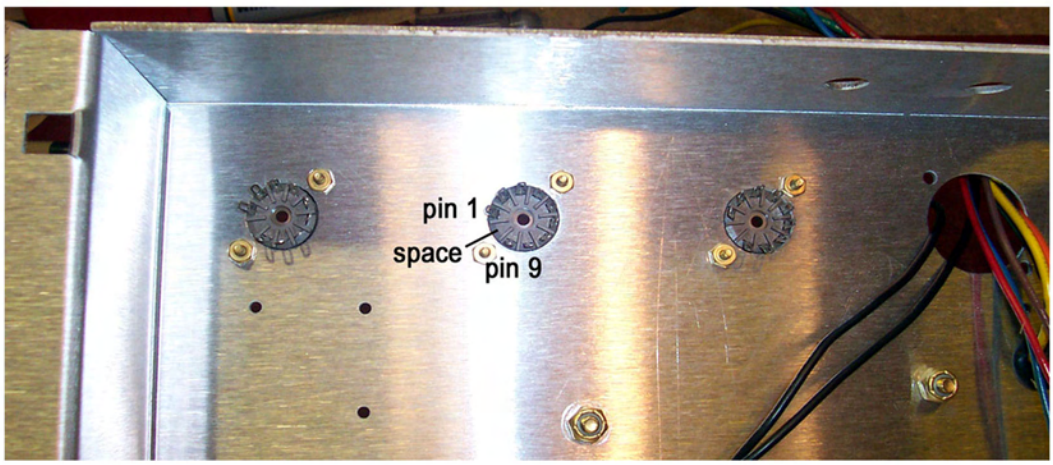
Install the **3/8" grommet** and **JT45C-7H** choke using large brass bolts.





Installing the preamp tube sockets.

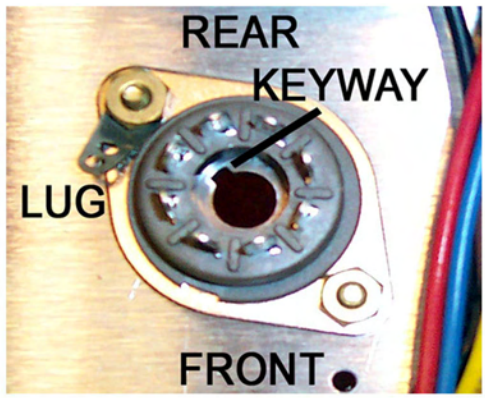
Install the (3) 9 pin preamp tube sockets using the small brass bolts. Make sure the space between pin 1 and pin 9 on the socket faces away from the rear panel.



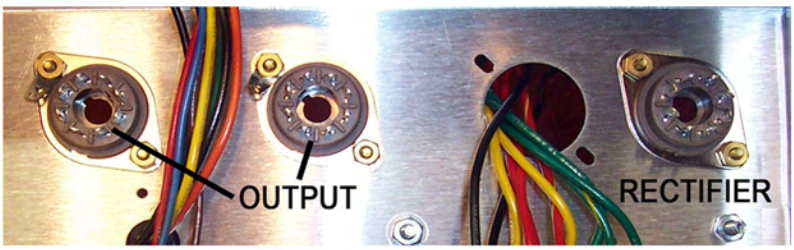
JTM 45 AMP KIT INSTRUCTIONS: STEP # 2

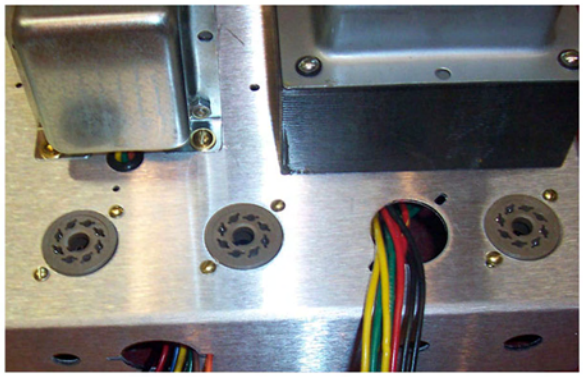
Installing the output and rectifier tube sockets.

Install **(3) octal Micalex** sockets using medium brass bolts. Tighten with **5/16"** nut driver.
All sockets should have the keyway (between pins 1 and 8) facing the rear of the chassis.



The output tube sockets require a **ground lug** installed on the bolt nearest the rear of the chassis.

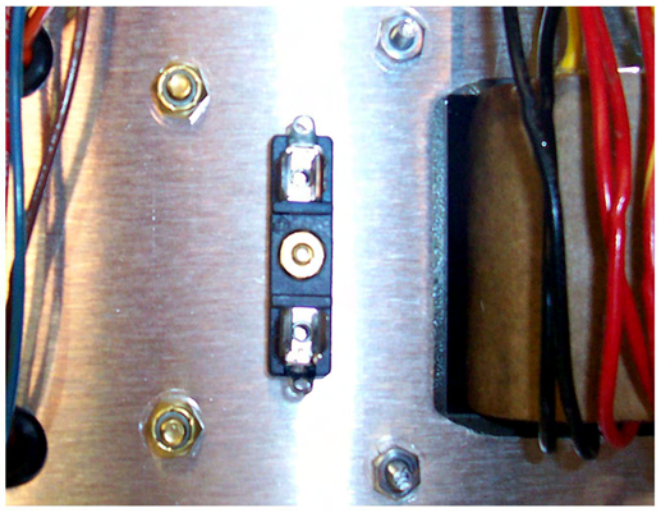




Installing the internal fuse holder.

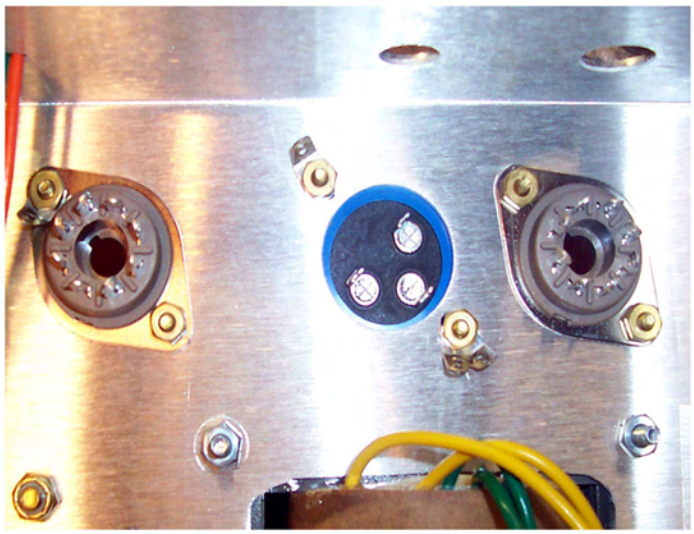
Install the **flush mount fuse holder** near the power transformer using a medium brass bolt.

NOTE: Don't force the nut inside the holder. If it doesn't fit, put the bolt through the fuse holder and the nut on top of the chassis.

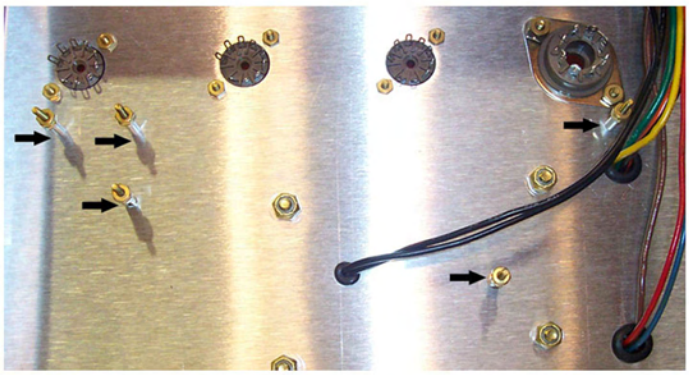


JTM 45 AMP KIT INSTRUCTIONS: STEP # 3

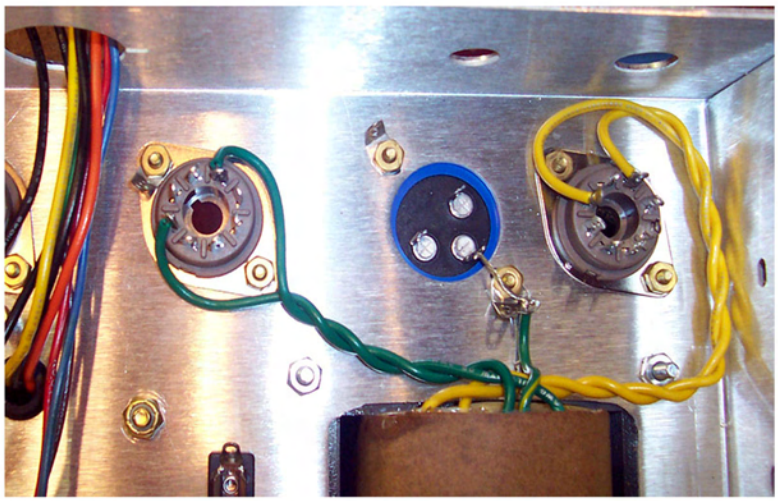
Install the F&T dual 32uf can capacitor using the mounting bracket and medium brass bolts.
The negative terminal should face the mounting bolt closest to the power transformer. This bolt should have (2) ground lugs. The bolt near the rear of the chassis should get (1) ground lug.



Install the (5) circuit board mounting bolts.
Each should have a flat washer outside of the chassis, and a spacer and (2) brass nuts inside.
Once installed, put the circuit board in place to check the alignment of the bolts.

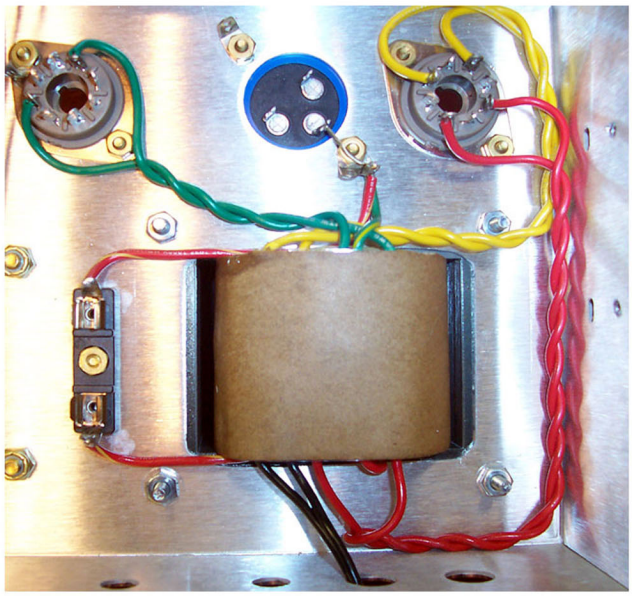


Wiring the heater windings. Tightly twist the (2) yellow wires on the power transfomrer. And also the (2) green wires. Route the yellow wires to pin 2 and pin 8 of the recifier tube socket and solder in place.
Route the green wires to pin 2 and pin 7 of the closest output tube socket.
The remaining green with yellow stripe wire gets wired to the ground lug on the nearby filter cap. Strip back enough insulation to run the wire through the lug and over to the negative terminal on the cap. Providing a ground connection.

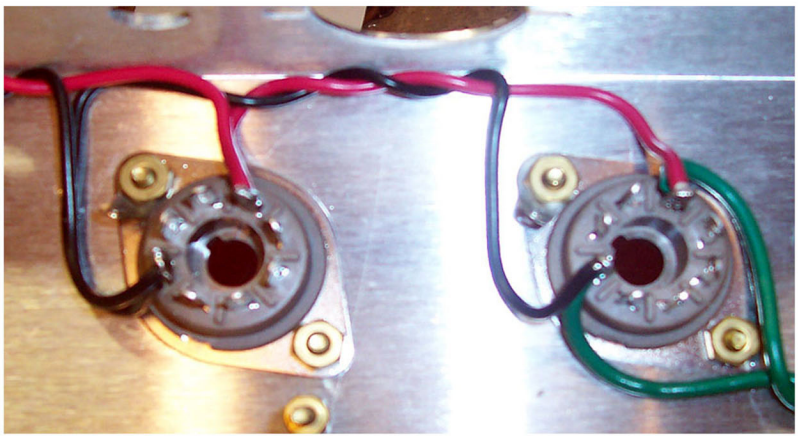


JTM 45 AMP KIT INSTRUCTIONS: STEP # 4

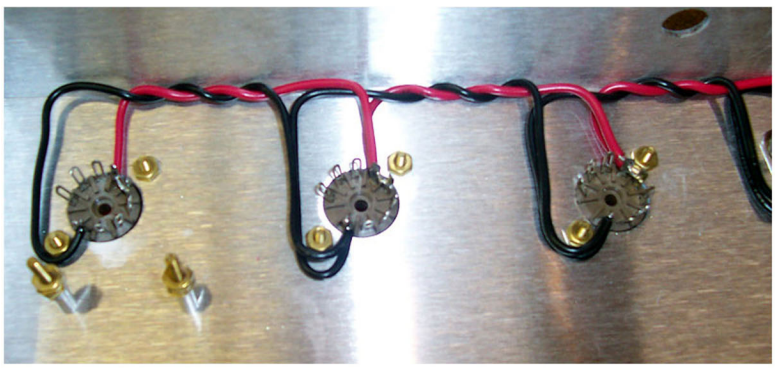
Wiring the high voltage tap. Tightly twist the red wires from the power transformer and route them to pin 4 and pin 6 of the rectifier tube socket.
Route the red with yellow stripe wire to the nearby fuse holder. Solder it in place and then use the left over wire to connect the other terminal to the ground near the filter cap.

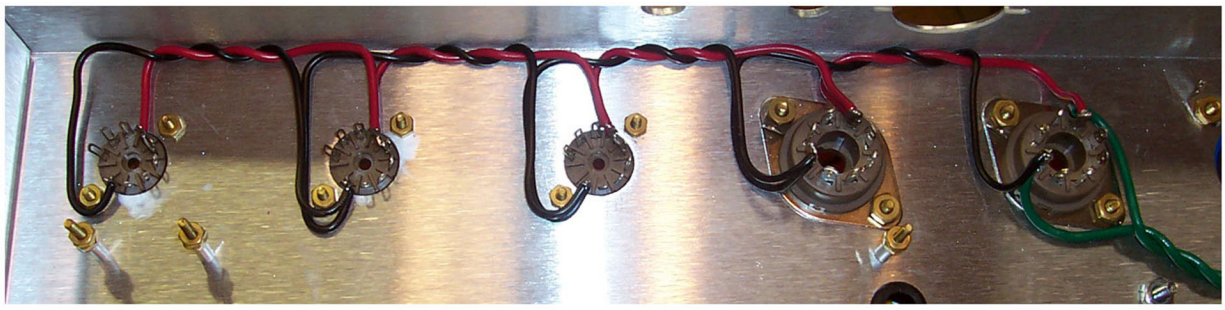


Daisy chaining the tube socket heater wires. Connect a 6" section of red wire to pin 2 of the 8 pin socket closest to the power trans. Also connect a 6" section of black wire to pin 7 of the same socket. Route them to the rear of the chassis and twist them together. Wire these to pin 2 and pin 7 of the socket next in line to the left.
Also connect 6" pieces of red and black wire on these pins to run to the next socket to the left.



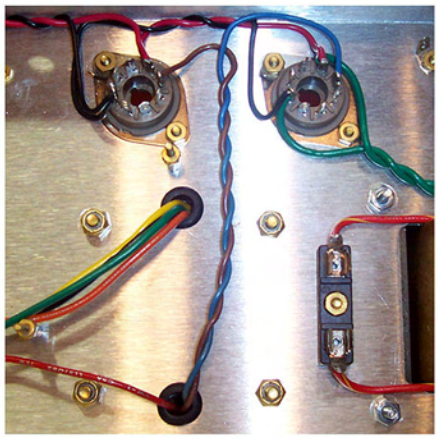
Route these wires to the nearest 9 pin socket. Attach the red wire so that it connects both pin 4 and pin 5. Attach the black wire to pin 9.
Continue this process for the remaining (2) tube sockets, always bridging pins 4 and 5.
Once complete, your heater wiring should look like the picture below.



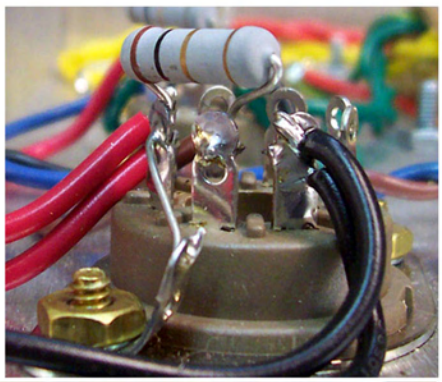


JTM 45 AMP KIT INSTRUCTIONS: STEP # 5

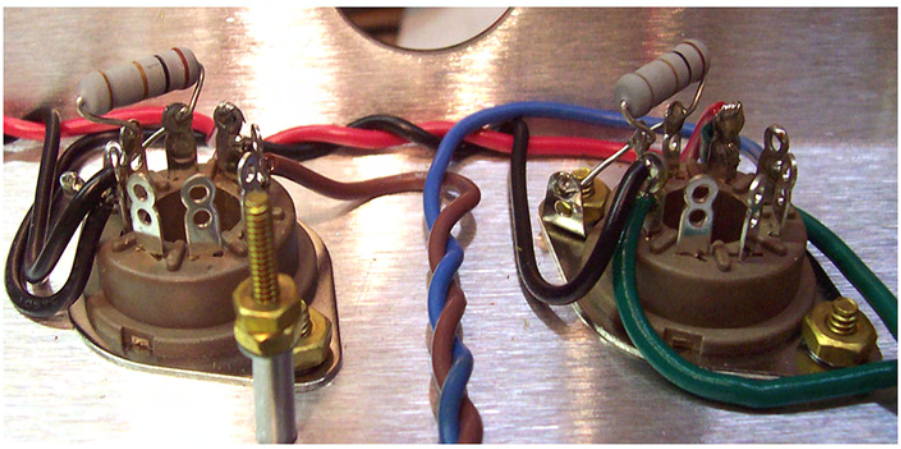
Wiring the output transformer primary. Twist the blue and brown wires from the output trans and route them to the output tube sockets. Attach the brown wire to pin 3 of the socket nearest the preamp sockets. And attach the blue wire to pin 3 of the socket nearest the power trans. If you are using the optional Mercury Magnetics O45JT output trans. the black wire attaches to pin 3 of the left socket and the red wire attaches to pin 3 of the right socket.

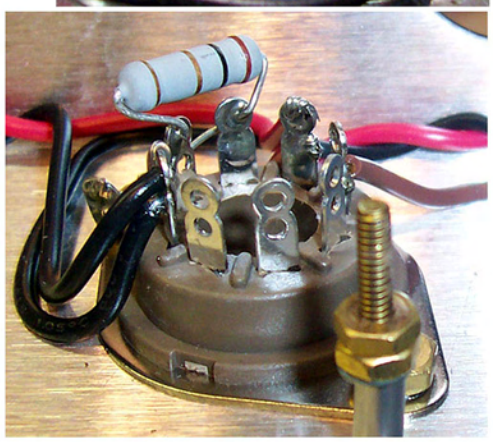


Installing the bias resistors. Locate the (2) 1 ohm 2 watt metal oxide resistors (brown-black-gold). Install (1) on each output tube socket between pin 1 and pin 8.
Do not clip the extra lead off from the pin 1 connection. Instead, run it to the ground lug on the socket mounting bolt. This is the only ground for the output tube so be sure to make good connections.

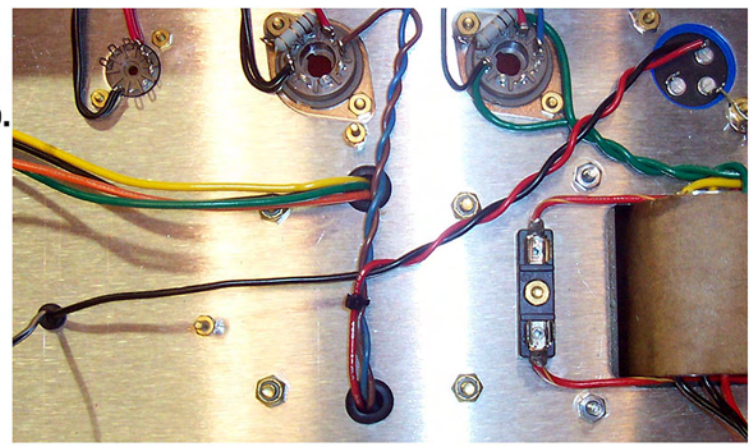


NOTE: Due to availablitity, the color and shape of 1 ohm bias resistors may vary.



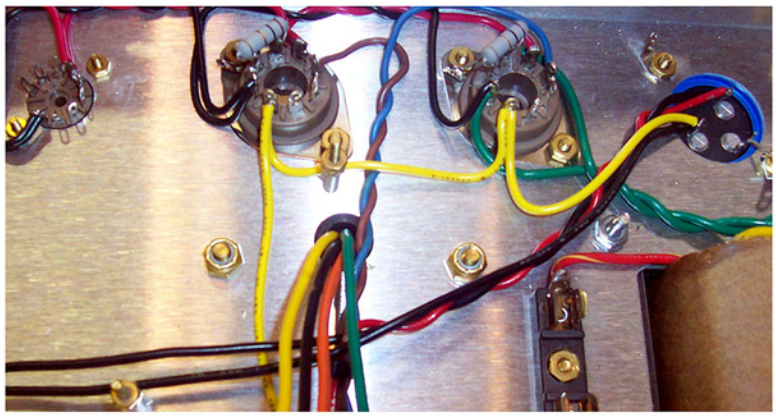


Wiring the choke and output trans. center tap. Twist the red wire from the output trans and (1) of the choke wires together and route them to the filter cap. Attach both wires to the terminal closest to the rear of the chassis.
For the optional MM O45JT output trans. this wire will be brown instead of red.



JTM 45 AMP KIT INSTRUCTIONS: STEP # 6

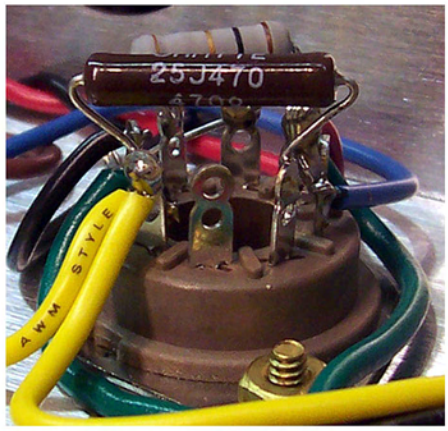
Connecting the screen grids and choke.



Route the remaining choke wire to the filter cap and attach it to the positive terminal closest to the power trans. Also connect a section of yellow wire to this terminal and route it to the nearest output tube socket, pin 6. Solder this wire and another section of yellow to pin 6 in lower hole of the terminal, a resistor will later be attached to the upper hole.

Route this new yellow wire to pin 6 of the other output tube socket, again in the lower hole and with a section of yellow wire. This wire will later attach to the circuit board, so leave 4" to 5" of extra wire.

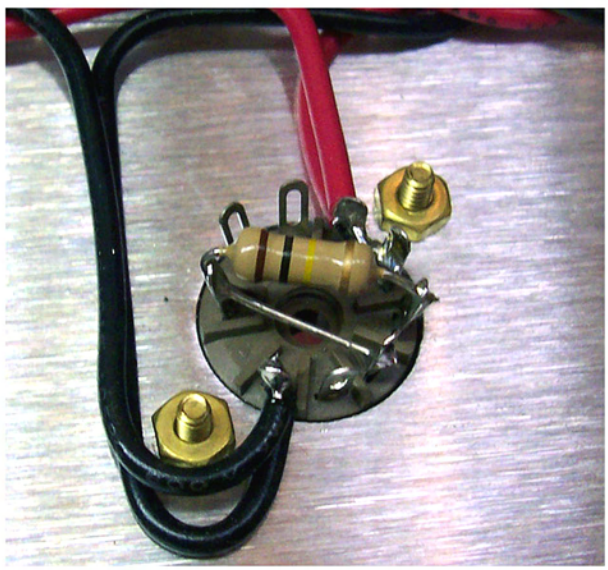
Installing the screen grid resistors. Locate the (2) Ohmite 470 ohm 5 watt resistors. Install one on each output tube socket between pin 4 and pin 6. Be sure to bend the leads up from the terminals so they don't contact the adjacent terminals.



Installing the 100k plate to grid resistor on V2.

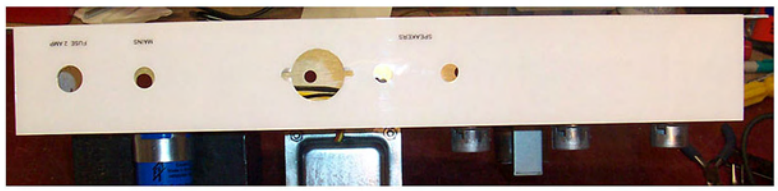
Locate a 100k 1 watt carbon film resistor. On the middle preamp tube socket (also referred to as "V2") solder the resistor so that one lead connects pin 1 to pin 7. The other lead attaches to pin 6. Later a wire from the board will also attach to pin 6, so don't fill the entire terminal with solder.

The resistor should mount between the terminals as shown.

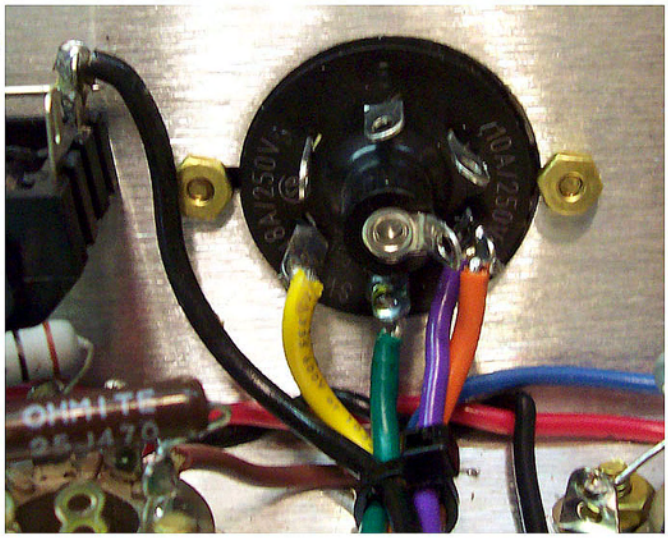


JTM 45 AMP KIT INSTRUCTIONS: STEP # 7

Attaching the face plates. Peel the backing material and put the front and rear plexi panels in place. Align the punched holes with the corresponding chassis holes and be sure the panels are flush with the bottom of the chassis. Be careful, the adhesive is very strong and you only get one chance to get the placement right. Once in place, you can remove any excess panel material from the holes with a round file.

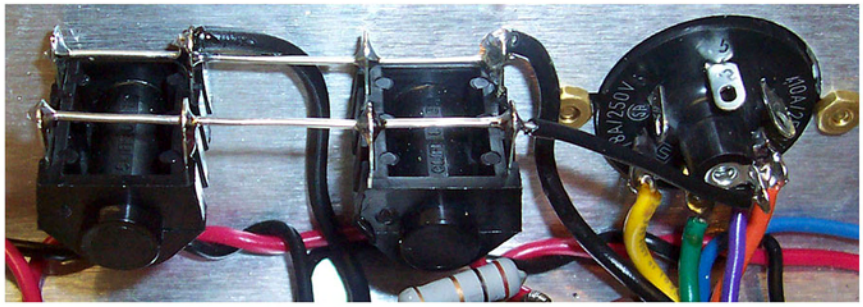


Wiring the output trans secondary to the impedance switch. Install the impedance switch using the small brass bolts. Route the remaning output trans. wires to the switch and wire as shown. Yellow is the 4 ohm tap. green is the 8 ohm and orange is the 16 ohm tap. Also connect a 10" section of purple wire to the 16 ohm terminal, this will later connect to the board. Install the (2) output jacks (identified by the plain plastic nuts) and wire the black (common) wire to the terminal closest to the switch and the rear of the chassis. See the included diagram for the color codes if you are using the MM O45JT output trans.



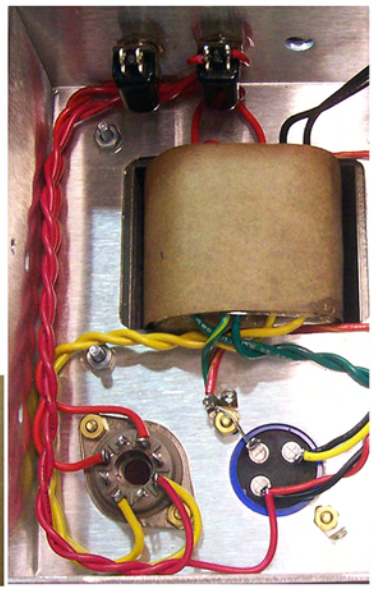
Using 18 gauge buss wire, connect the (4) terminals closest to the chassis. Also connect a section of black wire to any of these (4) terminals and connect it to the ground lug on the output tube socket just below.

Again using 18 gauge buss wire, connect each of the (4) inner most terminals. Extend this wire to the center terminal of the impedance switch and cover it with the insulating tubing. Insure that these are solid connections since a failure here could easily ruin your output transformer and/or tubes.

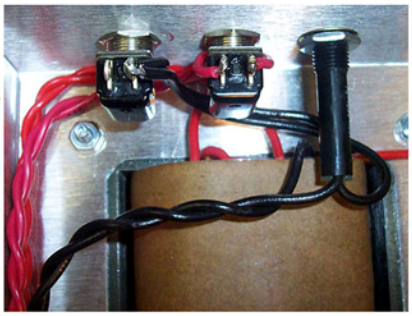


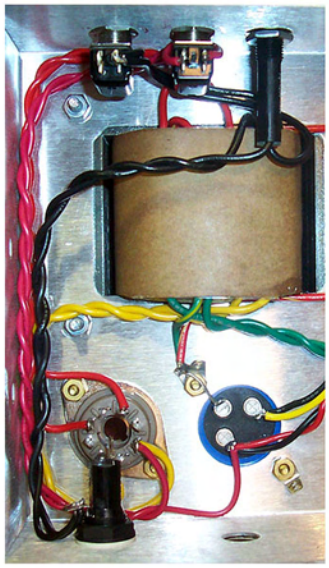
JTM 45 AMP KIT INSTRUCTIONS: STEP # 8

Installing the switches and wiring the standby.
Install the (2) Carling SP/ST switches on the chassis using the plexi type chrome rings.
Attach (2) 14" sections of red wire to the stand-by switch terminals. Twist and route these wires to the rectifier tube socket and filter cap.
Attach (1) red wire to pin 8 of the recitifer tube socket, in addition to the yellow wire. Attach the other red wire to the positive terminal of the filter cap nearest the rear of the chassis, in addition to the red and black wires attached in Step #5.



Installing the lamp and fuse holder. Wiring the PT primary.
Install the **amber lamp** using the included lock washer and nut. Nut size is **9/16"**. Install the **chassis mount fuse holder**. The plastic nut requires a **17mm** wrench (pliers will work as well).
For **120V AC** operation: twist the **ORANGE** PT primary wire **(common)** and one of the lamp wires **(BLACK)** together and route to the fuse holder. Solder both to the side terminal on the fuse holder.
Attach the remaining lamp wire **(BLACK)** and the **RED** PT primary wire **(120V)** to the terminal of the power switch, nearest the standby switch.

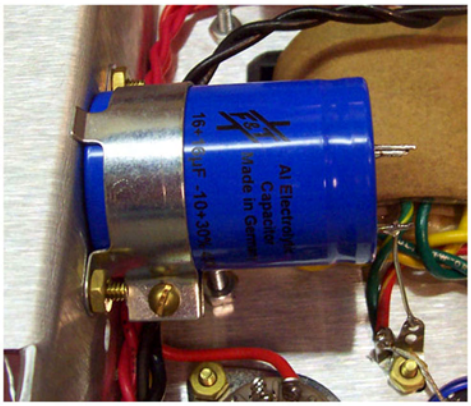


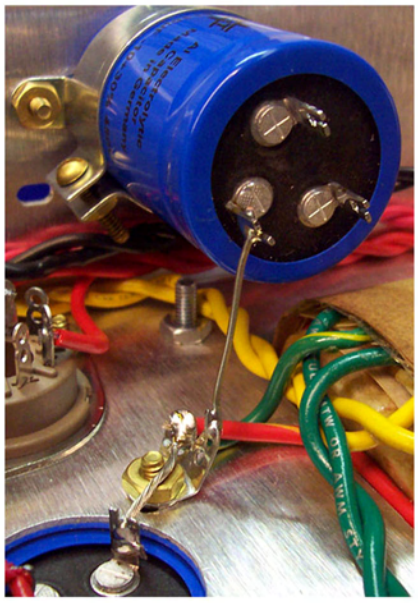


NOTE: For **220V** operation, use **BLUE** instead of **RED**.
For **240V** operation, use **VIOLET** instead of **RED**.

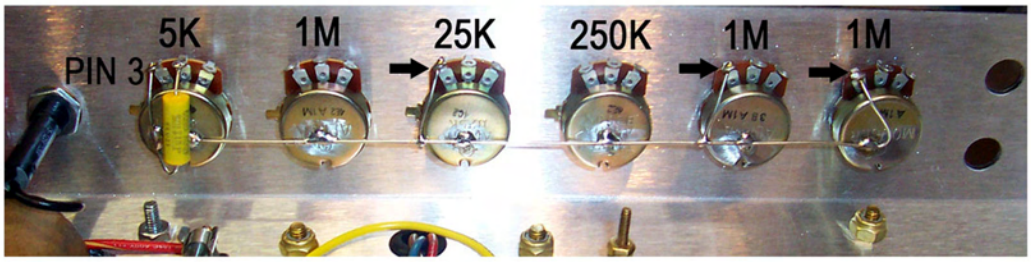
*****PT pictured is 120V operation ONLY, see the diagram in the APPENDIX for 120,220,240V specs*****

Installing the internal filter cap. Attach the F&T dual 16uf can cap to the chassis using the mounting clamp and medium brass bolts.
Align the cap so that the negative terminal points down towards the ground lug on the filter cap. Using 20 gauge buss wire, connect the negative terminal to the groung lug.





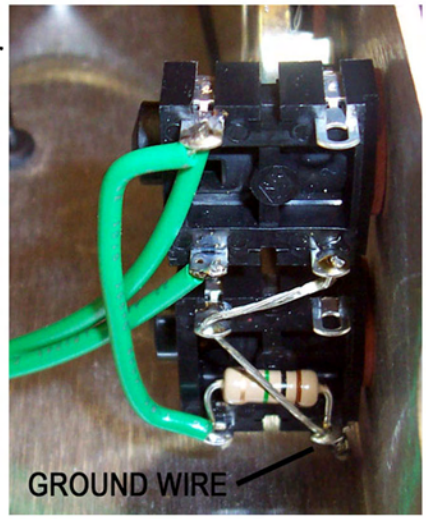
JTM 45 AMP KIT INSTRUCTIONS: STEP # 9



Installing the pots and buss wire. Locate the (6) pots and file or sand the gold material off of the center of each. This will allow the solder to stick to the pot. Install each pot on the chassis according to the diagram. Using 18 gauge buss wire, solder a strip across the back of all (6) pots. Also connect buss wire between the strip and the left most pin (pin 3) of the 25K (middle), 1M (high treble) and 1M (normal) pots. These are indicated above with arrows. Locate the Mallory .1uf cap and attatch the leads to pin 2 (center) and pin 3 (left) of the 5K presence pot. Solder the lead going to pin 3 to the back of the pot in addition to the buss wire.

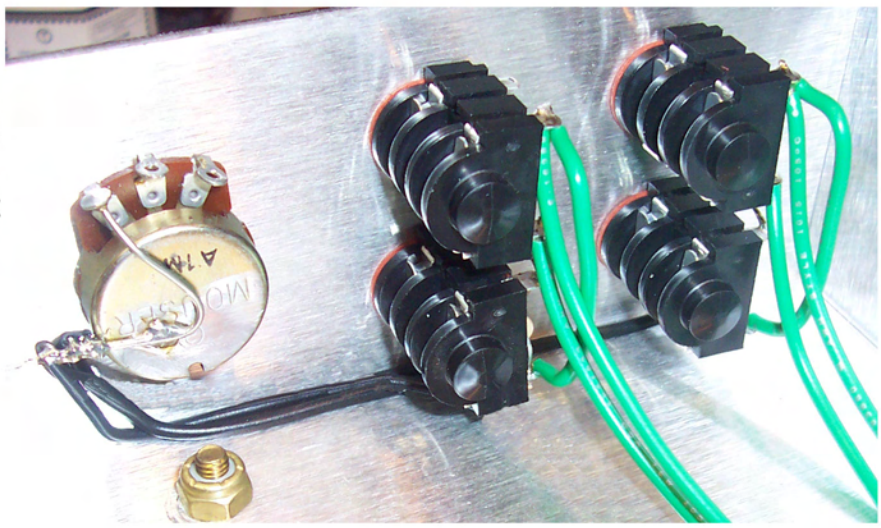
Install the (6) Marshall set screw knobs and secure into place on the pots with a 5/64" Allen wrench.

Installing and wiring the input jacks.
Prepare (2) **Cliff old style jacks** by soldering a 1M ohm 1 watt resistor across the lower terminals, leave room on the terminals for wire connections. If you opted for the **Allen Bradley NOS carbon comp** resistor kit, use (2) **AB NOS 1M 1/2 watt** here.
Next, strip **2"** of insulation from (2) **8"** lengths of **BLACK** wire. Attach one on each jack, connecting the lower right terminal and upper left terminal, leaving approx 1" of bare wire which will attach to the upper jack. Install the prepped jack into the high sensitivity jack hole for the "HIGH TREBLE" channel **I**. Install another jack into the low sensitivity hole and connect the bare wire as shown.
Repeat for "NORMAL" channel **II**.



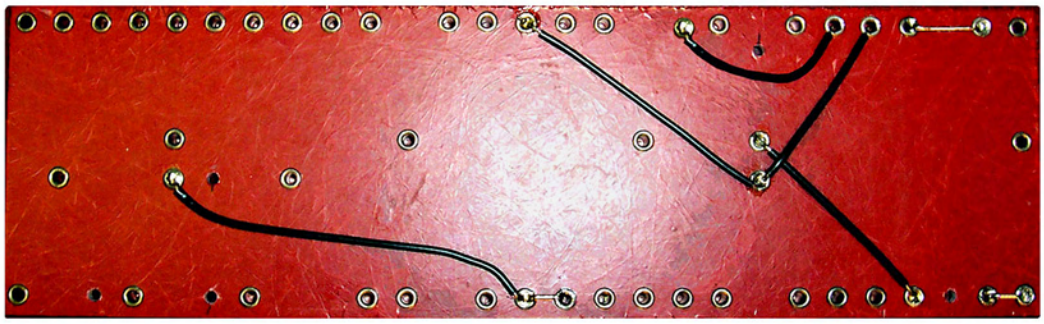
Attach (4) **4"** sections of **GREEN** wire to the upper jacks, as shown. These will later attach to the board and it's important to keep these short to prevent noise and hum.
Also jumper the upper-left and lower-left terminals together with a short section of **GREEN** wire, as shown.

Route the **BLACK** ground wires to the pot buss and solder in place.

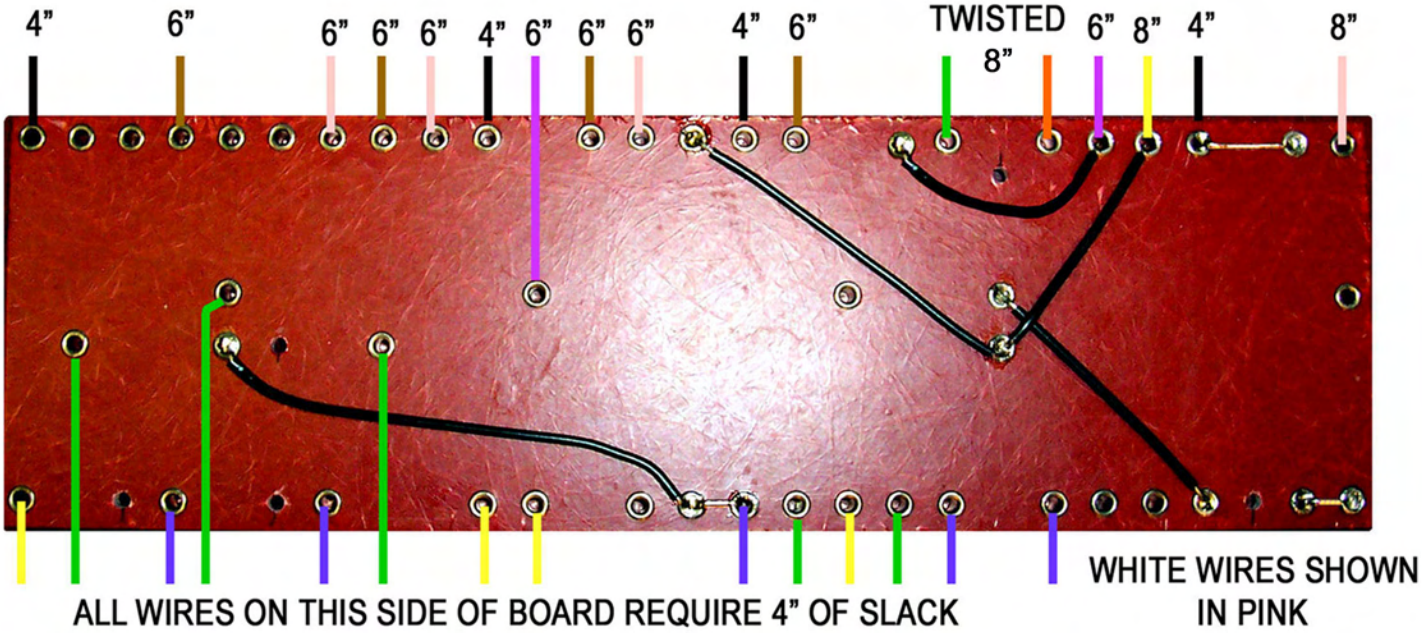


JTM 45 AMP KIT INSTRUCTIONS: STEP # 10

Wiring the bottom of the PTP board. Using 20 gauge buss wire and insulation material, make the connections shown in the picture on the bottom of the PTP board.

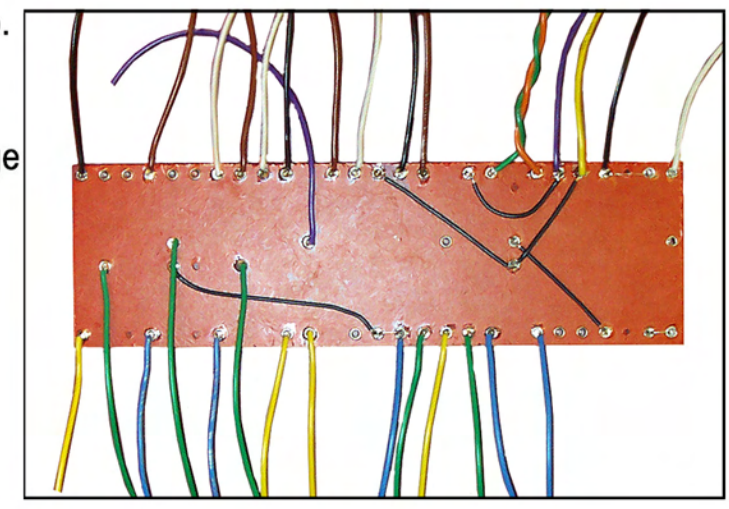


Prewiring the board for installation. Attach wires to the board according to the diagram below for wire color and length. For each wire, strip 1/4" of insulation from the end and fold the bare section over. Insert the folded wire into the corresponding terminal and solder in place.



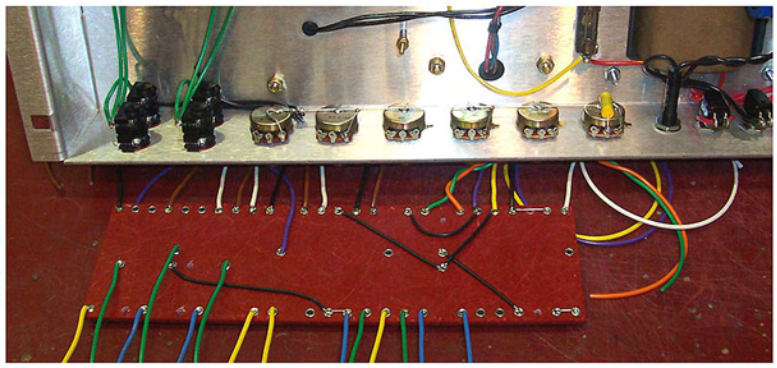
Be sure not to insert the wire too far into the terminal or the component leads may not fit in from the top.

With all the wires attached, the board should look like the picture shown here. Notice that the orange and green wires get twisted together.

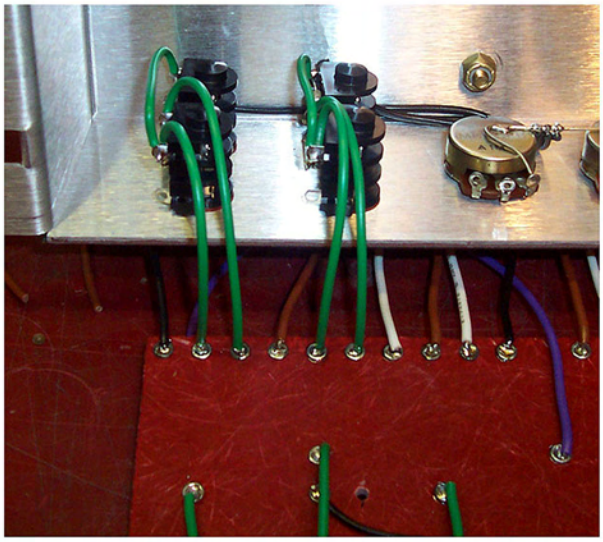


JTM 45 AMP KIT INSTRUCTIONS: STEP # 11

Wiring the board into the chassis. Tilt the chassis up on it's front and lay the board in front of it. This will make it easy to attach (6) wires from the chassis to the board before installing the board on the mounting bolts.

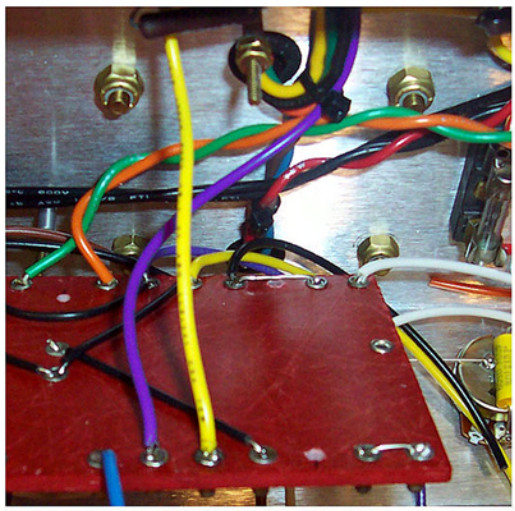


First are the (4) green wires from the input jacks. Cut each of them to length, strip the ends and solder them into place on the bottom of the board, as shown.

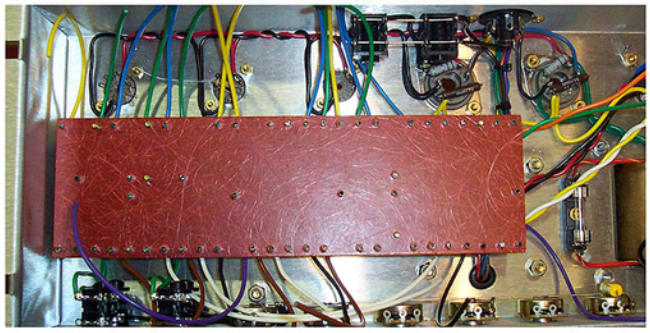


Route the yellow wire attached to pin 6 of the output tube socket furthest from the power trans to the board. Attach it to the fourth terminal from the right end of the board (not counting the mounting hole), on the tube side of the board.

Attach the purple wire from the impedance switch to the next terminal to the left. It's the fifth terminal from the right end of the board, on the tube side.

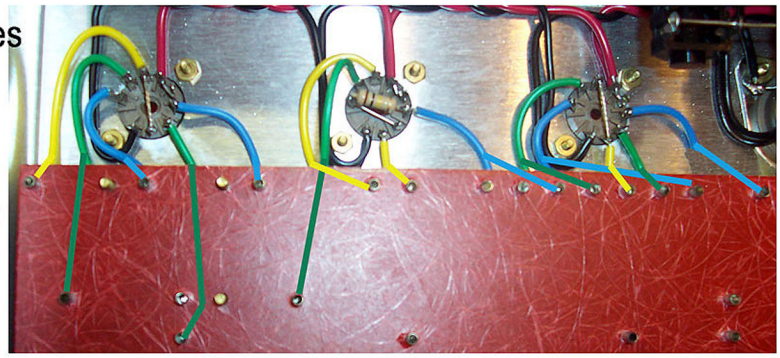


Set the board in the chassis, on the mounting bolts, and pull the wires straight out from each side. Next you can start wiring the board wires to the components in the chassis.



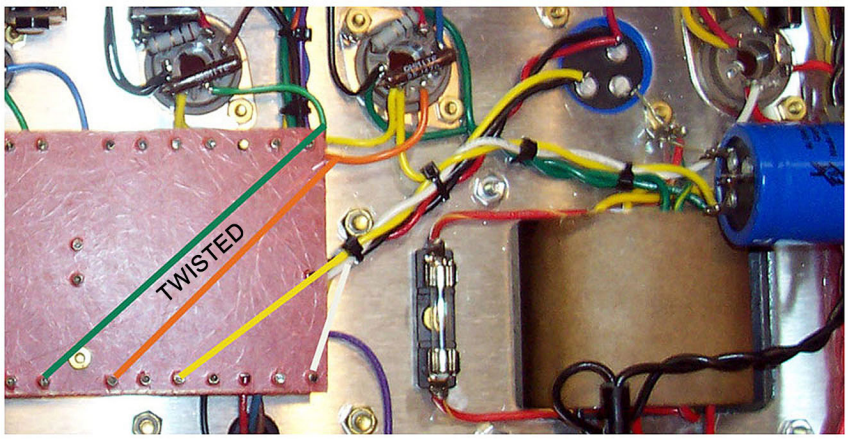
JTM 45 AMP KIT INSTRUCTIONS: STEP # 12

Wiring the preamp tube sockets. Cut the wires that attatch to the preamp tube sockets to length and attach them to the terminals according to the picture at right. The wire colors have been extended to show where each wire attaches under the board. Notice that the yellow cathode wire extends to connect pin 3 and pin 8 on both the far right (V3) and far left (V1) preamp tube sockets.



Wiring the output tube grids.

Route the twisted GREEN and ORANGE wires to the output tube sockets (V4 and V5). Cut to length and attach the GREEN wire to V4, PIN 5. Repeat with ORANGE on V5, PIN5.
These wires deliver AC signal and negative DC bias voltage from the phase inverter to the grids of the output tubes.



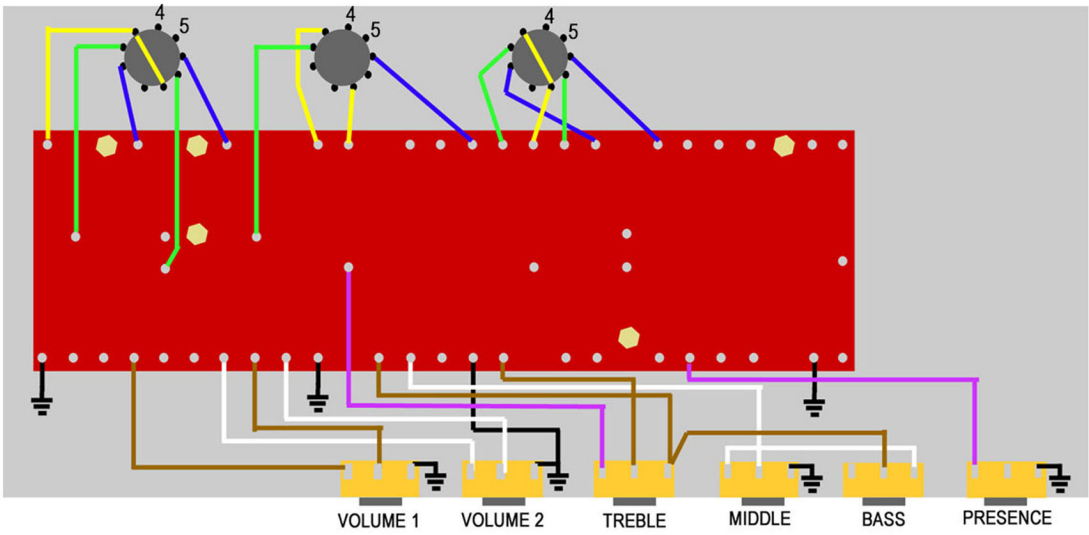
Wiring the phase inverter cap and bias supply wire.

Route the YELLOW wire to the **dual 16uF filter capacitor**. Attach to one, or bridge both positive terminals (as shown). With one terminal connected, there is **16uF** total filtering at the phase invertor. This is the original **JTM 45** spec. Connecting both positive terminals increases filtering to **32uF** total. The difference is subtle, but you may prefer it. Especially if you later tweak the amp for more gain.

Route the WHITE wire to the RECTIFIER tube socket and attach at PIN 6, joining the already attached RED wire.

You may now cable-tie these wires together.

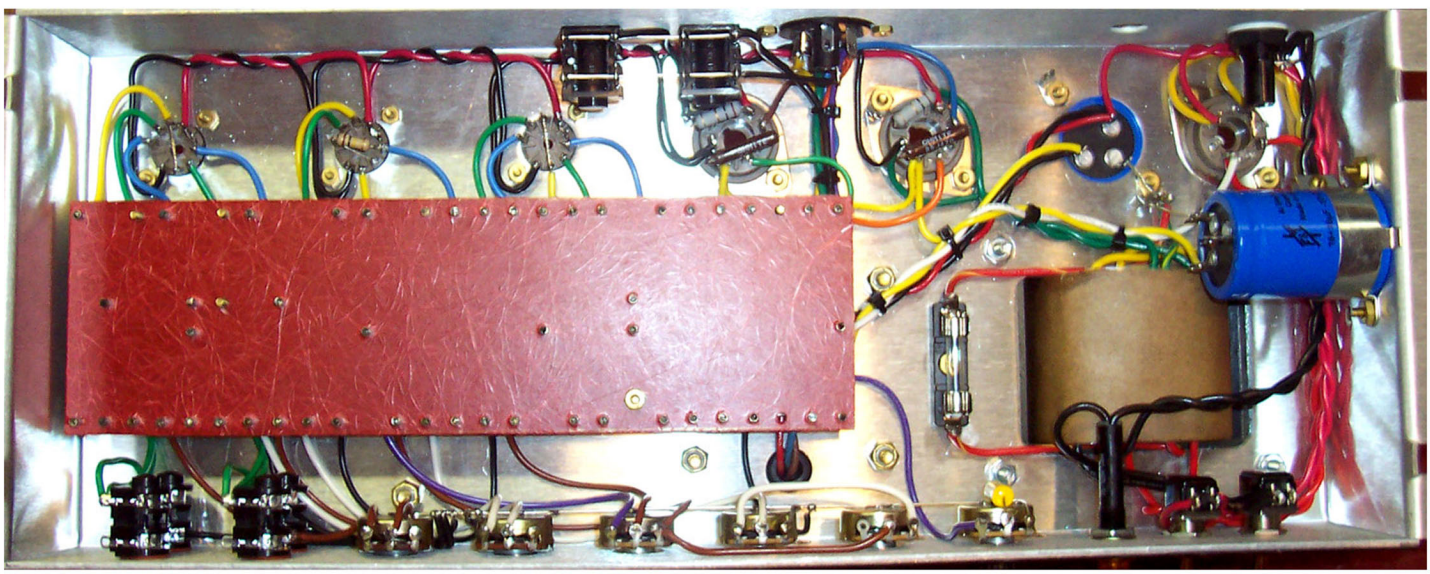
Wiring the board into the chassis, continued. Using the diagram, cut to length and attach the wires from the board. Refer to the actual pic at the bottom of the step for wire routing. Certain wires need to be routed to insure low noise.



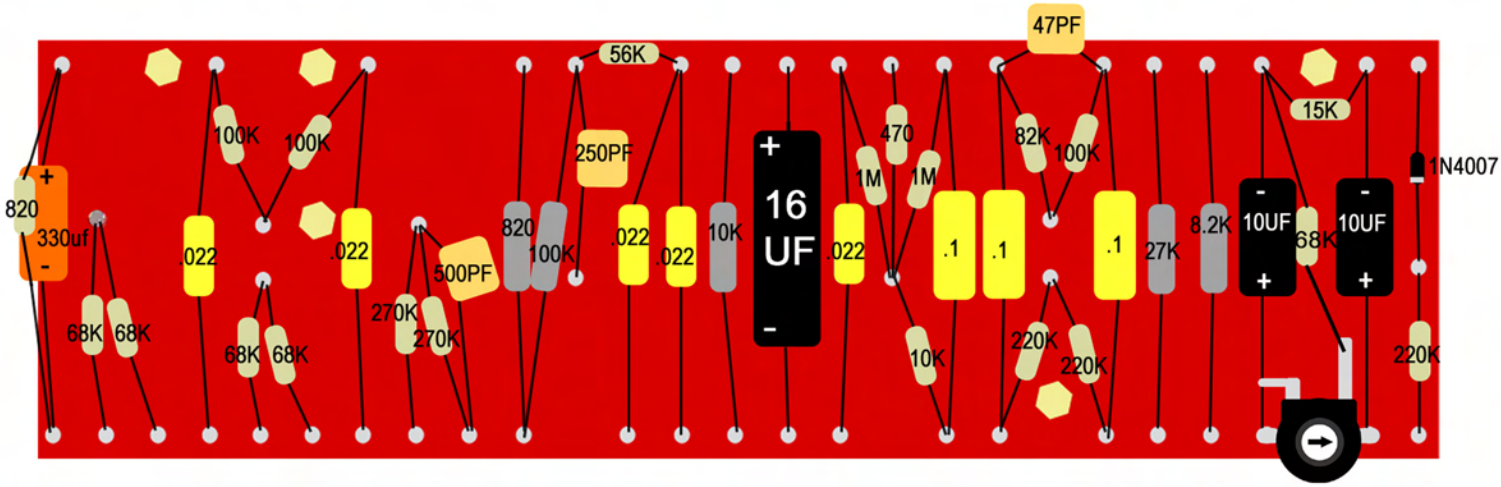
The green wires from the board to pin 2 and pin 7 of the V1 tube socket, for example. They should run along the bottom of the board, up above the chassis, and attach to the tube socket terminals. The blue wires running to pin 1 and pin 6 of V1 should go from the board, straight down and run along the chassis to the tube socket terminal. The purple wire from the board to the presence pot should run along the chassis, over away from the other tone controls, and to the terminal on the pot.

In the diagram, the grounds are indicated with the schematic symbol for ground (three horizontal lines in an upside down triangle). These should all attach to the buss wire ground on the pots.

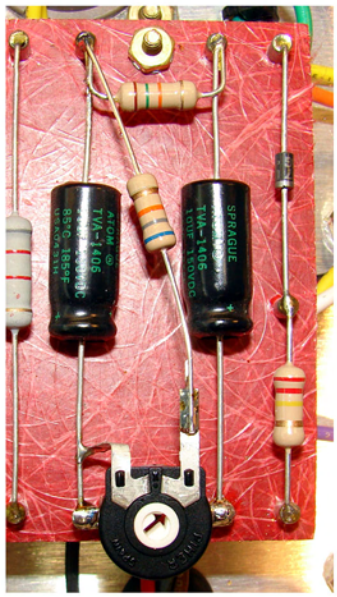
Clean wiring and solid connections are essential for a reliable amp, so don't rush this step. Also pay close attention to the wiring of the tone pots, make sure the jumpers from the treble and middle pots to the bass pot are wired correctly.



JTM 45 AMP KIT INSTRUCTIONS: STEP # 14



Populating the board. Using the resistor color code chart in the APPENDIX, identify the correct values and positions of resistors. Also locate the capacitors, diode and vertical mount **25K bias pot**. If you are using the optional **Sozo** brand caps and/or **Allen Bradley NOS** resistors, substitute those parts. A diagram detailing where to use AB NOS carbon comp resistors is located in the APPENDIX.

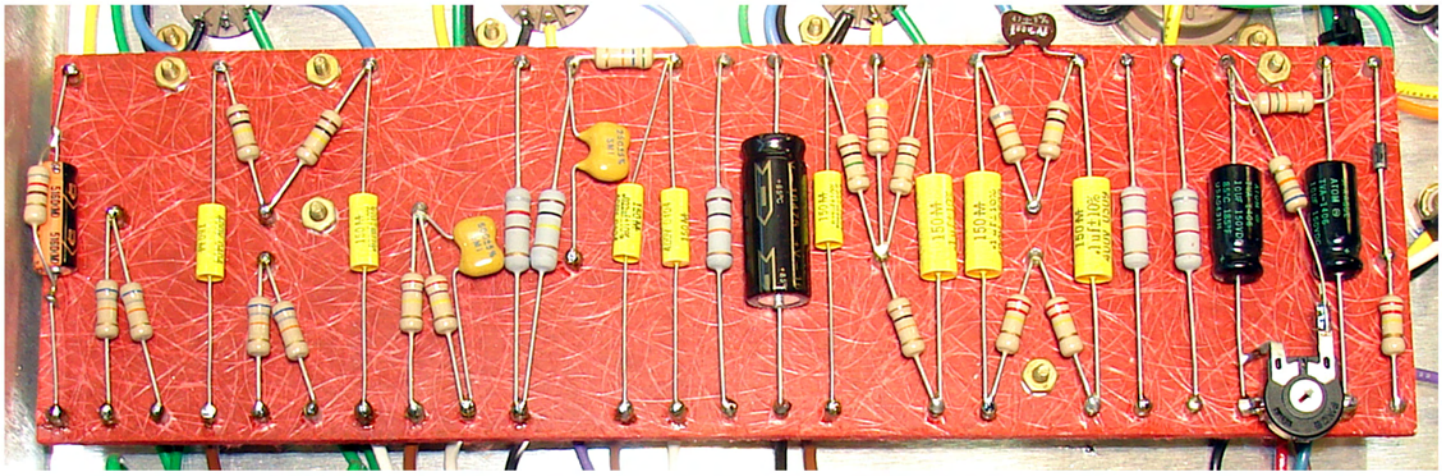


NOTE: Be sure to observe the correct polarity on (2) **10uF**, **16uF** and **330uF** capacitors. Also be sure to orient the diode correctly.

Prepare components for installation by cutting leads to size and making an **1/8"** bend which will go inside the terminal. Solder in place making sure there is even solder flow connecting each lead and the terminal.

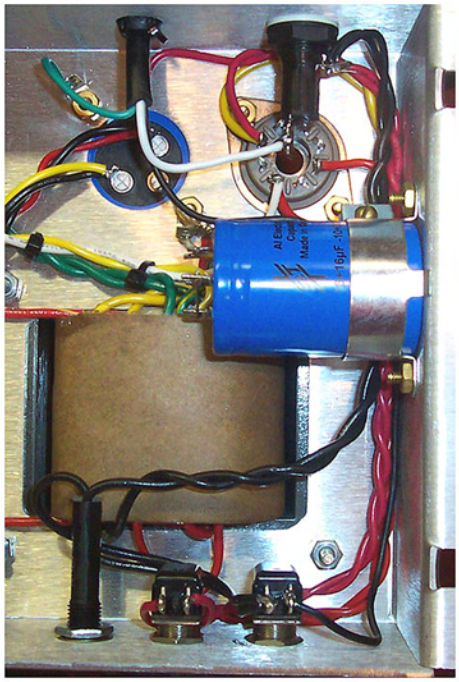
Prepare the **vertical mount bias pot** by bending the rounded, side tabs out flat, the right, pointed terminal out straight and the left, pointed terminal to the side, as shown in the picture. Solder in place and attach a **68K** 1 watt carbon film resistor.

Install (5) **small brass nuts** and tighten using an **1/4"** nut driver.



JTM 45 AMP KIT INSTRUCTIONS: STEP # 15

Installing the power cable and strain relief.

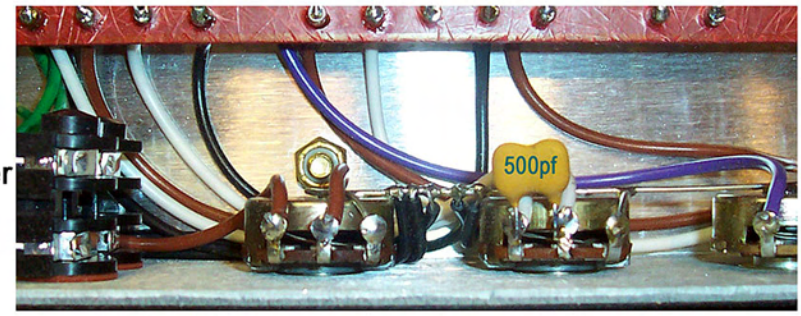


Strip **10"** of insulation from the end of your **power cord** (you may need to remove the molded IEC plug). Place the plastic **strain relief** on the cord, aprrox. 1" from the exposed wires. Squeeze the strain relief with pliers and insert it into the chassis hole.

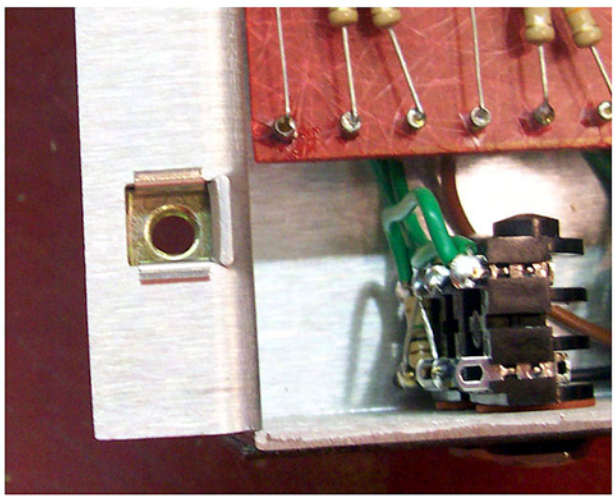
Cut the **GREEN** ground wire to length and attach to the ground lug on the filter cap mounting bolt (as shown).
Cut the **WHITE** wire to length and attach to the end terminal of the chassis mount fuse holder.
Route the **BLACK** wire to the power switch, cut to length and attach to the open terminal.

Install a **500mA** fuse in the internal fuse holder. Also install the appropriate value fuse in the chassis mount fuse holder:

3A for 120V AC operation
2A for 220/240V AC operation



Install a **500pF** silver mica capacitor across pins 1 and 2 of the HIGH TREBLE pot. This is the **"bright cap"** and it allows high frequencies to bypass the volume pot. Which keeps the tone from being dull at lower settings. Feel free to try different values or no cap at all. Common values range from **100pF** to **5,600pF**.



Install the (4) cage nuts into the square holes on the chassis mounting tabs. Place one tab of the cage nut in the hole and use a flat scewdriver to snap the other into place.

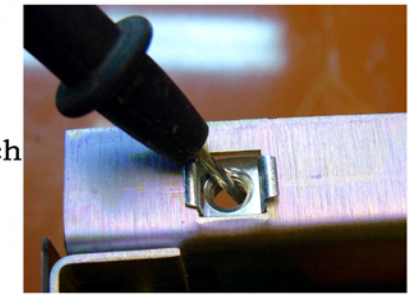
This completes the assembly of the kit. The next steps will guide you through powering on, biasing and testing your **JTM 45.**

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, BIAISNG, 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, as shown.



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. You should also measure more than **5V AC** between pins **2** and **8** of the rectifier tube socket. This reading will drop into range when the rectifier tube is installed.

D. If all tests correct so far, power **OFF** and install the **GZ34** recifier tube. Power **ON** and allow the tube to warm up. You should now measure approx **325V DC** on one side of the STANDBY switch. You should also measure approx **-45V DC** on V4 and V5, pin 5 (with the bias pot adjusted fully clockwise).

E. Power **OFF** again and install (3) **12AX7** preamp tubes. Power **ON**, allow the tubes to heat up and turn the STANDBY switch to **ON**. Set your meter to 500V DC range and test **V1, V2 and V3**, pins **1,3,6** and **8**. These should read approx **10%** higher than the voltages listed below, and will drop into range when the KT66 tubes are installed and biased.

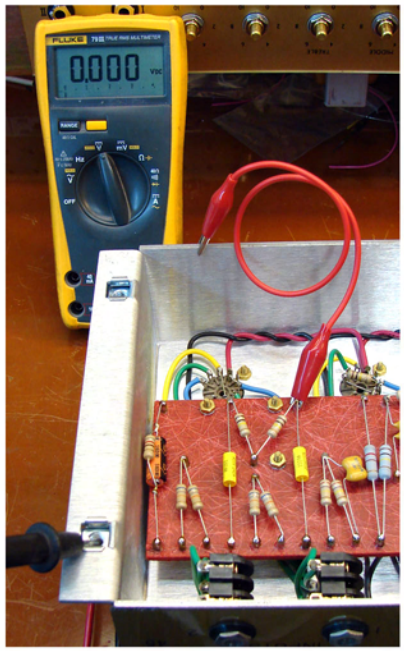
TUBE	PIN NUMBER 1	2	3	4	5	6	7	8	9
V1	180	---	1.6	3.15AC	3.15AC	180	---	1.6	3.15AC
V2	155	---	1.0	3.15AC	3.15AC	280	150	150	3.15AC
V3	205	---	48	3.15AC	3.15AC	195	---	48	3.15AC
V4	---	3.15AC	400	395	-42	400	3.15AC	---	
V5	---	3.15AC	400	395	-42	400	3.15AC	---	
V6	---	400 5AC	---	320AC	---	320AC	---	400 5AC	

V 1,2 AND 3 ARE 12AX7
V 4 AND 5 ARE KT66
V 6 IS GZ34

NOTE: ***5V AC MEASURED BETWEEN PINS 2 AND 8***

TESTING PART 2: INSTALLING OUTPUT TUBES

A. 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, unplugged 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 amp is powered ON.

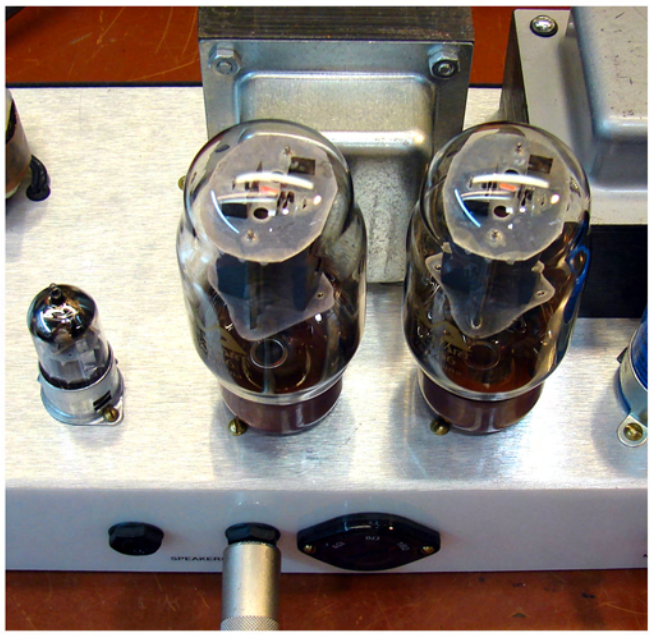
Always measure to confirm that the stored voltage has been fully drained. As shown on our meter.

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

B. With the caps drained, make sure the bias pot is adjusted fully clockwise. This will provide the highest negative DC bias voltage.

Now install (2) **KT66** output tubes. Attach a suitable load (50 watts minimum) or a speaker cabinet. Plug in the power cord and power ON, but leave the amp in STANDBY to allow the tubes to heat up. You will see the heaters glow orange in the top of the KT66's, as in the picture.

C. Power **OFF** and turn the chassis over. You'll need something under the transformers to keep the chassis from resting on the tubes.



Power **ON**, allow the tubes to heat up and then turn the STANDBY switch to **ON**.

If you notice any issues i.e. a fuse blows or the lamp goes out, **turn off the power switch immediately**, unplug the amp, drain the caps and retrace your wiring. Especially the output section.

If everything looks good, your amp is now operating at **high voltage** and is biased cold. You can move on to TESTING PART 3 to set the bias.

TESTING PART 3: BIASING

A. Extremely improtant 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 JTM 45, 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 forumla. Based on KT66 maximum plate dissapation and B+ voltage in the amp: **(27*.7) / B+ = Cathode Current**

Here, **27 Watts** is the specified maximum plate dissapation for an KT66. We multiply this by **(.7)** to assure a safe rating of **70%** of the maximum spec. Or **approx 19 Watts**. We get our **B+** value by measuring at the **STANDBY switch**. Here we have **400V DC**.

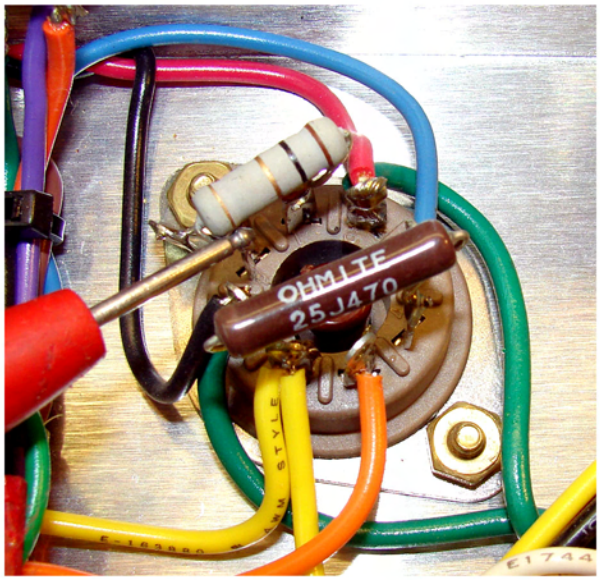
The adjusted formula is: **19W / 400V = 47.5mA.** So we want to adjust our output tubes to maximum **47.5 mA** of cathode current at idle. I prefer to stay slightly lower with modern KT66 tubes and opt for **40-45mA**.

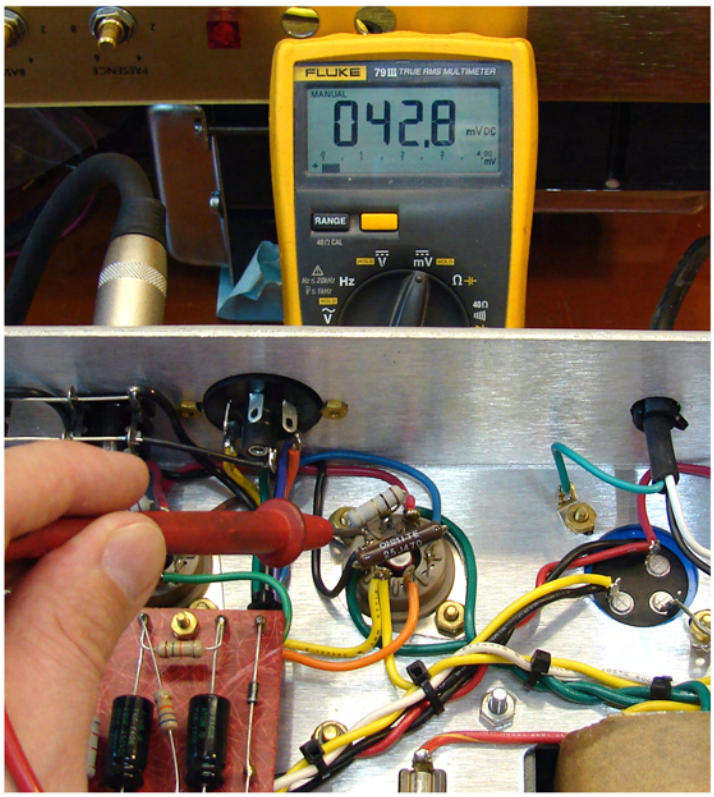
C. Thanks to **OHMS LAW** we can determine cathode current by measuring millivolts across a **1 ohm** resistor between the cathode and ground. As installed in **STEP 5.** Our reading in millivolts **(mV)** is equal to cathode current in milliamps **(mA).**

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 8** of each output tube, as shown below. These measurements should be simular, but not identical.

Slowly adjust the bias pot counter-clockwise and remeasure until you get in the desired range. In this case, between **40** and **45mA** is safe operating range. Corresponding to **60-70%** of maximum plate dissapation. 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

JTM 45 KIT CHASSIS

JTM 45 KIT BOARD LAYOUT

ALLEN BRADLEY NOS CC LAYOUT

METRO TRANSFORMER DIAGRAMS

220/240V AC WIRING

JTM 45 KIT VOLTAGE CHART

JTM 45 SCHEMATIC

RESISTOR AND CAPACITOR CODES

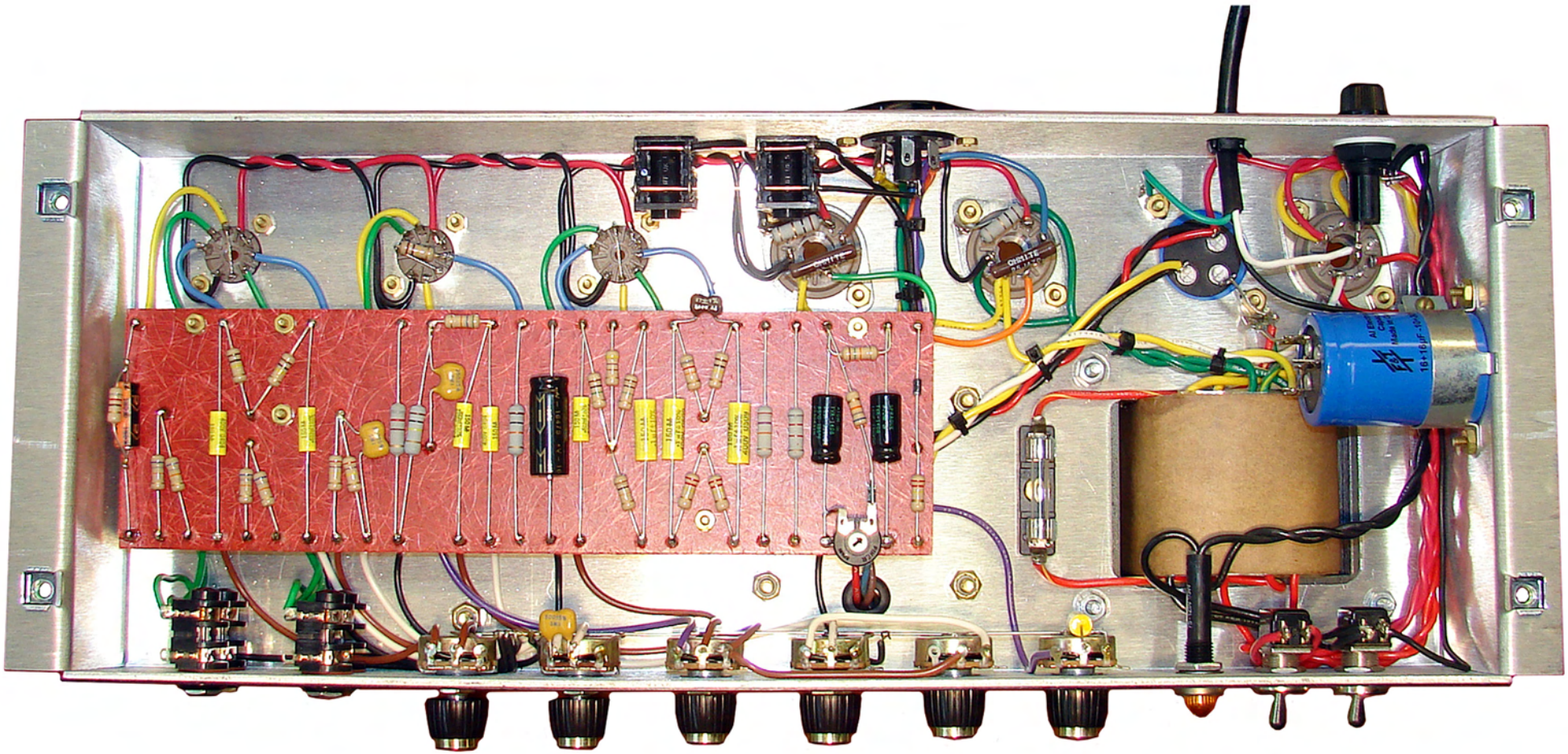
MERCURY MAGNETICS DIAGRAMS

RADIO SPARES DE-LUXE 4 OHM WIRING

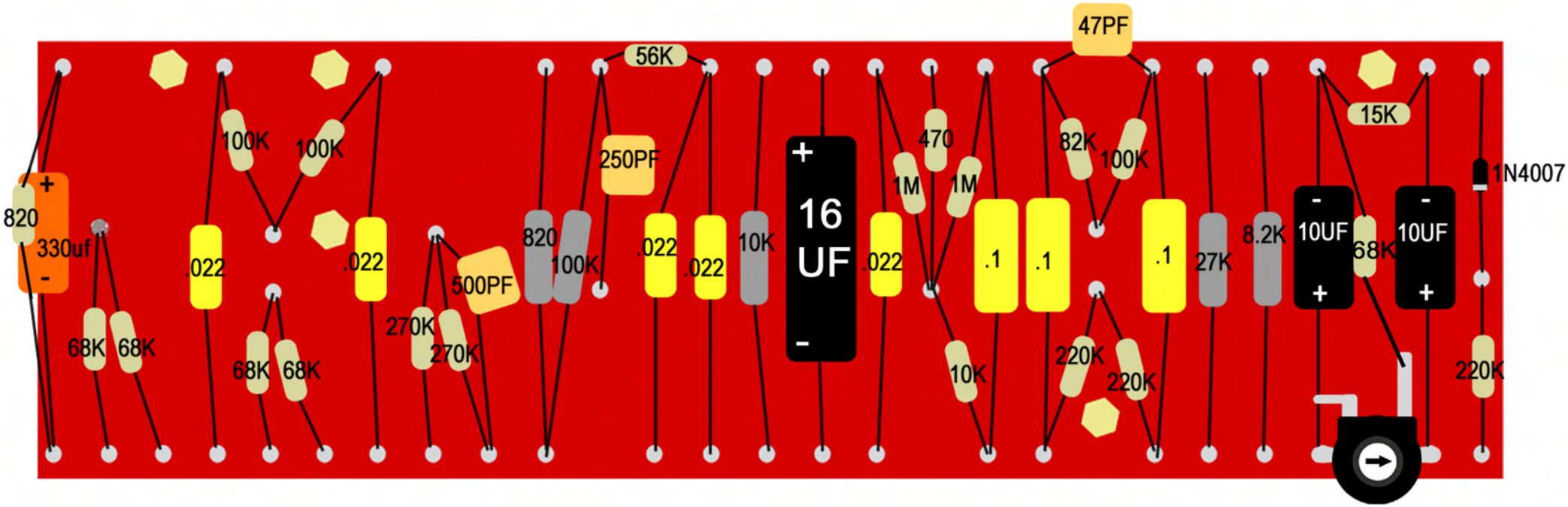
RADIO SPARES DE-LUXE 8 OHM WIRING

RADIO SPARES DE-LUXE 16 OHM WIRING

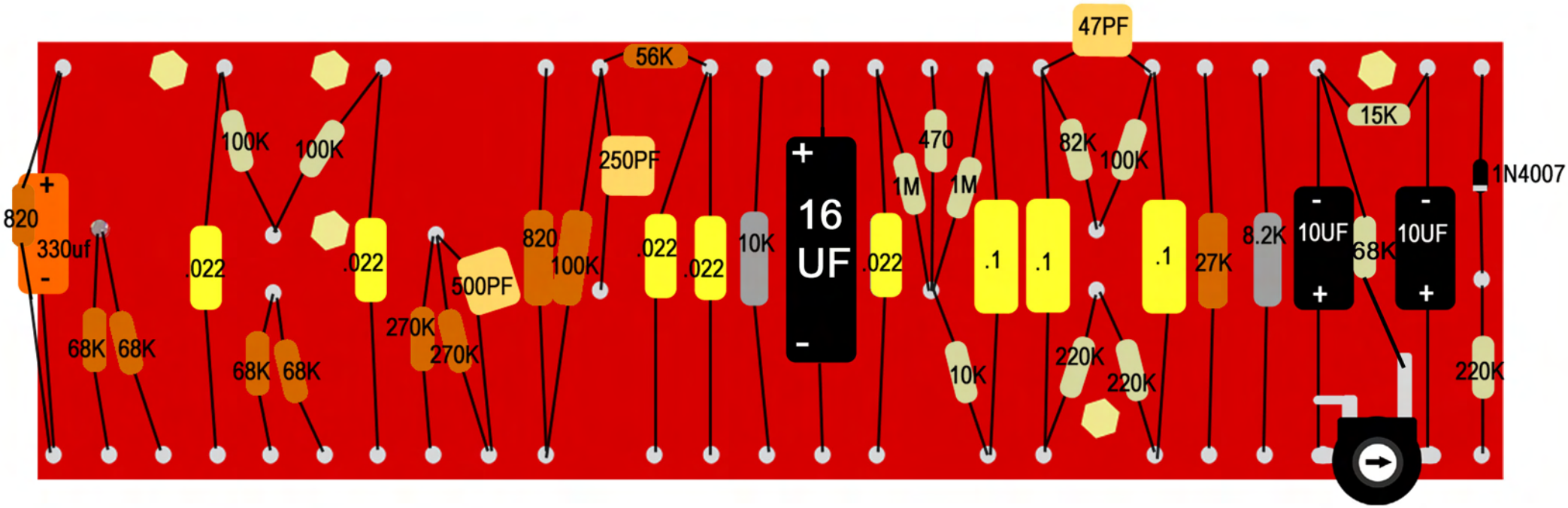
METROAMP JTM 45 KIT CHASSIS

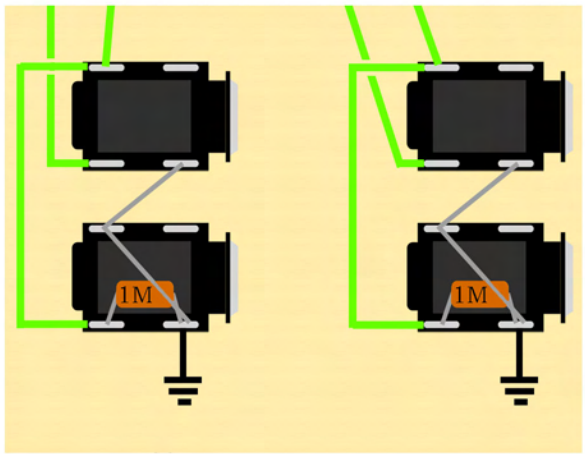


METROAMP JTM 45 KIT - BOARD LAYOUT



ALLEN BRADLEY NOS CARBON COMP RESISTORS



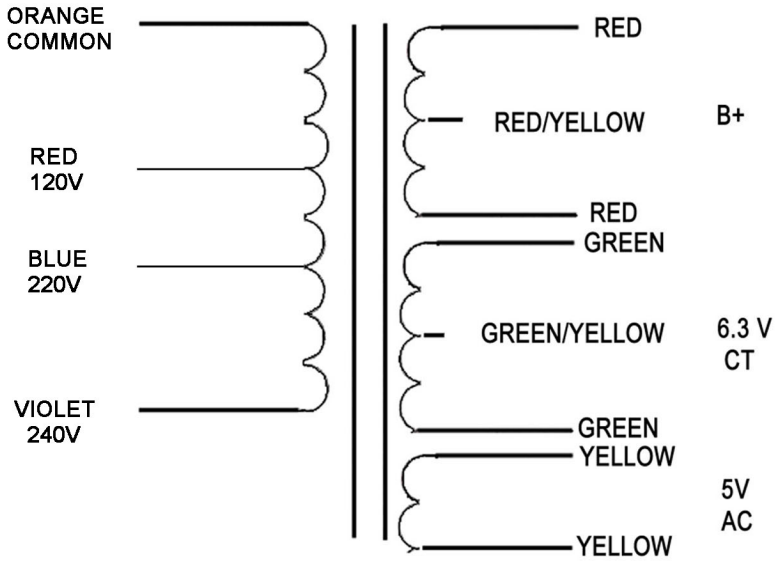


POSITIONS FOR OPTIONAL ALLEN BRADLEY NOS CARBON COMP RESISTORS, INDICATED IN BROWN.

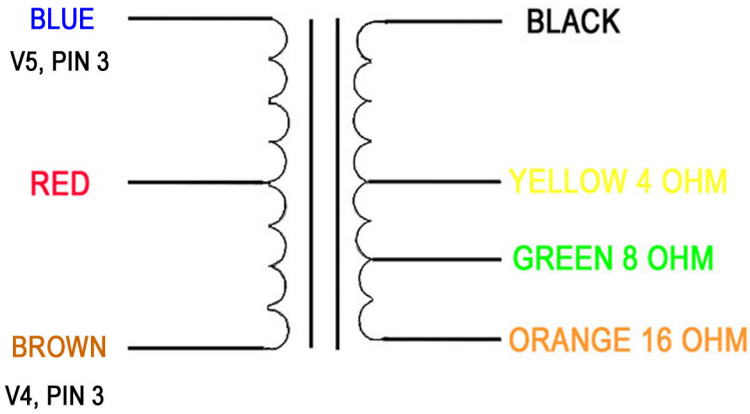
NOTE: NEW OLD STOCK (NOS) COMPONENTS SHOULD ALWAYS BE PREPPED BY STEEL WOOLING THE LEADS.

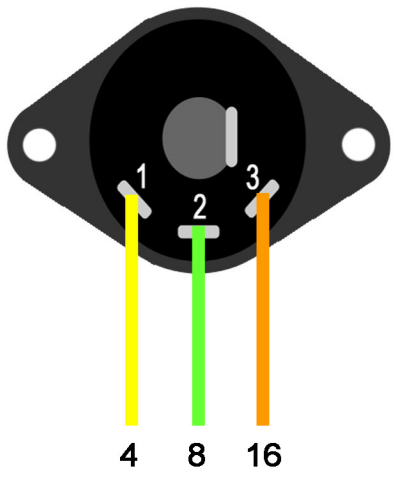
JTM 45 TRANSFORMER DIAGRAMS

METRO 1202-55 POWER TRANSFORMER



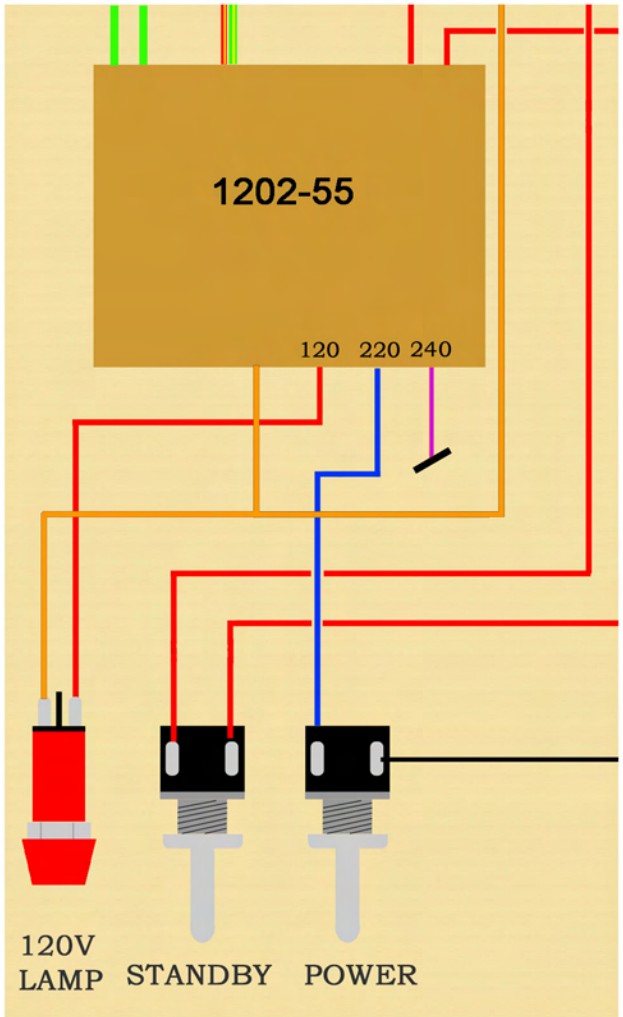
METRO 784-103 OUTPUT TRANSFORMER



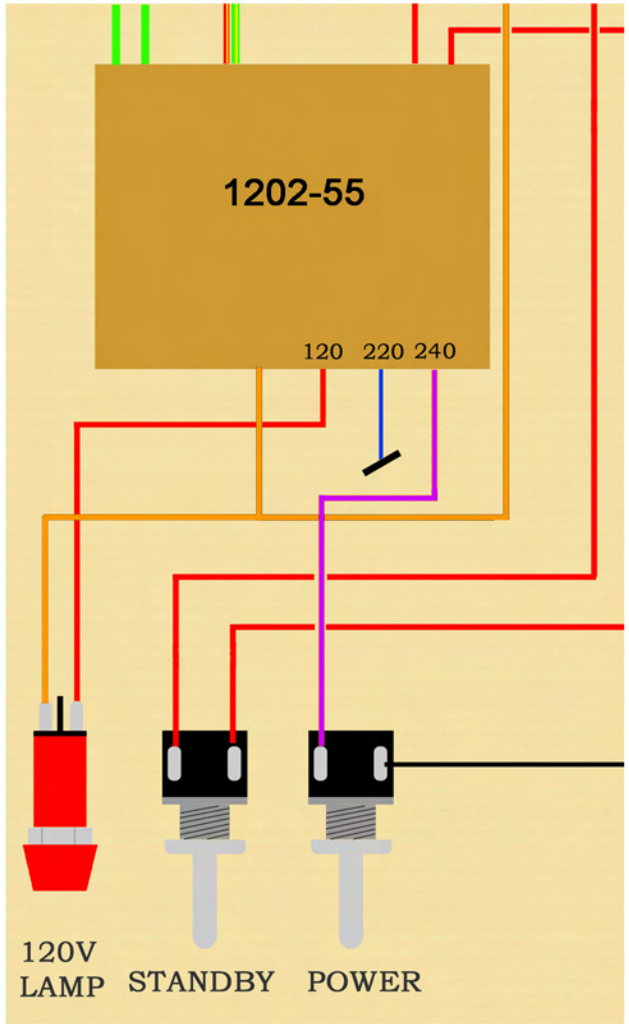


JTM 45 220/240V AC WIRING

220V AC



240V AC

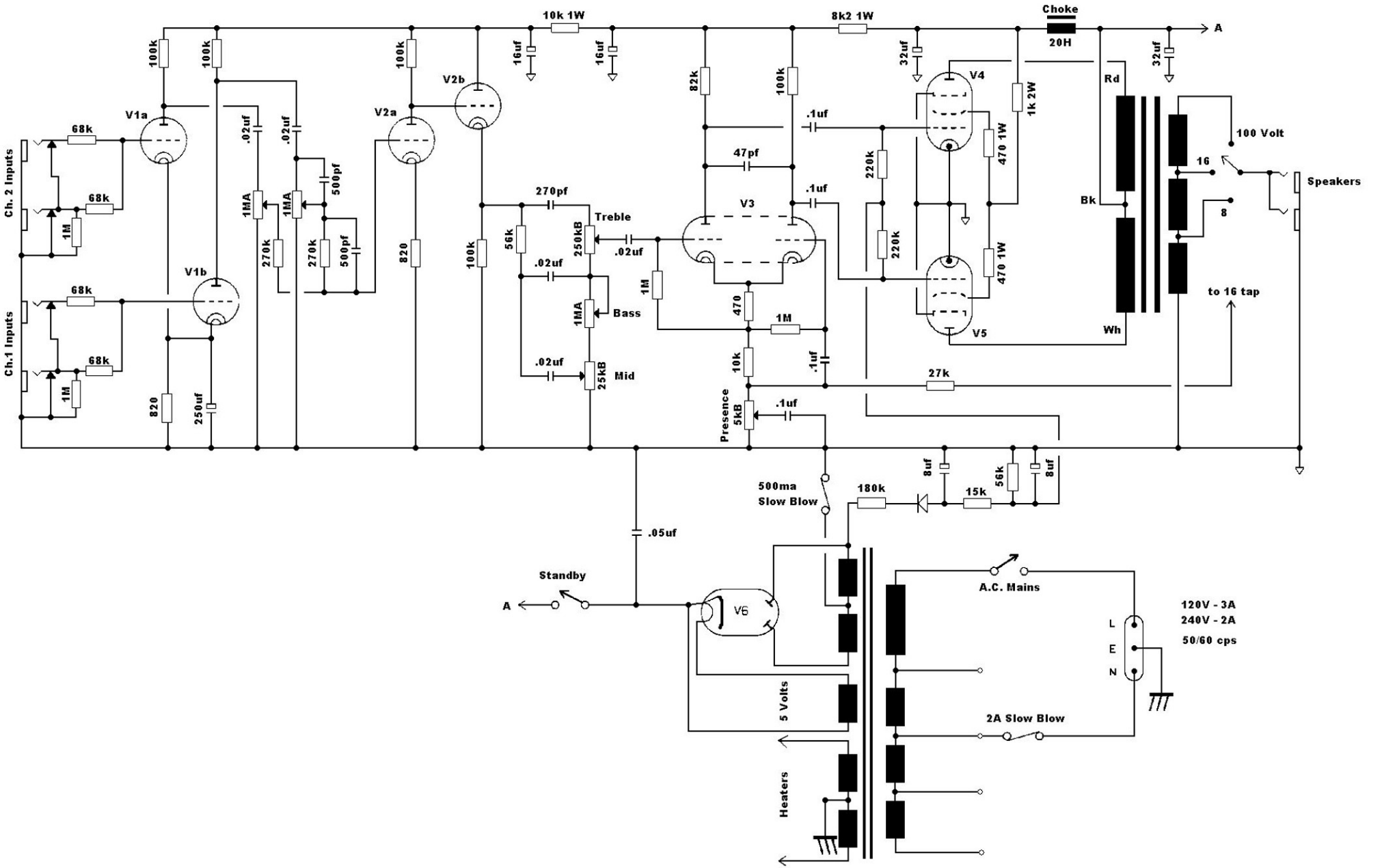


JTM 45 KIT VOLTAGE CHART

TUBE	PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V1	180	---	1.6	3.15AC	3.15AC	180	---	1.6	3.15AC
V2	155	---	1.0	3.15AC	3.15AC	280	150	150	3.15AC
V3	205	---	48	3.15AC	3.15AC	195	---	48	3.15AC
V4	---	3.15AC	400	395	-42	400	3.15AC	---	
V5	---	3.15AC	400	395	-42	400	3.15AC	---	
V6	---	400 5AC	---	320AC	---	320AC	---	400 5AC	

V 1,2 AND 3 ARE 12AX7
V 4 AND 5 ARE KT66
V 6 IS GZ34

NOTE: ***5V AC MEASURED BETWEEN PINS 2 AND 8***



MATERIAL		DIMENSIONS IN	
MATERIAL THICKNESS		TOLERANCE UNLESS OTHERWISE STATED	
INTERNAL BEND RADII		DIMENSIONAL	
EXTERNAL B/A		CENTRES	
BEND DIE		ANGULAR	
DRAWN BKW	DATE 5/12/01	MODEL	JTM45
CHECKED	DATE		
APPROVED	DATE		

Marshall

MARSHALL AMPLIFICATION PLC
DENBIGH ROAD, BLETCHLEY, MILTON KEYNES, MK1 1DQ.
TEL 08000137541 FAX 08000278160

TITLE

CIRCUIT DIAGRAM

DWG.No JTM45.DGM

ISSUE 7

RESISTOR COLOR CODES

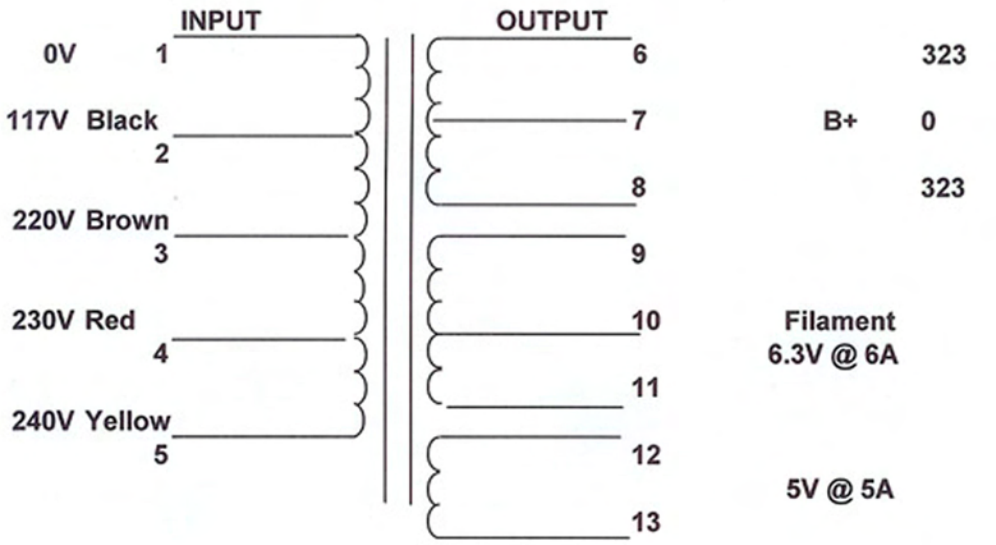
1 ohm	brown-black-gold
470	yellow-violet-brown
820	grey-red-brown
1k	brown-black-red
1.5k	brown-green-red
2.7k	red-violet-red
5.6k	green-blue-red
8.2k	grey-red-red
10k	brown-black-orange
15k	brown-green-orange
27k	red-violet-orange
33k	orange-orange-orange
47k	yellow-violet-orange
56k	green-blue-orange
68k	blue-grey-orange
82k	grey-red-orange
100k	brown-black-yellow
150k	brown-green-yellow
220k	red-red-yellow
270k	red-violet-yellow
470k	yellow-violet-yellow
1M	brown-black-green

CAPACITOR CODES

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

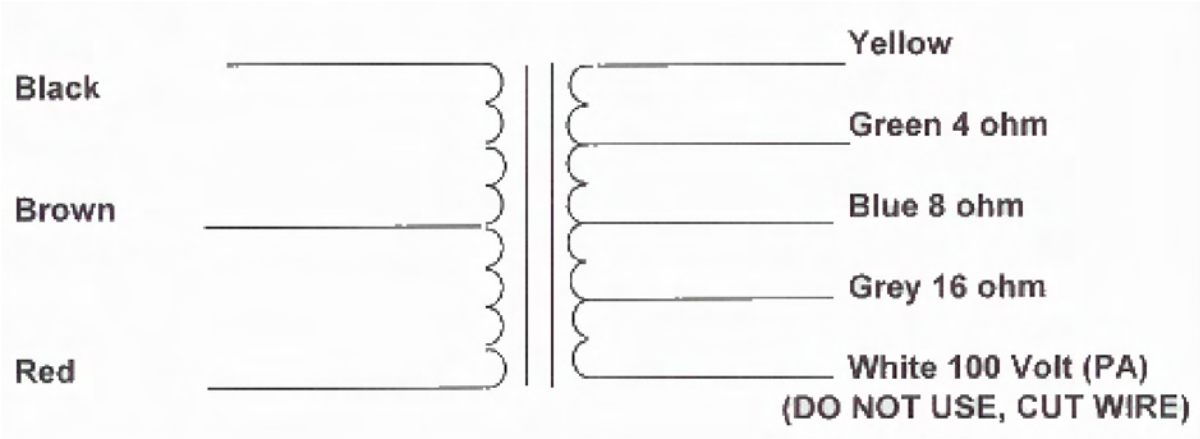
OPTIONAL MERCURY MAGNETICS TRANSFORMERS

AXIOM P4550JT AUDIO POWER TRANSFORMER
Version G2



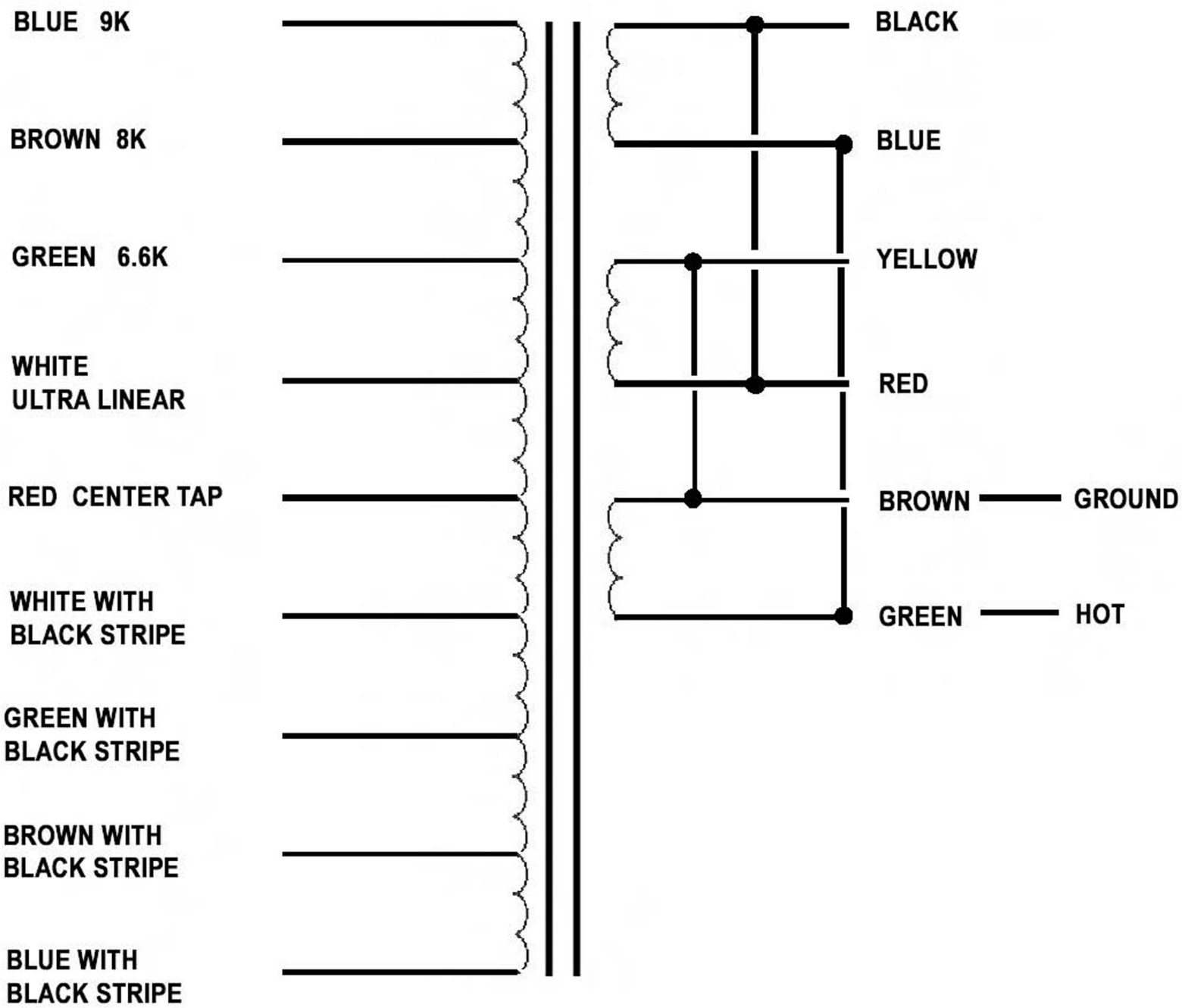
Approximate Solid State Rectification	Approx B+ Unloaded	Approximate Tube Rectification
G2 = 420V	323 - 0 - 323	G1 = 355V

AXIOM 045JT-16 OUTPUT TRANSFORMER



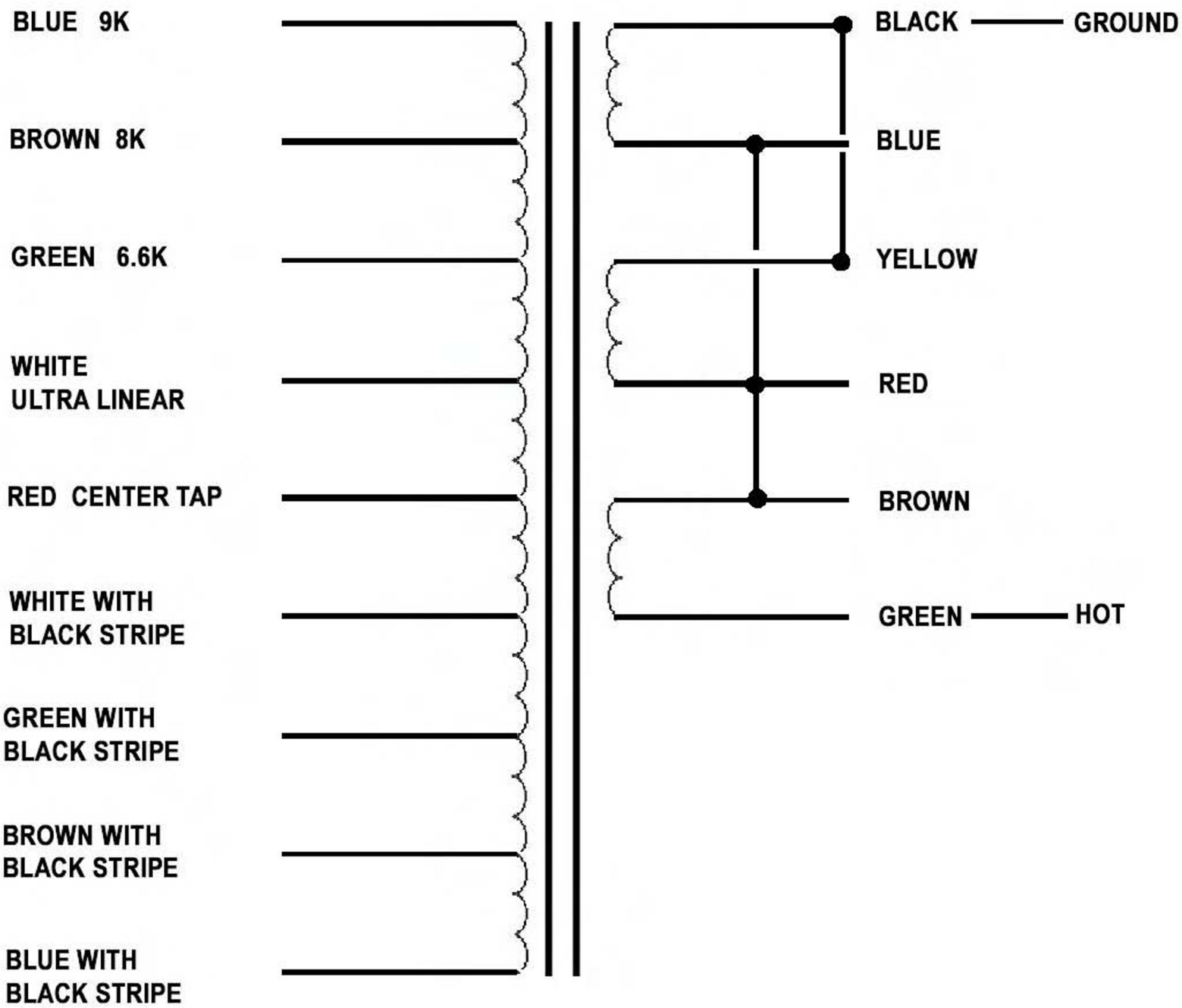
RADIO SPARES DE-LUXE OUTPUT

4 OHM WIRING



RADIO SPARES DE-LUXE OUTPUT

8 OHM WIRING



RADIO SPARES DE-LUXE OUTPUT

16 OHM WIRING