Amp Builder's Guide

July 6, 2025, Version 25.8

Thank You

Thank you for purchasing a Retro ‘64 kit. We truly hope that you enjoy building it and that it will be enjoyed for many years. If you have any questions, please do not hesitate to contact us and. Please be sure to check the package contents in case there are any missing items.

We are always looking for feedback from our customers on our products. We have checked the build instructions over thoroughly and are confident in our product. However, mistakes do happen so our advice is that as you connect each wire and part according to the layout, cross-check against the schematic. If you find any inconsistencies, or have any concerns, please let us know. Do not hesitate to contact us! We want this build to be successful for you and for Trinity Amps!

We’re confident that you will like our product and our support and when you’re completed, we’d appreciate your comments posted on any of the internet forums such as thegearpage.net, 18watt.com, AX84.com or trinityamps.com. You will find some extra business cards in the package. Please keep one and pass the rest around.

We know you have a choice in suppliers and do appreciate your business. If there is any other product we can provide to you or your associates, please get in touch and we will be happy to discuss requirements.

Sincerely,

Trinity Amps

Web site: **www.trinityamps.com**

email: **sales@trinityamps.com**

TABLE OF CONTENTS

INTRODUCTION

This guide has been prepared for builders of Retro '64 Kits. It is always being improved and we would appreciate your feedback and comments to: **sales@trinityamps.com**

Accordingly, content and specifications are subject to change without notice.

We do try to make it as accurate as possible, but it is sometimes hard to keep up with the changes. Therefore, if you do find an error, please let us know about it and we will correct it. Suggestions are welcome so if you have one, please get in touch with us.

Sources of help.

Forums: Please use the various forums to get help. They are an excellent resource and can be found at trinityamps.com, AX84.com, the Gear Page etc..

Color assembly pictures and the latest drawings, tips, techniques are all in the Trinity Amps Forum, in the Resources Forum. To view the Resources, you need to sign up so go to **www.trinityamps.com** and click on the Forum button.

Email: We can't help with every problem but if you cannot get your problem resolved, email us and we'll do our best to help.

Phone Call: If your problem can't be solved, email for a phone appointment.

ACKNOWLEDGEMENTS

Much of the content in this document is original. Rather than reinvent content, some parts are based on content from other excellent sources and are hereby acknowledged.

R.G. Keen's site www.geofex.com - Tube Amp FAQ, Tube Amp Debugging

AX84.com site www.AX84.com - Gary Anwyl's P1 construction guide version 1.0

Aron from www.diystompboxes.com

PLEASE READ THIS INFORMATION CAREFULLY

THERE ARE VOLTAGES INSIDE THIS AMPLIFIER IN EXCESS OF 450 VDC.

THE PROJECTS DESCRIBED IN THESE PAGES UTILIZE POTENTIALLY FATAL HIGH VOLTAGES. IF YOU ARE IN ANY WAY UNFAMILIAR WITH HIGH VOLTAGE CIRCUITS OR ARE UNCOMFORTABLE WORKING AROUND HIGH VOLTAGES, DO NOT RISK YOUR LIFE BY BUILDING THEM.

SEEK HELP FROM A COMPETENT TECHNICIAN BEFORE BUILDING ANY UNFAMILIAR ELECTRONICS CIRCUIT. WHILE EFFORTS ARE MADE TO ENSURE ACCURACY OF THESE CIRCUITS, NO GUARANTEE IS PROVIDED, OF ANY KIND!

USE AT YOUR OWN RISK

TRINITY AMPS INC. EXPRESSLY DISCLAIMS ALL LIABILITY FOR INJURY OR PROPERTY DAMAGE RESULTING FROM THIS INFORMATION!

ALL INFORMATION IS PROVIDED 'AS IS' AND WITHOUT WARRANTY OF ANY KIND.

VERSION CONTROL

Version	Date	Change
24.1	Oct. 14, 2024	SC- Created First draft
24.2	Oct. 27, 2024	SC - Added Footswitch section and Tweak section
24.3	Nov. 1, 2024	SC Updated Control Potentiometer Termination drawings & board mounting procedure: BOM
24.4	Nov.2, 2024	SC- Updated speaker connections and PT specs to match layout
24.5	Nov. 12, 2024	SC – Added 10K grid resistor to V2 and updated loop jumper on V2.
24.6	Nov. 26, 2024	SC – Corrected lead connection from Speed control to board
24.7	Nov. 28, 2024	SC – added fibre insulating shoulder washers to the input jack install and BOM; added cut lengths to lead layout instructions; updated jumper layout and component layout for 100K & 56K 2W resistors. Updated BOM as well
24.8	Dec. 31, 2024	Updated bias board layout; RCA jack, reverb driver transformer, can cap clamp, 3M-RA pot, pilot light procedures and install. Corrected and updated the input jack installation procedure; change location of HV fuse and wiring; corrected orientation of power switch; Updated BOM
25.1	Jan. 9, 2025	Changed to 22uF bias filter cap.
25.2	Jan. 15, 2025	Corrected speaker jack layout; update PSU wiring layout: added unloaded AC and Bias voltages; changed R21 from 18K to 15K; Updated start-up procedure and as-built voltages.
25.3	Mar. 6, 2025	Updated switch terminal labels and neatened power supply wiring
25.4	Mar.9, 2025	Clarified jumper diagram & eyelet board procedure; updated index
25.5	Mar. 18, 2025	Corrected REVERB FOOTSWITCH JACK colour coding.
25.6	Apr. 5, 2025	Added note how to install the Reverb Tank into the cabinet and mods to the reverb control.
25.7	Jul. 4, 2025	Updated fasteners; updated BOM
25.8	Jul. 6, 2025	Additional mods added per D. Driver build.


DON'T YOU BOYS EVER GET TIRED OF BUILDING THOSE STUPID AMPLIFIERS?
1994 Angela Inst.

ABOUT THE RETRO ‘64

The Retro ‘64 is a guitar amplifier combo which is built around the 1964 Princeton Reverb. The 12 Watt Blackface version was introduced in 1964 and available until 1967. The smallest member of the black-panel family to offer both reverb and tremolo, this amp made its name as a jangly pop dream machine. Aficionados treasure its early low-end breakup powered by a pair of 6V6 power tubes.

The 1964 Fender Princeton Reverb is one of the most iconic and sought-after amplifiers in the world of electric guitars. Here’s a look at the features it shares with the Retro ’64.

Your Trinity Amps Retro ‘64 will be a blast to play through and even more fun to build . Plug your single-coils straight in and use its signature clean tone, or go surfing with the onboard effects .

1. Introduction

Released in 1964, the Princeton Reverb was part of Fender's lineup during the golden era of tube amplifiers, a period when Fender was dominating the amp market.

It was intended to be a smaller, lower-wattage amp suitable for home use or smaller gigs, yet it still offered high-quality tone and classic Fender reverb and vibrato effects.

The amp was particularly popular among jazz, blues, and rock musicians due to its warm, clean tones and excellent reverb/vibrato.

2. Power and Design

Power Rating: The Princeton Reverb is powered by a 12-watt design, which gives it a relatively low output but still enough to create rich, dynamic sounds. This low wattage makes it great for achieving "natural" overdrive at a manageable volume.

Speakers: It originally came with a 10-inch speaker, often a Jensen C10Q or C10N, which helped provide a balanced, bright sound with smooth bass response.

Construction: Built with a solid wooden cabinet, the amp was both durable and lightweight, ideal for players who needed portability.

3. Circuitry and Components

The 1964 Princeton Reverb used point-to-point wiring (no printed circuit boards), which contributed to its vintage, warm tone and reliability.

Preamp: The amp used 12AX7 and 12AT7 tubes for the preamp section, known for their bright, clear tone and responsive touch sensitivity.

Power Amp: The 6V6 tubes in the power section contributed to its smooth and slightly compressed sound when pushed into overdrive.

Reverb and Vibrato: One of the defining features of the Princeton Reverb was its spring reverb and vibrato. These effects, both widely regarded as benchmarks of Fender’s sound, added depth and texture, making the amp versatile for various genres.

4. Tone Characteristics

Clean Tone: The Princeton Reverb is renowned for its bright, chimey clean tones, making it ideal for clean jazz chords, blues riffs, and sparkling rhythm guitar.

Overdrive: While it excels in clean tones, cranking up the volume can result in a beautiful natural overdrive, ideal for blues and rock.

Reverb and Vibrato: The rich reverb sound, combined with Fender's famous vibrato, gave players the ability to add depth and movement to their playing. The reverb was not as pronounced or "boingy" as other Fender amps, but it provided a lovely, subtle ambiance.

5. Notable Players and Popularity

The Princeton Reverb gained a reputation over the years as a go-to amp for studio musicians and smaller venues.

Notable musicians who have used Fender Princetons include Bob Dylan, Neil Young, John Mayer, and Eric Clapton. Many have appreciated its versatility, portability, and classic Fender tone.

The 1964 Fender Princeton Reverb remains a hallmark of vintage tone, prized for its simplicity, portability, and character. Whether as a historical piece for collectors or as a functional amp for live performance and recording, it holds a special place in the hearts of musicians who appreciate classic American sound engineering.

Your Trinity Amps Retro '64 captures the tone and "mojo" of the original.

BUILDERS GUIDE GENERAL THEORY

For a discussion on Guitar Amp Basics and Tube Amp Theory, please refer to our support page document **Builders Guide General Theory**

BUILDERS GUIDE GENERAL TROUBLESHOOTING

For a discussion on Guitar Amp Troubleshooting, please refer to our support page document **Builders Guide General Troubleshooting**

BUILDING AN AMP

Warning: Do not attempt to build a guitar amp unless you know how to work safely with the dangerous voltages present in a tube amp. These can exceed 700 volts.

INTRODUCTION

If you have purchased your amp as a kit, this guide will help you build a tube guitar amplifier. It is oriented towards someone who knows a little about electronics but is new to do-it-yourself amps. It outlines a simple path to getting a quality amp build.

SWITCHES AND WIRE

Use standard UL approved switches with a 125V/5A rating for the Power and Standby switches. Use 20 or 22 Gauge insulated solid wire with a 600V rating. It is good to get a variety of colors so you can color code your wiring.

Use 18 Gauge stranded for mains wiring.

PHYSICAL LAYOUT

Make sure the jacks, sockets and pots mounted along the edge won't interfere with parts mounted on the underside of the chassis. Imagine how chassis will be mounted in the cabinet and make sure there is enough clearance for the speaker and mounting brackets. Trinity amp chassis are laid out with serviceability and neatness in mind.

GROUNDING

It is recommended that you follow the layout provided with your amp kit. It has been tested and has proven reliable. If you choose to deviate, consider the following information.

Amps traditionally use the chassis for signal ground. This is not the best choice since it can create ground loops and bad ground connections may develop over time. It is better to use star grounding in which all of the local

grounds are collected at a single 'star ground' point. With star grounding there is only one connection between the chassis and signal ground.

Here are some rules for laying out a star ground. More information on grounding can be found in the Tube Amp FAQ and the Tech Info page of Aiken Amplification.

(1) Connect the power transformer center tap directly to the negative terminal of the first power supply filter capacitor (cap) then run a separate wire from the negative terminal to the star ground point.

(2) Collect the ground points of each tube and its associated resistors and capacitors to a local ground point that is not connected to the chassis. Run one wire to the star ground point from each collection.

(3) Run exactly one wire from the star ground point to chassis.

(4) Insulate the input and output jacks from the chassis.

The safety ground wire from the mains is separate from the signal ground. Run a wire from the AC ground to the chassis near where the AC power enters the chassis.

INSULATED JACKS

To insulate the input and output jacks either use plastic insulated jacks or metal jacks with insulating washers. Some people prefer the increased durability of metal jacks. Insulating a metal jack requires a shoulder washer with a 3/8"internal hole that fits a ½' panel hole.

MINIMIZING TRANSFORMER INTERFERENCE

To minimize coupling between the power transformer and output transformer orient them so their plates are at right angles. If possible, place them at opposite ends of the chassis.

Keep the input stage wiring short and away from the output stages. This minimizes the possibility of oscillations caused by coupling of the output signal into the input.

Mount the grid resistors as physically close to the grid pins as possible.

Use a twisted pair of wires for the tube filament wiring. Route it away from AC lines and close to the chassis.

WIRING

The traditional method of constructing amps involved mounting the components on tag board or fiberboard. This is the technique that is used for Trinity Amplifiers and is the recommended approach for service and reliability.

ASSEMBLING THE AMP

BEFORE YOU BEGIN

When you first receive your kit, remove all of the parts from the shipping box and place them on a well-lit, clean surface. Check all of the parts against the parts list and verify that you have everything before you begin. Contact us at once if you are missing anything, or if something appears to be damaged**.**

TOOLS

To assemble the amp you need:

25 watt pencil tip soldering iron

60/40 rosin core solder

wire stripper

wire cutter

needle nose pliers

screwdrivers (Philips, standard)

multi-meter with minimum 600V range

Use a stand for the soldering iron, a sponge to keep the tip clean, de-soldering wick material and clip leads. You should also have a multi-meter with at least 600V range, preferably 1000V and an audible continuity checker. Try to get a multi-meter that measures capacitance. This lets you verify the value of your components before you install them.

SOLDERING

Soldering is accomplished by heating the components to be soldered and allowing the molten solder to flow onto them. Do not try to melt solder on the tip of the iron and transfer it to the solder joint. It doesn't work.

Follow these steps when soldering to boards. **Note ROHS instructions**:

1. Use 60/40 rosin-core solder. (use **lead free** when soldering ROHS boards.)
2. Keep the tip of the soldering iron clean. If it's dirty, wipe it on a damp sponge to clean it.
3. Set the temperature of your soldering iron to about 700F.

ROHS: 725-750F when soldering ROHS eyeletboards, the dwell time (time to heat and complete the connection) is a little longer and temperature is set a little hotter. The solder used was Lead-free solder 97/3 formula tin/copper with a Rosin Core.

4. Melt some solder on the tip of the iron. The molten solder helps to efficiently transfer heat from the soldering iron to the component leads.
5. Make a good mechanical connection first, and then make a good solder joint.
6. Heat the leads to be soldered by touching it with the tip of the iron.
7. Touch the solder to the leads. The solder should flow onto the leads. Avoid breathing the fumes.
8. Remove the soldering iron and allow the solder joint to cool.

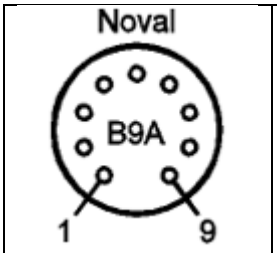
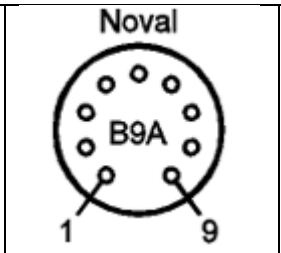
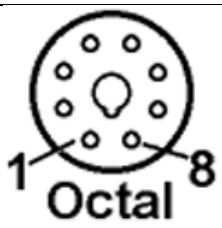
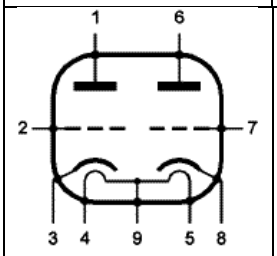
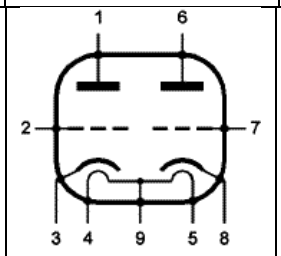
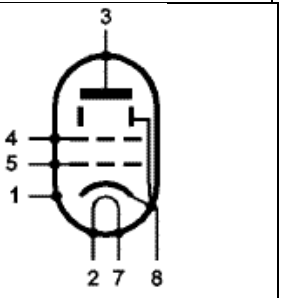
NOTE: Do not apply the tip of the soldering iron to the eyelet boardany longer than it takes for the solder to flow.

Some people do have success using leaded solder on ROHS boards. Your experience may vary.

The solder joint should be clean and shiny. (ROHS joints are not as shiny as non-ROHS). If it is dull looking it may be a ‘cold solder joint’ which is not a good electrical connection. If a solder joint is suspect, heat it with the iron to reflow the solder.

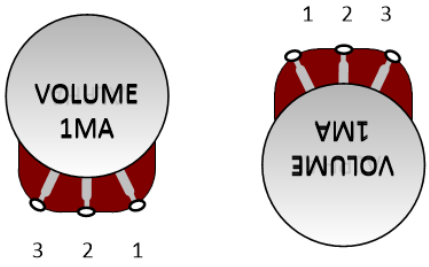
TUBE PIN NUMBERING

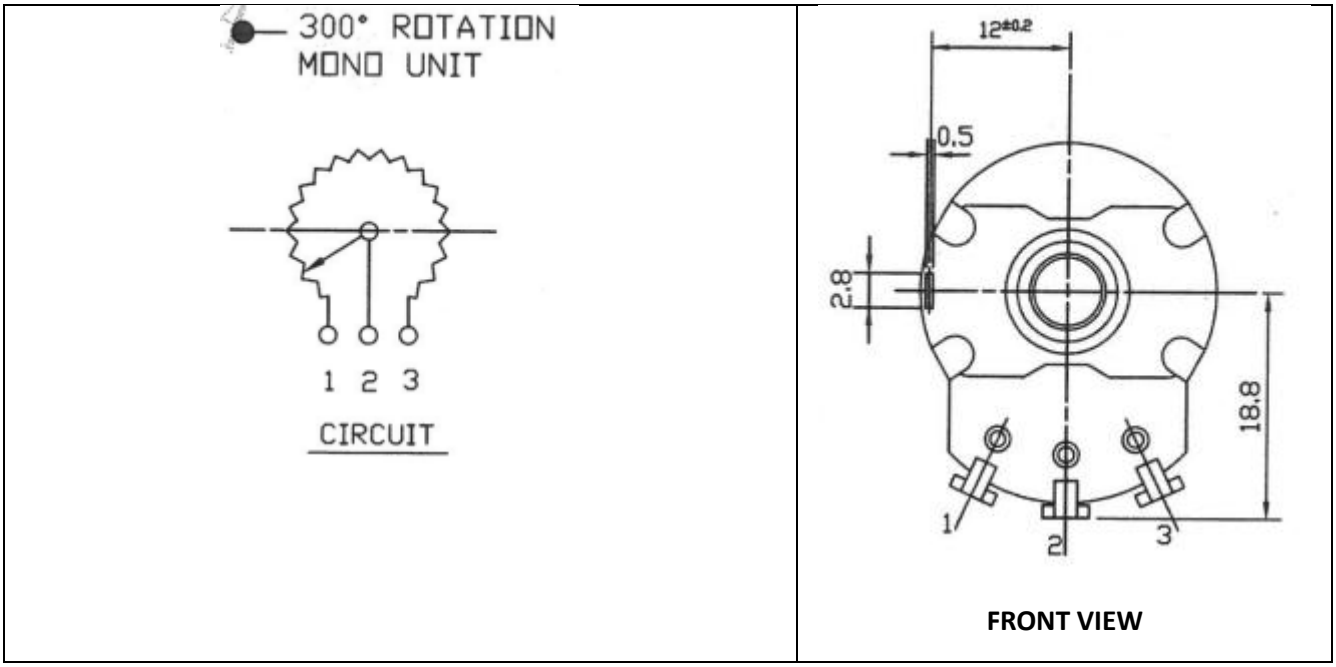
The pins on a 9-pin tube socket are numbered 1 to 9 in a clockwise direction when a tube or socket is viewed from the bottom. Note that there is a gap between pins 1 and 9. The pins on an 8-pin tube socket are numbered 1 to 8 in a clockwise direction when viewed from the bottom. Note that there is a gap between pins 1 and 8.

		
12AX7	12AT7	6V6 /KT66
		
12AX7	12AT7	6V6

PONTENTIOMETER PIN NUMBERING

The pins on the potentiometers are numbered 1 to 3 from left to right when the shaft is facing towards you and the pins are at the top.

Potentiometer Pot Termination. With the shaft away from you, looking at the back of the pot, and the solder lugs pointing up, the pins are numbered 1, 2, 3. With the pot turned all the way clockwise (full on), pin 1 will be max resistance with respect to the wiper.	 **REAR VIEW**


300° ROTATION
MONO UNIT
1 2 3
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2
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FRONT VIEW

CHECK YOUR KIT

Check your kit carefully against the Bill Of Materials (BOM) contained in this manual. If you find any damaged or missing components, or have a question about substitutions, please contact us immediately to arrange a replacement.

RETRO '64 BUILD STEPS SUMMARY

1. Install hardware.
2. Install all the terminal strips on the tube socket mounting screws.
3. Install the components between the terminal strips and a tube sockets starting with v5 and then to v6.
4. Install components on the Reverb jack and control pots.
5. Install components on the input jacks. Install Input Jacks.
6. Install the power, output and reverb transformers.
7. Complete the wiring of the output transformer.
8. Complete the wiring of the reverb transformer
9. Wire the power transformer primary leads and grounds. Test the power transformer.
10. Build the eyelet board and install it in the chassis.
11. Wire the ground points from board to chassis
12. Wire the Tube Sockets.
13. Wire the Controls and Input Jack.
14. Complete the power transformer secondary wiring.
15. Wire the heater wires.
16. Double check that all the connections are made according to the layout and it is neat and tidy.
17. Modify the footswitch Tremolo lead.
18. Plug in the foot switch, reverb tank and follow the start-up procedure.

1. INSTALL ALL THE HARDWARE

1. Ensure that all ground points and holes for jacks are clean to bare metal before installing any hardware. Use a scraper and small wire brush to remove any overspray. There may be areas that need scraping; specifically, the speaker jack holes and the IEC ground point.
2. Install preamp tube sockets. The preamp tubes are mounted with pin 9 facing the circuit board using #4-5/16" screws into threaded holes in chassis.
3. Install power tube sockets. Power tubes are mounted with the alignment notch towards the rear of the chassis. Use #4-5/16" screws into threaded holes in chassis. **NOTE:** V4 and V5 have a ground lug and 1-lug terminal strips. See next section.
4. Install 3 #6 ground lugs with #6 X 3/8" and KEPS nut; 2 at POWER GND Ground hole and 1 at a PRE GND amp ground hole with clearance for 6-32 bolts/nut below input jack. Make sure the bolt does not touch the jack tip. You might run the screw through from the inside to maximize clearance.
5. Install 1 #8 POWER LUG with 3/8" 8-32 bolt and KEPS nut at the MAINS GND hole. A second #6 lug be installed later with the REVERB Drive transformer. Two #4 Chassis Lugs are installed on the power tube sockets using ½" 4-40 bolts and 4-40 nuts to hold them in place.
6. Attach can cap clamp to lower part of can capacitor (40/20/20/20uf) with the supplied 2 screws. Align the clamp with the bottom of the can. Align with the chassis mounting holes and install the clamped assembly with 6-32 screws and KEPS nuts. Then loosen off the 2 clamp screws and align the "Y" terminal (40uF cap) by grabbing it and twisting it towards the power tubes as per layout. Tighten the clamp screws.
7. On the rear of the chassis align the panel holes and install the:
   - 7.1. IEC power entry socket using #4 – 7/16" bolt and KEPS nut. Mount the H.V. FUSE holder
   - 7.2. 2 SPEAKER jacks aligning the tips sideways.
   - 7.3. 4 RCA jacks for Reverb SEND & RETURN and for the Footswitches. These are supplied with flat and shoulder washers plus a ground lug. Put the jack in from the rear, through the panel then shoulder washer on inside (shoulder into the chassis) then a ground lug and then a nut.
     - 7.3.1. Jacks are colour coded RED and WHITE. Use WHITE for REVERB IN and RED for REVERB OUT.
     - 7.3.2. Use RED for REVERB PEDAL and WHITE for VIBRATO PEDAL
   - 7.4. POWER and STAND-BY progressive toggle switch. The round dress nut goes on the inside with the lock washer and the Hex nut goes on the outside. Orient the 4 lugs so they are away from the chassis
8. On the **FRONT OF THE CHASSIS** align the panel holes and Install:

8.1. PILOT light – the RED jewel screws in from the outside - align the lugs facing upwards but angled about 30 degrees inwards. Just make sure there is clearance for a through bolt to pass by without interfering with it. (see picture). Tighten securely in place.

8.2. CONTROL potentiometers. Sort out the 6 Control Potentiometers that go on the front of the chassis. VOLUME (1MA), TREBLE (250KA), BASS (250KA), REVERB (100KL), SPEED (3MRA), INTENSITY (250KL). Ensure the potentiometers are located in the correct positions according to their values and the layout. Locate the locking tabs in the anti-rotate holes. Install each Control Potentiometer with a washer on the outside between the nut and chassis. For the 3M -RA pot, don't use the provided lock washer, use spare washers from the other control pots. 2 inside and 1 on the outside.

8.3. INPUT JACKs. Install with lugs facing upwards. Leave it slightly loose for now as you will remove them to assemble them later. You will need 1 fiber shoulder washer on the inside. The front panel on the outside will insulate the jack insulate from the chassis. Use the supplied chrome washer and hex nut to hold the jack in place.

9. Insert 3 - ½" plastic bushings for the output and reverb transformer leads
10. Install the 4 RCA jacks with colours of the jacks as follows: WHITE for VIBRATO PEDAL and REVERB IN. RED for REVERB PEDAL and REVERB OUT.
11. Check your work. Make sure that all hardware is securely tightened as required and that all pots and switches operate smoothly.

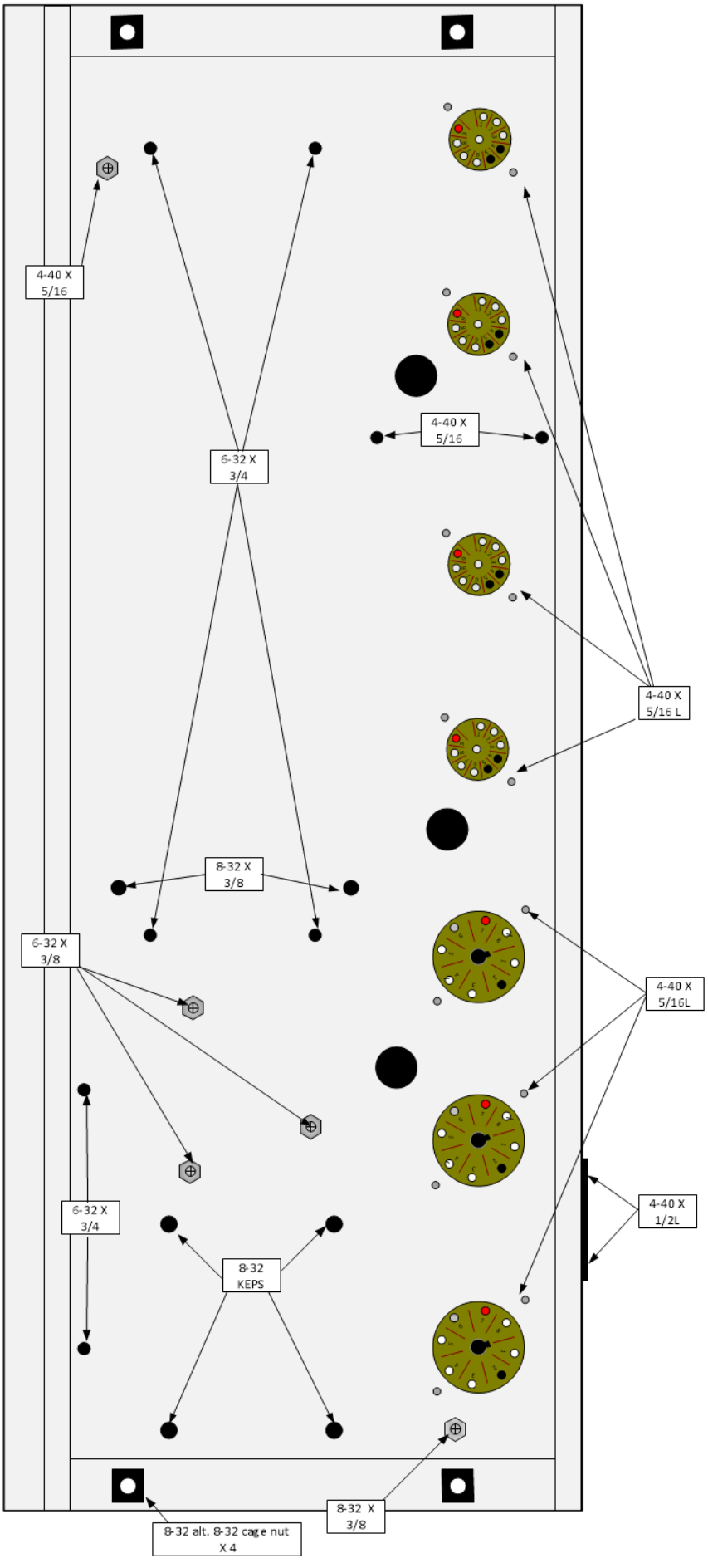
FASTENER CHART

Part	Qty	Where to use
4-40 X 5/16	17	Mount tube sockets in threaded chassis (14), Mount PRE AMP Ground; (1) Mount Reverb Transformer (2) with KEPS nuts (2) and #4 washers (2)
4-40 KEPS nuts	7	Mounting terminal strips (2), ground lugs on octal sockets (2) ; reverb transformer (2) (with 4 washers); PRE AMP Ground (1)
4-40 X 1/2	*2*	*Use with KEPS nuts (2) to mount IEC connector* *If supplied – to mount tube sockets with terminal strip, use nut to hold terminal strip with KEPS lock nut.*
6-32 X 3/4	6	Mount eyelet board (4)_ and Bias Control Board (2) to chassis using stand-off. Use with lock washer under screw head.
6-32 X 3/8”	3	Power Ground with #6 chassis lug (1) , Can-cap clamp (2).
6-32 KEPS nuts	3	Power Ground (1) with #6 chassis lug, Can-cap clamp (2).
8-32 X 3/8”	3	Mount Mains ground (1). Use KEPS nut (1) with #8 chassis lug. Mount Output transformer (2) with KEPS nuts.
8-32 lock nuts	10	KEPS for power transformer (4) with #8 washer ; KEPs nut for output transformer bolt (2) with #8 washer; 4 chassis mounting bolts with #8 washers
8-32 X 3-1/4”	4	Mount chassis to cabinet using the 3-1/4 “ long 8-32 bolts that go through the cabinet and chassis and use a 8-32 KEPS nut and washer inside the cabinet.
*8-32 X 1-½	4	Alternative to mount chassis to cabinet. Use cage nuts into the 3/8” square holes pressed into chassis and fasten with 1-1/2” 8-32 screws into the cage nuts.
*8-32 CAGE Nuts	4	Alternative to mount chassis to cabinet with 1-1/2” 8-32 screws.

***Not provided in kit but optional.**

Note Some components are more easily installed when they are pre-installed on other components prior to installation. In building the amp, you may want to remove some parts to build these sub-assemblies.

For example the Input Jack, Volume control. Be prepared to remove these parts to build these sub-assemblies.


4-40 X
5/16
6-32 X
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KEPS
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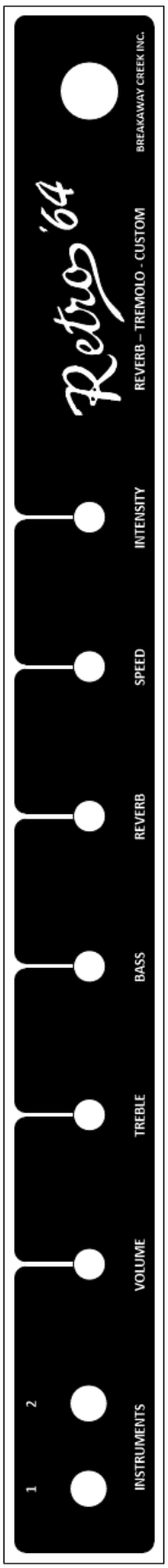
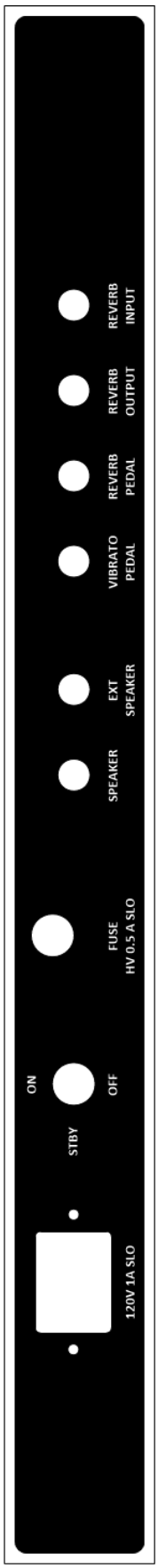
X 4
8-32 X
3/8



Retro ‘64 FRONT VIEW

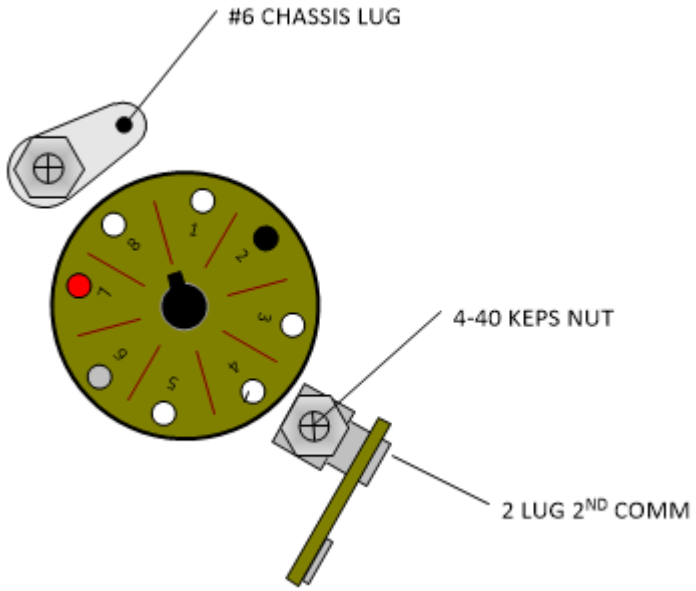


Retro ‘64 REAR VIEW

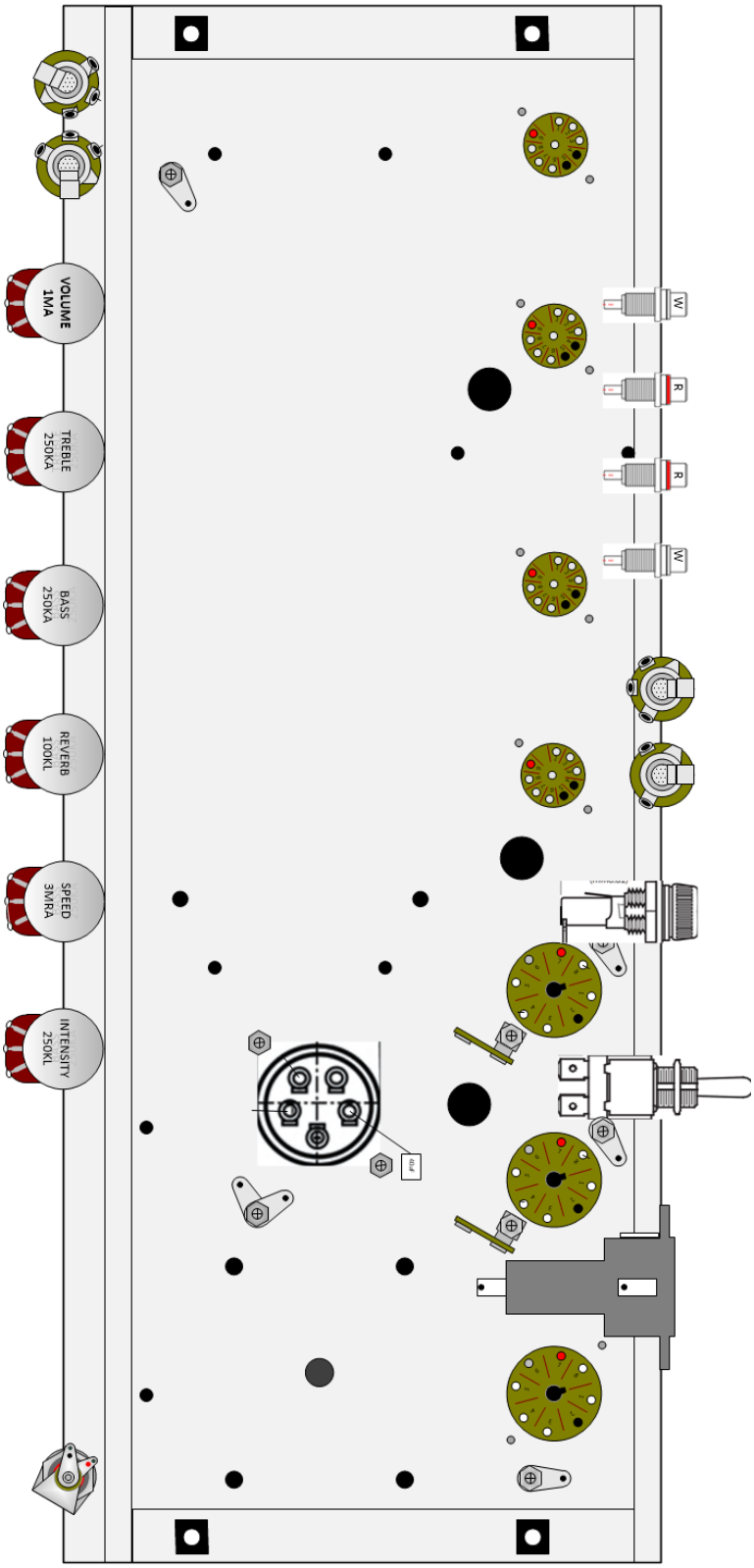
2. INSTALL TERMINAL STRIPS

There are 2 terminal strips that need orientation and installation. Each terminal strip is mounted on the 4-40 X ½" L screw holding the tube socket in place, but with the addition of a 4-40 KEPS nut.

1. Make sure the strip is oriented correctly to align with pin 4 of the octal socket.
2. Cut off one terminal to make a 2-lug 2ndcommon terminal strip out of the 3-lug strip provided.
3. Align and install the modified strip using a 4-40 KEPS nut on the socket mounting screw.

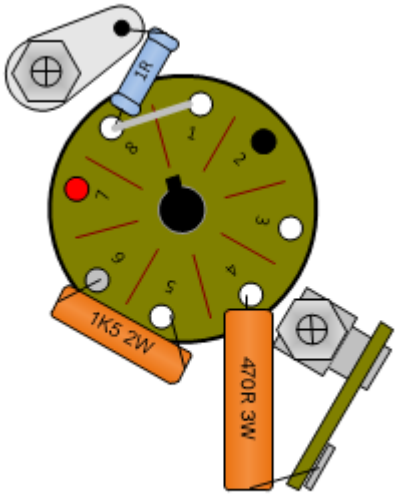
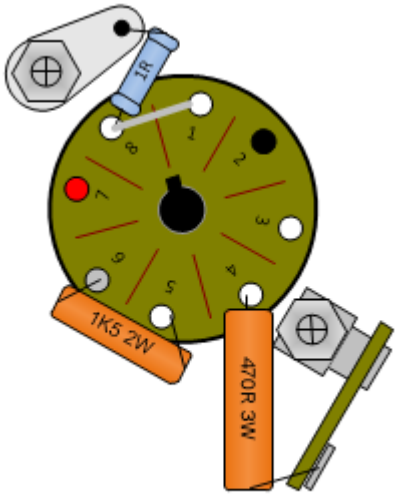
Sockets for V5 and V6 requires a 2 lug 2nd common terminal strip plus a chassis lug installed on the inside (closest to eyelet board) screw.	

Your chassis should look like this.



3. INSTALL TERMINAL STRIP COMPONENTS

Install the components between the terminal strips and a tube sockets starting with v5 and moving across to v6; In cases where many parts and leads will need to fit into the eyelet or lug, you will want to resist filling the eyelet with solder at this point in time.

V5 Components Locate the following parts: 1-1K5 2W Resistor 1-1R Metal Film Precision Resistor 1-470R 3W Resistor From the chassis lug , form and install the 1R lead to pin 2 and then across to pin 1. Solder at the lug and pin 2. On pin 5, form and install the 1K5 2W to pin 6. Solder at both pins. On pin 4, form and install the 470R 3W to the installed terminal strip.. Solder at both ends.	
V6 Components Locate the following parts: 1-1K5 2W Resistor 1-1R Metal Film Precision Resistor 1-470R 3W Resistor From the chassis lug , form and install the 1R lead to pin 2 and then across to pin 1. Solder at the lug and pin 2. On pin 5, form and install the 1K5 2W to pin 6. Solder at both pins. On pin 4, form and install the 470R 3W to the installed terminal strip.. Solder at both ends.	

4 INSTALL COMPONENTS ON JACKS AND CONTROLS

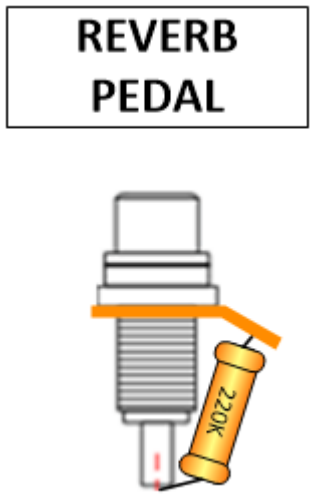
In cases where many parts and leads will need to fit into one eyelet or lug, you will want to resist filling the eyelet with solder at this point time.

Reverb Pedal Components

Locate the following parts:

1-220K Carbon Film Resistor

Wrap a 220K resistor onto the middle pin of the reverb pedal jack . Solder this resistor's other lead to the gold REVERB PEDAL (RED) GROUND LUG.



Input Jack Components

To get the spacing correct and facilitate assembly, remove the input jacks and install them from the outside with jack 2 on the left and jack 1 on the right, as in picture.

Locate the following parts:

2 – 68K Metal Film Resistors

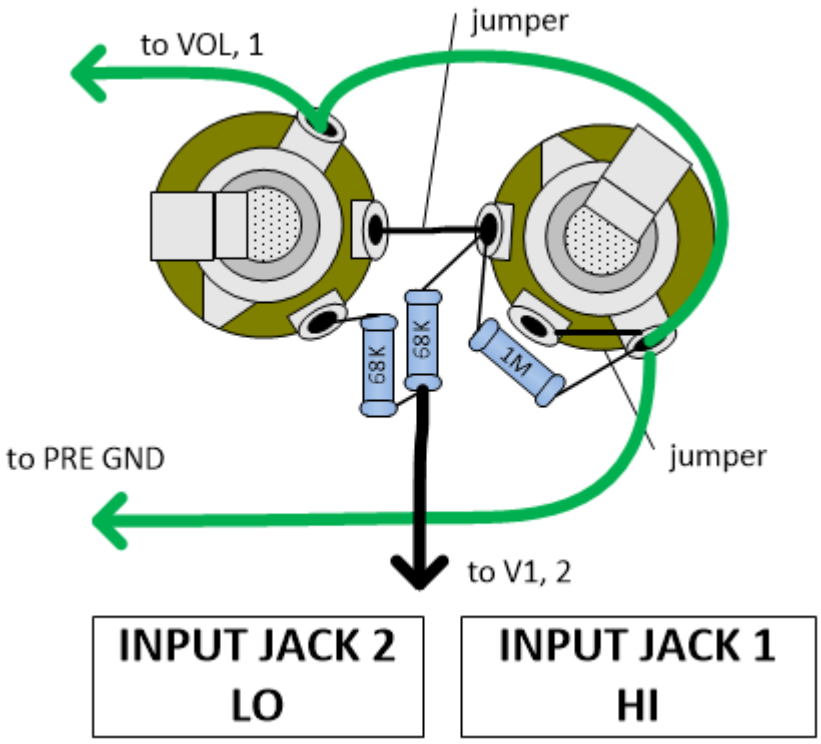
1 – 1M Metal film Resistor

Green ground wire length

Align the Input jacks according to the picture.

Wrap a jumper from the centre lug of lug of input jack 2 onto the right lug of input jack 1 .

Wrap a jumper from centre lug of input jack 1 onto the left lug of input jack 1.



Wrap the 1M resistor from the left lug of input jack 1 to the right lug of input jack 1 checking that it won't impede the input plug when inserted.

Twist one end of the pair of 68K resistor leads together and wrap one unconnected lead to the centre jumper between jack 1 and 2 and the other to the right lug of input jack 2. (see picture).

Cut enough wire to easily reach the PRE GND chassis lug and then Connect all ground wires to the input jack lugs.

Solder all connections on the input jacks and trim any excess wires.

Remove the jacks and re-install them in the inside of the chassis along with shoulder washers, washers and hex nuts.

CO-AXIAL INPUT AND VOLUME CONTROL CABLE

Should you prefer, you can install co-axial cables between the 68K grid resistors and V1 and also from V1 to the Volume control. This may help reduce noise. See APPENDIX 6 for details.

Control Potentiometer Components

Locate the following parts:

1 – 6K8 Carbon Film Resistors

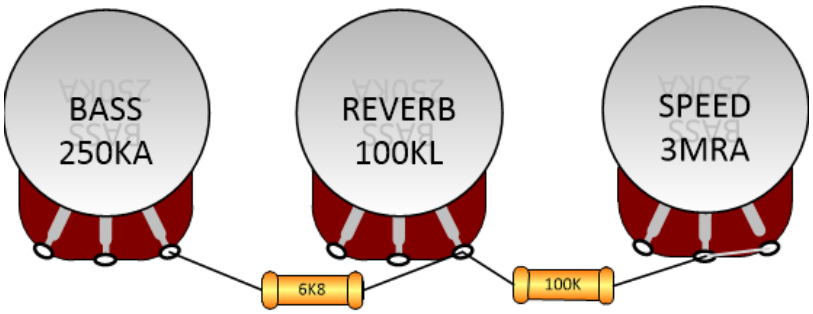
1 – 100K Carbon Film Resistors

Use heat shrink tubing to ensure the resistor leads do not touch the chassis or lugs on the controls.

Wrap the 100K resistor from the 100KL REVERB pot terminal 1 to terminal 2 AND 1 on the SPEED pot.

Wrap the 6K8 resistor from terminal 1 of the 250KA BASS pot to terminal 1 of the 100KL REVERB pot

Solder all connections on the controls and trim any excess wires.



Filter Cap Components

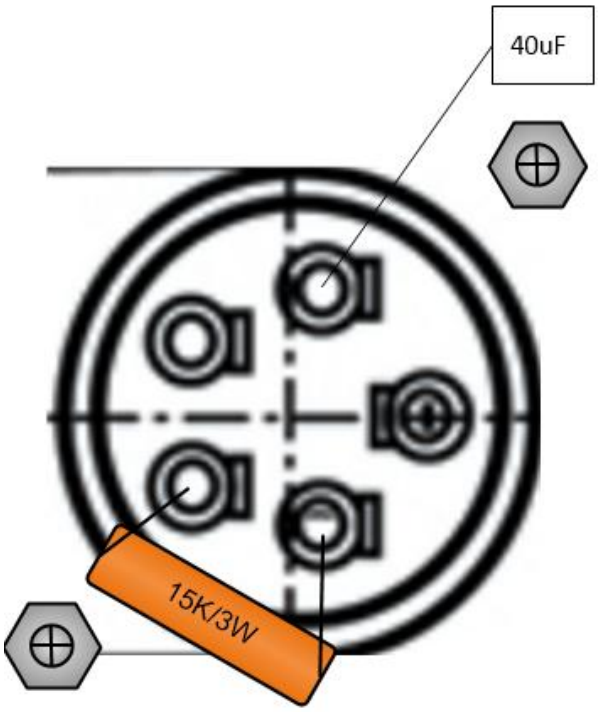
Locate the following parts:

1 – 15K 3W Resistor

Orient the Can-Cap so that the 40 uF faces the middle of the chassis. Tighten the clamp.

Wrap the 15K 3W Resistor between the last 2 capacitor lugs

Solder all connections on the controls and trim any excess wires.



5 INSTALL THE TRANSFORMERS

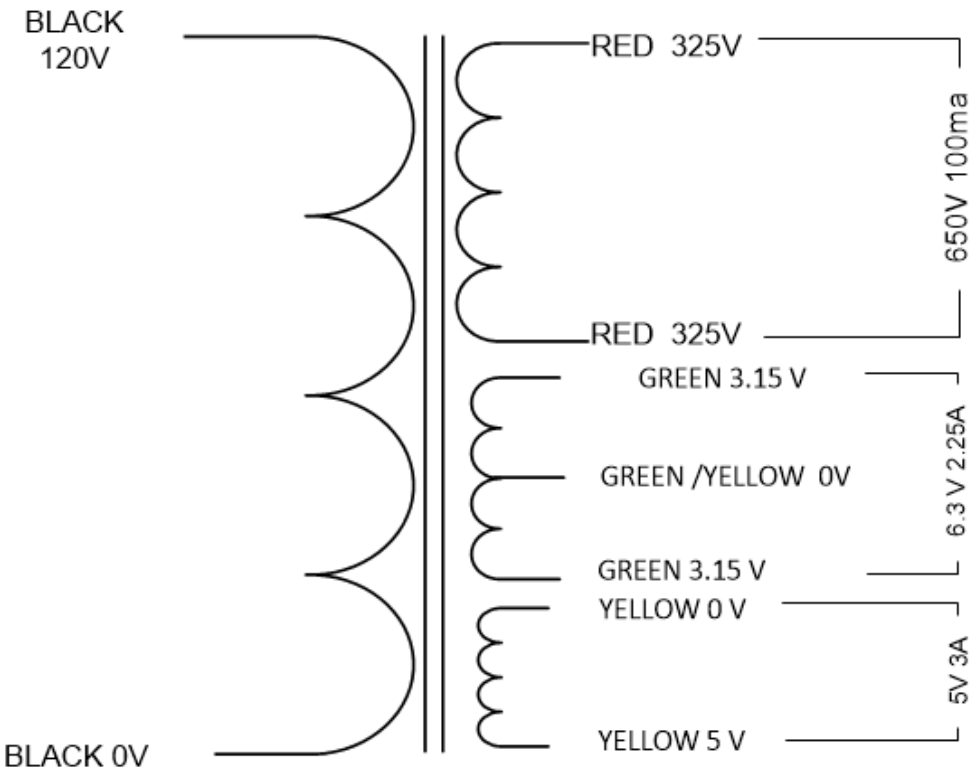
POWER TRANSFORMER

Mount the power transformer with four 8-32 machine screws, locknuts and washers. The power transformer has eleven leads, including three pairs with matching colors.

Twist the same-color pairs together and pull the red lead and green lead with a yellow stripe off to the side. In North America you twist the black wires together for 120V . Twist any unused transformer wires together.

Align it so that the GREEN and YELLOW leads are facing the outside.

Install the transformer on the outside of the chassis, with four 8-32 locknuts inside.

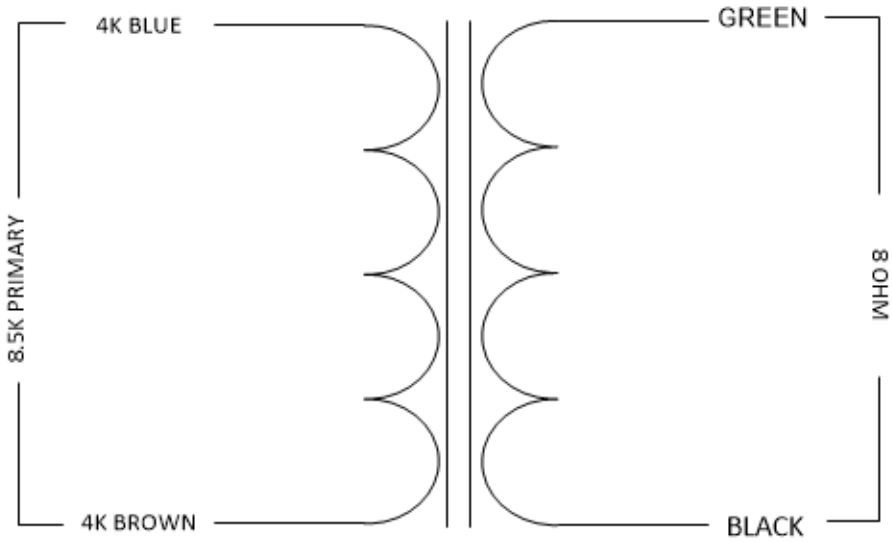


Retro '64 POWER TRANSFORMER
HTS-5473

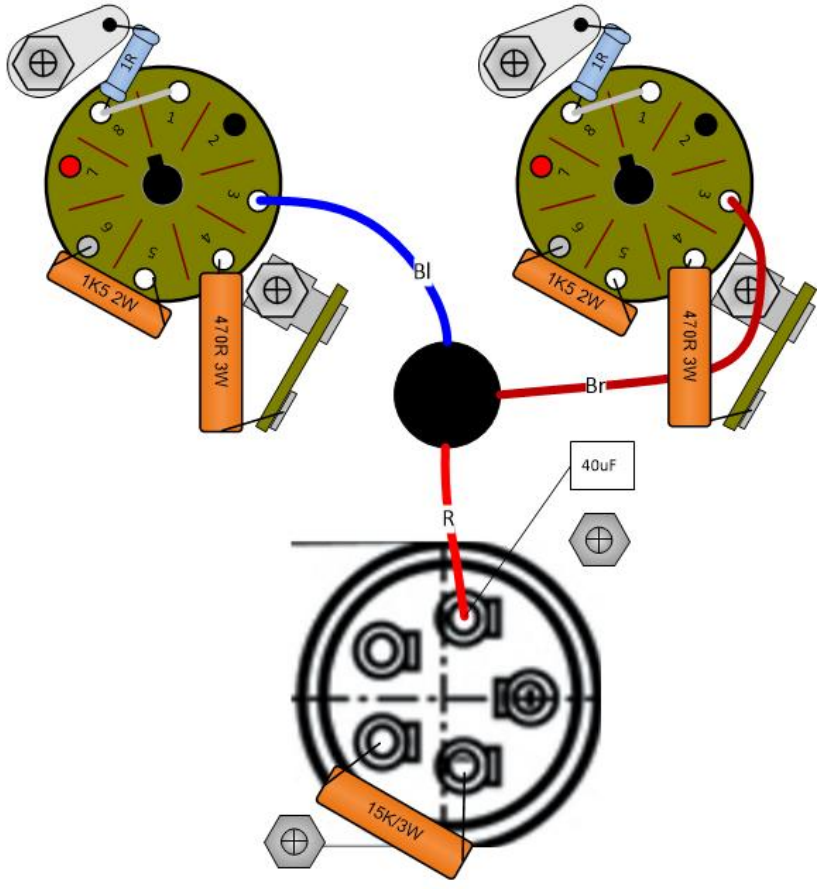
There is a dedicated section below on wiring the POWER TRASNFORMER.

OUTPUT TRANSFORMER

Mount the output transformer using two 8-32 machine screws locknuts and washers, mount the transformer to the outside of the chassis . **'64 OUTPUT TRANSFORMER**



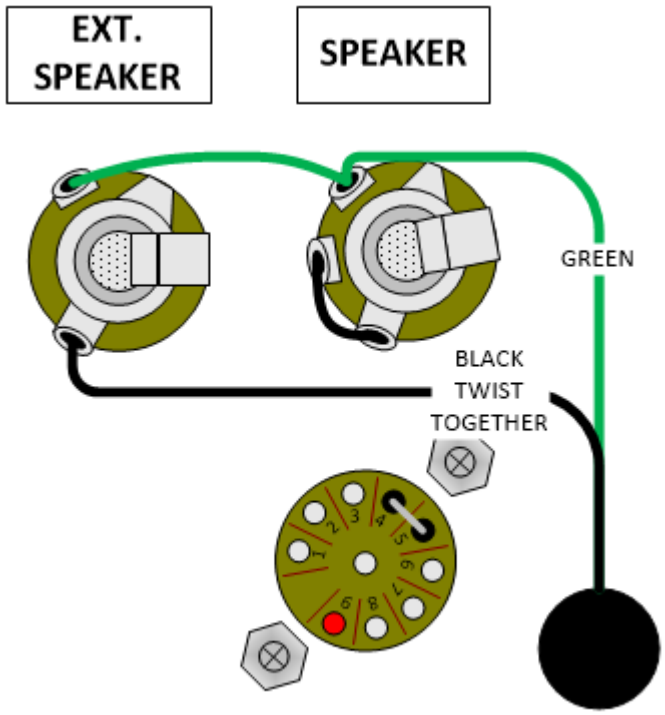
Refer to the Output Transformer schematic. The Retro ‘64 is set up with 6V6 – 8.5K primary of BROWN – RED – BLUE leads.

Follow the diagram closely. **NOTE**: Leave enough length of leads to reverse the leads from one socket to the other if necessary to eliminate amplifier squealing. Trim the BLUE transformer lead and solder to socket V5, pin 3. Trim the BROWN transformer lead and solder to socket V6, pin 3 Connect the RED lead to the 40uF lug on the multi-cap filter.	

SPEAKER JACKS.

Orient the jacks according to the diagram, with terminals located horizontally. The Output transformer speaker leads are GREEN and BLACK. Trim these two wires to reach the speaker jack and extension speaker jack . Solder the green lead to the top lug of the speaker jack. Solder a jumper across the other two terminals of the SPEAKER jack.. Run a jumper from the top terminal to the top terminal of the EXT. SPEAKER Jack and solder in place.

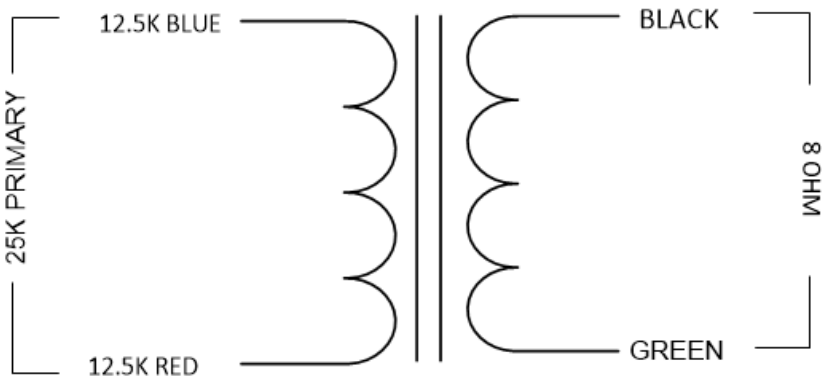
Finally, Solder the BLACK lead to the bottom lug of the EXT. Speaker Jack.



REVERB DRIVER TRANSFORMER

Mount the Reverb Driver Transformer The reverb driver is a transformer with RED, BLUE, GREEN, BLACK. Thread these four leads through the chassis grommet and then use two 4-40 machine screws with washers on top and bottom to mount the reverb driver on the outside of the chassis. See Important Note below

***Important Note**: Tolerances are tight and the driver transformer needs to be installed so it doesn't interfere with the tube shield on V2. The easiest way to do this is to insert the screws and nuts then push the transformers away from the V2 socket and tighten the screw while pushed away. If you want more space, drill out the existing holes in the chassis and possible the transformer mounting holes to allow more play when you push it away.*



Retro '64 REVERB DRIVER TRANSFORMER

Ensure jacks are colour aligned. REV OUT and REV PEDAL are red. REV IN and VIB PEDAL are white.

Daisy chain all the ground lugs of the RCA Jacks together with short ground wires to each lug.

Connect the REVERB OUT ground lug to the Reverb Driver #6 chassis lug.

Connect the reverb driver leads

Twist the GREEN and BLACK reverb driver leads together. Then route and trim the GREEN lead to reach the middle pin of the REVERB IN jack, and solder it.

Trim the BLACK lead to reach the ground lug on the REVERB PEDAL jack. Solder it to the lug.

Wrap jumpers from pins 2 to 7 and 3 to 8.

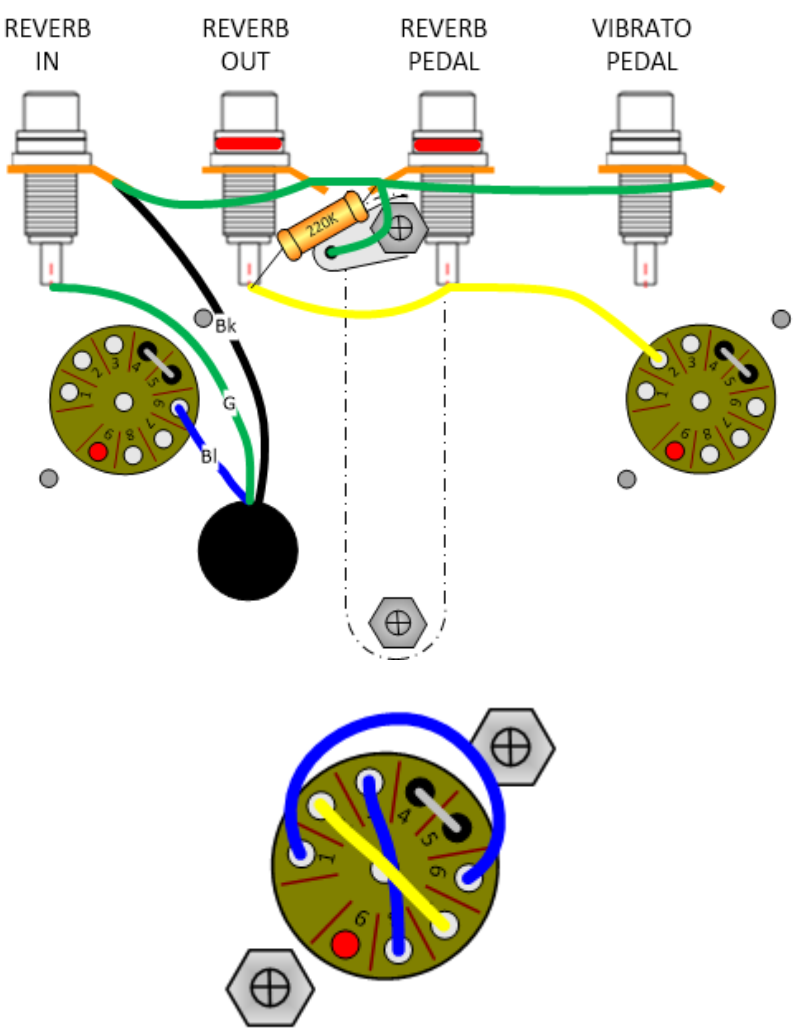
Create a loop jumper by wrapping a wire around a 3/4" diameter object. Install this at pins 1 and 6. Tack solder all jumpers for now.

Trim the Reverb Driver BLUE lead to reach pin 6 of socket V2 . Wrap it onto the pin and solder it in place along with the circular jumper.

Connect a lead from socket 3, pin 2 to the centre terminal of the REVERB PEDAL RCA jack/220K resistor.

Connect a jumper from the REVERB PEDAL RCA jack to the centre terminal of the REVERB OUT RCA jack.

Solder all in place.



Leave the RED reverb driver transformer lead free for now, you'll connect it to the eyelet board later on.	

6 WIRING THE POWER TRANSFORMER PRIMARY LEADS

Now is the time to wire up much of the mains for the power transformer.

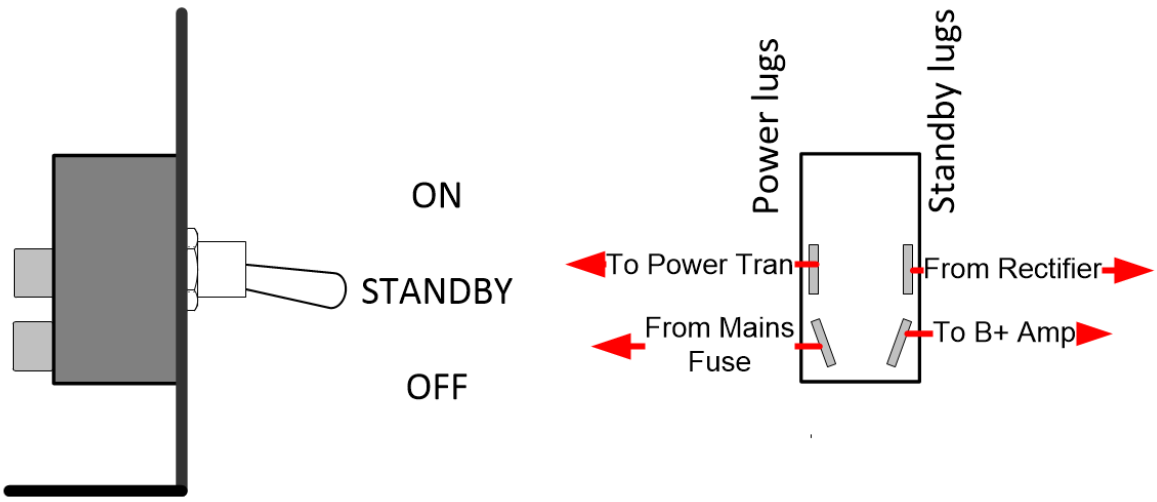
120V MAINS

WIRING THE PROGRESSIVE POWER SWITCH

This amp has a special power switch that combines both Power and Standby into one convenient switch. In one extreme position, the amp is OFFf, in the middle position it is on STANDBY and in the third position it is in the ON position. This switch is not wired up like other power switches so follow the diagrams below and layout closely.

Make sure the switch is in the desired on position when it is on. Align according to the front panel.

Connect the twisted leads to the AC POWER side of the switch.



WIRING THE POWER TRANSFORMER

Cut a green wire to neatly go from the chassis main ground to the GROUND lug of the IEC socket and solder it at both ends.

Tightly twist the 2 120V AC MAINS LEADS (BLACK and BLACK) together. Route them to the IEC Socket and trim one and solder it to the NEUTRAL lug of the IEC socket. Trim and Solder the LINE BLACK lead to the lower tab of the POWER SWITCH.

Run an 18 gauge, stranded BLACK wire from the internally fused, 'LINE' or 'Hot' side of the IEC connector to the UPPER lug of the POWER SWITCH lugs. Solder both ends in place.

Note - make sure the switch was installed with the desired 'ON' position when the connection is 'made'. i.e. with lugs facing towards the chassis, away from the builder.

Tightly twist the two GREEN 3.15V wires together and connect one to each lug of the INDICATOR HOLDER leaving one of the lug holes open, solder them both in place.

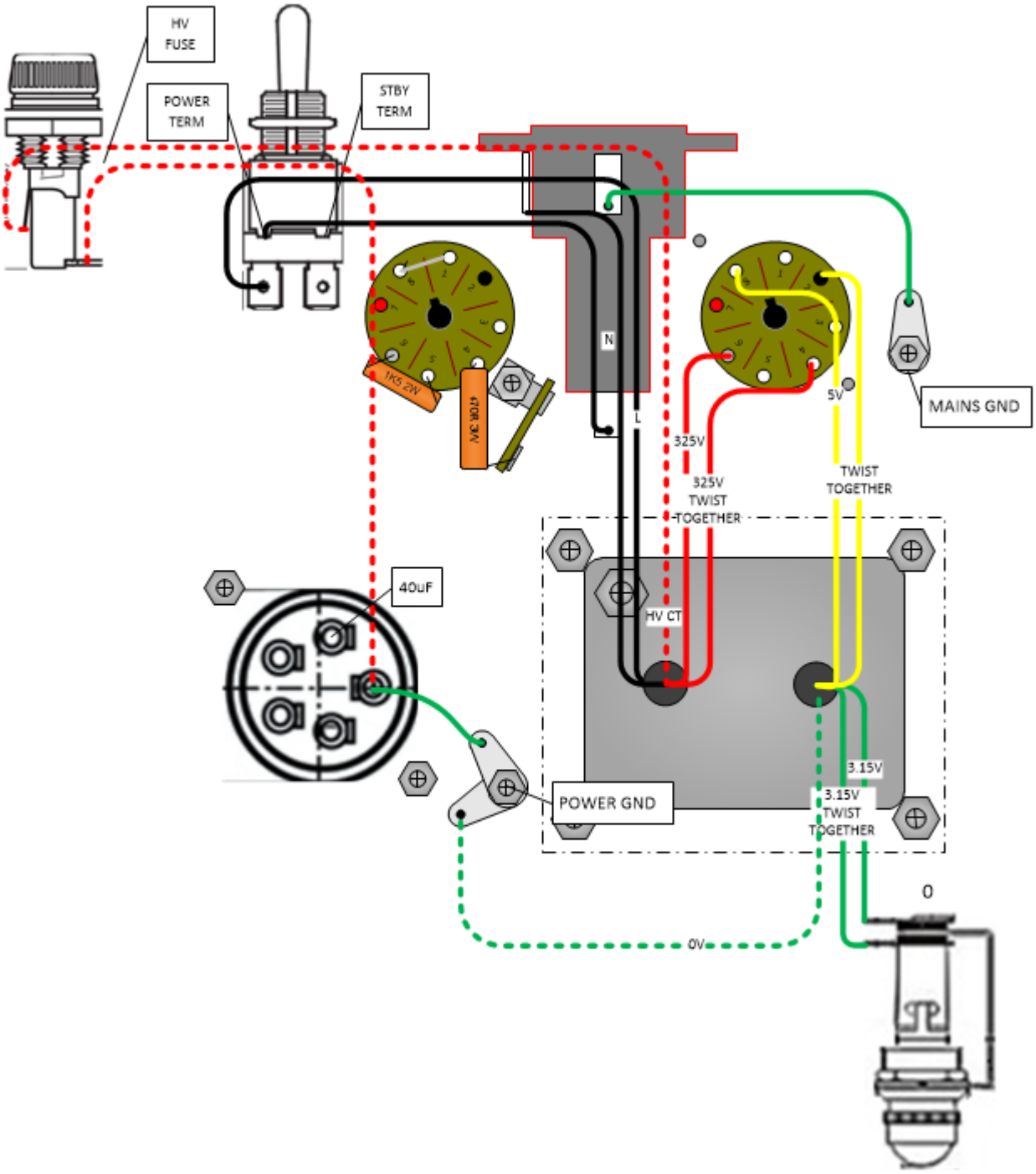
Neatly run the GREEN/YELLOW 0V lead to the chassis Power ground lug. Leaving one of the lug holes open for the eyelet board ground wire, solder them both in place.

Neatly run the RED/YELLOW transformer centre tap to a HV FUSE terminal. Run a return from the other HV fuse Termainal back to a POWER GROUND lug.

Solder a GREEN jumper from the NEGATIVE terminal of the CAN-CAP to a ground LUG.

Trim the power transformer's RED HV leads to an appropriate length, twist together and wrap one lead onto pin 4 of the V7 tube socket. Socket pins have upper and lower eyelets for multiple connections. Wrap the other red lead onto pin 6 of the same socket. Solder in place.

Trim the power transformer's YELLOW 5V leads to an appropriate length to reach the rectifier socket . Twist together and wrap one of these leads onto pin 2 of socket V7 . Wrap the other yellow lead onto pin 8 of the same socket. Solder in place.


HV
FUSE
POWER
TERM
STBY
TERM
1K5 2W
470R 3W
N
L
5V
MAINS GND
325V
325V
TWIST
TOGETHER
TWIST
TOGETHER
40uF
HV CT
POWER GND
3.15V
3.15V
TWIST
TOGETHER
0
0V

TEST THE POWER TRANSFORMER

BE EXTREMELY CAREFUL WHEN MEASURING HIGH VOLTAGES. THEY CAN KILL YOU.

This is a good time to check your mains wiring to the power transformer and ensure all wires are safely connected or tied off.

NOTE: Voltages are referenced to 120V Mains.

Without tubes installed, mains supply **UNPLUGGED**, transformer **HV LEADS NOT** soldered to the board, get out an ohmmeter. Remove the pilot lamp from the holder assembly. Use an ohmmeter to verify that the connection points for the Power Transformer (PT) secondaries are not shorted to ground. With no tubes and no pilot lamp, each half of the 6.3VAC (Volts A C) secondary when measured to ground, should not read zero ohms. It will be very low, but not zero.

Install a pilot lamp and a GMD 1A fuse in the IEC socket.. Switch to power on for 1 second just to see the pilot come on nice and bright. This checks that the 6.3VAC supply line is not shorted and is properly connected to the lamp. If the lamp did not come on, check to see if the fuse blew. If not, try another lamp and do the 1-second power test again. If the fuse blows, there is a short on the PT or mains. If the fuse survives, then it's likely that the 6.3VAC is not properly connected to the pilot lamp. Use your AC voltmeter to check for 6.6VAC with no tubes installed at the lamp and all the tube sockets.

In the following steps, be extremely careful.

Assuming you had a bright pilot light. Measure the voltages with an AC voltmeter. You should measure 5.6VAC between the 2 YELLOW leads.

Measure the voltage across the RED leads with an AC voltmeter. You should get a value about 640VAC between the 2 RED leads with NO LOAD on them.

If you get a value less than the rating, shut down the amp and check the fuse. If you get a proper value from the HV secondary, record the Mains and AC secondary voltages to ensure they are within spec of the transformer schematics and specs. The voltages below are under LOAD.

NOTE: After you build and install the bias board, you should get about - 39 VDC when the trim pot is turned fully clockwise. This is measured at the Intensity pot terminal 1.

7 BUILD THE EYELET BOARD. INSTALL IT IN THE CHASSIS

If you do not have a pre-built Trinity Amps Retro '64 Eyelet board, now is the time to build it.

Some builders like to install jumpers under the board and some on top of the boards. Installing them on top facilitates servicing and testing while installing them on the bottom looks neater but servicing is harder to do.

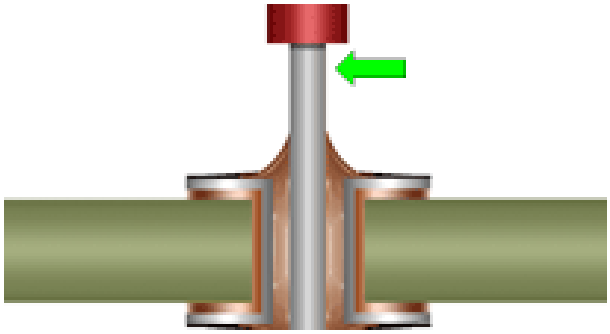
We tend to install jumpers underneath using the following process but you can do it however you prefer.

- ***Fully solder jumpers in place (fill in the eyelet with solder), when all the remaining parts are installed. Tack solder leads in place if necessary to hold them in position***.
- ***Read ahead in the manual and study the layout to determine where multiple connections are made.***

Soldering Leads onto Eyelet Boards

Several sections require the termination of jumpers or leads directly to the eyelet board, rather than to terminal posts or through a connector. Terminations are typically through-hole, but lap terminations are also possible.

1. The jumper should enter the eyelet, perpendicular to the board surface, with proper insulation clearance and lead protrusion. The wire end may be clinched to aid assembly.
2. The termination should exhibit proper insulation clearance and lead protrusion. The termination is fully wetted, with complete fillet formation on both sides of the board.
3. The insulation gap (referenced from the first point of contact of the conductor to the terminal) should be less than two (2) wire diameters and not be imbedded in the solder joint. The wire contour should be visible at the end of the insulation.
4. Discrete wires are treated as components - with the same bending, soldering and stress relief requirements seen for other discrete axial/radial devices.



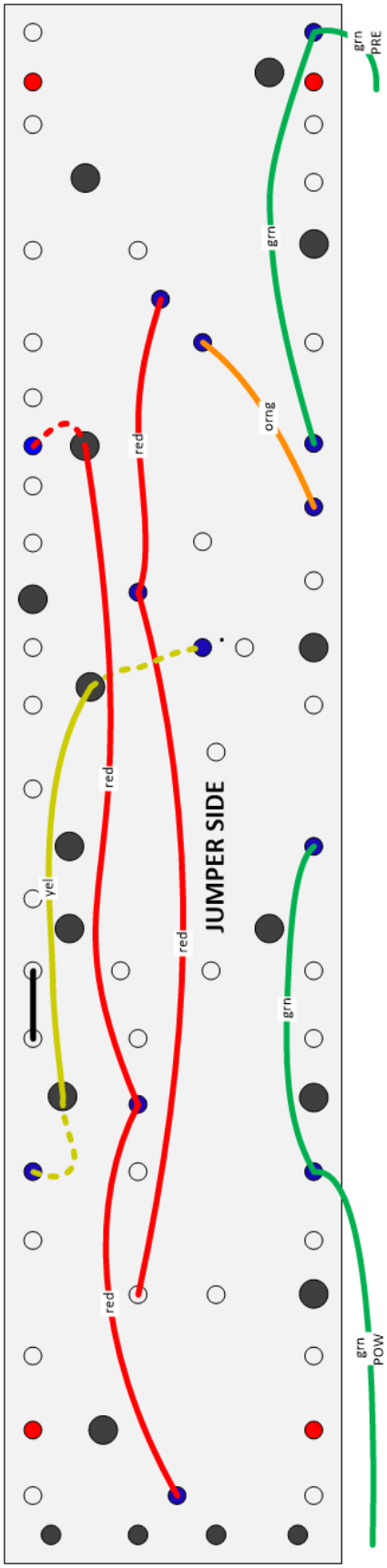
PROCEDURE TO INSTALL EYELET BOARD JUMPERS

1. Measure and cut to length a piece of 22 gauge solid wire that will reach each between eyelet. Use diagram to determine approximate jumper lengths.
2. Bare 3/8" to ½" solid wire at each end.
3. Push the bare wire through the eyelet and bend it over on the other side so that it "hooks' the eyelet. This is done so any unsoldering will not let the jumper disconnect from the eyelet.
4. Tack Solder it in place with a minimum of solder until the remaining parts are installed then fully solder it and fill in the eyelet with solder. See "Soldering Leads onto Eyelet Boards" **Read ahead in the manual and study the layout to determine where multiple connections are made. Most jumpers will need to be tacked only.**
5. Use some hot glue to hold the jumper to the eyelet board again so any unsoldering will not let the jumper disconnect from the eyelet.

Using the above procedure, install 8 jumper wires on the underside of the board between the dark dots on the picture. The colour of the jumper wire does not really matter.

Make sure the jumper does not cover up another eyelet, hole or mounting hole.

When soldering the eyelets, take note of which ones need to have components installed in the same eyelets and do not fill those eyelets with solder.



EYELET BOARD GENERAL ASSEMBLY NOTES

Locate and carefully identify the board components and their values. **Measure the resistor values to confirm they are correct**. **If possible, check the capacitor values as well**.

There are Carbon Film, Metal Film (precision) Metal Oxide, Wirewound (power), See the section on how to read Resistor and wire wound (power) resistors in the kit. The carbon film have coloured bands, the others have values printed on them. Generally, they look like the layout diagram.

Capacitor codes. Ensure that electrolytic capacitors (power supply, bypass caps) are aligned with the correct polarity on the board. There will be a '**+**' sign, or indentation to identify the positive end of the capacitor.

Non-Polarized Capacitor Orientation: Generally, it does not matter which way these parts are installed. However, in the manufacturing of a non-polarized capacitor, Mallory, SOZO, ETR etc., one of the foils ends up on the outside while the other is wrapped on the inside. As a result, the outside foil may be used as a "shield". To minimize amp noise, we can orient the outer foil side in circuit stages to take advantage of this inherent shielding.

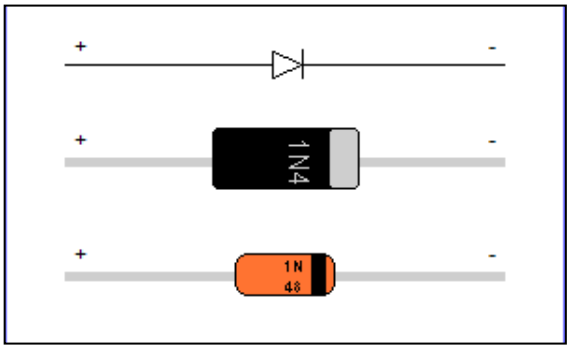
If a signal travels into a coupling capacitor and enters the outside foil side, this will act as a shield, minimizing induced noise interference. Ideally you would be able to connect the outer foil to the incoming signal point or to the lower impedance stage. For capacitors that are used as cathode bypass capacitors or in tone stacks, the outer foil gets connected towards ground. For coupling, the outer foil is oriented towards the previous stage.

Some manufacturers such as SOZO have this polarity marked. Others do not. In this case, if you have access to an oscilloscope, you can quickly determine which lead is the outer foil.

Set your oscilloscope to a low AC setting [10 - 20mV] and hold the capacitor between your fingers to induce noise. Connect the oscilloscope probes to the capacitor leads. One orientation of leads will result in a lower reading. In this case, make note of the lead that is connected to the oscilloscope ground lead (usually has an alligator clip) and that identifies the outer foil. Mark the capacitor with a sharpie and install the cap as per the layout.

NOTE: For multiple component leads that must fit into one eyelet, insert them first and solder once when they are all in place. If you can, solder each eyelet once all component leads that connect to it are in place.

Diode Orientation: Pay particular attention to the orientation diodes when they are installed. Even though Rectifier diodes are quite robust and require no special precautions for soldering them, use a minimum amount of heat.



Diodes must be connected the correct way round, and circuit diagrams may be labeled 'a' or '+' for anode and 'k' or '-' for cathode (yes, it really is 'k', not 'c', for cathode!). The cathode is marked by a line painted on the body of the diode. Diodes are labeled with their code in small print, and you may need a magnifying glass to read! The diagram below shows the orientation of the 1N4007 diode.

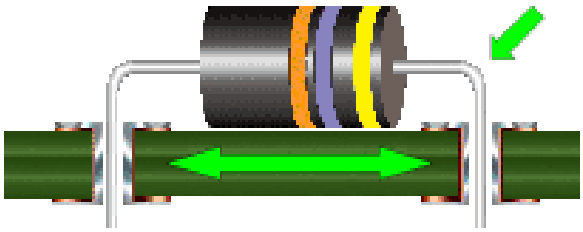
Testing Diodes: If you ever need to test a diode, you can test with an ohm meter, using a setting that shows a picture of a diode on it. Put it to that setting and just put the RED (+ve) lead on one leg of the diode and the BLACK lead on the other leg. If you get a resistance reading the cathode is on the side where the BLACK lead is. If you get no reading the cathode is where the RED lead is. If there is a dead short you will get a buzz tone out of the meter. Same as if you touched the leads together.

General Eyelet Board Build Requirements

Components should be installed per documentation, parallel to, and in contact with, the board surface. Component and any board markings should remain clear and legible. Component leads exhibit proper bend radii and stress relief. Solder fillets are smooth and shiny with concave profiles.

Horizontal mounting axial components

Parts should be parallel to, and in full contact with the mounting surface and approximately centered between the termination holes. Leads exhibit proper stress relief bends and spacing.



Populated eyelets should exhibit a vertical solder fill of 100%, with a fully formed fillet on the solder side, and evidence of 100% wetting on the component side lead, barrel and pad.

Preparation of conductors The quality of solder terminations can be correlated to the preparation of the conductors prior to soldering.

Solderability can be significantly improved by the pre-tinning and thorough cleaning of all surfaces designated to be part of the completed solder termination. Pre-forming of component leads and other conductors reduces stresses in the solder joint and component body

Component Installation Process

- Form the component as shown above to fit the eyelet spacing for it's location.
- Bend the leads outwards (or inwards) so that you can flip the board upside down and the components stay put.

- Repeat for all the components that are intended to fit into each eyelet.
- Solder in place and fill the eyelet with solder, as above.
- Inspect the connection

EYELET BOARD COMPONENT ASSEMBLY

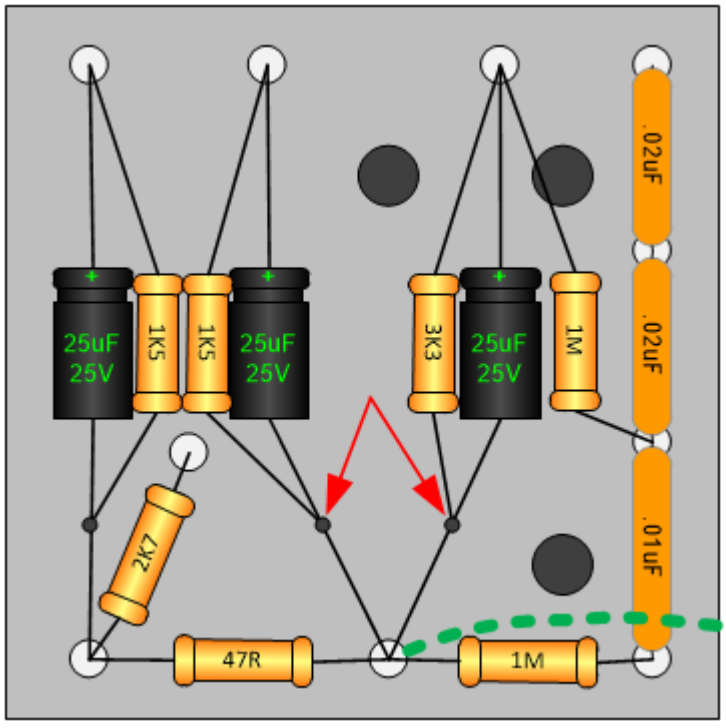
Arrange the board according to the layout diagram and follow the diagram closely and build it in logical component sections. E.g. Rectifier and bias Supply, Power Supply Filer capacitors, Power tube and Phase Inverter, Preamp

Install the components on the board by following the layout pictures. When soldering the eyelets, take note of which ones need to have wire leads or other components installed in the same eyelets and do not fill the eyelet with solder.

Tip: Sometimes it is a good idea to first solder at the eyelet that has no other part inserted in it. This is in order to keep the component located correctly on the eyelet board while the required components are installed.

TIP: For eyelets with a lot of leads passing through, consider doubling up on selected connections.

For example solder the components e.g. cathode bypass resistors, to the leads of other components, e.g. the bypass capacitor, thereby reducing the number of leads in the eyelet.



V1 Components

Locate and test the following components:

1 – 1K5 Carbon Film 1W resistor

1 – 100K Carbon Film 1W resistor

1 – 25uF, 25V electrolytic capacitor

1 –.1uF 600V Orange Drop Capacitor

1 –.047uF 600V Orange Drop Capacitor

1 –.250pF Silver Mica Capacitor

Familiarize yourself with the axial capacitor and note the POSITIVE end.

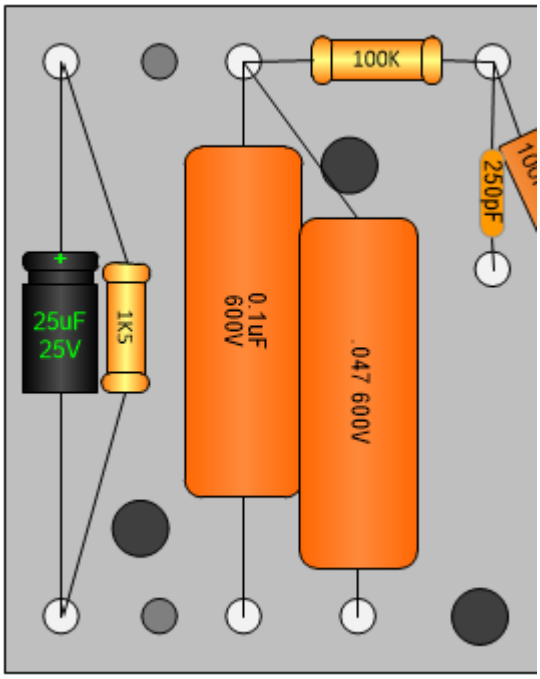
Using the Component Installation Process, install the:

25uF capacitor (negative end to ground!) and 1K5 resistor;

.1uF & .047uF OD capacitors; and

250pF SM capacitor

Inspect the connections



V1, V2 Components

Locate and test the following components:

1 – 1M Carbon Film 1W resistor

2 – 100K 2W Metal Film resistor

1 – 1K5 Carbon Film 1W resistor

1 – 2K2 Carbon Film 1W resistor

2 – 25uF, 25V electrolytic capacitor

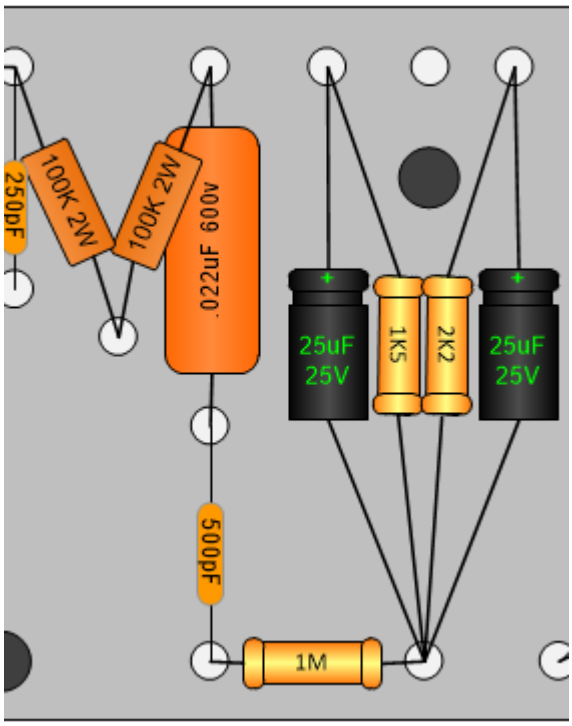
1 –.022uF 600V Orange Drop Capacitor

1 –.500pF Silver Mica Capacitor

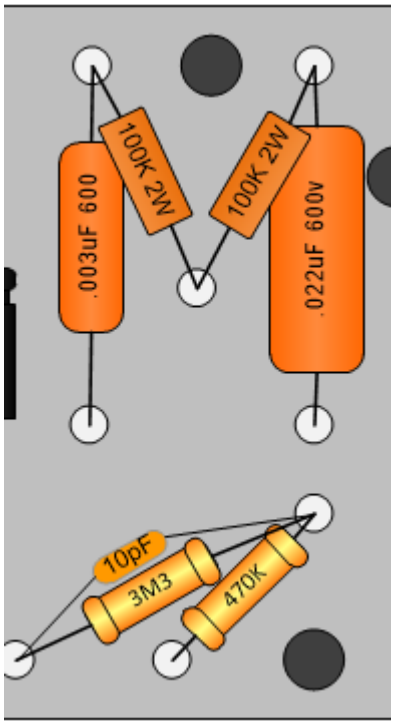
Familiarize yourself with the axial capacitor and note the POSITIVE end.

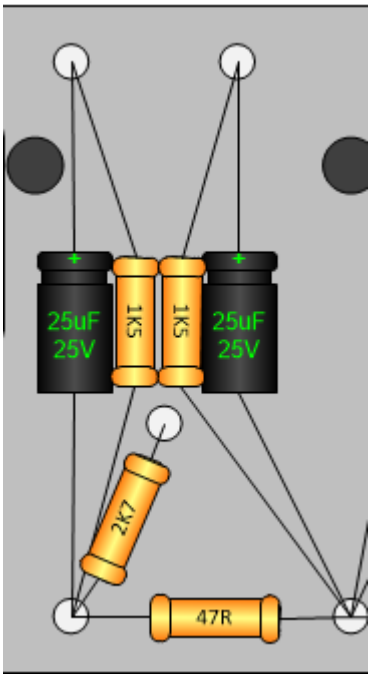
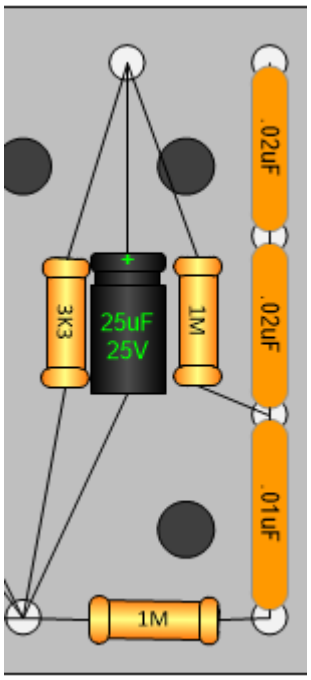
Using the Component Installation Process, install the:

2 - 100K resistors, .022uF OD capacitor, 500pF SM capacitor and 1M resistor;



25uF capacitor and 1K5 resistor; and 25uF capacitor and 2K2 resistor Inspect the connections	

V3, V4 Components Locate and test the following components: 1 – 3M3 Carbon Film 1W resistor 2 – 100K 2W Metal Film resistor 1 – 470K Carbon Film 1W resistor 1 –.022uF 600V Orange Drop Capacitor 1 –.003uF 600V Orange Drop Capacitor 1 –10pF Silver Mica Capacitor Using the Component Installation Process, install the: 2 – 100K Carbon Film 1W resistors, .022uF OD Capacitor and .003uF OD Capacitor; and 10pF SM capacitor, 3M3 resistor and 470K resistor Inspect the connections	

V3, V4 Components Locate and test the following components: 1 – 1K5 Carbon Film 1W resistor 1 – 2K7 Carbon Film 1W resistor 1 – 47R Carbon Film 1W resistor 1– 25uF, 25V electrolytic capacitor Using the Component Installation Process, install the: 2 – 1K5 Carbon Film 1W resistors, 25uF Capacitor; and 2K7 resistor and 47R resistor Inspect the connections	
V3, V4 Components Locate and test the following components: 1 – 3K3 Carbon Film 1W resistor 2 – 1M Carbon Film 1W resistor 2 –.022uF Ceramic disc Capacitor 1 –.01uF Ceramic disc Capacitor 1– 25uF, 25V electrolytic capacitor Using the Component Installation Process, install the: 3K3 resistor, 2 – 1M resistors and 25uF, 25V electrolytic capacitor; ; 2 - .02uF disc capacitors and - .01uF disc capacitor. Inspect the connections	

V4, V5 Components

Locate and test the following components:

3 – 220K 1W Carbon Film resistor

2 – 1M 1W Carbon Film resistor

1 – 1K Carbon Film resistor

1 – 56K 2W Metal Film resistor

1 – 56K Metal Film resistor

1 - .022uF 600V Orange Drop Capacitor

3- .01uF 600V Orange Drop Capacitor

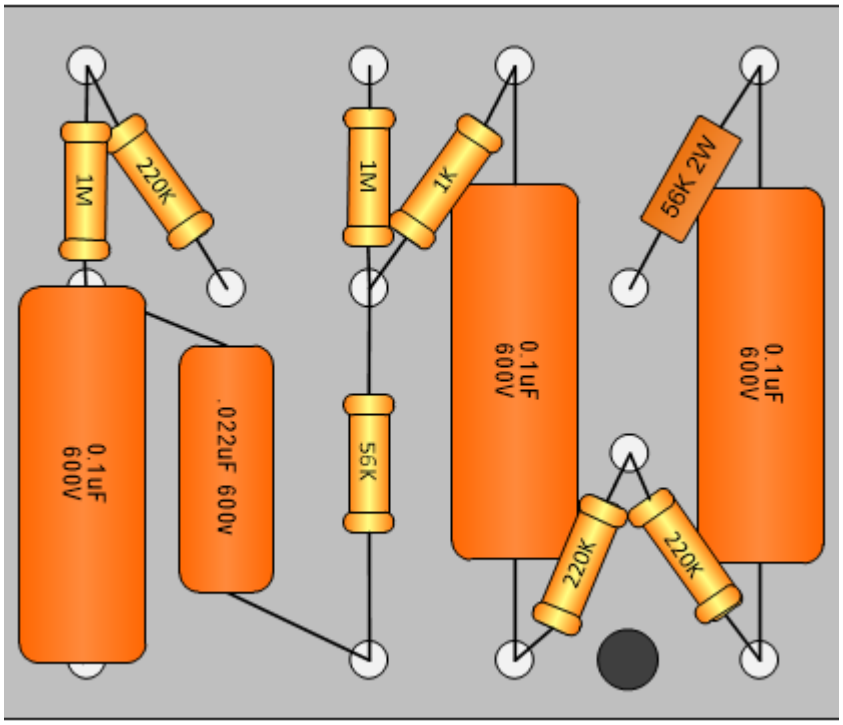
Using the Component Installation Process, install the:

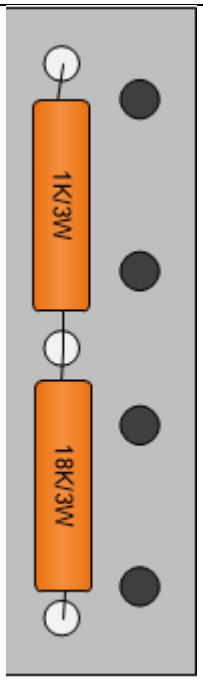
1M resistor, 220K resistor, .01uF OD capacitor, .022 OD capacitor;

56K carbon film resistor, 1M resistor, 1K resistor, .1 uF OD capacitor;

2- 220K resistors, .1uF OD capacitor and 56K metal film 1W resistor

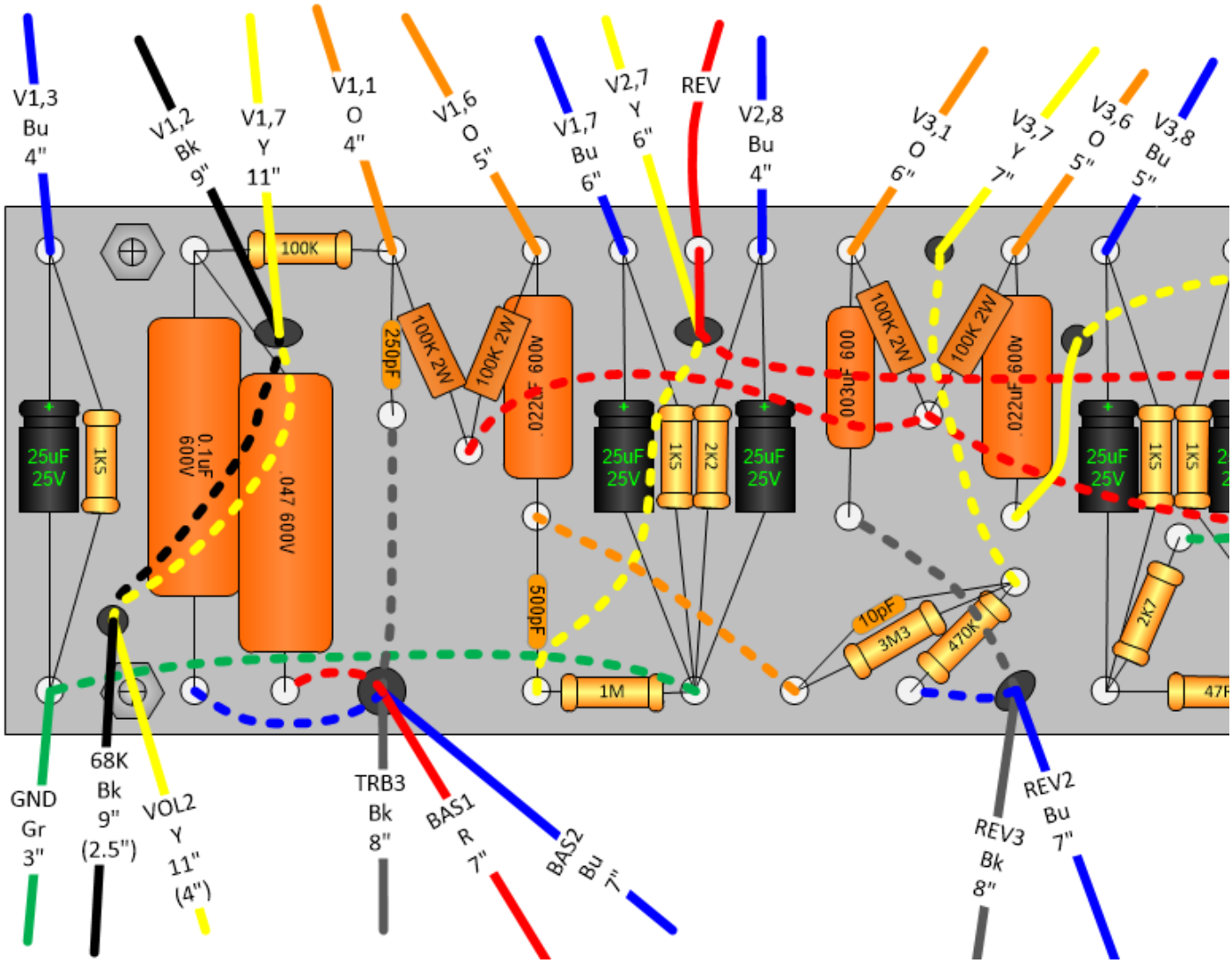
Inspect the connections



Power Supply Components Locate and test the following components: 1 – 1K 3W Power Metal Film resistor 1 – 18K 3W Power Metal Film Resistor Using the Component Installation Process, install the: 1 – 1K and 18K resistors.	

With the board now fully populated, **inspect for** accuracy and proper connections.

INSTALL EYELET BOARD LEADS



Many sections require the termination of leads directly to the eyelet board. Refer to the previous Soldering Leads onto Eyelet Boards section.

In the diagram above, the termination of the lead is identified as follows: Valve/Tube #, pin # or Control Name pin#, colour, cut length in inches, (optional length on that side of the board) e.g. V1,3, Bu, 4" means Valve 1, pin 3, Blue lead 4 inches long or another e.g. 68K, Bk, 9" (2.5") means black lead, leave 2.5" past the board and then connect black lead to 68K resistors.

Note: Control pin numbering: With the shaft away from you, looking at the back of the pot, and the solder lugs pointing up, the **pins are numbered 1, 2, 3. So in the layout, these are 3, 2, 1 from left to right.**

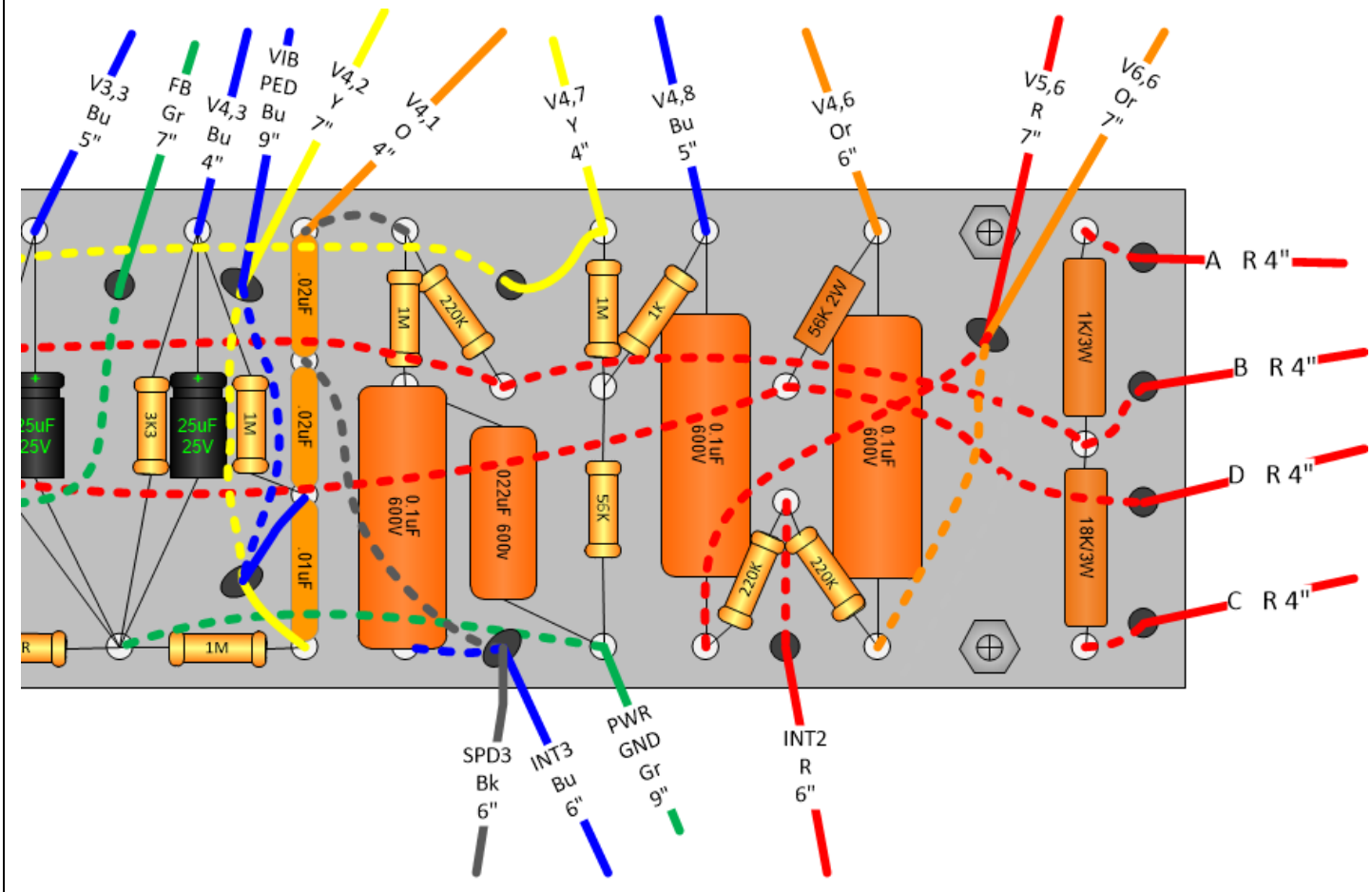
The eyelet board also has many leads that go underneath the board and out through holes in the board and onwards to another part. These are identified on the diagram as dotted and solid lines. (Note: not to be confused with jumpers).

Using 22-gauge solid wire cut in correct colors according to the layout diagram to 5” to 10” long. Confirm the approximate lengths before cutting. Leave extra so once the board is installed, they can be trimmed to length.

Following the layout, measure and cut leads according to layout and solder the leads onto the eyelet board to the bottom of the board and then feed them out the correct holes to the top. Start at the lead going to V1,3 and install a blue lead. Proceed from there.

This is the time to fully solder all eyelets that had previously been left ‘open’.

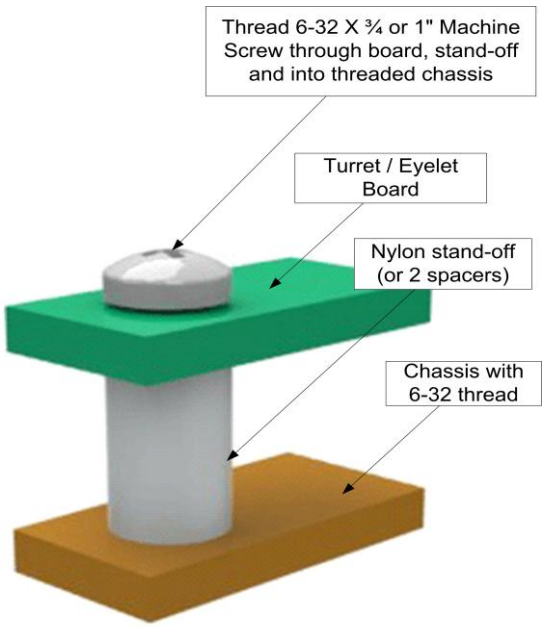
Note: the lead from V1,2 to 68K just passes through the board as does the lead v1,7 to Vol2. It is not soldered to any eyelet.



When the board is built, double check all components, jumpers and leads against the layout.

TIP: It is prudent to '**ring out' the leads** to make sure they go to where you intended them to. Use the continuity checker on your meter to do tis for every lead and compare to the layout.

If all is correct, carefully install the board into the amp. Locate 4 - #6 X 3/4" screws, ½" nylon spacers and lock washers. At one end of the board, put two screws through the lock washer, board, and spacers. Align the screw with the #6 holes in the chassis and install the board. Loosely tighten the screws. Repeat at other end and middle and then tighten nuts firmly.



The chassis is tapped to receive 6-32 machine screws. To mount the board, align the board mounting hole, stand-off and tapped hole and then thread a 6-32 X ¾ / 1" machine screw through board, stand-off and into threaded chassis. Tighten to keep it in place and repeat for each corner. Use #6 lock washers under the screw head.

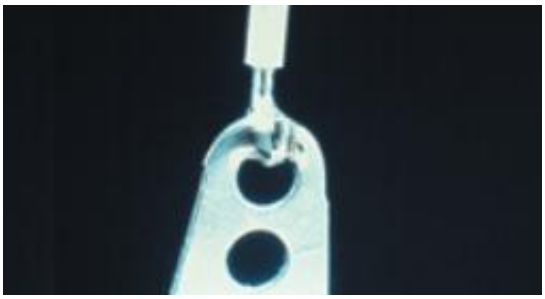
8 CONNECT EYELET BOARD GROUND POINTS

The proper installation and soldering of wires and component leads to lugs terminals is important to the overall electrical and mechanical reliability of the termination.

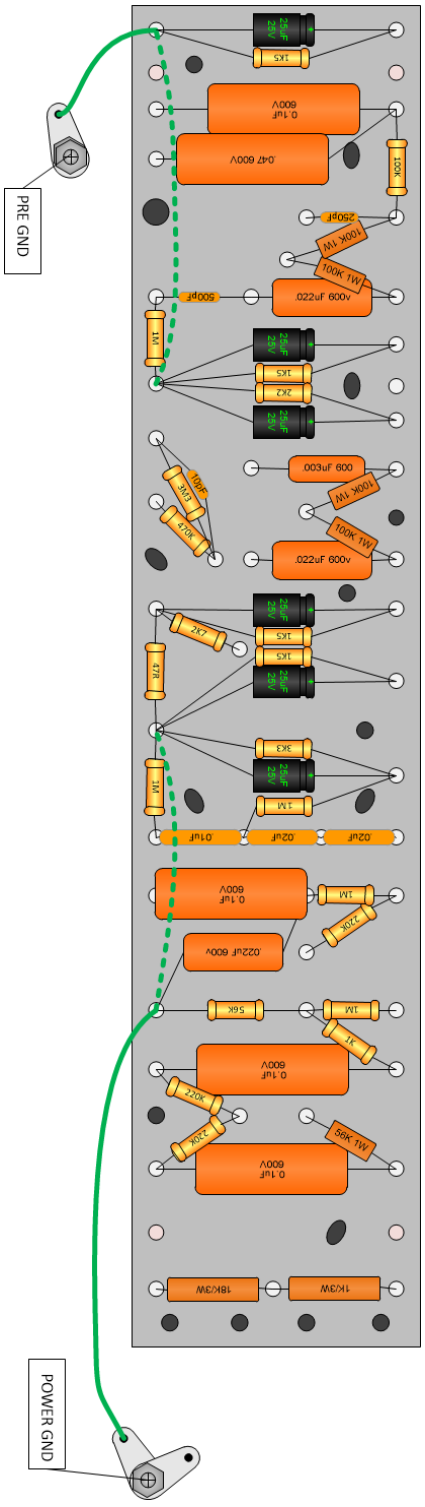
The insulation gap (referenced from the first point of contact of the conductor to the terminal) should be less than two (2) wire diameters, but shall not be imbedded in the solder joint. Wire/harness terminations should exhibit an even distribution of conductor dress and tension throughout the cable and harness, to prevent stress to the terminations.

For pierced or perforated terminal lugs, socket pins,switch lugs and terminals, the wire passes through the eye of the terminal, is wrapped in contact with both sides of the terminal, and does not overhang the terminal edge. Insulation clearance is less than 1 wire diameter.

The lead profile is discernable, with wire and terminal interface completely wetted. The solder is smooth and shiny, and fillets the entire wire/lead and terminal interface.



Using GREEN Solid wire, route and connect two board ground points to the chassis ground lugs labelled PRE GND and POWER GND.



9 BUILD THE BIAS SUPPLY BOARD

Now is the time to install the jumpers and leads to the BIAS SUPPLY board.

BIAS BOARD JUMPERS

Locate the BIAS SUPPLY board

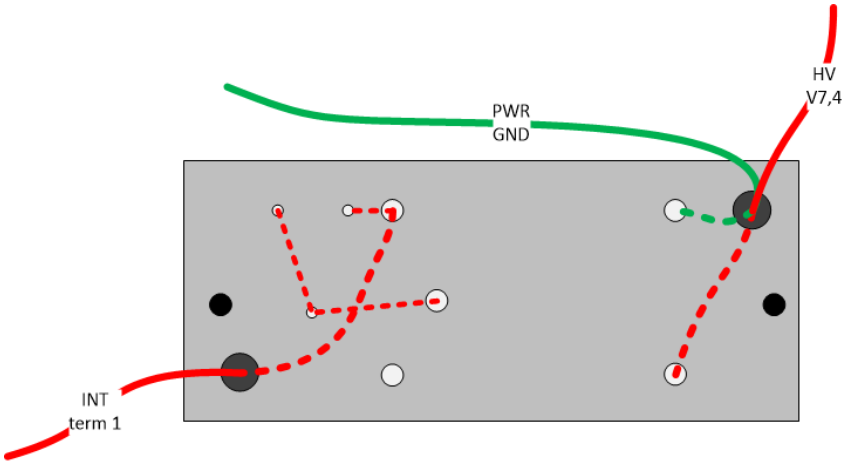
Connect the 3 RED jumpers under the board. Bend leads over the eyelet. Do Not solder in place

Cut a 12” long RED lead (HV), 6” long RED lead (INT) and 6” long GREEN lead (GND).

Lead the 6” RED lead through the access hole to the DIODE/100uF capacitor junction eyelet. Bend over the eyelet. Do Not solder in place

Lead the 6” GREEN lead through the access hole to the 100uF electrolytic capacitor eyelet. Bend over the eyelet. Do Not solder in place.

Lead the 12” RED lead through the access hole to the 100K resistor eyelet. Bend over the eyelet. Do Not solder in place



BIAS BOARD COMPONENTS

Locate and test the following components:

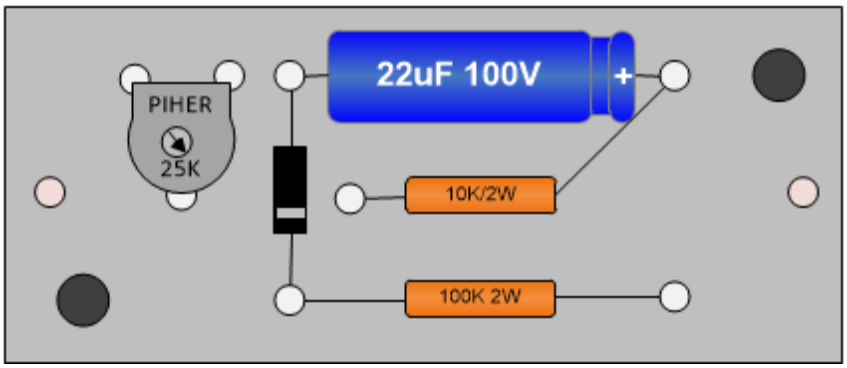
1 – 10K 2W Metal Power Resistor

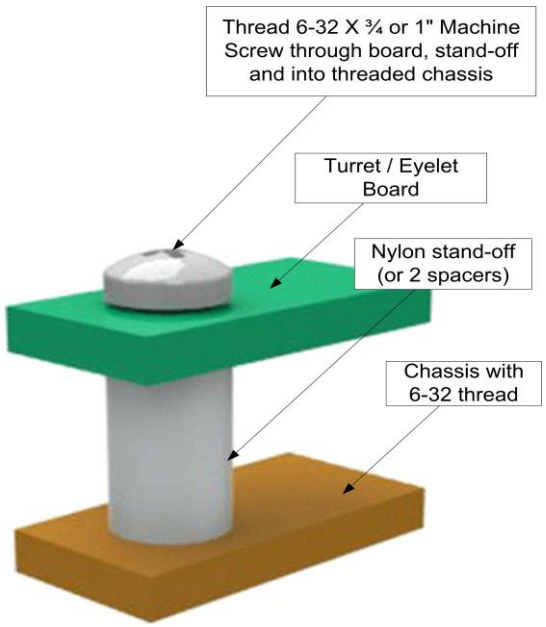
1 – 100K 2W Metal Power Resistor

1 – 1N4007 DIODE

1 – 22uF, 100V electrolytic capacitor

1 –.25K Trim Pot



Familiarize yourself with the axial capacitor and note the POSITIVE end and the diode cathode end. Using the Component Installation Process, install the: 100uF capacitor (positive end to ground this time!!); 10K 2W resistor and DIODE. Make sure the DIODE is pointing in the correct direction, indicated by the band at one end.; 100K 2W resistor; and 25K BIAS TRIM POT. Now fully solder all the eyelet connections and inspect them. Install the BIAS SUPPLY BOARD beside the INDICATOR LAMP HOLDER . Locate 2 - #6 X 1" screws, ½" nylon spacers and lock washers. At either end of the board, put two screws through the lock washer, board, and spacers. Align the screw with the #6 holes in the chassis and install the board. Firmly tighten the screws.	

10 CONNECTING THE EYELET BOARD TO TUBE SOCKETS

Now is the time to make the connections from the eyelet board to the tubes.

***TIP**: It is a very good idea to '**ring out' each leads** before you connect it to make sure it goes to the eyelet/component you are supposed to be connecting to according to the layout and/or schematic. Use the continuity checker on your meter to do this for every lead and compare to the layout*.

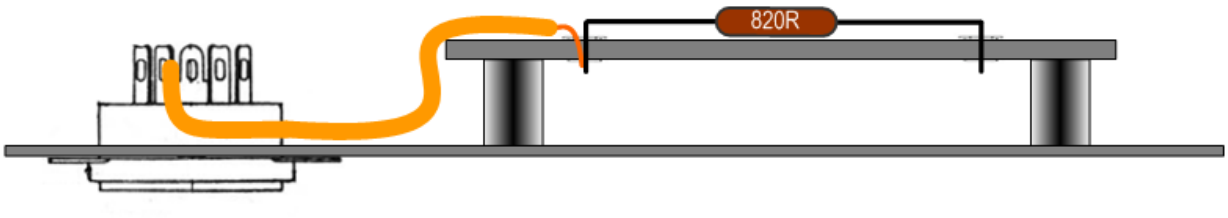
TIP: On a photo-copy of the layout, highlight the connections as you complete them to make sure they are done correctly.

Some tube sockets require components or jumpers to be installed on them. Some builders prefer to do this work out of the chassis. Pre-form these components to fit into place and you may use some heat shrink tubing make sure they do not touch other parts or pins especially the jumper on V3. Solder the parts in place following the layout provided keeping in mind what connections to the board still may need to be made.

Start at the V1 end of the amp and work your way sequentially to V5 doing the point-to-point wiring. Board to tube pin; board to tube pin etc. Start at V1, pin 1 and move to the far end of the board to V6.

Identify the first eyelet and its destination socket pin.

Follow the colour code on the layout. Cut a length of the supplied 22 Guage solid core wire so it will easily reach (with some extra) from the destination eyelet to the correct tube socket pin while laying flat to the eyelet board and against the chassis.



Once the connection is cool, press the wire so that it lies flat on the board and chassis with any excess tucked underneath the board.

Repeat for each eyelet that has a connection to another part.

Use the following layout to get an idea of the lengths of the connecting wires

Connecting to V1 Socket 1

PREAMP TUBE

Connect the previously wired ORANGE lead from the 250pF capacitor to, socket 1, pin 1.

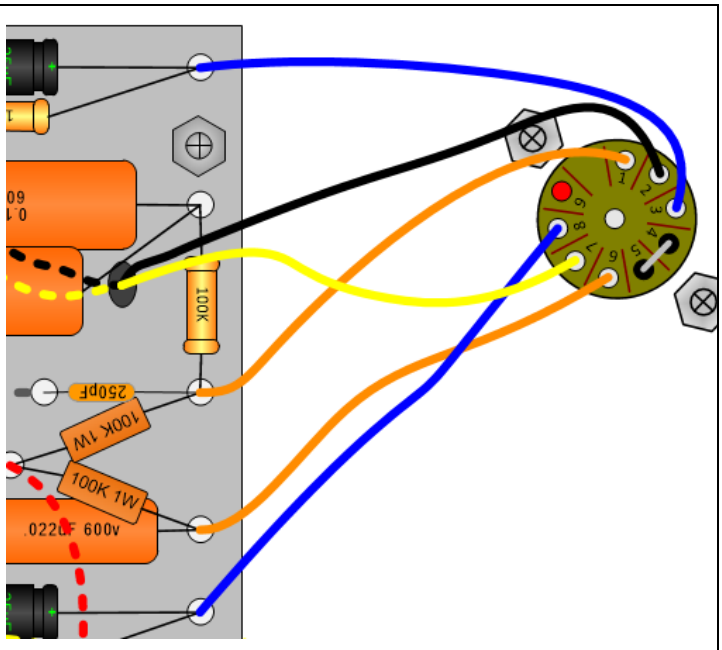
Connect a loose lead from the 68K grid resistor pair on input jacks to socket 1, pin 2.

Connect the 25uF / 1K5 pair with the previously wired BLUE lead to socket 1, pin 3

Connect the previously wired ORANGE under-board lead from the .022uF capacitor to socket 1, pin 6.

Connect a loose lead from VOL lug to socket 1, pin 7

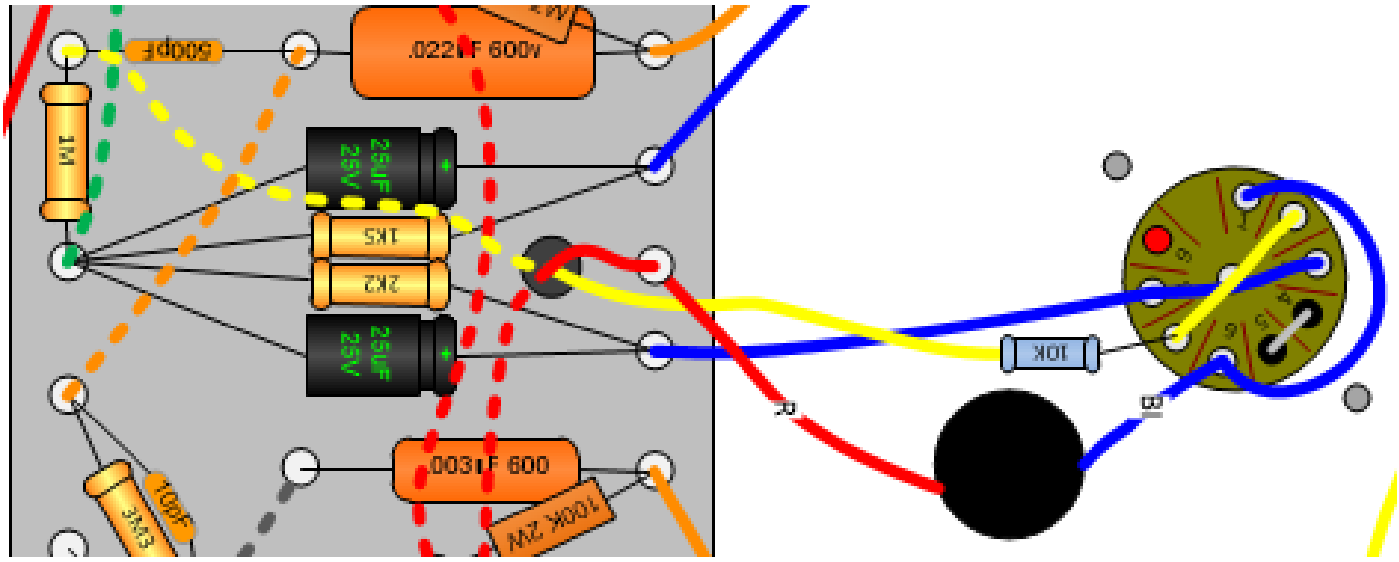
Connect the 25uF / 1K5 pair with the previously wired BLUE lead to socket 1, pin 8



Connecting to V2, Socket 2

Connect the 500pF SM capacitor with a YELLOW lead. Put a 1” piece of heat-shrink tubing over the lead and then solder the lead to a 10K Metal Film (grid stopper) resistor. Finally, solder the other end of the resistor to socket 2 pin 7.

Connect the 25uF / 2K2 pair with a BLUE lead to socket 2 pin 8



Connecting to V3, Socket 3

Connect the previously wired ORANGE lead from the 0.003uF OD capacitor/100K resistor to socket 3 pin 1.

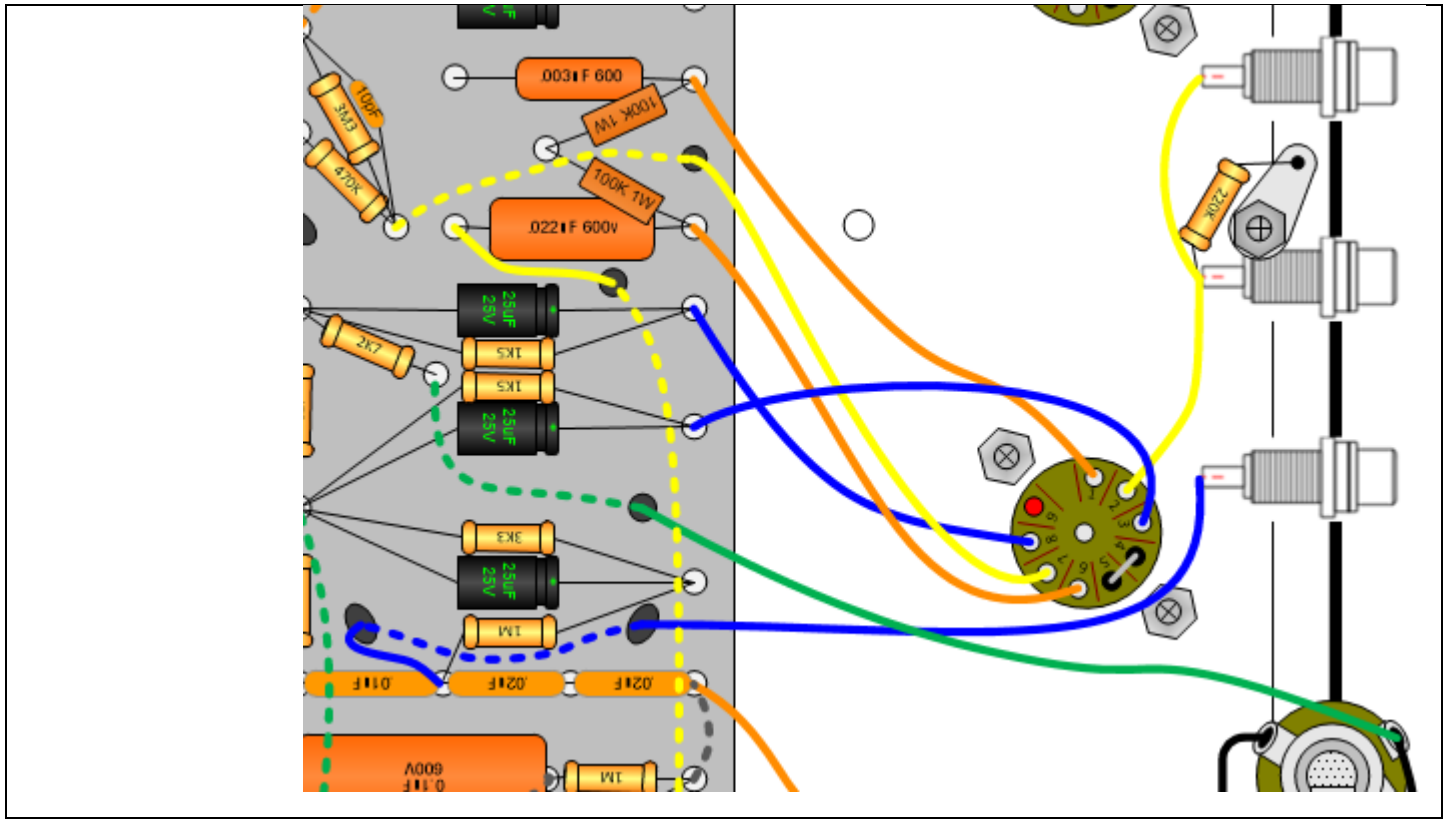
Connect the 3M3/470K resistor pair with a YELLOW lead to socket 3 pin 7.

Connect the 25uF / 1K5 pair with a BLUE lead to socket 2 pin 8

Connect the 25uF / 1K5 pair with a BLUE lead to socket 2 pin 1

Connect the previously wired ORANGE lead from the 0.022uF OD capacitor/100K resistor to socket 3 pin 6.

Connect the GREEN lead from the 2K7 FEEDBACK resistor to the TIP lug of the EXTENSION output jack.


.003µF 600
100K 1W
100K 1W
.022µF 600v
25uF 25V
1K5
1K5
25uF 25V
3K3
25uF 25V
1M
.01µF
.02µF
.02µF
0.1µF 600V
1M
10pF
3K3
470K
2K7
220K

Connecting to V4, Socket 4

Connect the 25uF / 1K5 pair with a BLUE lead to socket 4 pin 3

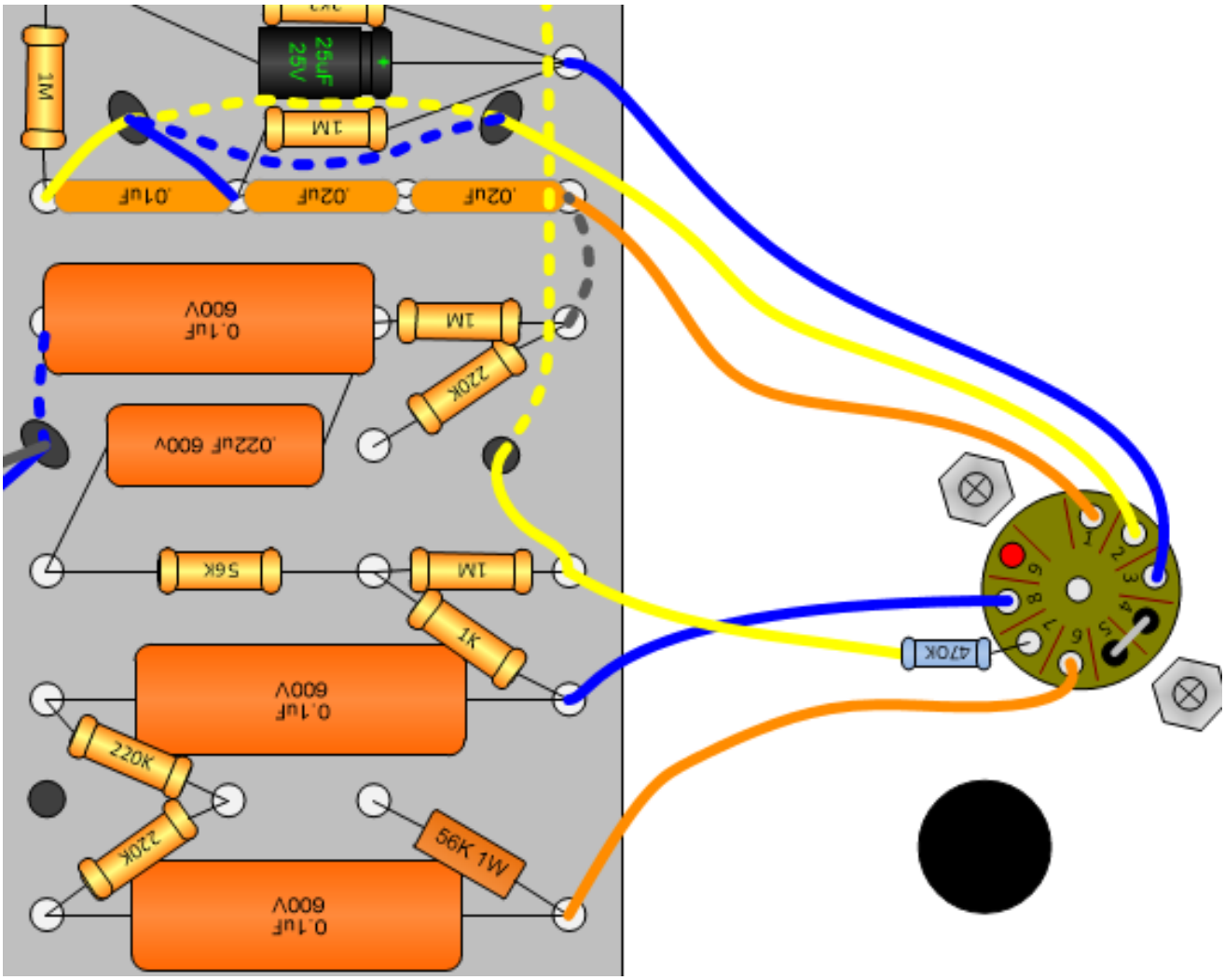
Connect the previously wired ORANGE lead from the 0.02uF disc capacitor to socket 4 pin 1.

Connect the .1uF OD capacitor / 1K resistor pair with a BLUE lead to socket 4 pin 8.

Connect the .1uF OD capacitor / 56K resistor pair with an ORANGE lead to socket 4 pin 6.

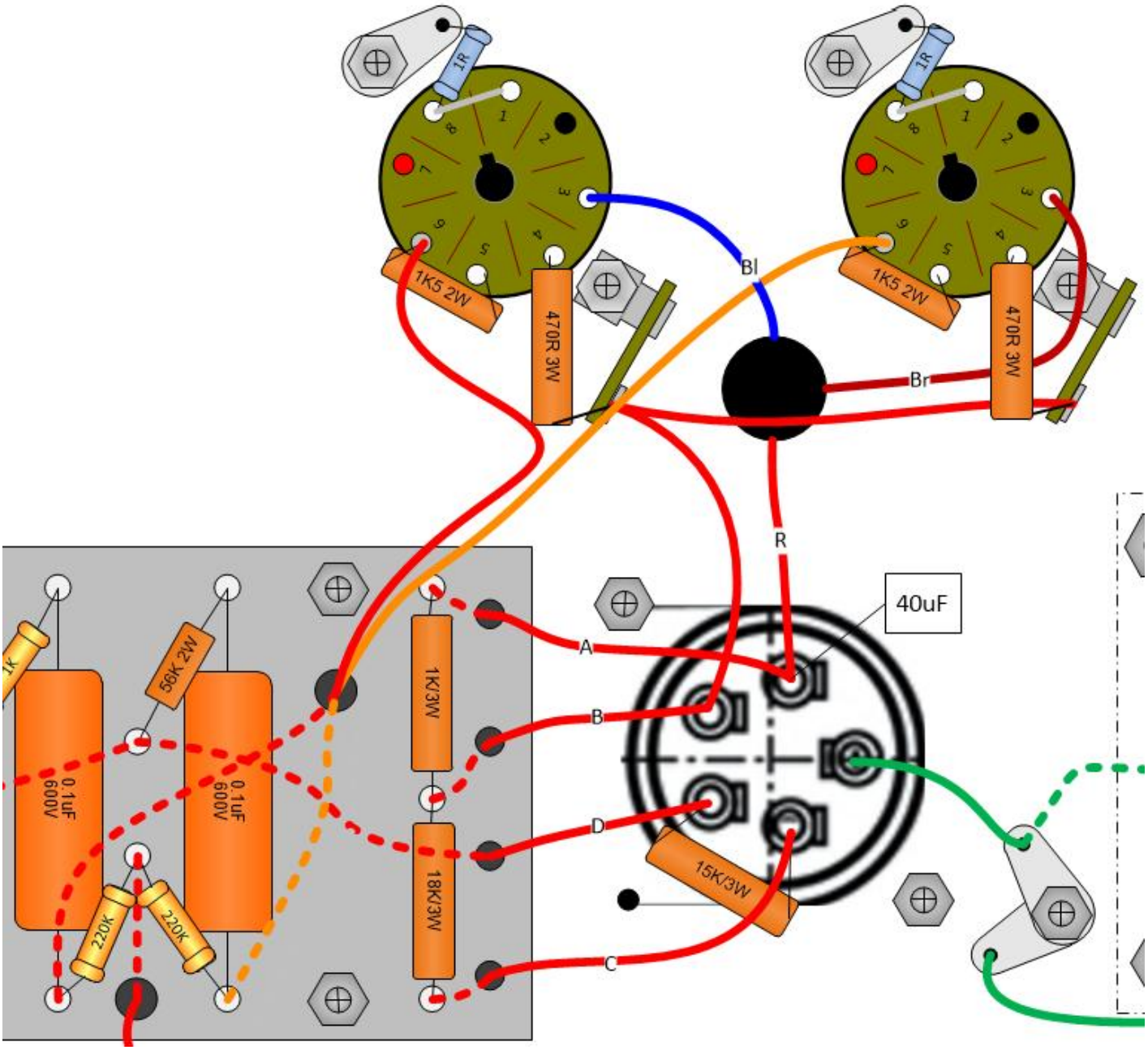
Wrap a 470K METAL FILM resistor to socket 4, pin 7 and solder it in place.

Put a 1-1/2" X ¼" shrink tube over the YELLOW through the board lead from the 1M resistor and solder the lead to the 470K resistor at socket 4, pin 7. Shrink the tubing with a heat gun.



Connect Power Tubes and Power Supply

Locate the two GRID leads. Red and ORANGE. Make sure you take note of which lead goes to which eyelet. A BLACK permanent mark on the end of one of them will help. Twist the leads together as they exit the board..



Connect the first lead from the 220K resistor (RED) to terminal 6 of V5.

Connect the second lead from the 220K resistor (ORANGE) to socket 5, terminal 6

Route neatly, trim to length and solder a jumper to each 470R 3W resistor on the terminal strips.

Route neatly, trim to length and solder a jumper from the 470R 3W resistor on socket 5, to the first 20uF terminal on the can-cap.

Route neatly, trim to length and solder the lead from the 1K/2W power resistor to the 40uF terminal on the can-cap. Call it LINE A

Route neatly, trim to length and solder the lead from the 1K/2W/18K 3W power resistor junction to the first 20uF terminal on the can-cap. Call it LINE B.

Route neatly, trim to length and solder the lead from the 18K 3W power resistor to the last 20uF terminal on the can-cap with an 18K power resistor. Call it LINE C

Route neatly, trim to length and solder the lead from the 56K 2W power resistor to the third 20uF terminal on the can-cap with an 15K power resistor. Call it LINE D

11 CONNECTING THE EYELET BOARD TO THE CONTROLS

Now is the time to make the connections from the controls to eyelet board and jacks

TIP: On a photo-copy of the layout, highlight the connections as you complete them to make sure they are done correctly.

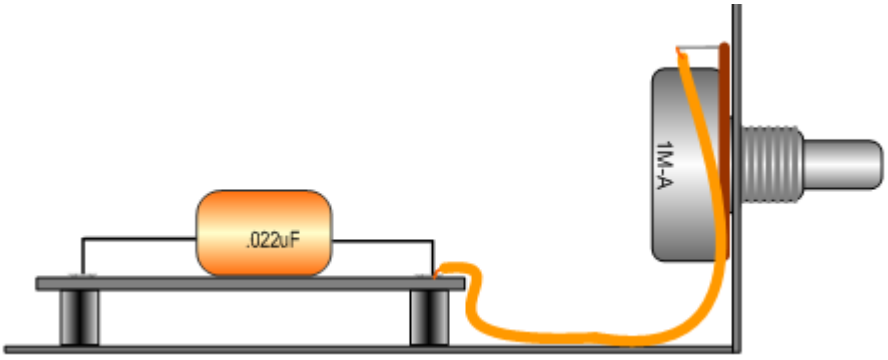
Identify the first eyelet and its destination point.

Route each control lead from the destination eyelet to the correct terminal while lying flat to the eyelet board and against the chassis and into the corners.

Once the connection is cool, press the wire so that it lies flat on the board and chassis with any excess tucked underneath the board.

Repeat for each eyelet that has a connection to another part.

The pictorial guide below is in addition to the layout in order to make the task as clear as possible.



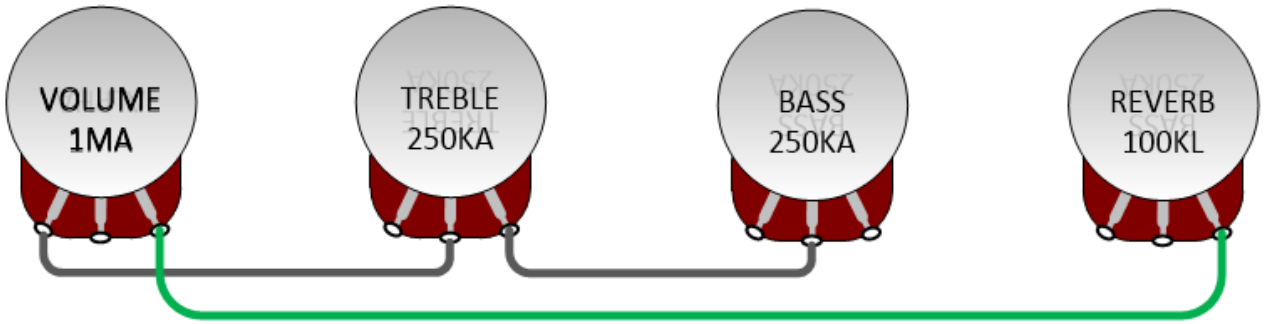
JUMPERS

Connect a GREEN jumper between VOLUME terminal 1 and REVERB terminal 1. Do not solder yet

Connect WHITE jumpers between. Do not solder yet

VOLUME terminal 3 and TREBLE terminal 2; Do not solder yet

TREBLE terminal 1 and BASS terminal 2. Do not solder yet



VOLUME – TREBLE – BASS CONTROLS

Route neatly and Connect the loose, long YELLOW lead to the VOLUME CONTROL terminal 2.

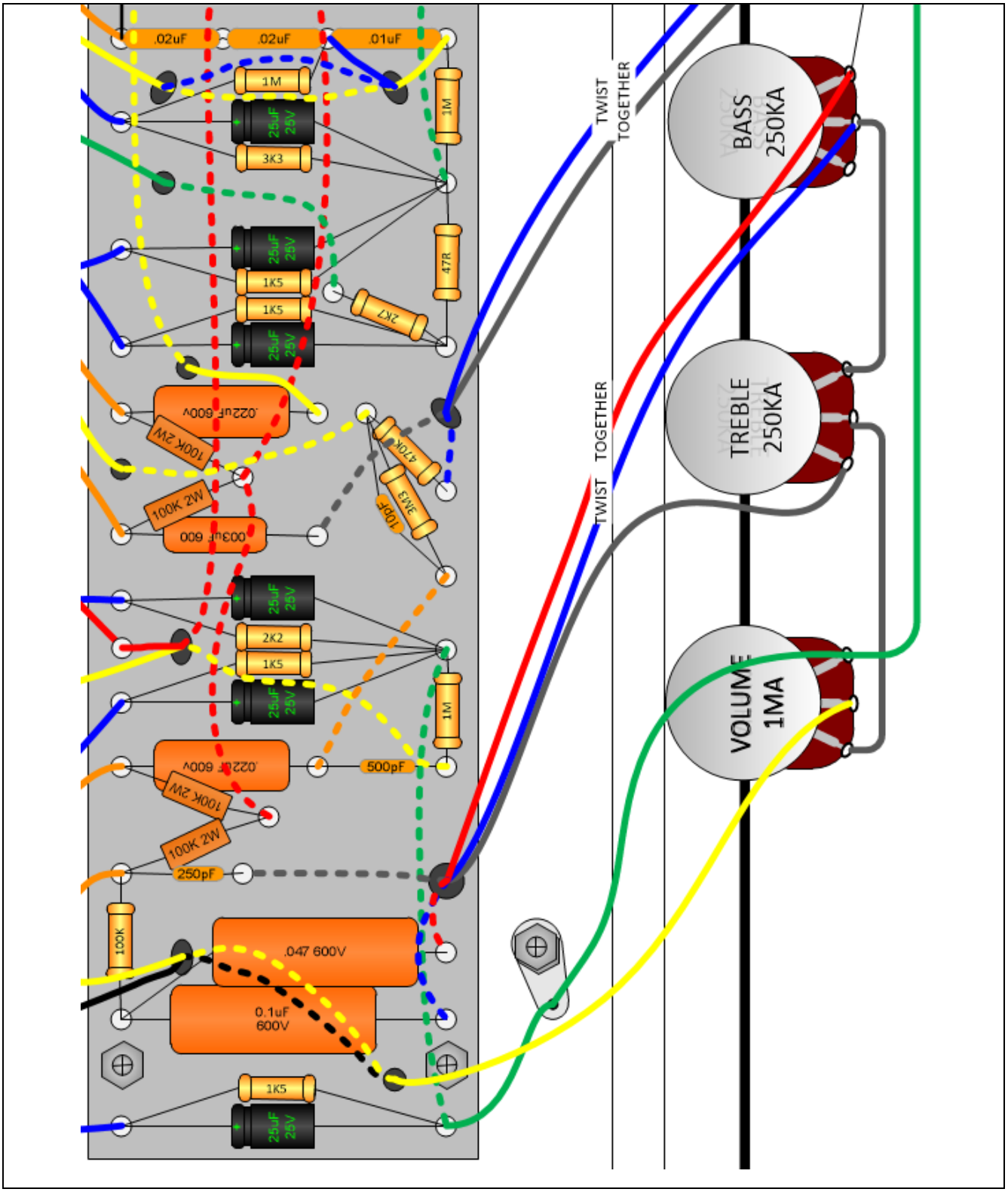
Route neatly and Connect a GREEN lead from VOLUME CONTROL terminal 1 to the PRE GND chassis lug.

Twist three leads for the TREBLE and BASS controls, from the board.

Route neatly and Connect the BLACK lead from the 250pF treble cap to to the TREBLE CONTROL terminal 3.

Route neatly and Connect the RED lead from the 0.047uF OD capacitor to to the BASS CONTROL terminal 1.

Route neatly and Connect the BLUE lead from the 0.1uF OD capacitor to to the BASS CONTROL terminal 2.


.02uF
.02uF
.01uF
1M
25uF 25V
3K3
1M
25uF 25V
1K5
1K5
47R
2K7
25uF 25V
.022uF 600V
100K 2W
470K
3N3
100pF
100K 2W
.003uF 600
25uF 25V
2K2
1K5
25uF 25V
1M
.022uF 600V
500pF
100K 2W
100K 2W
250pF
100K
.047 600V
0.1uF 600V
1K5
25uF 25V
TWIST
TOGETHER
TOGETHER
TWIST
BASS 250KA
TREBLE 250KA
VOLUME 1MA

REVERB – SPEED – INTENSITY CONTROLS

Twist two leads for the REVERB control, from the board.

Route neatly and Connect the BLACK lead from the .003uF OD Capacitor to the REVERB CONTROL terminal 3.

Route neatly and Connect the BLUE lead from the 470K resistor to the REVERB CONTROL terminal 2

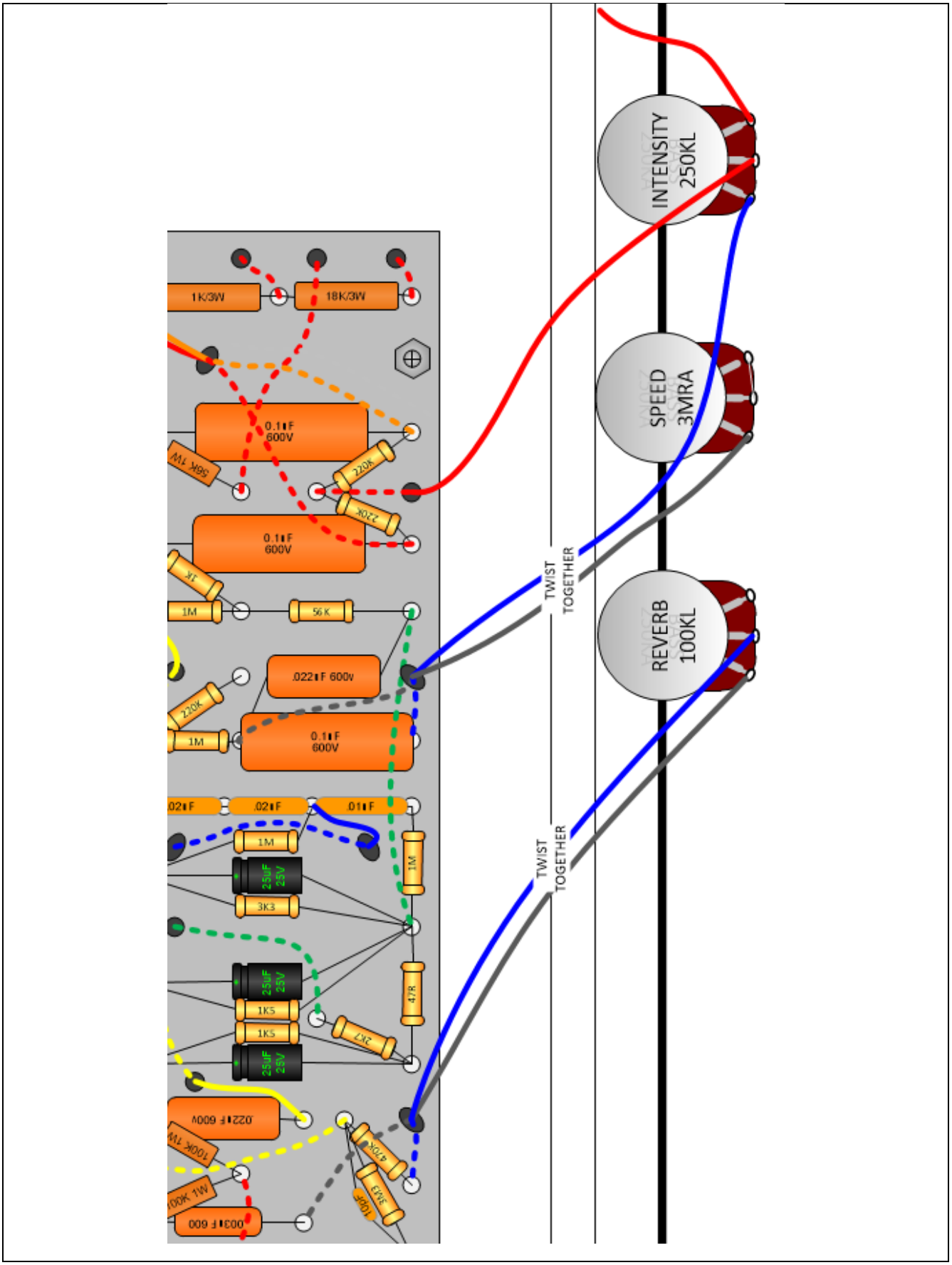
Twist two leads for the TREMOLO and INTENSITY controls, from the board.

Route neatly and Connect the BLACK lead from the 1M resistor to to the SPEED CONTROL terminal 3.

Route neatly and Connect the BLUE lead from the .1 OD capacitor to to the INTENSITY CONTROL terminal 3.

Route neatly and Connect the RED lead from the two 220K resistors to to the INTENSITY CONTROL terminal 2.

Connect a RED lead from BIAS CONTROL board the INTENSITY CONTROL terminal 1.


INTENSITY
250KL
SPEED
3MRA
REVERB
100KL
TWIST
TOGETHER
TWIST
TOGETHER
1K/3W
18K/3W
0.1µF
600V
56K 1W
220K
0.1µF
600V
1K
1M
56K
.022µF 600v
220K
1M
0.1µF
600V
.02µF
.02µF
.01µF
1M
1M
25UF
25V
3K3
25UF
25V
1K5
1K5
25UF
25V
2K7
47R
.022µF 600V
100K 1W
M1 300
.003µF 600
470K
10pF
3K3

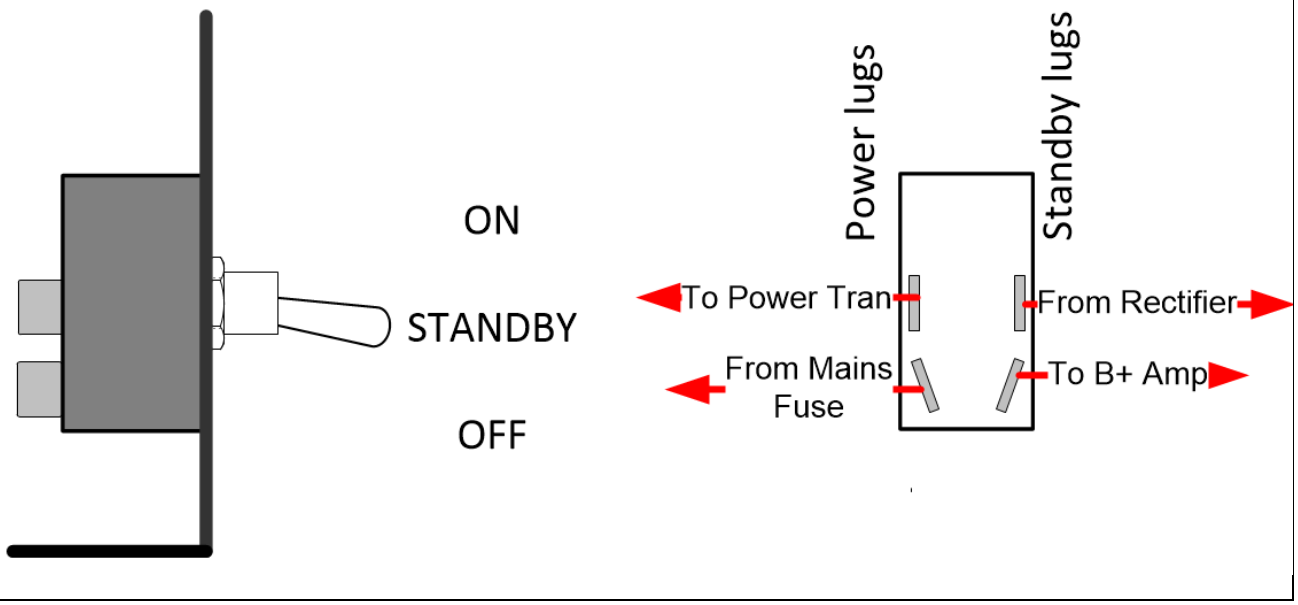
12 COMPLETE THE POWER TRANSFORMER SECONDARY WIRING.

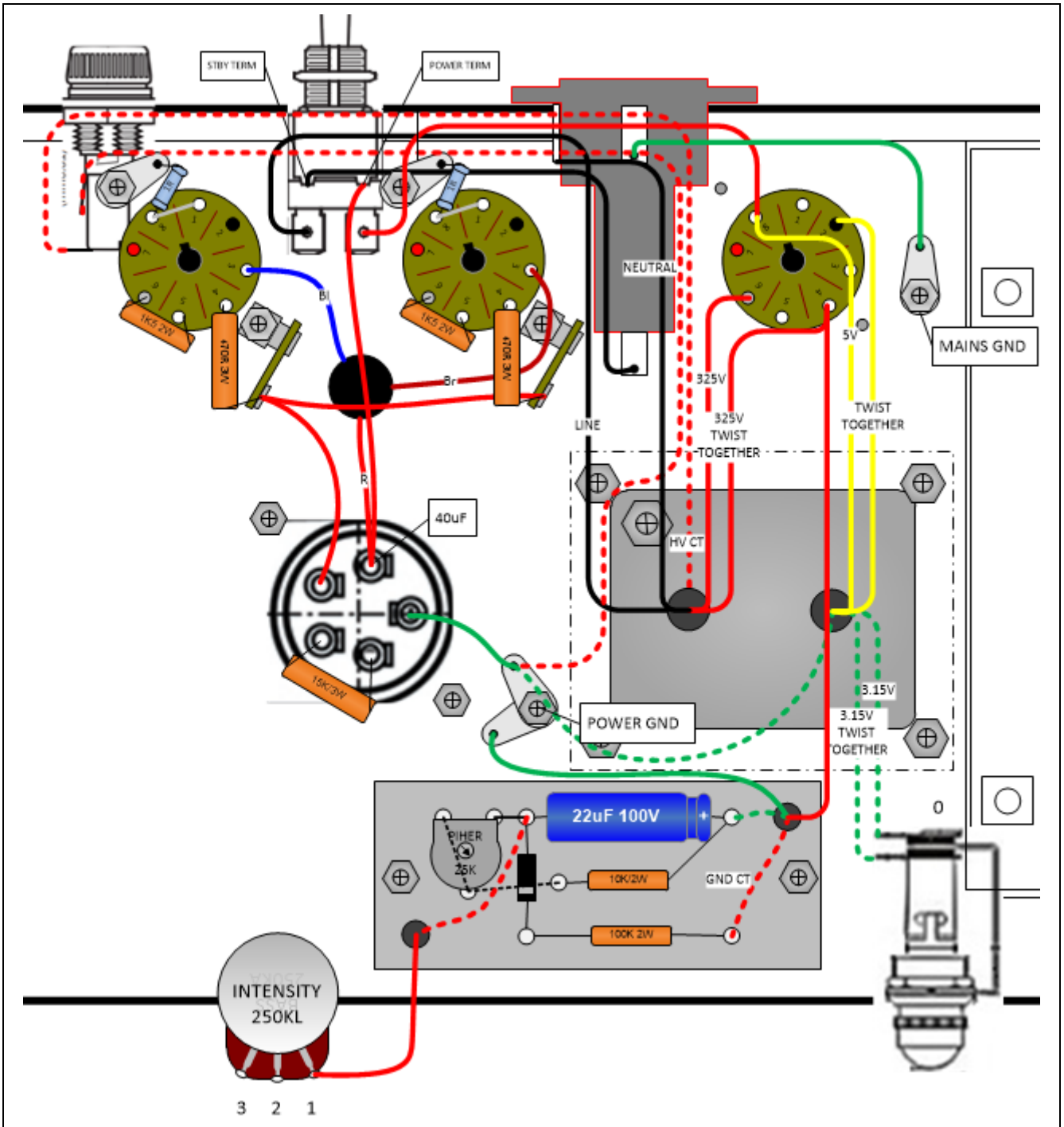
When we wired and tested the Power Transformer, all that was left to connect were the High Voltage (HV) RED leads and the STAND-BY Switch.

WIRING THE PROGRESSIVE POWER SWITCH

This amp has a special power switch that combines both POWER and STANDBY into one convenient switch. In one extreme position, the amp is OFF, in the middle position it is on STANDBY and in the third position it is in the ON position. This switch is not wired up like other power switches so follow the diagrams below and layout closely.

Make sure the switch is aligned with the lugs towards the chassis.





Neatly run a RED lead along the chassis between socket 7, pin 8 to one lug of the power switch terminal pair used for STAND-BY.

Neatly run a RED lead along the chassis between one lug of the power switch pair used for STAND-BY and the 40uF can cap lug.

Neatly run a RED lead along the chassis between the middle termial of the HV fuse and the POWER GROUND lug. ’

Neatly run the RED-WHITE dashed HV Centre Tap lead from the transformer lead, along the chassis to the end lug of the HV fuse.

Install a 500 mA SLO-BLO fues in the HV Fuse Holder.

Connect the 12” RED lead from the BIAS CONTROL BOARD to socket 7, terminal 4.

Connect the 6” GREEN lead from the BIAS CONTROL BOARD to a chassis POWER GROUND lug..

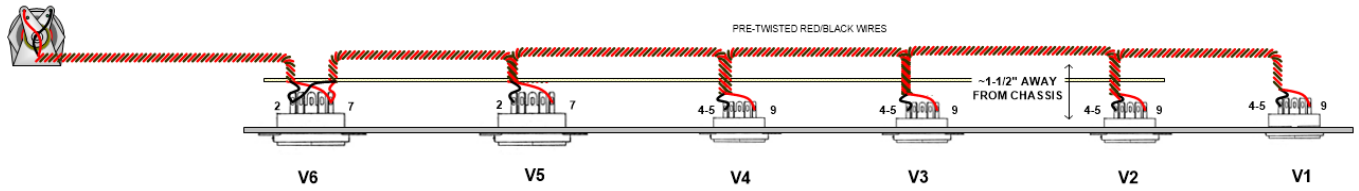
This completes the POWER TRANSFORMER SECONDARY and BIAS CONTROL BOARD wiring.

NOW <u>DOUBLE CHECK</u> YOUR WORK.

13 WIRE THE HEATERS

Heater leads “fly” above the tube sockets making neat right-angle bends to connect directly to the socket pins. Finish off by connecting a twisted pair back to the two indicator light terminals.

For the heater wires, the pre- twisted 22 gauge wires connect to the pilot lamp socket and then to the terminals of the first Power Tube then the second Power Tube. From there, the wires daisy chain across the preamp tubes, keeping the colours of wires connected to the tube sockets consistent. . This phasing or ‘polarity’ on the preamp heaters needs to be maintained. The two power tube sockets also should have their heaters wired in the same phase (using the same colours) to reduce hum.



Use the pre-twisted 22 gauge wire to minimize any hum.

Solder a RED and BLACK wire to each lug of the pilot light assembly.

Route the twisted pair wire tight to the chassis, along the corners to socket V6. Locate the centre of socket 6 and bend the wires at 90 degrees and cut them off at 2” long. Strip ½” of each wire and hook the BLACK lead onto V6, pin 2 and the RED lead onto pin 7.

Make a “U” shaped lead of pre-twisted wire that goes between V6 and V5 centres. Bend the ends 90 degrees and cut them off 2” long. Strip ½” of each wire and hook one end BLACK lead onto V6, pin 2 and the RED lead onto pin 7. Solder V6 pins. Hook the other end BLACK lead onto V5, pin 2 and the RED lead onto pin 7.

Make a “U” shaped lead of pre-twisted wire that goes between V5 and V4 centres. Bend the ends 90 degrees and cut them off 2” long. Strip ½” of each wire and hook one end BLACK lead onto V5, pin 2 and the RED lead onto pin 7. Solder V5 pins. Hook the other end RED lead onto V4, pin 9 and the BLACK lead onto pins 4 AND 5 together.

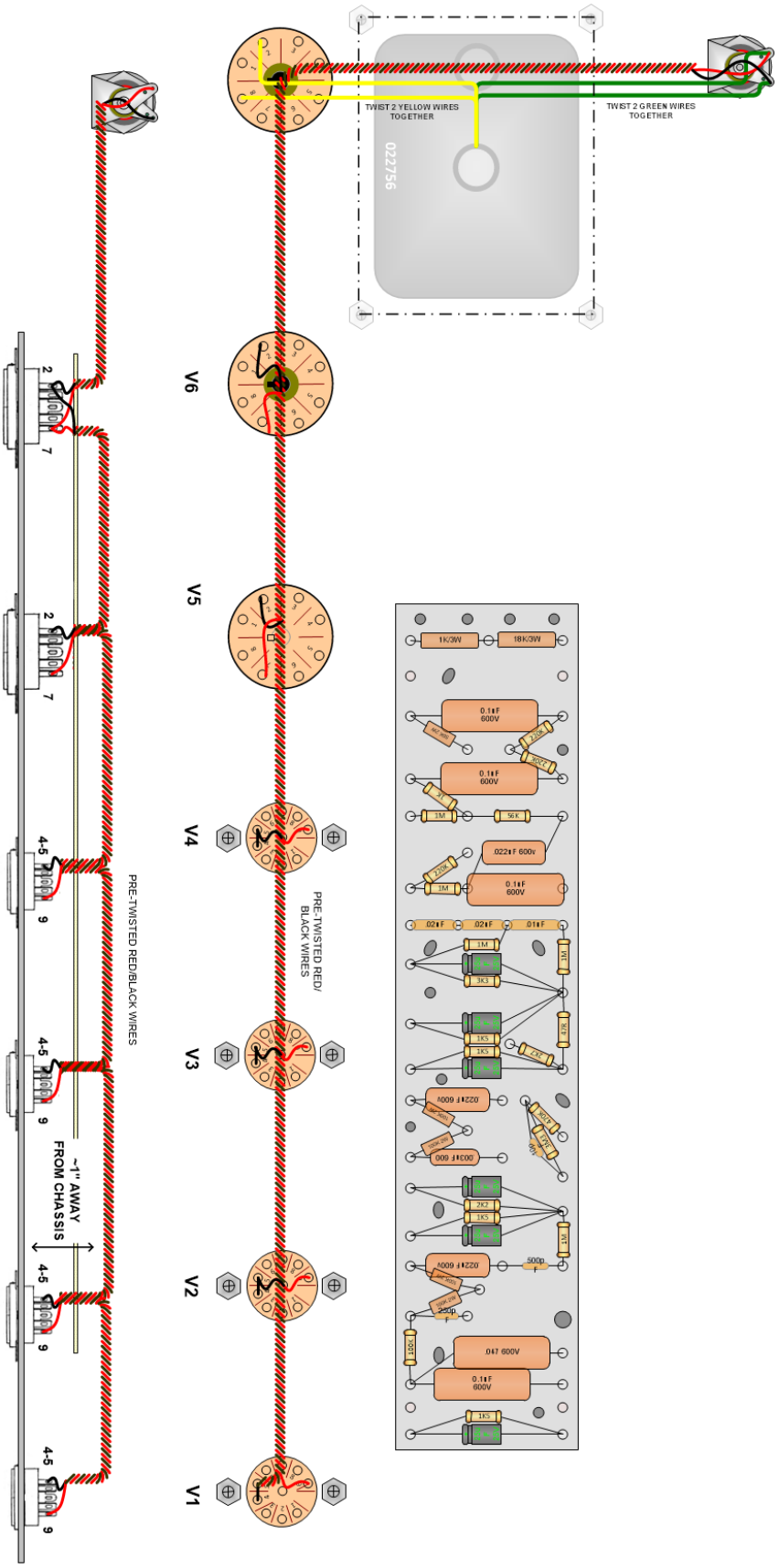
Make a “U” shaped lead of pre-twisted wire that goes between V4 and V3 centres. Bend the ends 90 degrees and cut them off 2” long. Strip ½” of each wire and Hook the other end RED lead onto V4, pin 9 and the BLACK lead onto pins 4 AND 5 together.. Solder V4 pins. Hook the other end RED lead onto V3, pin 9 and the BLACK lead onto pins 4 AND 5 together..

Make a “U” shaped lead of pre-twisted wire that goes between V3 and V2 centres. Bend the ends 90 degrees and cut them off 2” long. Strip ½” of each wire and Hook the other end RED lead onto V3, pin 9 and the BLACK lead onto pins 4 AND 5 together.. Solder V3 pins. Hook the other end RED lead onto V2, pin 9 and the BLACK lead onto pins 4 AND 5 together..

Make a “U” shaped lead of pre-twisted wire that goes between V2 and V1 centres. Bend the ends 90 degrees and cut them off 2” long. Strip ½” of each wire and Hook the other end RED lead onto V2, pin 9 and the BLACK lead onto pins 4 AND 5 together.. Solder V2 pins. Hook the other end RED lead onto V1, pin 9 and the BLACK lead onto pins 4 AND 5 together..

Neatly align all the heater wires.

When the heater wiring is complete it should look like the diagrams below with the fly-over connections.



14 FOOTSWITCH.

You may want to make these modifications to the footswitch if it is noisy (i.e. picks up ambient noise) or if it pops when foot switching.

GROUND THE ENCLOSURE

First make sure the reverb shield is grounded to the switch enclosure. Sometimes its not, and this turns the reverb circuit into a radio station or worse.

1. Pull the plastic back off of the footswitch.
2. Loosen and just pull out the Reverb switch.
3. Remove the paint from the enclosure around the hole.
4. Wrap a piece of bus wire around the loosened switch as close to the switch end as possible and solder it to itself.
5. Reassemble it in the enclosure and tighten it to the enclosure.
6. Attach the bus wire to the switch terminal the cable shield is attached to

VIBRATO CHANNEL LEAD

1. Desolder the wire connected to the Vibrato switch.
2. Solder a 47K Resistor to the wire and heat shrink over the wire and resistor so they stay together.
3. Resolder the 47K resistor to the Vibrato switch.

No more reverb pop.

You might need to adjust this value if your tremolo no longer turns all the way off. If you use over 100k the tremolo might keep going. 47K is enough to kill the pop and do the job. On most of those switches its just a single wire, and the ground jumps over. Put the 47K on the side that isn't grounded.

15 DOUBLE CHECK.

Double check that all the connections are made according to the layout and the layout is neat, tidy and organized.

1. When you finish assembling the amp, double-check the wiring and the components against the check-print layout and schematic. Look for any ‘missed’ connections. i.e. those that weren’t highlighted during your build.
2. Check the wiring and the components against the layout and schematic and any on-line pictures of “official” builds.
3. Test continuity for all the connections. Set your meter to continuity and follow the layout diagram to make sure all the connections are correct. Trace or highlight the connections on a copy of the layout provided with the kit to ensure the amp is wired correctly. Check everything

at least once! To test, touch each component's lead and touch the lead at the other connection.

4. Measure the resistances to confirm they are correct.
5. Measure the resistance from each part that has a ground connection to the chassis. Put your probe on the parts lead. All readings should be between 1 ohm and 0.1 ohm typically.
6. Make sure the Mains ground at the chassis is **very** tight.

16 START-UP PROCEDURE

WORKING INSIDE A TUBE AMPLIFIER SAFELY

Working inside a tube amplifier can be dangerous if you don't know the basic safety practices. If you aren't prepared to take the time to learn and apply the right precautions to keep yourself safe, don't work on your own amp. You can seriously injure yourself or get yourself killed.

UNPLUG Pretty self explanatory. Do not, ever, ever, leave the equipment plugged in and start work on it. Leaving it plugged in guarantees that you will have hazardous voltages inside the chassis where you are about to work.

SIT If the amp has been turned on recently, the caps will still have some high voltage left in them after the switch is turned off. Let it sit for five minutes after you turn it off.

DRAIN When you open up an amp, you need to find a way to drain off any residual high voltage. A handy way to do this is to connect a shorting jumper between the plate of a preamp tube and chassis ground. This jumper will drain any high voltage to ground through the 50k to 100K 2W plate resistor on the tube. To do this successfully, you will need to know which pins are the plate pins. Look it up for the amp you're going to be working on. You'll need to know this for the work anyway. Leave the jumper in place while you do your work. Remember to remove it when you finish your work. You can also permanently install a 220K 2W resistor on the B+ line to chassis ground to do this.

TEST Take your multimeter and ground the negative, black lead to the chassis. With the positive, red lead, probe the high voltage cap terminals or leads and be sure the voltage across them is low. Preferably to less than 10V.

CLOSE First take the shorting jumper out. Put the chassis back in the cabinet, making sure all of your tools, stray bits of solder, wire, etc. are out of it. You don't have to actually put all the screws and so forth back in if you believe more work might be needed, but make sure that the chassis is sitting stably in the cabinet and won't fall out.

First note that most meters have three input jacks (some have four) one is marked COM, the BLACK lead goes there. Another jack is marked V, ohm, mA, the RED lead goes there for most measurements. The third jack is a high current jack usually marked 10ADC (sometimes it is 20 or some other number). This jack is used only for high current measurements. The four jack models use separate jacks for current measurements, this makes accidentally setting the meter to a current mode harder, but it still can be set to resistance. For vacuum tube electronics we can usually ignore the high current mode. Put your test leads into the COM and V(ohm)mA jacks and leave them there.

MAKING A VOLTAGE MEASUREMENT

Before attempting to make a voltage measurement, think about the anticipated result.

- Is this a DC or AC voltage?
- How much voltage will be present?
- If things are not working correctly what is the highest voltage that I might find?

A voltage is ALWAYS measured between TWO points. Is one of those points CHASSIS GROUND? This is the most common case. If not, can you make a different measurement such that one of the measurement points IS

GROUND? If your measurements are all referenced to CHASSIS GROUND, you can then connect the black lead (Negative or Common) to the CHASSIS with a clip and probe the other test point with the RED (Positive) lead.

1. Set the selector switch on the meter to the range that is higher than the maximum anticipated voltage of the appropriate type (DC or AC). If the maximum anticipated voltage is not known, set the meter to the highest range available.
2. Wherever possible connect the meter into the circuit when the circuit is OFF, then power up the circuit without touching anything.
3. Read the meter. If the reading is lower than the next available lower range on the meter you may set the meter to a lower range while the circuit is on. When doing this touch ONLY the meter with ONE hand, and be careful to only lower the meter one range, allow the readings to stabilize (2 or 3 seconds) before proceeding further.

NOTE: ACCIDENTALLY SETTING THE METER TO A CURRENT OR RESISTANCE RANGE CAN DAMAGE THE METER, AND THE CIRCUIT IT IS CONNECTED TO. IF THE CIRCUIT HAS SUFFICIENT POWER THE METER CAN EXPLODE OR BURST INTO FLAMES. I KNOW FROM EXPERIENCE THAT THIS WILL HAPPEN IF YOU TRY TO MEASURE THE RESISTANCE OF THE WALL OUTLET. MOST MODERN METERS ARE "FUSE AND DIODE PROTECTED" THIS IS TO PREVENT FIREWORKS, BUT WILL NOT USUALLY SAVE THE METER FROM AN OVERLOAD OF THIS MAGNITUDE.

DISCHARGING THE POWER SUPPLY

If you need to service the amp after having it on, you must “discharge” the power supply capacitors. This is done by unplugging the amp, turning the power to the on position and letting it sit for 60 seconds or so. A 220K 2W resistor will drain the supply in about 60 seconds but always use a multi-meter to check the residual B+ voltage in the large filter capacitors to make sure it is fully discharged.

REMEMBER: DO NOT OPERATE YOUR AMP WITHOUT A LOAD

NOTE: On first power-up, we recommend you make and use a bulb limiter (or variac if you have one). It will keep you from destroying some very expensive parts if there is any problem with your amp. Typically use a 40W to start with.

The following the procedure to follow for the first power up of a new amp. Don’t give in into the temptation to "fire it up" as soon as the last solder joint is cold.

1. Complete all the basic circuit checks already mentioned before soldering the transformers into the rest of the circuit. **If you haven’t performed the Power transformer test, go back and do it now.** If you've already soldered in your trannies, take a minute to desolder the secondaries from the rest of the amp and go back and test them.
2. Install a 1 AMP SLO BLO GMD fuse and 500maA SLO BLO HV fuse.
3. Plug in the foot switch.
4. Plug in the RCA cables for REVERB IN and OUT. Follow the colour codes on the tank and rear panel labels.

NOTE: If you see or smell smoke when you turn on an amp, turn it off immediately and re-check the connections. It is common for new tubes to emit an odour upon initial start-up.

4 **THIS IS IMPORTANT**: Before powering up **INSPECT DIODES, FILTER caps and CATHODE BYPASS capacitors**. You MUST have the **diodes and cap polarities correct**. This is critical but an easy mistake. If either the diodes or caps are wired in reverse, you can destroy the caps, diodes and possibly the power transformer!

5 If you have one, put the BULB LIMITER in circuit, and with **NO TUBES INSTALLED**, power up the amp and watch the following things as quickly as possible and roughly in this order:

a. pilot lamp comes on brightly; and
b. Test the 6.3 AC filament voltages and ensure they are on the correct pins for all tubes. Remember this is AC voltage, not DC so set your meter accordingly.

Measure Mains voltage at approximately 120 VAC

c. Measure Heater Voltage at approximately 6.6 VAC (@ 120 mains, no load)
d. Measure Rectifier Heater Voltage at approximately 5.6 VAC (@ 120 mains, no load)
e. Measure High Voltage across Rectifier pins 4 - 6 at approximately 640 VAC (@ 120 mains, no load)

If you don't have a Bulb limiter, you can also use a VARIAC to slowly bring up the mains voltage.

If you have neither, device, TRIPLE CHECK your connections before turning it on.

6 Power down. If any of these tests did not agree and find the problem by looping back to the beginning of this checklist.

7 **INSTALL ONLY THE 5AR4 RECTIFIER TUBE**. Connect your DC voltmeter between B+ (lead A) and ground. Power up again and check the B+ voltage. With no other tubes installed, all the filter caps will charge up to the same voltage. The voltage should be approximately 435VDC. (@ 120 VAC mains)

a. Check for high voltage DC at all the filter caps.
b. Check for high voltage DC at all plate resistors including the preamp.
c. Check for negative DC voltage on the BIAS POT wiper. In the approximate -40VDC range.
d. <u>Set BIAS POT to the maximum negative value (fully clockwise)</u>

If all is well, check that B+ is at the OT on all the primary taps. Without the power tubes installed, the OT primary should be at B+. If not, something is wrong at the OT. Power down immediately and check for shorts of the OT primary. This should not be the case, however. An OT short should have been caught by now by checking B+ levels in the previous steps. This is really just a final sanity check to really make sure the trannies aren't going to be killed by any mistakes. Leave the amp on for a few minutes and make sure neither tranny is getting warm. The OT should stay dead cold and the PT should get just a little warm supplying the pilot lamp and heaters. Make sure the negative voltage is being generated and check that it gets to the power tube grids and is adjustable with the bias pot.

8 If everything checks out, turn the amp off and wait for the caps to drain. (Since there are no tubes installed, the caps take a little longer than usual to bleed down.

9 Remove the Bulb Limiter if you were using one.

KEEP IN MIND that every time you power up from now on that B+ will be high. In all the following steps, allowing B+ to bleed to zero volts at each power down is implied.

B+ MUST be discharged to safely continue messing with the amp guts. A 220K 2W bleeder resistor from the 40uF can-cap to ground will take a minute to bring B+ down to safe levels. **Measure the voltage before proceeding to the next step.**

10 INSTALL THE PREAMP TUBES 3 – 12AX7, 1 – 12AT7, 2 – 6V6 and RECTIFIER TUBE 5AR4 OR 5U4GB

a. Adjust all controls as follows:
   Vol – 1 (off)
   Treble, Bass – 6
   Reverb – 1 **REV pedal OFF**
   Speed –1
   Intensity – 1 **VIB pedal OFF**
   25K BIAS TRIM POT all the way down (fully clockwise) at most negative voltage
b. Power up again and check the B+ voltage.
c. Check that voltages at preamp plates (pins 1,6) and cathode (pins 3,8) are close to the chart provided. For example, the plates of V1, V3 at 140-160 and cathodes at 1.1-1.3
d. If voltages are in line, power down. If not, check your connections. One often missed connection when there is no cathode voltages, or high plate voltages, is the eyelet board grounding.

11 INSTALL THE POWER TUBES 2 – 6V6

12 IMPORTANT: **CONNECT A SPEAKER (OR SPEAKER LOAD) TO THE SPEAKER JACK**. Familiarize yourself with the 1R bias test resistors from pin 8 to the ground lug.

13 Turn on the amp and wait a minute for the tubes to warm up.

14 Switch the amp from Standby to ON.

Using a DMM set at mV, clip the BLACK (negative) test probe to a ground lug. Clip the other into the RED bias test point jack at the end of one of the 1R 1W BIAS RESISTORS. Check and slowly move the TRIM POT with a small screwdriver until bias current is 18-22mV. (The bias taps convert mA to mV so you'll be reading on the millivolt scale. The readings are as follows:

6V6 Bias	15 ma min	23 ma max

With the bias set correctly, (-32VDC reference) you can now test all the voltages and compare them to the voltage chart. Measure and write down the B+ levels at each filter cap. Also write down cathode and plate voltages at all stages and also the screen grid voltage at the power tubes. Note that when measuring V4a, set the **VIB PEDAL TO OFF**. Compare all the DC voltages to those on the supplied **RETRO '64 6V6 VOLTAGE CHART**. As a rule of thumb, the triode gain stages should have ~1V on the cathode, 0V on the grids and ~1/2 to 1/3 B+ on the plates. If the DC voltages are not in the ballpark (within 50% of the general rule just stated), take some time to check the circuitry of the offending stage.

15 Check plate and screen voltages at the power tubes. You should see about 380-390 VDC on the plates (pin 3) and 370-380VDC on the screens (pin 4).

16 Check plate voltage at the phase inverter. You should see about 205VDC. (This will vary depending on the tube and may range between 200 and 240VDC)

17 Check plate voltages at V1 and V3. They will be about 160VDC, Cathode voltages will be in the 1.3VDC range. Check plate voltage at v2, it should be in the 350 - 380 VDC range with about 8 VDC on the cathode.

If the plate voltages for V1, V3, V4 seem low, adjust R21. REDUCE IT BY 3K to increase about 5V on plates.

You should be able to hear a little hiss or hum from the speaker. Hopefully this is at a low level, requiring your ear up next to the speaker to tell (make sure the Overdrive control is pushed in –i.e. Off). If hiss and hum is loud at this point, there are problems. If there is dead silence, something is likely wrong, too.

18 Plug in your guitar and turn the Vol control to 12:00. Listen for any unusual noises. There should be no volume from the speaker since the Master is still turned off.
19 Gradually turn up the VOLUME while strumming the guitar. At 9:00 the volume should be reasonably loud. .
20 Check the foot switch for correct operation…REVERB, TREMOLO.
21 With the footswitch in the REVERB position, turn up the REVERB control to achieve desired level of REVERB.
22 With the footswitch in the TREMOLO position, turn up the SPEED and INTENSITY control to achieve desired level of TREMOLO.

If all has gone according to plan, you should be grinning from ear to ear by now! Congrats!!!

NOTE: *When you install the* ***Reverb Tank into the cabinet,*** *make sure that the* ***RCA connections are facing frontwards,*** *toward the speaker baffle*.

If you have any problems, get on the forum and get some help. Don't get frustrated. Most start-up problems are relatively simple mistakes. Go back to the Double-Check part of the build.

QUICK RETRO ‘64 PLAYER SETUP

The Retro ‘64 amp is known for its gorgeous clean tones and luscious reverb. The vibrato has been deepened to get closer to typical Fender optocoupler-driven versions. The amp’s cathodyne phase inverter creates “brown” distortion when you really start to drive the power tubes. This overdrive really pushes the mids and lows. The grid resistor to the cathodyne PI has been modified to reduce harsh and flabby distortion typical with the original design. Use the Bass and Treble controls to dial this in. With humbuckers, try turning the bass down a bit. Give single coils a little more bass. With single coils you can also push the reverb a little higher, which would make humbuckers become muddy. The ’64 Retro is a great pedal platform, especially for modulation and delay. Fuzz pedals will most likely need a mids-booster such as an over- drive to keep your tone from being lost in the mix, because fuzz pedals typically cut mids drastically. Overdrive pedals on their own are great to kick in when you want to jump to the front of the mix. Still, a great way to play this amp is to plug straight in and go. This amp is a classic because it has everything you need for that clean Americana tone and that drenched surfy jangle, all in one box!

USING THE RETRO ‘64 CONTROLS

VOLUME adjusts the signal strength coming out of the tone stack, and going into the second tube stage. Think of this as a gain control primarily for your clean channel.

BASS adjusts low frequencies in your amplifier.

TREBLE adjusts the high frequency response. At near-maximum settings, you may also notice an increase in gain.

REVERB Use this control to add REVERB Level to your tone when the footswitch is engaged

SPEED Use this control to adjust the TREMOLO oscillation speed to your tone when the footswitch is engaged.

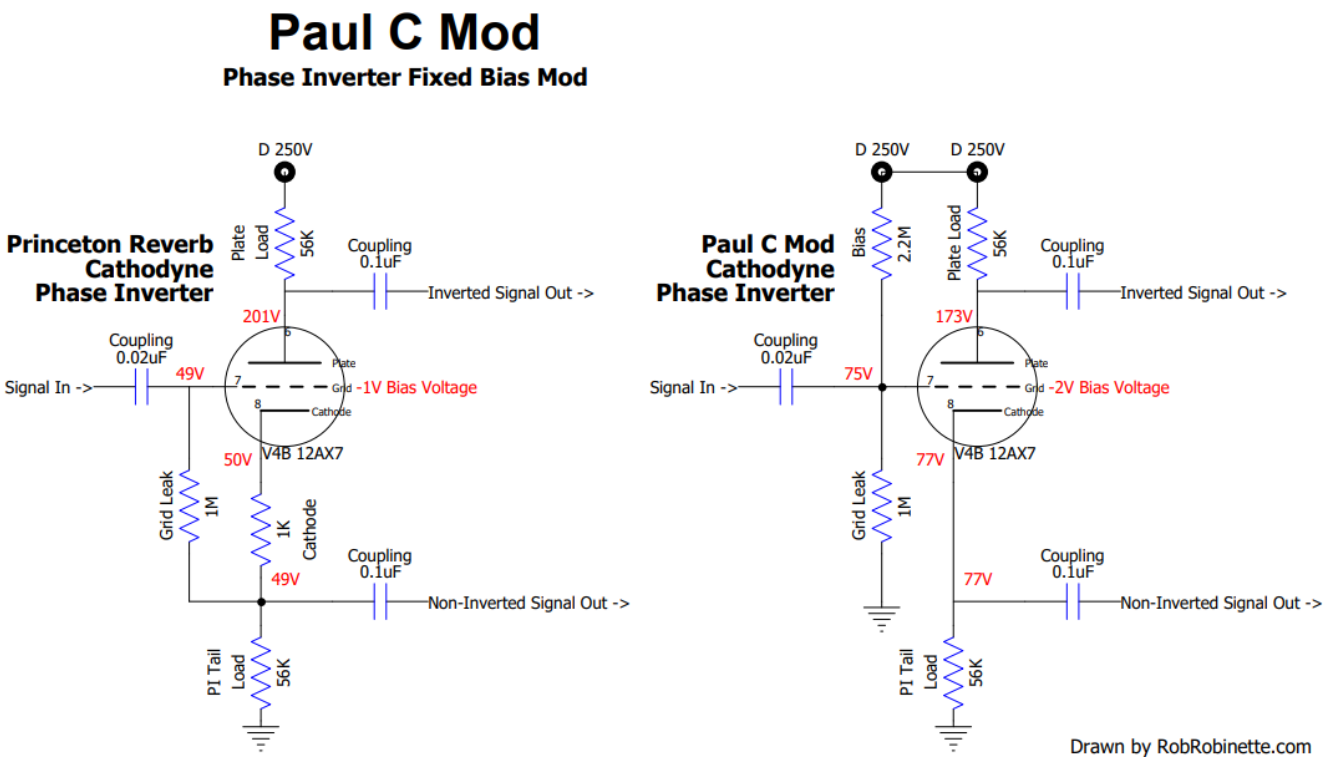
INTENSITY Use this control to adjust the TREMOLO intensity to your tone when the footswitch is engaged.

2-BUTTON FOOT SWITCH is used to control the REVERB and TREMOLO ON/OFF modes.

RETRO ‘64 TWEAKS

Many acknowledged Princeton Reverb tweaks have already been included in the ’64 Retro design in advance but there are a few more you can try.

- To Deepen the TREM, reduce R35 to 500K or 330K. This can easily be done by adding a second 1M across the existing 1M.
- Reduce Bass drive by replacing the 25uF cathode bypass caps with 5uF on V1.
- Negative Feedback Resistor – You can disconnect the NFB resistor but some people find "No NFB" too loose and hairy to be of use to them. If you don't like "No NFB" you can parallel a second 5K6 resistors for 2K7 of NFB resistance. Or you can parallel the 5K6 with a 2K2 resistors for 1.6k of "Heavy" NFB resistance (twice normal NFB). The more feedback, the less gain, the cleaner the amp and maybe the more sterile.
- Add a mid control pot. Put a 25K pot in series with R7, 6K8, MID resistor, wired as rheostat. Connect wiper of pot to ground
- The reverb works exactly like the standard Fender reverb in that the effect starts about 1.4 on the dial and by about 2.2 on the dial is approaching "cavernous" and may be too much for some. What might work well is to swap the 100K **linear** taper Reverb pot for a 100K **audio** taper pot. Now the action that was between 1.4 and 2.2 is spread between 1.5 and 5 and you have more control over the "touch/taste" of reverb although it will come on fast at the top of the range.
- You may also consider swapping out the 4AB3C1B 2-spring long decay tank for a 9AB2C1B 3-spring medium decay tank just to reduce the "splash" a bit.
- Substitute a 12AU7 for the 12AT7 to reduce reverb drive and potential distortion
- Stokes Mod. If you need more clean headroom and volume than what an efficient speaker can do then the "Stokes Mod" is an easy way to get it. The phase inverter is powered by the "D" power node at the 56K resistor with only 240 volts on tap. The Stokes Mod changes the phase inverter's power source to the unused "C" power node located at the extreme upper left of the circuit board. The C power node has 320 volts to give the phase inverter a larger signal swing before distortion begins for added headroom. This mod is often combined with the Paul C Mod in the next section. When used with 6V6 power tubes the Stokes Mod will shift the balance between preamp and power tube distortion toward the power tubes which you may or may not prefer.
- The Paul C Mod changes the cathodyne phase inverter from cathode bias to fixed bias to offer more clean headroom and give a more balanced output. You will get a more balanced phase inverter output but the decrease in sweet sounding even order harmonics will sterilize the tone a little. According to Rob Robinette, this is one of the most "didn't like it so I reversed it" mods for the Princeton Reverb. The mod creates a fixed bias on the phase inverter grid by creating a voltage divider with the 2M2M Bias resistor and 1M Grid Leak. If the phase inverter power node is around 250v the grid voltage after the divider will be +75v. The cathode will be at an even higher voltage of around +77v due to the 56k PI Tail Load resistor so the difference between grid and cathode results in a fixed negative bias voltage of around -2v. This leads to a more balanced bias point and reduces harsh "double frequency" overdrive created by excessive plate clipping.

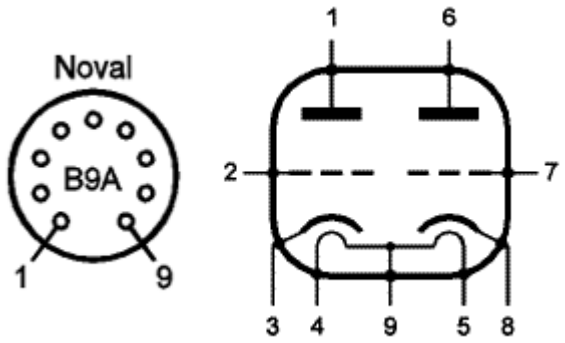


- around -2v. This leads to a more balanced bias point and reduces harsh "double frequency" overdrive created by excessive plate clipping.

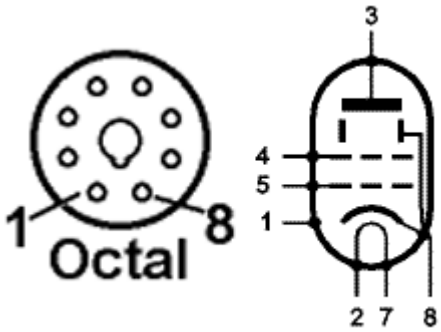
RETRO ‘64 6V6 VOLTAGE CHART

AC Mains Voltage 120VAC; B+ 435 VDC no tubes; With Tubes: B+ (A) 387 VDC; B 377 VDC; C 300 VDC; D 237 VDC

6V6 Bias	22 ma @ -33 VDC Bias Voltage	



12AX7 / 12AT7



6V6

TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1 - PRE (12AX7/ECC83)	149	--	1.29	--	--	151	--	1.26	--
V2 - REVERB (12AT7)	376	--	7.25	--	--	376	--	7.25	--
V3- PI/TREMOLO (12AX7/ECC83)	151		1.25	--	--	155.5		1.27	--
V4- PI/TREMOLO (12AX7/ECC83)	232		2.1	--	--	185.8		51.5	--
V5 6V6	--		385	376	--	--		--	
V6 6V6	--	--	385	376	--	--	--	--	

* Varies with bias pot setting

READ THIS INFORMATION CAREFULLY

THERE ARE VOLTAGES INSIDE THIS AMPLIFIER IN EXCESS OF 450 VDC.

THE PROJECTS DESCRIBED IN THESE PAGES UTILIZE POTENTIALLY FATAL HIGH VOLTAGES. IF YOU ARE IN ANY WAY UNFAMILIAR WITH HIGH VOLTAGE CIRCUITS OR ARE UNCOMFORTABLE WORKING AROUND HIGH VOLTAGES, DO NOT RISK YOUR LIFE BY BUILDING THEM.

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APPENDIX 1 - CALCULATING POWER TUBE BIAS

To calculate bias, there are two pieces of information you need to know: Your amplifier's power tube plate voltage, and the published value for maximum plate dissipation for the power tubes used in your amplifier.

NOTE – ***Plate voltage is measured between pin 3 of the POWER tube and ground***.

Maximum plate dissipation for 6V6s = 14W. for JJ but Vintage tubes are more like 12W

The formula for calculating bias is as follows:

$$\frac{maximum\ plate\ dissipation}{amplifier\ plate\ voltage} \times percent\ of\ max.\ dissipation \times 1000 = bias\ current\ (mA)$$

In most cases, amplifiers are biased between 50% and 75% dissipation. We suggest a bias for the Retro '64 to approximately 15mV-22mV reading on a DMM.

As an example: $\frac{12W}{410VDC} \times 70\% \times 1000 = 20.4\ mA$ <- set your bias to this

You might wonder why your DMM is set to millivolts and not milliamps – simply, we have a 1 Ohm resistor placed between the probe jacks and ground to convert a current reading to a voltage reading across the resistor. That way, a bias current of 24mA measures as 24mV on your DMM.

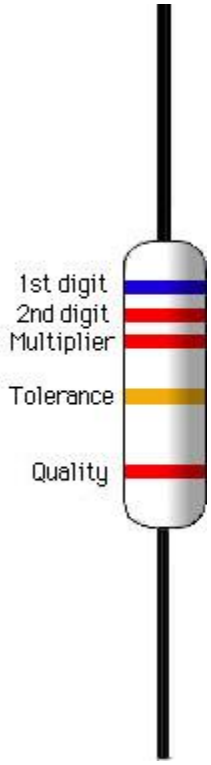
NOTE – Only set your DMM to mV for measuring bias on the Retro '64 amplifiers. Not doing so may damage your DMM.

APPENDIX 2 - HOW TO READ RESISTOR COLOR CODES

FIRST THE CODE

BLACK	BROWN	RED	ORANGE	YELLOW	GREEN	BLUE	VIOLET	GRAY	WHITE
0	1	2	3	4	5	6	7	8	9

HOW TO READ THE COLOR CODE



First find the tolerance band, it will typically be gold (5%) and sometimes silver (10%).

Starting from the other end, identify the first band - write down the number associated with that color; in this case BLUE is 6.

Now 'read' the next color, here it is RED so write down a '2' next to the six. (you should have '62' so far.)

Now read the third or 'multiplier' band and write down that number of zeros.

In this example it is two so we get '6200' or '6,200'. If the 'multiplier' band is BLACK (for zero) don't write any zeros down.

If the 'multiplier' band is Gold move the decimal point one to the left. If the 'multiplier' band is Silver move the decimal point two places to the left. If the resistor has one more band past the tolerance band it is a quality band.

Read the number as the '% Failure rate per 1000 hour'. This is rated assuming full wattage being applied to the resistors. (To get better failure rates, resistors are typically specified to have twice the needed wattage dissipation that the circuit produces.) 1% resistors have three bands to read digits to the left of the multiplier. They have a different temperature coefficient in order to provide the 1% tolerance. At 1%, most error is in the temperature coefficient - i.e. 20ppm.

APPENDIX 3 - HOW TO READ CAPACITOR CODES

Large capacitor have the value printed plainly on them, such as 10.uF (Ten Micro Farads) but smaller disk types along with plastic film types often have just 2 or three numbers on them?

First, most will have three numbers, but sometimes there are just two numbers. These are read as Pico-Farads. An example: 47 printed on a small disk can be assumed to be 47 Pico-Farads (or 47 puff as some like to say)

Now, what about the three numbers? It is somewhat similar to the **resistor code**. The first two are the 1st and 2nd significant digits and the third is a multiplier code. Most of the time the last digit tells you how many zeros to write after the first two digits, but the standard (EIA standard RS-198) has a couple of curves that you probably will never see. But just to be complete here it is in a table.

milli, micro, nano, pico

1 mili Farad (or any other unit) is 1/1,000th or .001 times the unit. (10^{-3})

1 micro = 1/1,000,000 or 0.000 001 times the unit (10^{-6})

1 nano = 1/1,000,000,000 or 0.000 000 001 times the unit (10^{-9})

1 pico = 1/1,000,000,000,000 or 0.000 000 000 001 times the unit (10^{-12})

Table 1 Digit multipliers

Third digit	Multiplier (this times the first two digits gives you the value in Pico-Farads)
0	1
1	10
2	100
3	1,000
4	10,000
5	100,000
6 not used	
7 not used	
8	.01
9	.1

Now for an example: A capacitor marked 104 is 10 with 4 more zeros or 100,000pF which is otherwise referred to as a 0.1 µF capacitor.

Most kit builders don't need to go further but there is sometimes a tolerance code given by a single letter.

So a 102K is a 1,000 pF with +/-10% tolerance

Typical Capacitor Markings

Code	pf	nf	uF
510	51	0.051	.0000510
181	180	0.18	.00018
501	500	0.5	.0005
102	1000	1.0	.001
122	1200	1.2	.0012
152	1500	1.5	.0015
202	2000	2.0	.002
222	2200	2.2	.0022
472	4700	4.7	.0047
502	5000	5.0	.005
103	10000	10	.01
123	12000	12	.012
203	20000	20	.02
223	22000	22	.022
473	47000	47	.047
104	100000	100	.1
684	680000	680	.68

Table 2 Letter tolerance code	
Letter symbol	Tolerance of capacitor
B +/	0.10%
C +/	0.25%
D +/	0.5%
E +/	0.5%
F +/	1%
G +/	2%
H +/	3%
J +/	5%
K +/	10%
M +/	20%
N +/	0.05%
P +100%	0%
Z +80%	20%

APPENDIX 4 - FAQ

Q: Where can I find more help and support?

A: Sign up at the Trinity Amps Forum and check the “Resources” section or post a question in the Retro ‘64, Lightning Strikes or, 18 Watt forums.

NOTE: B+ stands Battery Plus == B+ and came from the old days of tubes. B+ is measured at the intersection of the rectifier DC output and the first filter cap.

On an Retro ‘64, it is measured between the 40uF can-cap and chassis ground. It should be about 420 VDC with tubes, with 120 VAC mains.

Q: Does it make a difference as to what orientation I choose to make sure the power switch operates correctly, i.e. on is on and off is off?

A: It does it make a difference as to what orientation you choose to make sure the switches operate correctly. Put a switch in any position and measure the resistance across two terminals on the side. "ON" is where resistance is zero. Then rotate the switch so that UP is ON (US style).

Q: The picture and layout show a grounding screw next to the IEC plug, the chassis is not drilled for one. Can I run the ground to the common star ground that the power transformer.

A: To meet electrical safety code, the mains ground must be connect by itself to the chassis. It is best to drill a hole to connect the 120 V ground to a bolt that fastens to the chassis.

Don't run the 120 V ground to the common star ground.

Q: I assume that the shield is only attached to the pot; it is NOT connected to the tube socket?

A: Yes. Do not connect shield at both ends on the volume pot OR input cables.

Q: The wire looks to be two basic sizes, "thin" and "thick". From the pictures, it looks like the "thin" is used for the pot wiring and the "thick" is for the tube sockets. Is this correct?

A:

Use 20/22 Gauge solid for hook up to tubes;

Use 20/22 Gauge, twisted tightly for tube heater wiring;

Use 20/22 Gauge solid/stranded for hook up to pots/front panel; and

Use 18 gauge, stranded, 600V for power supply hook up - to transformers, rectifier, standby etc.

Use 18 gauge, stranded, for connection from IEC to POWER SWITCH

Tip: Re-use cut-offs from the transformers for power supply hook up.

Q: What should I use for the jumper wires on the back of the eyelet board?

A: Use the provided solid 22 ga or the stranded supplied for jumpers,

Q: For the input jacks with shielded cable:

a): I should be using the shielded wire which is the thick gray/BLACK wire that you supplied about 3' of. Does the shield braid from both lines go to the common tip lug on the lower jack while the core line goes to the individual tip lugs on both jacks? I want to make sure I am interpreting the drawing correctly.

b). The other end of the shield does NOT get connected to the tag strip at V1, correct?

c). Each pair of input jacks gets only one resistor, correct? Can I lace one lead of the resistor through both jacks for the connection?

A: Take a look at the drawing of the input jacks. That should help you out. Use the shielded wire which is the heavy BLACK wire. The core goes to the hot. At the other end, the shield does NOT get connected to the tag strip at V1.

Q: How are the three terminal tag strips next to V1 were supposed to be mounted, looked at the pictures on line and found they go under the V1 socket mounting nuts.

A: Yes. They are part of the socket mounting. Use the 4-40 nuts supplied to fasten them down.

Q: I assume you don't have to use both of the fiber/rubber washers when mounting the cliff jacks; I can get only one on, is this normal?

A: Yes

Q: Is there hardware provided for the grounding? Screws, star washers, nuts, etc.?

A: Yes, these should be in the kit.

NOTE: The power grounds should go to the separate hole to mount the grounding points.

Q: Is it easier to wire the pots up outside of the chassis on a cardboard with the pots spaced correctly, or can it be done easily in the chassis?

A: You can wire them in place, it's not too difficult. It is recommended that you wire the input jacks outside of the chassis with the approximate spacing to fit the panel.

TIP: It is easy to solder up the input jacks by putting them "inside out". Use a set of jack locations to the right of the normal channel and mount the jacks in their final orientation, but mounted outside of the chassis with the mounting screw inside the chassis. This keeps the orientation and spacing correct and provides a lot of room to solder the resistor, jumpers grounding wire and shielded wires. Then, when done, remove the completed jacks, mount them correctly inside the chassis and tighten up the mounting screws and solder up the other end of the shielded wires to the tag strips at V1.

TIP: More, larger format, colour pictures and the schematic & layout that are helpful in the build are posted on the Trinity Forum – Resources Section. Right click on them to download if you want print in large, colour format.

TIP: Sometimes it is hard to decode the resistors colours. It is a good idea to check the resistances of these parts before assembly.

TIP: Use insulation tubes from the wiring on the resistor / cap leads around the tubes and pots by using longer pieces of insulation stripped from the supplied 20 ga wire.

APPENDIX 5- RETRO '64 BILL OF MATERIALS

Description	Qty	Check
RETRO 64 1-10 GUITAR AMPLIFIER		
RETRO 64 CAPACITORS	**1**	
CAPACITOR - 600V 716P SERIES POLYPROPYLENE CAPACITANCE: .0033 UF	1	
CAPACITOR - VISHAY BC, CERAMIC DISC, D SERIES, RADIAL LEAD 0.01 µF	1	
CAPACITOR - VISHAY BC, CERAMIC DISC, D SERIES, RADIAL LEAD 0.02 µF	2	
CAPACITOR - 600V, 716P SERIES, POLYPROPYLENE, CAPACITANCE: .022 UF	3	
CAPACITOR - 600V, 716P SERIES, POLYPROPYLENE, CAPACITANCE: .047 UF	1	
CAPACITOR - 600V, 716P SERIES, POLYPROPYLENE, CAPACITANCE: .1 UF	4	
CAPACITOR - 500V, SILVER MICA, ± 5% 10pF	1	
CAPACITOR - 500V, SILVER MICA, ± 5% 250pF	1	
CAPACITOR - 500V, SILVER MICA, ± 5% 500pF	1	
CAPACITOR - 50V, AXIAL LEAD ELECTROLYTIC 25uF 25V	6	
CAPACITOR - VISHAY BC, ALUMINUM ELECTROLYTIC, AXIAL LEAD 22uF 100V	1	
CAPACITOR - JJ ELECTRONICS, 500V, 40/20/20/20µF, ELECTROLYTIC	1	
RETRO 64 RESISTORS	**1**	
RESISTOR - 1 WATT, CARBON FILM, 5% TOLERANCE 100K	2	
RESISTOR - 1 WATT, CARBON FILM, 5% TOLERANCE 1K	1	
RESISTOR - 1 WATT, CARBON FILM, 5% TOLERANCE 1K5	5	
RESISTOR - 1 WATT, CARBON FILM, 5% TOLERANCE 1M	5	
RESISTOR - 1 WATT, CARBON FILM, 5% TOLERANCE 220K	4	
RESISTOR - 1 WATT, CARBON FILM, 5% TOLERANCE 2K2	1	
RESISTOR - 1 WATT, CARBON FILM, 5% TOLERANCE 2K7	1	
RESISTOR - 1 WATT, CARBON FILM, 5% TOLERANCE 3M	1	
RESISTOR - 1 WATT, CARBON FILM, 5% TOLERANCE 3K3	1	
RESISTOR - 1 WATT, CARBON FILM, 5% TOLERANCE 470K	1	
RESISTOR - 1 WATT, CARBON FILM, 5% TOLERANCE 47R	1	
RESISTOR - 1 WATT, CARBON FILM, 5% TOLERANCE 56K	1	
RESISTOR - 1 WATT, CARBON FILM, 5% TOLERANCE 6K8	1	
RESISTORS - 0.5 WATT, METAL FILM, 1% TOLERANCE, RESISTANCE: 10 KOHM	1	
RESISTORS - 0.5 WATT, METAL FILM, 1% TOLERANCE, RESISTANCE: 68 KOHM	2	
RESISTORS - 0.5 WATT, METAL FILM, 1% TOLERANCE, RESISTANCE: 1 MOHM	1	
RESISTOR - 56K VISHAY BC, 2 WATT, POWER METAL FILM	1	
RESISTOR - 1R 1%, 1 WATT METAL FILM	2	
RESISTOR - 10K VISHAY BC, 2 WATT, POWER METAL FILM	1	
RESISTOR - 1K5 VISHAY BC, 2 WATT, POWER METAL FILM	2	
RESISTOR - 100K VISHAY BC, 2 WATT, POWER METAL FILM	5	
RESISTOR - 1K VISHAY BC, 3 WATT, POWER METAL FILM	1	

RESISTOR - 18K VISHAY BC, 3 WATT, POWER METAL FILM	1	
RESISTOR - 15K VISHAY BC, 3 WATT, POWER METAL FILM	1	
RESISTOR - 470R VISHAY BC, 3 WATT, POWER METAL FILM	2	
RETRO 64 POTENTIOMETERS	**1**	
POTENTIOMETER - ALPHA,100K LINEAR, 3/8 BUSHING"	1	
POTENTIOMETER - ALPHA, 1M AUDIO, 3/8 BUSHING"	1	
POTENTIOMETER - ALPHA, 250K AUDIO, 3/8 BUSHING"	2	
POTENTIOMETER - ALPHA, 250K LINEAR, 3/8 BUSHING"	1	
TRIMMER - PIHER, SINGLE TURN, TOP ADJUST, HORIZONTAL PCB MOUNT, 25K	1	
POTENTIOMETER - CTS 3M REVERSE AUDIO POT PLASTIC SPLINE SHAFT	1	
RETRO 64 SOCKETS	**1**	
SOCKET - BELTON, 9 PIN, MINIATURE, TOP MOUNT	4	
SOCKET - BELTON, MICALEX, 8 PIN OCTAL, MIP	3	
TUBE SHIELD - FOR 9-PIN MINIATURE, ALUMINUM, MULTIPLE COLORS, COLOR: ALUMINUM	4	
TUBE CLIP - BELTON, FOR OCTAL, SOLD INDIVIDUALLY	3	
RETRO 64 JACKS	**1**	
1/4 JACK - SWITCHCRAFT MONO OPEN CIRCUIT	1	
1/4 JACK - SWITCHCRAFT MONO SHUNT TIP	3	
SCREWS & FASTENERS SHOULDER WASHER 3/8"	2	
RCA JACK FRONT PANEL-MOUNT, RED	2	
RCA JACK FRONT PANEL-MOUNT, WHITE	2	
RETRO 64 TUBES	**1**	
VACUUM TUBE - 12AT7 / ECC81, JJ ELECTRONICS	1	
VACUUM TUBE - 12AX7 / ECC83, JJ ELECTRONICS	3	
VACUUM TUBE - 6V6, JJ ELECTRONICS	2	
VACUUM TUBE - 5AR4 / GZ34, JJ ELECTRONICS	1	
RETRO 64 TRANSFORMERS	**1**	
HEYBOER RETRO'64 HEAVY DUTY POWER TRANSFORMER	1	
HEYBOER RETRO'64 HEAVY DUTY OUTPUT TRANSFORMER	1	
PRINCETON REVERB TRANSFORMER	1	
RETRO 64 HARDWARE	**1**	
RECEPTACLE - AC, MATES WITH S-W123 & S-W124 WITH FUSE HOLDER	1	
FUSE HOLDER - 3AG-TYPE TWEED STYLE RIGHT ANGLE SPADE LUG	1	
FUSE - SLOW BLOW, 250V, 3AG, 0.25" x 1.25" 0.5A	1	
FUSE - SLOW-BLOW, 250V, MINIATURE, 5MM X 20MM, AMPERAGE: 1 AMPS	1	
GROMMETS & BUSHINGS GROMMETS & BUSHINGS SB 500-6 BLK	3	
DIAL LAMP - FENDER STYLE, PREMIUM PILOT ASSEMBLY	1	
JEWEL - SMOOTH STYLE, FOR LAMPS / BULBS	1	
DIAL LAMP - #47, T-3-1/4, 6.3V, 0.15A, BAYONET BASE	1	
TERMINAL STRIP - 3 LUG, 2ND LUG COMMON, HORIZONTAL	2	
KNOB - WITCH HAT, BLACK 1-10, SKIRTED, SET SCREW, THICK NUMBERS	6	
SWITCH - CARLING TOGGLE DPST 3 POSITION PLAY-STDBY-OFF	1	

LOCK WASHER - CARLING, INTERNAL TOOTH, FOR TOGGLE AND FOOT SWITCHES	4	
TERMINALS TERMINALS LUG LOCKING MATTE TINNED#4	3	
TERMINALS TERMINALS LUG LOCKING MATTE TINNED#6	3	
TERMINALS TERMINALS LUG LOCKING MATTE TINNED#8	2	
CHASSIS STRAP - MEDIUM 4" SPACING HOLES FOR MOUNTING AMPLIFIER	2	
CAN CAP BRACKET	1	
RETRO 64 FASTENERS	**1**	
MACHINE SCREW PHILLIPS PAN HEAD 4-40X5/16 L	17	
MACHINE SCREW PHILLIPS PAN HEAD 4-40X1/2 L	2	
HEX NUT EXT TOOTH LOCKWASHER 4-40	7	
FLAT WASHER #4	4	
MACHINE SCREW PHILLIPS PAN HEAD 6-32X3/4 L	6	
MACHINE SCREW PHILLIPS PAN HEAD 6-32X3/8 L	3	
HEX NUT EXT TOOTH LOCKWASHER 6-32	3	
INTERNAL TOOTH LOCK WASHER #6 CHROME	6	
MACHINE SCREW PHILLIPS PAN HEAD 8-32X3/8 L	3	
HEX NUT EXT TOOTH LOCKWASHER 8-32	11	
SCREW - #8-32 X 3.25", FOR CHASSIS STRAPS	4	
SAE FLAT WASHER #8	10	
STANDOFFS & SPACERS ROUND SPACER, .140 ID, .250 OD, .375 LENGTH	6	
RETRO 64 WIRE	**1**	
22 GUAGE SOLID CORE WIRE (VARIOUS COLOURS)	15	
22 GAUGE TWISTED PAIR RED/BLACK	4	
22 GUAGE STRANDED TINNED COPPER WIRE 600 VOLT PVC RED	2	
18 GUAGE STRANDED WIRE BLACK	1.5	
18 GUAGE STRANDED WIRE WHITE	1.5	
HEAT SHRINK TUBING 1MM	4	
HEAT SHRINK TUBING 3MM	4	
CABLE TIE 4 IN BLACK 18 LBS	10	
DIODE - GENERAL PURPOSE RECTIFIER, 1A, 1N4007	1	
REVERB TANK - MOD 4AB3C1B, LONG DECAY, 2-SPRING	1	
CABLE - RCA, SHIELDED, RIGHT ANGLE PLUGS	1	
RETRO 64 CHASSIS WITH TAPPED HOLES	1	
RETRO 64 REAR PANEL	1	
RETRO 64 FRONT PANEL	1	
RETRO 64 MAIN BOARD	**1**	
RETRO 64 BIAS BOARD	**1**	
CORD - POWER, 18 AWG, 3 CONDUCTOR, DETACHABLE, BLACK, IEC	1	
FOOTSWITCH BOX - FOR FENDER, TWO BUTTON, VINTAGE, RCA PLUGS, BLACK	1	

APPENDIX 6- INSTALLING COAXIAL CABLES

CO-AXIAL CABLE FOR INPUT JACKS

To get the spacing correct and facilitate assembly, remove the input jacks and install them from the outside with jack 2 on the left and jack 1 on the right, as in picture.

Locate the following parts:

2 – 68K Metal Film Resistors

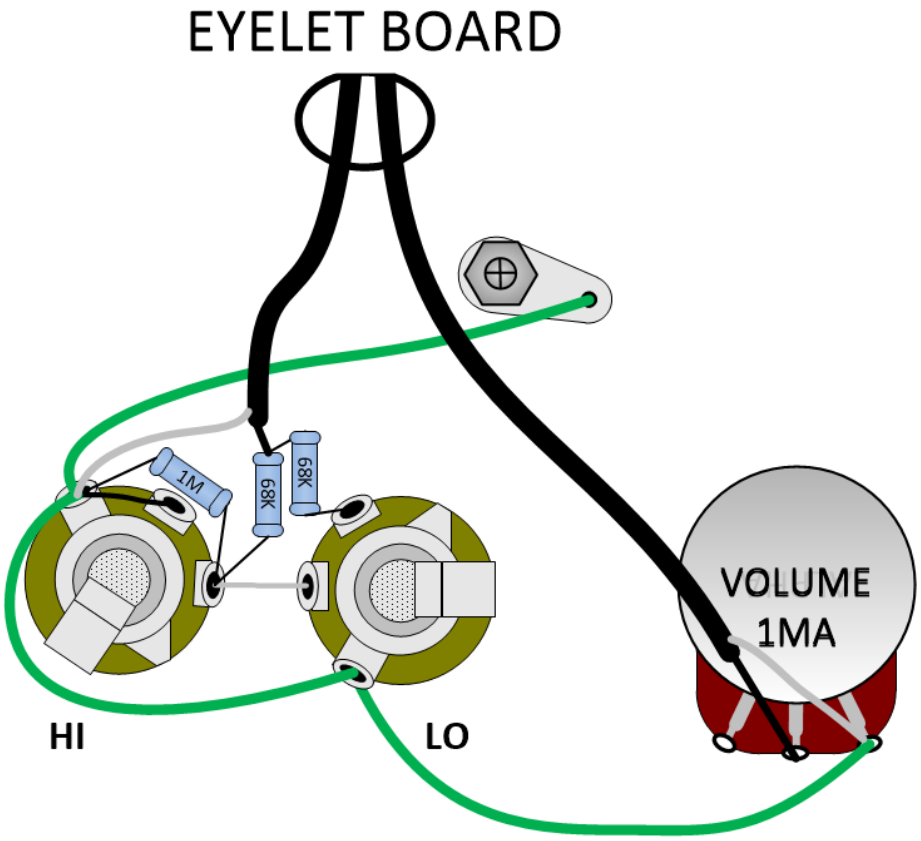
1 – 1M Metal film Resistor

Green ground wire length

Align the Input jacks according to the picture.

Wrap a jumper from the centre lug of lug of input jack 2 onto the right lug of input jack 1 .

Wrap a jumper from centre lug of input jack 1 onto the left lug of input jack 1.



Wrap the 1M resistor from the left lug of input jack 1 to the right lug of input jack 1 checking that it won't impede the input plug when inserted.

Twist one end of the pair of 68K resistor leads together and wrap one unconnected lead to the centre jumper between jack 1 and 2 and the other to the right lug of input jack 2. (see picture).

Cut enough wire to easily reach the PRE GND chassis lug and then Connect all ground wires to the input jack lugs.

Prepare a length of coaxial cable to reach from input jacks 68K resistor pair through or around the eyelet board, to V1, pin 2. At the input jack end, leave a minimum of 1" of coax shield and insulate it with 1/16" shrink tubing.

Attach the centre coaxial core lead to the 68K resistor pair and the shield lead to the ground connection on the jack as shown.

Solder all connections on the input jacks and trim any excess wires.

Remove the jacks and re-install them in the inside of the chassis along with shoulder washers, washers and hex nuts.

Fish the wire through/around the eyelet board and solder onto V1, pin 2

CO-AXIAL CABLE FOR VOLUME CONTROL

Prepare a length of coaxial cable to reach from Volume control, centre lug (wiper) jacks through or around the eyelet board, to V1, pin 7. At the Volume control end, leave 1" of coax shield. See picture

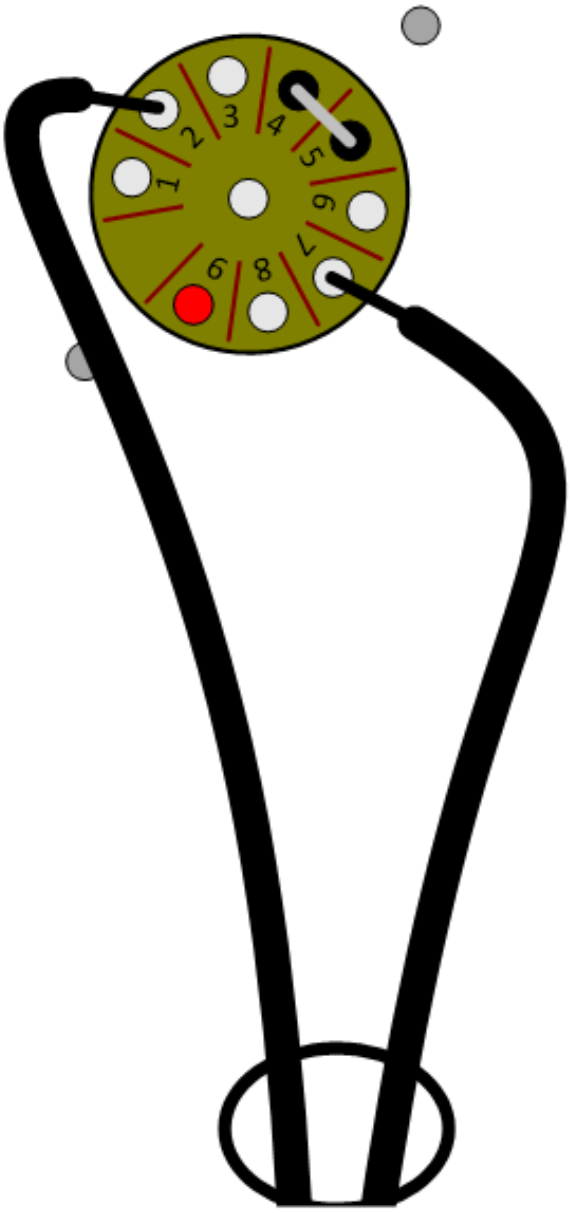
Attach the centre coaxial core lead to the centre lug and the shield lead to the ground connection on the potentiometer as shown.

Solder the centre connection on the volume control and trim any excess wires.

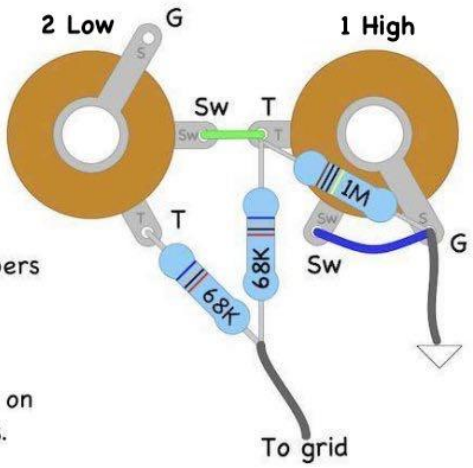
Connect the green grounding wires from Input jacks to Volume control ground and Treble control.

Fish the co-axial through/around the eyelet board and solder onto V1, pin 7

Solder the shield to the Volume control ground lug.



EYELET BOARD



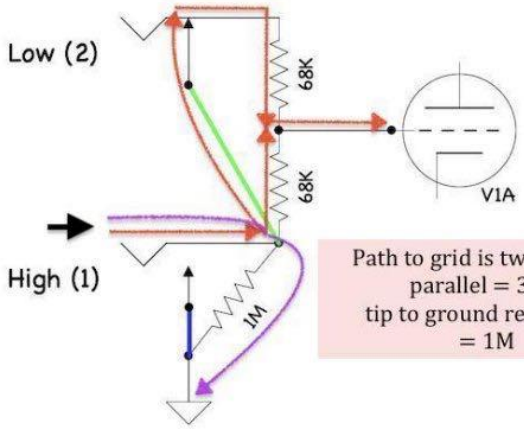
Fender 2-input wiring; jumpers are color-coded to match schematic below.

Note 68K grid stops appear on the board in vintage layouts.

D'tar input resistance tests
(measure using guitar cable or bare plug)
for 2-input Fender amps

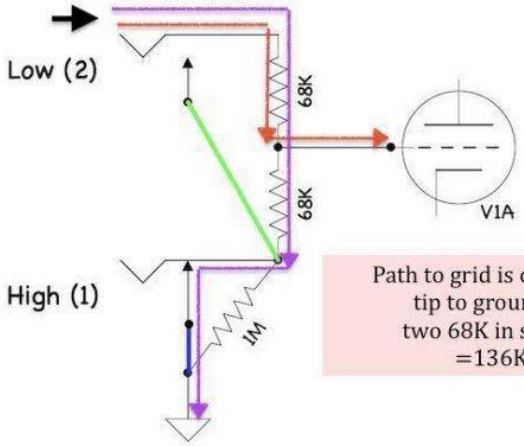
	"1" High	"2" Low
Tip to grid	34KΩ	68KΩ
Tip to chassis	1MΩ	136KΩ
Sleeve to chassis	<1Ω	<1Ω

Path to grid →
Path to ground →



Path to grid is two 68Ks in parallel = 34K; tip to ground resistance = 1M

High input active; plug opens hi switch



Path to grid is one 68K; tip to ground is two 68K in series =136K

Low input active; plug opens lo switch

SCHEMATICS AND LAYOUTS