



# Moondog 2A3

## A 2A3 Single Ended Amplifier Kit

### Assembly Manual

Designed by:

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Welborne Labs

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## ***Introduction***

The Welborne Labs Moondog 2A3 is a single ended all triode vacuum tube amplifier. The output tube of choice for this project is the 2A3 triode. New 2A3s are currently being produced in China and the quality is pretty good. KR Enterprise also manufactures a new 2A3 and the quality is excellent. NOS 2A3s can be found for \$60 to \$200 each. We like the RCA, Sylvania and Raytheon 2A3s. The driver tube of choice is the 6SN7.

The design is very simple with a minimum number of gain stages. It incorporates a driver circuit capacitor coupled to the grid of the 2A3 output stage. The Moondog incorporates point-to-point wiring (no circuit boards) using solid core OFC hookup wire and Cardas connectors for input jacks and binding posts.

The output transformers incorporated in this design are manufactured for us by Electra Print USA and the quality is exceptional. The output transformer has a primary impedance of 3400 ohms, provides an excellent damping factor and is well suited for the 2A3. Output taps are available for 4, 8 and 16 ohms.

The power supply consists of an LC filter network fed by a GZ37 rectifier tube. The power transformer is custom made to our specifications and is similar to the one used on our Laurel 300B monoblocks. It incorporates multiple taps on the primary for 100/115/230/240Vac and 50/60Hz operation.

Maximum power output is 3.5 watts. Distortion is load dependent but typical values range from <0.5% at 1/2 watt to <2% at full power. Not the best distortion figures in the world, therefore we recommend the use of very efficient speakers. In an average size room (12' x 15') using speakers with a sensitivity of 95dB, .5 watts of output will be very loud! These distortion levels are typical of SE amps and are primarily even order types.

The Amplifier is mounted in a very attractive chassis with a walnut base and brass top mounting plate.

## ***Parts and Sound Quality***

In voicing these amps we started with all carbon composition resistors and NOS paper & oil capacitors. The sound was somewhat congested but on the whole we were impressed. The 2A3 exhibited a relatively good sound stage and good tonal balance from top to bottom. The sound was not quite on par with a good 300B SE amp but was close, only lacking in weight and resolution.

After several iterations and tweaking we ended up with a configuration that included some oil caps in the power supply and Hovland MusiCaps in the signal path. The sound was now very detailed and open with the sound stage extending beyond each speaker (on some recordings). Depth of field started from a line parallel with the speakers and back about 8 or 10 feet. The resolution was now there and the 2A3 only lacked a little in weight when compared to an 8 watt 300B triode amp. Unfortunately, the oil filter caps are too big to fit inside our chassis so we are using a couple of Solen films in their place. The sonic trade off is almost negligible, but maybe in the future we will consider making our chassis larger to accommodate these capacitors. But right now we aren't losing sleep by not having them in the amp.

There are few passive components in this design and therefore all components are critical and will impart a different sonic characteristic to the end result. We welcome your experimentation and will customize your parts list if you wish to substitute paper & oil caps or other components.

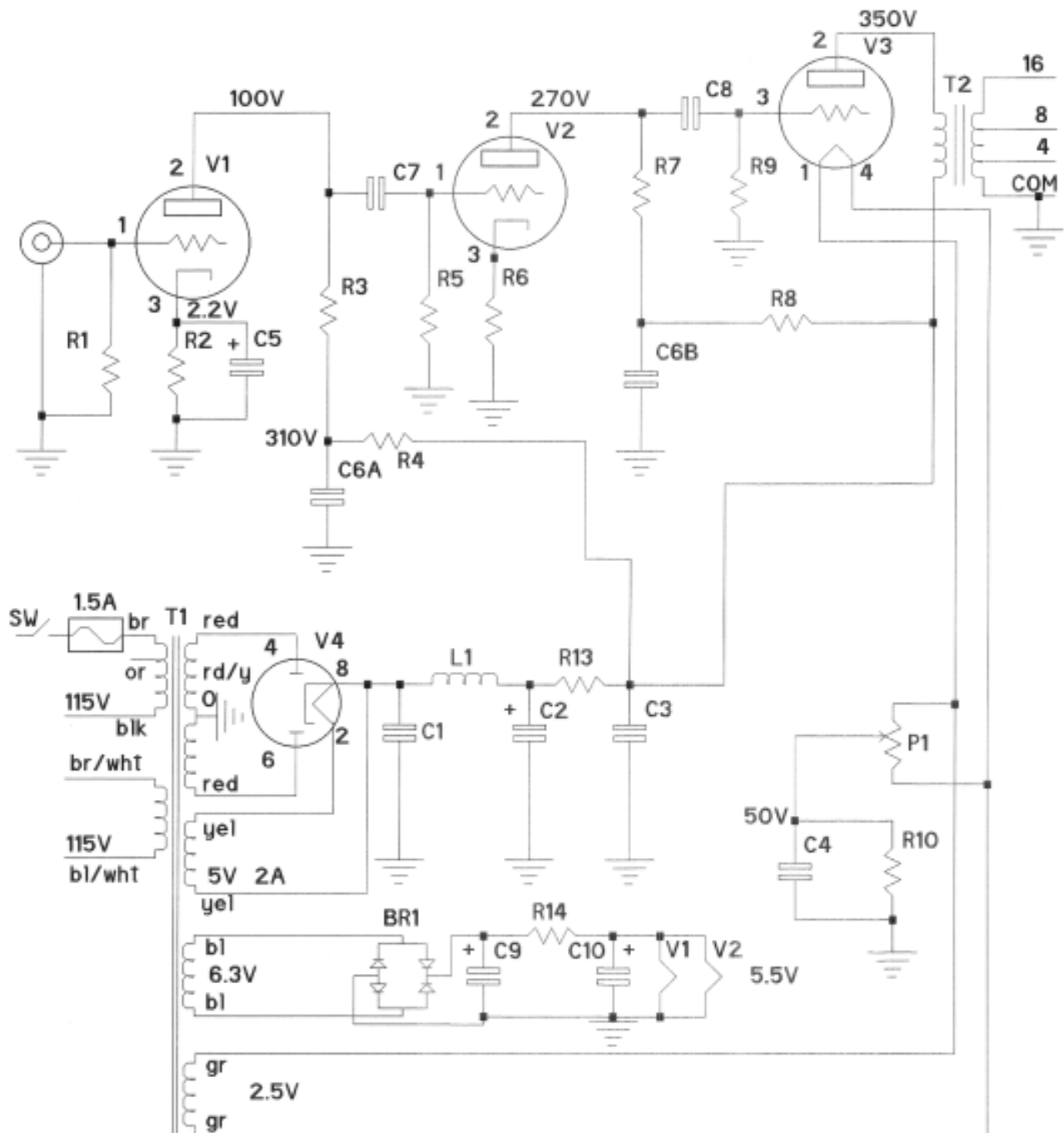
## ***Words of Caution***

Always keep in mind that you are the manufacturer of this amplifier. The final appearance of this amp and its sound quality will largely depend upon the care taken during the assembly of this kit. We recommend that your work surface be padded, clean of debris and kept clean during assembly. This will prevent the top plate and wooden base from becoming accidentally scratched. Keep finger prints to a minimum (wear white cotton gloves when handling the brass chassis plate). Once the transformers are mounted to the chassis plate, the unit becomes very heavy and much harder to handle. So be careful and don't drop it on your dining room table! Don't create antennas out of the hookup wire by making big loops and arches. The drawings in this manual depict a somewhat messy wiring layout however this was intentional, so that you can follow our instructions more easily. Keep all wiring neat, lead lengths short and routed close to the chassis plate. Believe us when we say "neat wiring sounds mo better".

Always remember the nature of the equipment that you are working on. It contains high voltages and can cause serious personal injury. Always make sure that capacitors are completely discharged before handling or soldering the internal components. Never disconnect the power cord, or remove tubes while the unit is powered on.

## ***Tools Required for Assembly***

Soldering Iron  
Solder  
Solder Wick™ or Solder-Removing Device  
Pliers  
Wire Strippers  
Hex Drivers  
Screw Drivers  
Volt/Ohm Meter  
Epoxy  
Cotton Gloves



MoonDog 2A3 Amplifier  
 Welborne Labs  
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## **Parts List Moondog 2A3 Amplifier Circuit (one channel)**

### **Resistors**

R1	100K	3/4 W	Allen Bradley Resistor (Caddock)
R2	549	3/4W	Allen Bradley Resistor (Caddock)
R3	49.9K	2W	Allen Bradley Resistor (Caddock)
R4	10K	3/4W	Allen Bradley Resistor (Caddock)
R5	475K	3/4W	Allen Bradley Resistor (Caddock)
R6	2.21K	3/4W	Allen Bradley Resistor (Caddock)
R7	20K	2W	Allen Bradley Resistor (Caddock)
R8	2.74K	3/4W	Allen Bradley Resistor (Caddock)
R9	221K	3/4W	Allen Bradley Resistor (Caddock)
R10	1.0K	12W	Mills Non-Inductive Wirewound
R13	1.0K	10W	Non-Inductive Wirewound
R14	0.5	5W	Non-Inductive Wirewound
P1	50		Potentiometer

### **Capacitors**

C1	10uF/600V		Solen Polypropylene Film
C2	47uf x 2 / 500V		ELNA Cerafine Electrolytic (Black Gate)
C4	47uf/250V		Solen Polypropylene Film
C5	100uf/35V		ELNA Cerafine Electrolytic
C6A,C6B	10uf/400V		Solen Polypropylene
C7,C8	0.1uf/400V		MusiCap Polypropylene Film (Jensen Copper Foil)
C9,C10	10,000uf/10V		Electrolytic

### **Vacuum Tubes**

V1	6SN7		NOS/Sovtek
V2	6SN7		NOS/Sovtek
V3	2A3		NOS/Chinese/Sovtek/KR Enterprise
V4	5AR4 or GZ37		NOS/Chinese

### **Miscellaneous**

L1	15H/75mA		Choke
T1			Power Transformer
T2			Electra Print (3.5K)
S1,S2,S4	Octal Chassis Mount Socket		Ceramic (Teflon)
S3	4 Pin Chassis Mount Socket		Ceramic (Teflon)
BR1	4A/200V		Bridge rectifier

( ) Indicates Ultimate Upgrade Components

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## ***Miscellaneous cont'd***

RCA BIND	RCA Chassis Mount Jack Binding Post	Cardas Cardas
Solder		Welborne Labs Solder
IEC		Male IEC Chassis Connector
FH		Fuse Holder
RP		Rear Panels
F1	1.5A/250V	Slo-blo Fuse
ICORD		IEC Power Cord
H/W		Transformer Mounting Hardware
BRASS		Brass Screws
SW	SPDT	Power Switch
Gloves		White Cotton Gloves
Wire Wire Wire	Input Wire Signal Path Ground Wire	Coax Solid Core OFC Bare Silver Plated OFC
Chassis		Brass/Walnut

# Moondog 2A3 Amplifier Assembly

It is assumed that the person(s) assembling this amplifier kit are somewhat knowledgeable in electronics, can read schematic diagrams, and have built kits and/or other equipment in a previous life. If you do not have experience building circuits it is recommended that you find someone that can help that is knowledgeable (GET HELP!). These instructions and diagrams are intended as a guide only. You are welcome to assemble the amp and position components as you like. However, we recommend that you follow this assembly sequence. Refer to the included figures as you follow the instructions. Assembly time will vary based upon your experience level and the attention given to doing a neat and tidy job, so you can expect anywhere from 8 to 10 hours to get it done right. If you have questions during assembly, please feel free to call.

The terminal boards have been installed to facilitate an easy and neat assembly. Solder components between terminals when possible (either vertically or horizontally) and use hookup wire from terminal-to-terminal and terminal-to-socket lug connections. Use a fast drying epoxy to tack components to the chassis plate when necessary. This will help to prevent components from flopping around and vibrating. Use the epoxy sparingly in case a component needs to be removed at a later time.

**The two amplifier chassis are mirror images of each other. When assembling the components note that all of the terminal strips are mirror images however the tube socket pin numbers are not. Refer to figures 2A and 2B.**

Teflon tubing has been provided to dress the bare component (resistors, caps, etc.) leads to prevent shorting.

- 1) To Begin, remove the brass chassis plates from their wooden bases and lay the plates upside down, on a padded surface, with the terminal boards facing up. Mount the tube sockets using the supplied hardware and in the direction shown in figure 2. The chassis plates are mirror images of each other and therefore as you continue through the assembly steps note that some components will have to mount differently on the opposite plate.

The lugs of the terminal boards TB1, TB2, TB3 and TB4 have been numbered (refer to figure 2) to facilitate assembly. In subsequent steps a specific lug will be referenced by the terminal board number followed by the lug number. For example: "solder a red wire from TB3-22 to TB1-2", refers to lug #22 of terminal board TB3 and lug #2 of terminal board TB1.

In a similar manner, the tube socket pins will be referenced first by the tube number followed by the pin number. For example V4-3 refers to pin #3 of the V4 rectifier tube.

Take a few minutes to familiarize yourself with the layouts of the chassis plates.

- 2) Install the power transformer T1, output transformer T2, and inductor L1 to the chassis plate using the supplied button head hex screws and brass nuts (see figure 3). Note that L1 mounts underneath T2 sharing its mounting hardware. Turn the plate upside down again and position a box or some item, of equivalent height to the transformers, under the plate so that it lays level. Be sure it does not scratch the surface of the brass.

Install the hum adjust potentiometers P1.

- 3) Connect the T1 transformer primary wires based upon your ac voltage requirements. Refer to figures 3, 4 & 6.

**For 115Vac/60Hz operation hookup the T1 primary as follows:**

Locate the brown, brown/white, black and black/white leads of transformer T1. Twist the brown and brown/white leads together using approximately 3 twists per inch. This pair of leads connects to TB1-5. Trim to an appropriate length, strip the ends and solder to the lug. Do the same for the black and black/white leads and solder them to TB1-4. Cut the orange wire to a length of approximately 1 inch and tape the end using electrical tape.

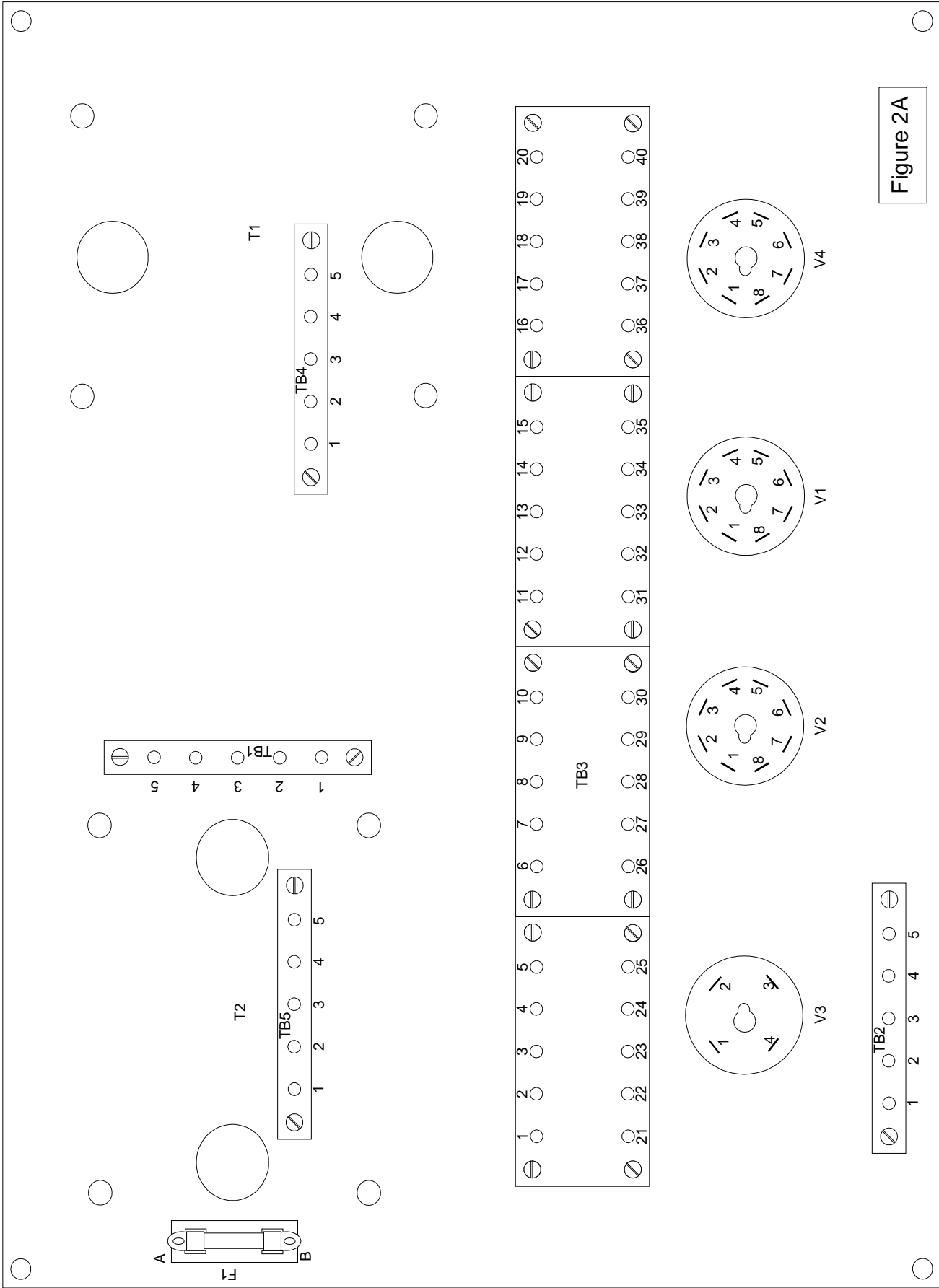
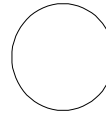
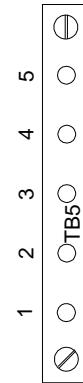
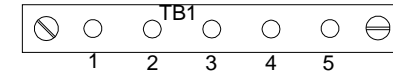
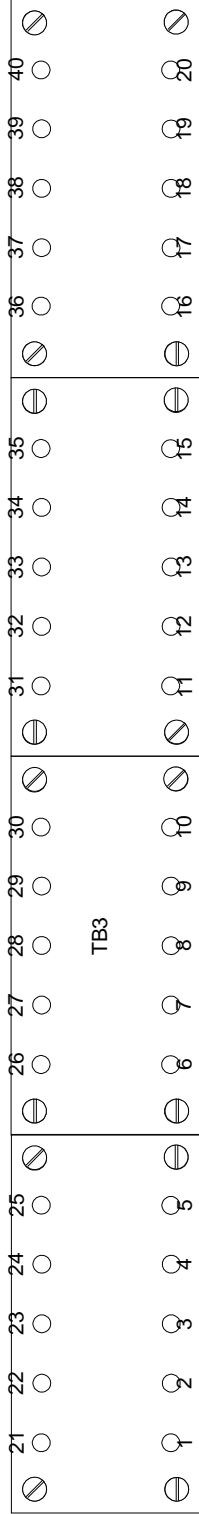
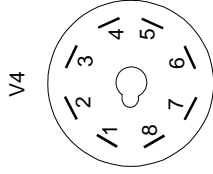
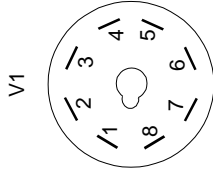
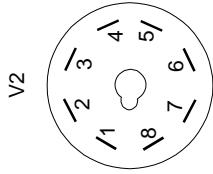
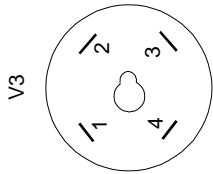
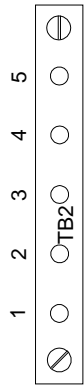


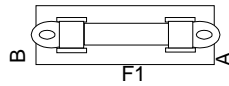
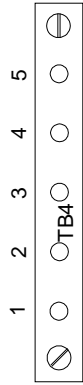
Figure 2A



Figure 2B



T1



# Moondog 2A3 Amplifier Assembly

For 220Vac/50Hz operation hookup the T1 primary as follows:

Solder the black and brown/white leads together and tape their ends. Connect the black/white leadwire to TB1-5. Trim to an appropriate length, strip the ends and solder to the lug. Connect the Orange lead wire to TB1-4. Cut the brown wire to a length of approximately 1 inch and tape the end using electrical tape.

For 240Vac/50Hz operation hookup the T1 primary as follows:

Solder the black and brown/white leads together and tape their ends. Connect the black/white leadwire to TB1-5. Trim to an appropriate length, strip the ends and solder to the lug. Connect the Brown lead wire to TB1-4. Cut the orange wire to a length of approximately 1 inch and tape the end using electrical tape.

For 100Vac/50Hz operation hookup the T1 primary as follows:

Solder the brown and brown/white leads together and tape their ends. Twist together the black and black/white leads and solder them to TB1-4. Solder the Orange lead wire to TB1-5.

4. In this step you will make the connections for power transformer T1's secondary leads. Refer to figure 3.

Locate T1's two yellow wires, twist them together, route them around the end of TB3 and solder one to V4-2 and the other one to V4-8.

Locate T1's two red wires, twist them together, route them under TB3 and solder one to V4-4 and the other to V4-6.

Locate the red/yellow lead of transformer T1, cut to length and solder to TB3-40.

Locate T1's two blue wires, twist them together, route them and solder to TB4-3 and TB4-4. Locate T1's blue/white wire, cut it to a length of approximately 1 inch and tape the end.

Locate the two Green wires from transformer T1, twist them together, cut to length and solder one to the potentiometer lug P1-1 and the other one to P1-3. Locate the green/White wire of T1 and cut it to a length of 1 inch and tape the end.

5. T2 primary lead connections: There is one blue and one red teflon coated lead wires on T2. Solder the red lead to TB3-20 and the blue lead to V3-2.
6. For this step you need to decide which tap of the output transformer T2 you will be using (2, 4, 8, or 16 ohms). This decision is best made based upon the impedance of the speakers you will be using.

Refer to the table on page 11 for the output transformer coding. The output impedances are selected by interconnecting the eight color coded **secondary** leads as shown below. Terminal Strip 5 (TB5) has been set up to facilitate the configuration of the output transformer wiring. Figure 3 depicts the connection for 8 ohms, however the terminals of TB5 can be used for connecting any of the configurations below. If you decide to shorten the output leads of the output transformer, the red enamel coating on the wires must be removed before soldering to the terminals. This can be easily done by applying a small amount of solder to the enamel coating which will melt it away. After the enamel has melted, quickly wipe the excess off with a cloth or paper towel. Any residual enamel can be scraped off with a razor blade.

### Output Transformer Secondary Connections

#### 16 OHMS

R - Output  
Join BK, CL  
Join WH, GR  
Join BL, Y  
BW - Ground

#### 8 OHMS

R - Output  
Join BK, CL, GR  
Join WH, BL, Y  
BW - Ground

#### 4 OHMS

Join BK, R - Output  
Join WH, BL, BW, Y  
Join CL, GR - Ground

#### 2 OHMS

Join BK, WH, BL, R - Output  
Join BW, CL, GR, Y - Ground

#### Secondary wire color code:

BW - Black w/White Letters	GR - Green
BK - Black	BL - Blue
CL - Clear	Y - Yellow
WH - White	R - Red

Join the leads by soldering them to the terminals of TB5.

### Transformer Do's and Don'ts

Do not attempt to remove the screws that are holding the transformer together. This can reduce the low frequency response.

Do not strike the laminations with any heavy objects.

Do not pull or hold the transformer with its leads.

Do not operate the transformer without a load (speaker or power resistor) with a signal into the amplifier. This will cause the signal to be at a very high voltage due to the infinite impedance and will arc across to the secondary. This will destroy the transformer.

Do not exceed the primary current rating (60mA). This will heat the transformer and saturate the core causing distortion.

7. Route the L1 inductor lead wires over to TB3 and strip and solder the black lead to TB3-16 and the white lead to TB3-18.

Cut a piece of the bare silver hookup wire, wrap and solder the piece such that it makes connection with TB3-37, TB3-38, TB3-39 and TB3-40. Refer to figure 3.

Cut a short piece of bare silver hookup wire and solder between TB3-19 and TB3-20.

Cut a piece of yellow hookup wire to length, and routing under TB3, solder from V4-8 to TB3-18.

Solder one white wire from TB4-1 to V1-7 and one black wire from TB4-5 to V1-8. Cut one white wire to length, and solder from V1-7 to V2-7. Solder a black wire from V1-8 to V2-8.

Cut one black wire to length and solder one end to TB4-5 and route the other end to the transformer mounting post located next to F1 as depicted in figure 3. You will connect this wire at a later time in the assembly.

Cut one black wire to appropriate length, and solder from TB1-4 to F1-A (fuse lug).

Cut two yellow wires to length, route under TB3 and solder one from P1-1 to V3-1. Solder the other yellow wire from P1-3 to V3-4.

Cut another yellow wire to length and solder from P1-2 to TB3-6.

Cut to length a short piece of the bare silver wire and solder such that it connects with terminals TB3-11, TB3-12, TB3-13 and TB3-14 as depicted in figure 3.

Cut to length a piece of black wire and solder from terminal TB3-14 to TB3-37. You can route this wire underneath TB3 or on top as shown in figure 3.

Cut to length a piece of black wire and solder from terminal TB3-11 to TB3-2. You can route this wire underneath TB3 or on top as shown in figure 3.

Cut to length a piece of black wire and solder from terminal TB3-11 to TB3-3. You can route this wire underneath TB3 or on top as shown in figure 3.

Cut to length a black wire and solder from terminal TB3-26 to TB3-12. You can route this wire underneath TB3 or on top as shown in figure 3.

Cut to length a black wire and solder from terminal TB3-30 to TB3-12. You can route this wire underneath TB3 or on top as shown in figure 3.

Cut to length a black wire and solder from terminal TB3-35 to TB3-14.

Solder a short black lead between TB3-9 and TB3-11.

Cut to length a black wire and solder from terminal TB3-32 to TB3-13. You can route this wire underneath TB3 or on top as shown in figure 3.

Cut to length a black wire and solder a terminal ring to one end and secure this end to transformer T2s mounting bolt as shown in figure 5. Solder the other end of this wire to terminal TB3-13.

Cut to length a yellow wire and solder from terminal TB3-22 to V2-2.

Cut to length a yellow wire and solder from terminal TB2-2 to V3-3.

Cut to length two yellow wires, route under TB3, and solder one from terminal TB3-33 to terminal TB3-20, and one from terminal TB3-28 to terminal TB3-19.

Cut to length a yellow wire and solder from terminal TB3-31 to V1-3.

Cut a piece of yellow hookup wire six inches in length and solder one end to TB3-16. The other end will be soldered to C2 on a step that comes later.

Cut a piece of white hookup wire six inches in length and solder one end to TB3-19. The other end will be soldered to C2 on a step that comes later.

Cut a piece of black hookup wire six inches in length, route under TB3 and solder to TB3-38. The other end will be soldered to C2 on a step that comes later.

This completes all of the steps associated with figure 3. Now is a good time to go through your wiring and compare it with the drawing of figure 3. Inspect all solder joints closely and make sure the connections are good.



## ***Moondog 2A3 Amplifier Assembly***

8. Refer to figure 4 for the following construction steps.

**Note:** As more and more of the components are installed it becomes easier for you to accidentally burn an adjacent component with the soldering iron when installing the remaining components. Use extra caution each time you solder a new component in place.

Solder bridge rectifier BR1 to TB4 as follows: Solder the two inner leads marked “ac” to terminal TB4-3 and TB4-4. Solder the outer lead marked “+” to terminal TB4-2 and the lead marked “-” to TB4-5. Bend the bridge rectifier leads so the rectifier is positioned vertically. (The leads are stiff so be careful not to break the terminal strip TB4 loose. Hold TB4 with your hand while bending the rectifier leads).

Solder R14 to terminals TB4-1 and TB4-2.

Attach capacitor C9 to TB4 by soldering the positive lead to TB4-2 and the negative lead to TB4-5.

Attach capacitor C10 to TB4 by soldering the positive lead to TB4-1 and the negative lead to TB4-5.

Mount capacitor C1 as shown in figure 4 and solder one lead of the capacitor to TB3-18 and the opposite lead to TB3-38. Note that capacitor C1 has no polarity.

Solder one lead of capacitor C4 to TB3-6. Solder the other lead to TB3-3. Note: C4 has no polarity.

Solder one end of R10 to terminal TB3-3 and the opposite end to TB3-6.

Solder resistor R9 from V3-3 to TB3-26.

Position resistor R5 as shown in figure 4 and solder one lead wire to TB3-26 and the other lead wire to V2-1.

Position capacitor C8 as shown in figure 4 and solder the red capacitor lead to TB3-22 and the green capacitor lead to TB2-2. (Note: The Jensen caps have no polarity)

Position resistor R8 as shown in figure 4 and solder one lead wire to TB3-28 and the other lead wire to TB3-29.

Position resistor R7 as shown in figure 4 and solder one lead wire to TB3-29 and the other lead wire to V2-2.

Position resistor R6 as shown in figure 4 and solder one lead wire to TB3-30 and the other lead wire to V2-3.

Position resistor R2 as shown in figure 4 and solder one lead wire to TB3-31 and the other lead wire to TB3-32.

Position capacitor C5 as shown in figure 4 and solder the capacitor’s negative terminal (identified by the gold band) to terminal TB3-32 and the positive capacitor terminal to terminal TB3-31.

Position resistor R4 as shown in figure 4 and solder one lead wire to TB3-33 and the other lead wire to TB3-34.

Position resistor R3 as shown in figure 4 and solder one lead wire to TB3-34 and the other lead wire to V1-2.

Position resistor R1 as shown in figure 4 and solder one lead wire to TB3-35 and the other lead wire to V1-1.

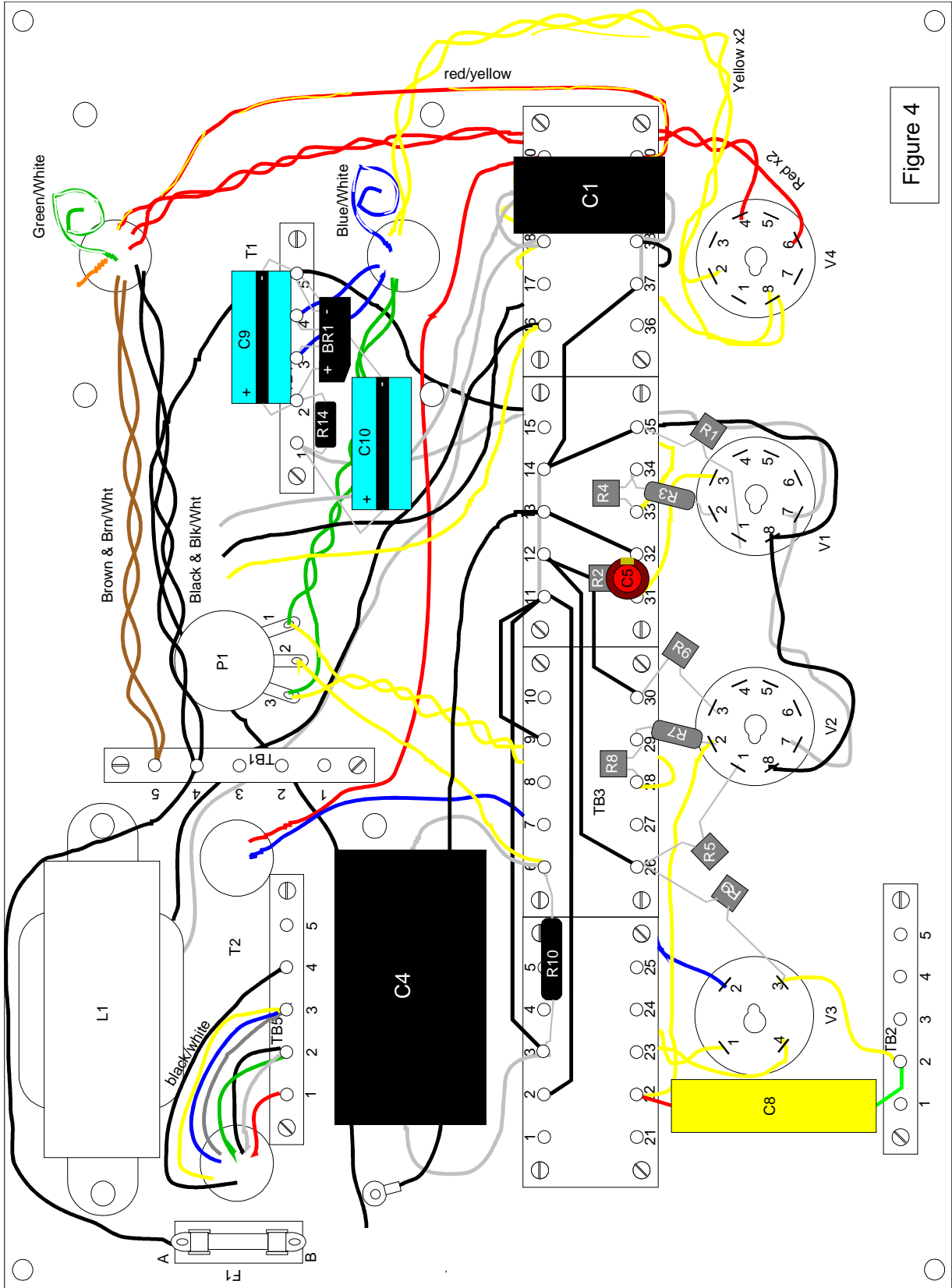


Figure 4

## ***Moondog 2A3 Amplifier Assembly***

Position capacitor C7 as shown in figure 8 and solder the red capacitor lead to V1-2 and the green capacitor lead to V2-1.

Position capacitors C6A and C6B as shown in figure 8 and solder one lead of C6A to terminal TB3-34 and the other lead to TB3-14. Solder one lead of C6B to terminal TB3-29 and the other lead to terminal TB3-9.

9. Cut a piece of yellow hookup wire approximately 6 inches in length and solder this wire to the positive (red) binding post terminal.

Cut two pieces of black hookup wire approximately 8 inches in length and solder both of these wires to the negative (black) binding post terminal.

Using the white coax cable, cut a length approximately 12 inches long. Strip off approximately 1 inch of the outer jacket so the silver braid is exposed. Using a pin, or some other small pointed device, slowly tease the braid starting at the cut end until it is completely unbraided. Pull the unbraided wire to one side of the cable and twist. Strip off approximately 1/8 inch of the center wire's insulation and solder this wire to the center lug of the rca jack. Solder the twisted coax shield to the rca ground plate. Solder a separate black ground wire approximately 12 inches in length to the rca ground plate as well.

Mount the power switches and IEC connectors to the small rear plates.

Cut a short length of wire and solder it between the outer IEC terminal and bottom lug of the on-off switch, refer to figure 5.

Cut a 4" piece of black wire and solder it to the center lug of the on-off switch.

Cut a piece of black hookup wire approximately 8 inches in length and solder one end to the other outer terminal of the IEC connector as depicted in figure 5.

Cut a piece of black hookup wire approximately 5 inches in length and solder one end to the center terminal of the IEC connector. Solder a terminal ring to the opposite end of the wire.

Mount the rca jacks and binding posts to the small rear plate. The insulating washers should be used with both the rca jacks and binding posts.

Mount the plates containing the rca jacks and binding posts to the walnut bases and secure with the brass screws. Be careful not to strip the heads of the brass screws.

10. It is now time to carefully mount the brass plate to the walnut base. Before mounting the brass plate, attach capacitor C2 to the side wall of the walnut box, using the provided bracket, as shown in figure 8. Once the capacitor is installed, mount the brass plate to the walnut box and secure it with the button head socket screws.

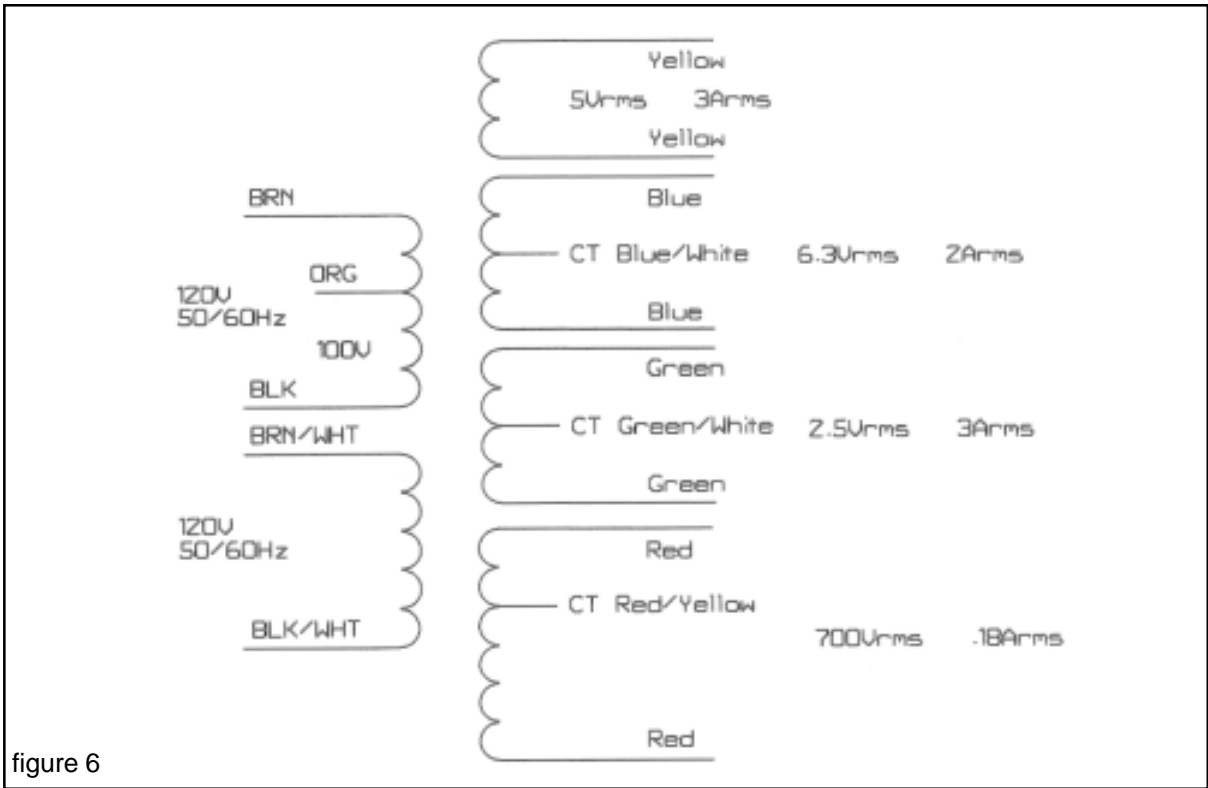
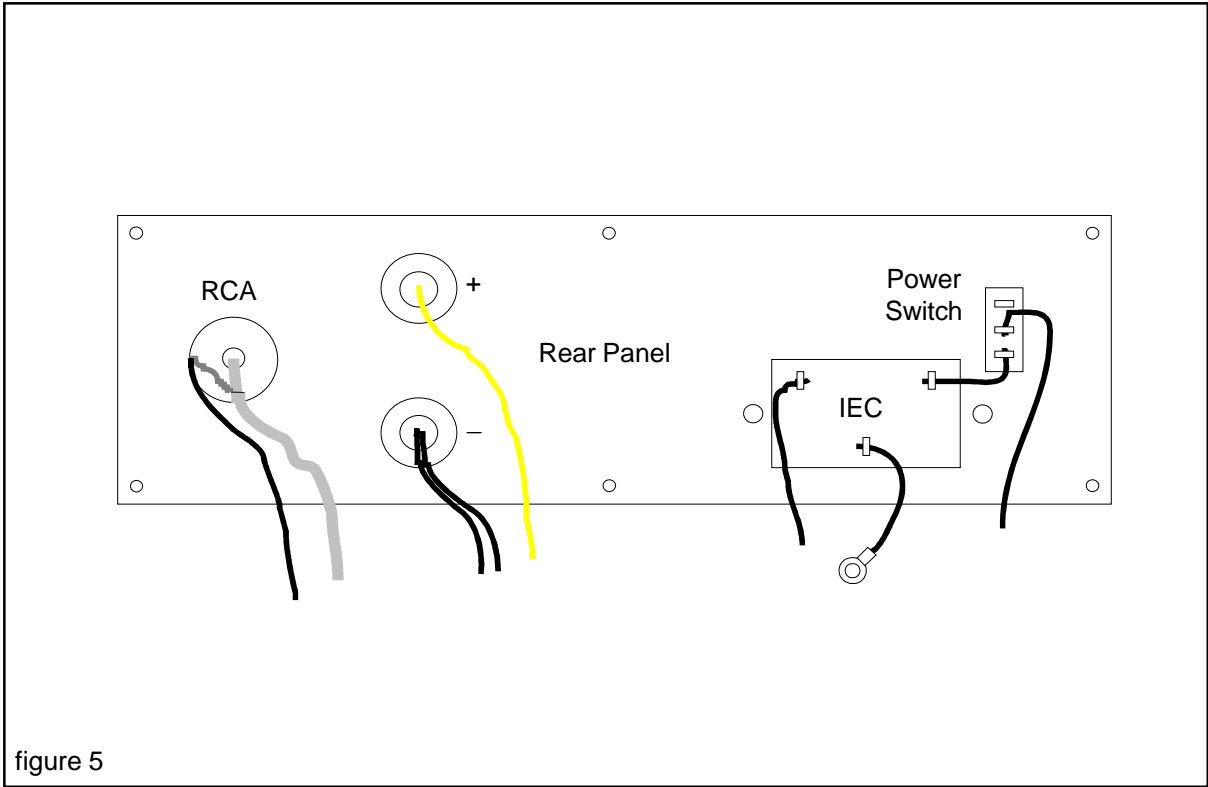
Solder resistor R13 between the two positive terminals of capacitor C2. The positive terminals of C2 are identified as 1 and 2 on the capacitor's solder lugs.

Solder the yellow wire, previously attached to TB3-16, to one of the positive terminals of capacitor C2.

Solder the white wire, previously attached to TB3-19, to one of the positive terminals of capacitor C2.

Solder the black wire, previously attached to TB3-38, to the negative terminal of capacitor C2.





## Moondog 2A3 Amplifier Assembly

As shown in figure 8, solder the loose end of the white coax cable to V1-1. The braid of the coax cable is not connected at this end so just cut it back.

Solder the loose end of the black ground wire, attached to the rca's ground plate, to TB3-32.

Route one of the black wires, attached to the negative binding post, under terminal board TB3 and solder the loose end to terminal TB3-2.

Solder the other black wire, attached to the negative binding post, to TB5-4. Solder the yellow lead attached to the positive binding post to TB5-1.

Solder the loose end of the black wire attached to the IEC connector to TB1-5.

Solder a terminal ring to the wire previously attached TB4-2 and secure it, and the wire soldered to the center lug of the IEC connector, to T2's mounting stud using the brass nut.

Solder the wire connected to the center terminal of the on-off switch to F1-B.

Install the 2 amp slo-blo fuse in the fuseholder F1.

11. Install the tubes in the locations shown in figure 7 below.

This ends the assembly portion of the Moondog 2A3 amplifier kit. Now is a good time to go back and check and double-check your work. This can be very tedious but it can also save time and money if you find your errors now instead of later. Of course applying power to the unit is usually the fastest way to find out your mistakes....just look for the smoke...but not the cheapest or best way!

V1 = 6SN7GTB  
V2 = 6SN7GTB  
V3 = 2A3  
V4 = GZ37

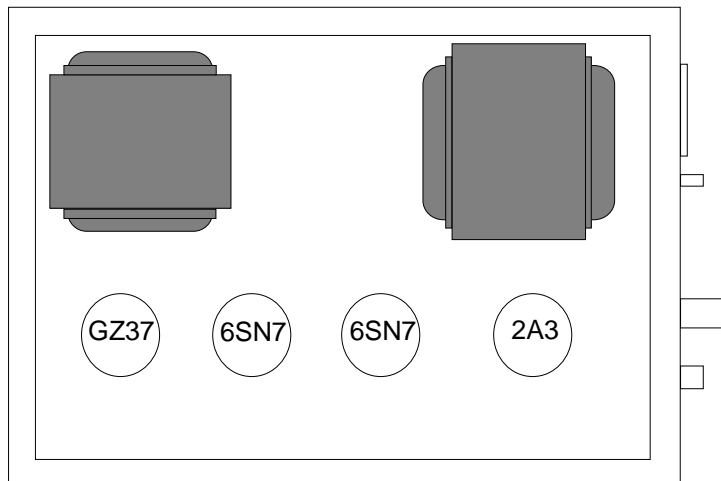


Figure 7.

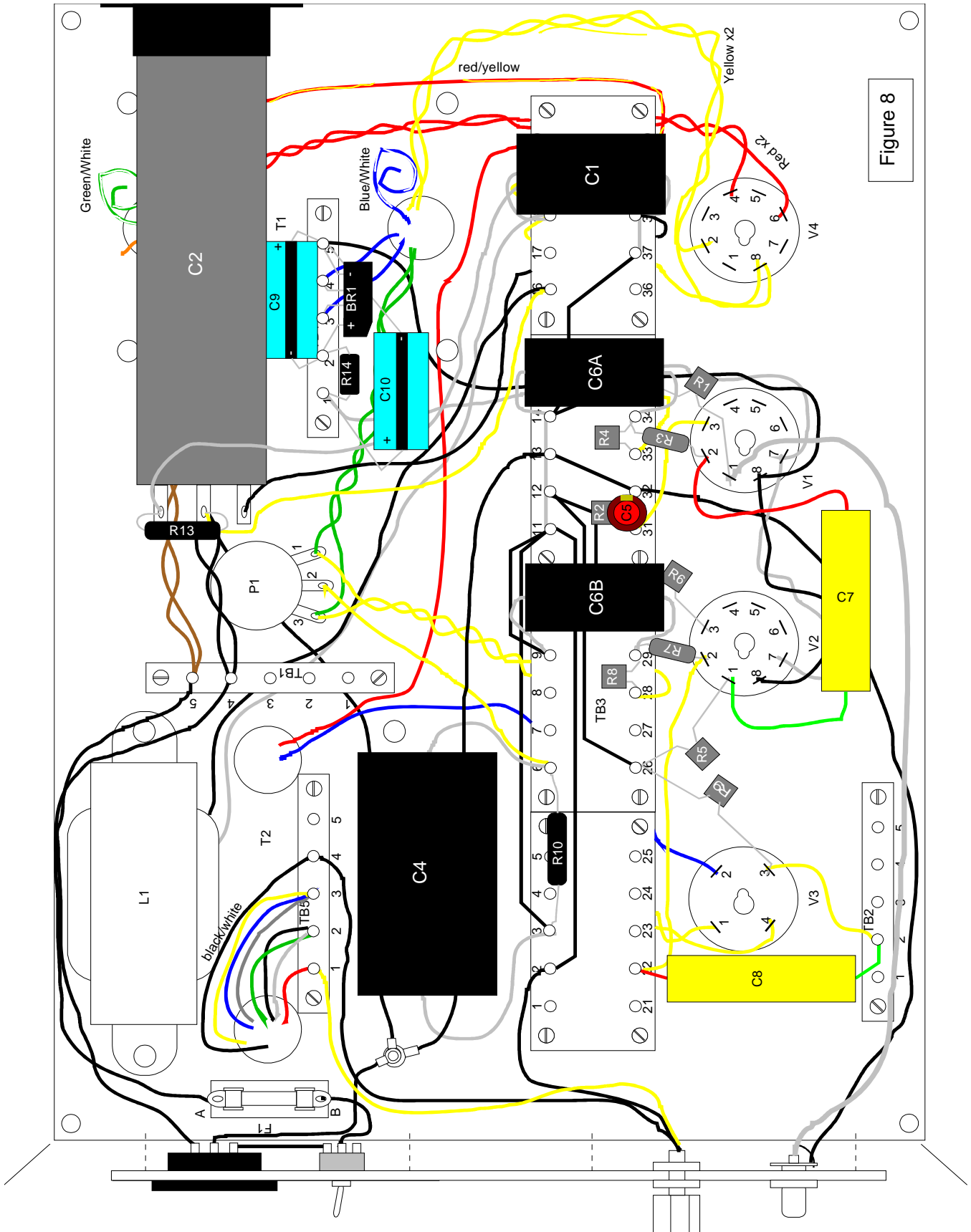


Figure 8

# **POWER-UP AND TEST INSTRUCTIONS**

## Power-up Sequence

- 1) It is recommended that you connect the amplifier to a dummy load or old set of speakers during the power-up procedure. The amplifier must have tubes installed to power-up and test operation.
- 2) If you own or have access to a variable ac transformer, use it to slowly increase the ac voltage during power-up. Monitor the B+ as you increase the ac voltage. At full ac you should measure approximately 350 Vdc +/- 10V across C3. If you do not have access to variable transformer, use a voltmeter to measure the B+ voltage as you power-up the amplifier. If the B+ does not show signs of increasing, immediately turn off the power. Adjust P1 for minimum hum. You can also use an ac voltmeter to measure the amount of ac voltage (hum/noise, etc.) and reduce it to a minimum level by adjusting P1.
- 3) If the B+ comes up OK, and you are connected to a set of speakers, listen for excessive noise, oscillations or hum.
- 4) If all measurements checkout OK, you can apply a signal to the input.

## Troubleshooting

Problem: Low or no B+	Check the polarity of all electrolytic capacitors.
Problem: No Sound	Are the tubes glowing? Are your speakers properly connected?
Problem: Excessive Hum	Possible ground loop in circuit or chassis may not be grounded. Check all ground wiring. Check filament voltages and wiring. Check all tubes.

If you have difficulty troubleshooting your equipment, give us a call. We will be glad to help you get your equipment running. Please keep in mind that it is sometimes difficult to troubleshoot equipment over the telephone and it can also be very expensive. A letter or e-mail might be more appropriate, but in either case it will help if you have taken the time to write down as many symptoms as possible and also take and record some voltage measurements at key nodes in the circuit.

If all else fails, you can send your amplifier to us, however this should be your last resort. We have built and tested this amplifier and it works and therefore we have to assume that if your amplifier does not work, it is probably something you did wrong during assembly. We charge a flat rate of \$30 per hour for repairs. Assuming that your mistake is only a minor one, in most cases the charges to get your amplifier up and running will be less than \$50.00.

## *Limited Warranty*

Thank you for purchasing the Welborne Labs Moondog 2A3 Amplifier.

All Welborne Labs audio kits are covered by a limited 90 day parts warranty, effective from the date of purchase. With some exceptions (for example tube warranties) this limited parts warranty may be extended.

All factory assembled Welborne Labs products purchased in the United States are covered by a limited 3 year warranty, effective from the date of purchase. This warranty is valid for the original purchaser only.

Welborne Labs warrants its products to perform according to their specifications. Any failure, due to a manufacturing defect, will be corrected by Welborne Labs.

Under no circumstances would the following be included as warranty coverage:

Any product which has been operated in a manner not in accordance with the instructions in this manual.

Any product which has been repaired or modified by any person(s) not specifically authorized by Welborne Labs.

Any product which, in our judgement has been subjected to abuse.

This warranty gives you specific legal rights. You may also have other rights depending on the laws of the state in which you reside.

Should your Welborne Labs product fail, pack it in its original box, along with your bill of sale, and return it to Welborne Labs. The unit should be shipped freight prepaid to the factory. Welborne Labs will prepay the freight for the return trip.