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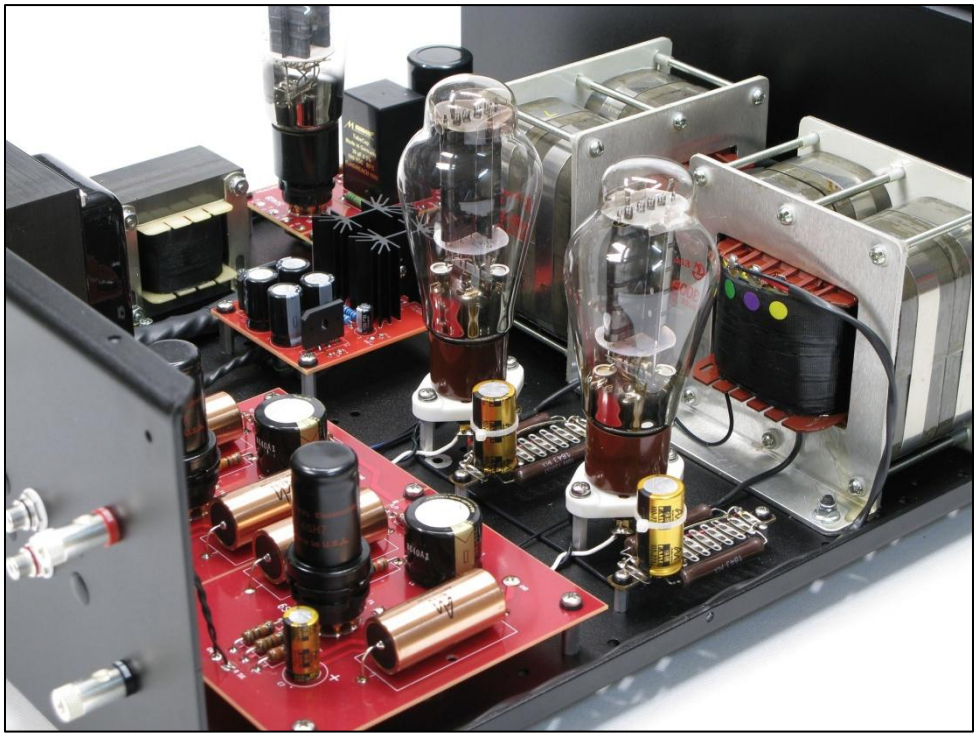
Mentor SET Power Amplifier



Construction Manual

2A/300B

Version 1.00-01 (Beta), October 2019

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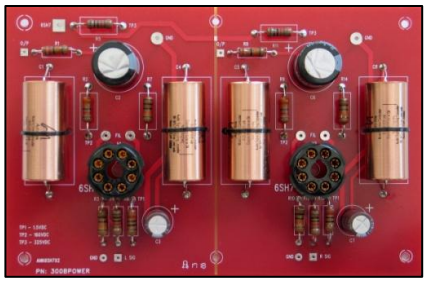

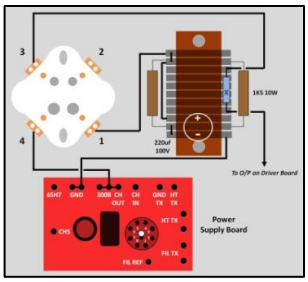

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Section 1

Introduction

Thanks for purchasing the ANK Audio Kits Mentor SET Power Amplifier. Our goal is to provide you with the highest quality kit that you will build from scratch with these instructions.

This is very high end and sophisticated piece of audio equipment that will surely become a showpiece of your sound system. We're excited that you have chosen to join us in enjoying and appreciating superb audio and we've created this manual to help guide you through each step of the build process with as much detail and clarity as possible. To facilitate the process, the manual has been divided into a number of sections, each focusing on a separate aspect of the system: follow the sections in order and we guarantee you not only a problem-free experience, but a pleasant time as well in doing so. If you are new to building kits — or if at any time you feel as though you need help or advice, feel free to contact us and we will do whatever it takes to get you on the right track.

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1.1 About ANK Audio Kits

Audio Note (UK) started out in the early '90s developing several DIY audio kits while they were building up their finished product business. DIY Audio has a long history and it was an opportunity for knowledgeable customers to take advantage of world class designs and components. Audio Note (UK) was focused on using the very finest materials and components custom-made to their specifications, across their entire product line — from custom film and electrolytic capacitors to tantalum resistors, transformers, binding posts, wires, etc. The Kit1 300B single-ended integrated amplifier was born during development of the Meishu and it proved to be extremely popular worldwide. The ANKit business was born!

As the finished product business and dealer network started to flourish, Audio Note (UK) eventually moved the kit business off into a separate division; thus, in 2004, Audio Note Kits started up and was supported by a website so that customers not located near Audio Note (UK) dealers could order kits and have them shipped direct. Kit development continued in earnest during the 2000s with development assisted by Audio Note (UK) engineering. Audio Note (UK) parts were used throughout the kits, depending on the various levels and budgets. By 2013, ANK Audio Kits (as it came to be called) had developed a wide product range covering all areas of two channel audio: a single-ended 300B product line, an EL34 Class AB and single-ended product line, digital to analog converters, pre-amplifiers, phono stages, and Audio Note (UK) speaker kits. The end result today is that customers worldwide with DIY skills can now build an entire high end audio system to their liking. With the introduction of higher product levels in 2013 and the release of the Level 5 Mentor Pre-amplifier and the DAC 5.1 Signature, some customers wanted these high end products assembled by a professional builder. As a result, ANK Audio Kits began offering this service for some Level 4 and 5 products so that a significant investment in a kit could be turned into a work of art! Since ANK Audio Kits was born in 2004, over 2,500 kits have been shipped to customers worldwide. Clearly, there is a real demand for high end audio kits and ANK Audio Kits has been delivering the goods now for 15 years.

We believe and hope that you will have a great experience building your kit and we look forward to hearing from you about your experience.

Regards,

Brian Smith — Director ANK Audio Kits

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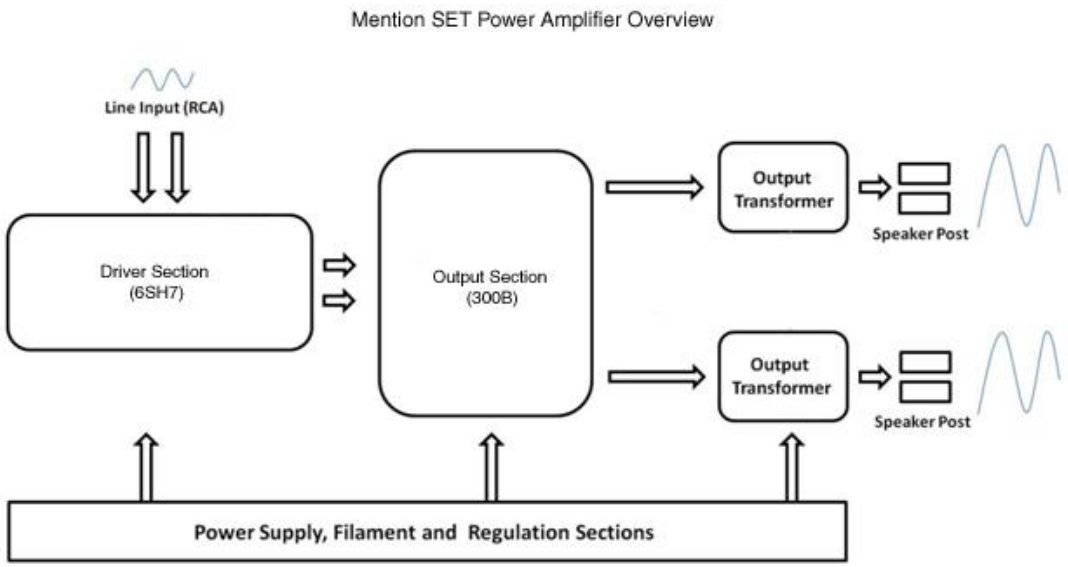
1.2 Basic Operation of the Amplifier

1.2.1 Overview

ANK Audio Kits is pleased to announce the new Mentor SET Power Amplifier. As anyone who has ever heard the transcendent musicality of a single-ended amplifier will tell you, there is something very special about the music that flows from (relatively) simple, classic Class A triode circuits. Perhaps it's the absence of crossover distortion, perhaps it's the gorgeous midband reproduction, perhaps it's the zero-feedback design, perhaps it's the organic (even desirable) expressiveness of the second harmonic; more likely it's all of this and more.

ANK Audio Kits and SET amplifiers go a long way back — right to the beginning in fact, with our Kit1 300B, which has had successive and very successful anniversary editions. Our single or parallel 300B or 2A3 Legend monoblocks are much sought after and the ultimate variant, our SET 300B Interstage C-Core monoblocks, is simply awesome!

The Mentor SET Power Amplifier's Power Supply uses the classic 5U4G(B) rectifier tube, a high quality Mundorf capacitor to smooth the AC power, DC 300B filaments, and a substantial Choke to supply clean, high quality DC power to the circuitry while assuring dead quiet operation. The 2 6SH7 driver tubes, selected by Andy Grove, Audio Note (UK)'s Senior Design and R&D Engineer, for reasons related to input impedance and power amplifier sensitivity, are wired in a pentode configuration to drive the 300B or 2A3 triodes, which in turn produce either 8.5W or 3.5W per channel respectively driving the EI-Core or quad C-Core output transformers. In our experience, even 3.5W is usually plenty of power for most listening, especially with higher efficiency speakers.[1]



[1] We recommend a minimum of 88db speaker sensitivity.

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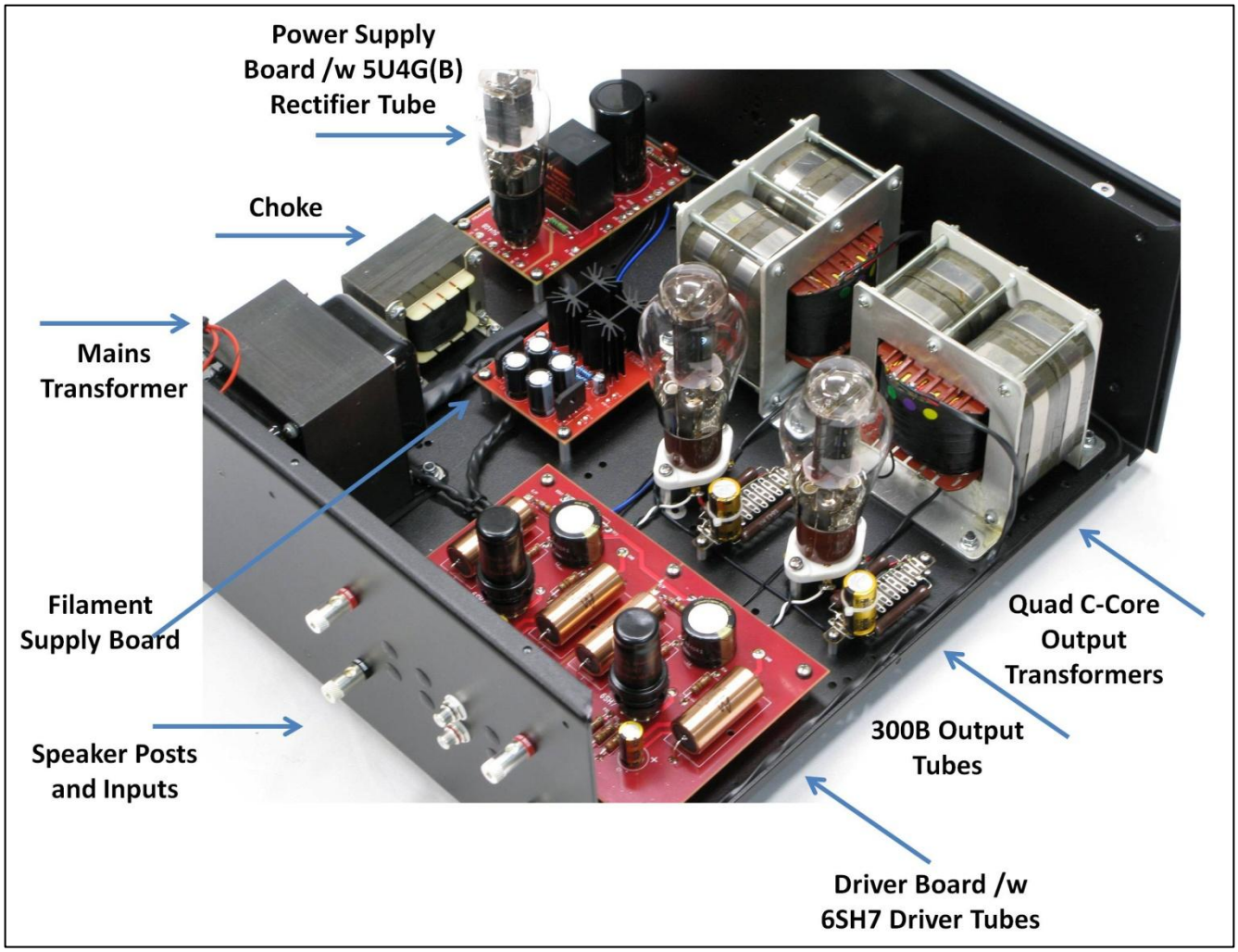
In developing the new Mentor SET Power Amplifier we have basically built the Legend monoblock circuit on three thick high quality printed circuit boards: a quality Power Supply board for the rectifier, a Filament Supply board to supply the output tubes, and a Driver (6SH7) board that includes high quality Audio Note (UK) 1W Tantalum non-magnetic resistors and four Audio Note (UK) Copper Foil capacitors. The amplifier has an ultra sturdy 3mm aluminum chassis, powder coated black, a new Mains transformer (T-195), a substantial Choke (CH-170), the latest Mundorf MLytic HV 4-pole capacitor technology to smooth the AC power, high quality black Teflon 4- and 8-pin valve bases, Audio Note (UK) hardwire tag strips, and EI-Core or C-Core output transformers.

It's an ideal 300B stereo power amplifier designed to mate with the Mentor pre-amplifier. It is modestly priced and, as such, an exceptional value.

1.2.2 Component Placement



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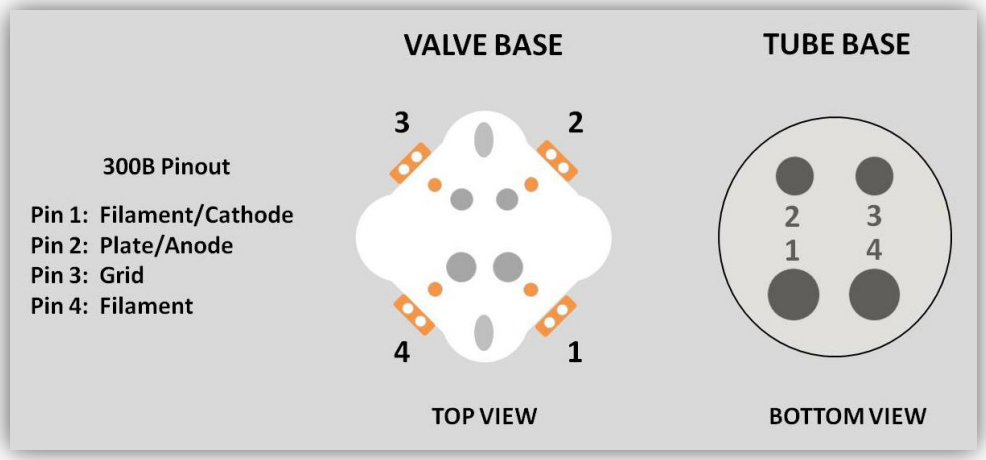
1.2.3 300B Pinout

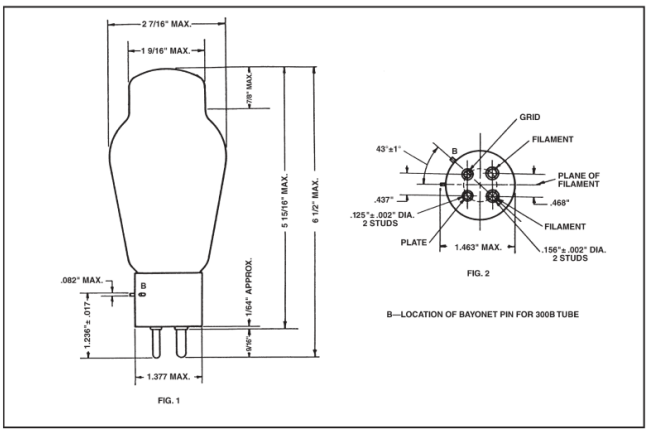
The 300B tube has four pins: two filaments (one of which serves as the Cathode; we use pin 1), the Plate/Anode, and the Grid. The two filament pins have noticeably larger diameters than the Anode and the Grid, so it's easy to make the distinction between the pairs of pins. However, as I'm sure you realize already, the left/right pin identification 'flips' when the valve base is viewed from the top or bottom. Therefore, it requires that you pay special attention as to which way you're looking at things when you wire the 300B valve bases and make the connections to the bases from other components.

Have a look at the following diagram:



On the left is the top view of a valve base; on the right, the bottom view of a 300B tube. *The wiring graphics in the manual generally use the valve base view; in any case, you can tell which view is being used by the different icons.* Please pay special attention to this.

FYI, here's the original Western Electric pinout[2]:



[2] Rotated left 90 degrees.

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1.3 Equipment

Here is the list of equipment that will be required:

- Philips screwdriver
- A pair of quality wire strippers
- A large, organized work area
- Soldering iron station with wet sponge
- Lead-based solder (4% Silver is recommended)

1.3.1 Overview of the Kit

In your kit you will find a series of kit bags containing all the hardware, wire, and parts for the associated sections of the amplifier. See the Parts List files on the disk to match up the parts in the kit bags with the lists. There is also a Master list for the kit.

1.4 Tips and Suggestions

We have learned a lot about kit building over the last decade from our customers and I'd like to share some tips with you to ensure a successful project. Please read through this section thoroughly, it will give you a good idea of what's ahead and help ensure your success!

1.4.1 Soldering

We highly recommend using lead-based solder with some silver content[3] on the build. You should use lead-free ONLY if you are experienced using it and confident. Lead-free solder requires a higher melting temperature and thus is more difficult to use. We don't recommend lead-free solder for first-time builders.

We suggest that you practice your soldering before starting on the kit. Feel free to request practice parts with your kit so that you can practice tinning wires and making nice solder joints. The key is a good soldering station with a sponge, the right temperature, a good size tip, and experience; remember, tips can wear out so make sure your tip is working. (You can also check out YouTube videos for soldering lessons and examples.) The solder should flow freely; if it's forming balls then there is likely a problem with the tip, the temperature, or (sometimes) the surface. Feel free to contact us for help!

[3] For example, WBT-0800.

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1.4.2 Components

Using the Ohm setting on your multimeter is very useful when building a kit. It's a good, practical way of measuring resistors and continuity and is much easier than reading the color codes on the side. (With practice, the color codes can also be a good way to determine the resistance, but that method is better left to experienced builders.)

1.4.3 Resistor Sizes

Resistors today, particularly metal film resistors, are often smaller than you might expect. It used to be that the difference between a 1/2W and a 1W resistor was obvious: the 1W was considerably larger. That way of looking at things sometimes now no longer applies. Please be assured that all resistors supplied with ANK Audio Kits are rated at least per the specified wattage: in some cases, a higher than specified wattage may be supplied.

1.4.4 Capacitor Manufacturers and Voltage Ratings

Occasionally, depending on parts availability, we may use capacitors from different manufacturers. These will always be of equal or higher quality! As a result, some of the pictures in the manual may look a bit different at times. With regard to voltage ratings, normally, the voltage rating of the supplied capacitors will be exactly what you see on the parts lists. Occasionally, a part may be supplied with a higher voltage. Think nothing of it!

1.4.5 Electrolytic Capacitors

For those who have not built a piece of electronics before, here is a little lesson on capacitors. There are basically two types of capacitors that we use in the kits: electrolytic and signal capacitors. Of these, electrolytic capacitors require special attention. Electrolytic capacitors are "polarized," which means they have a POSITIVE (+) and a NEGATIVE (–) lead and typically have values like 100uf 450V, 10uf 160V, or 470uf 35V. *These capacitors need to be installed correctly or else they will possibly blow up at some point!*

Each electrolytic capacitor will have a *wide stripe* on the NEGATIVE side. Always ensure that this stripe (NEGATIVE) is positioned correctly. There are several keys on a printed circuit board to help you to know how to position the capacitor:

1. There may be a "+" on the board indicating where to position the POSITIVE lead.
2. The segmented half of the circular stencil on the board shows where to position the NEGATIVE lead. The unsegmented ('half-moon') part of the circle is where the POSITIVE lead goes.
3. The POSITIVE lead goes to a square solder pad while the NEGATIVE lead goes to a round solder pad.

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1.4.6 Diodes

When installing diodes note that they are oriented with a stripe — *match the stripe on the diode with the banding (|||) stencil on the board.*

1.4.7 Hardware/Mechanical

Not all of us are mechanically oriented. So, the kit is well laid out such that all the hardware is provided and bagged in individual sections, so things should make sense. Start thinking mechanically because about a third of the kit is mechanical. The first thing to remember is that good hardware is beautiful: we use all stainless steel metric hardware in the kits. It truly is a thing of beauty: don't rush your hardware! Here are a few helpful things to understand:

- We use British metric hardware (M3, M4, M5, screw size 10mm, 15mm, etc..) as opposed to the American imperial system (5/1000th or 50/1000th, 1 inch, 3/4 inch). Please familiarize yourself with the hardware in the kit.
- The screws will be called M3 or M4, which is the diameter of the shaft. The length of the shaft will be in millimeters, so you will encounter things like an M4 screw 16mm, a PAN head screw (which is a round spherical head), or a COUNTERSUNK or FLAT head screw (a screw head that needs to be flush with a surface — for example, under a transformer). So if you are asked to use an M3 16mm CSK screw, this is an M3 size (obviously), which is a thinner shaft diameter than an M4; 16mm is the length of the shaft; and the head type is CSK, which is a countersunk or flat head screw.
- Once you have the screws mastered, look at the matching nuts such as M4 nut or M3 nut and corresponding washers.
- Standoffs are common in the kits (again, they are either M3 or M4 size, with different lengths). They are typically threaded, so the screw goes into them.
- If any of the hardware is confusing or something is not fitting right, please email us.

1.4.8 Wire Stripping and Tinning

When it comes to wires, we typically use 18 gauge (thicker) and 22 gauge in the kits. It's PTFE: Teflon silver-plated copper wire. Basically this is classed as hook-up wire; we typically twist wire for you when it needs to be. The other wire we use is called shielded cable, like an AN-A (Audio Note (UK)) for signals. This is two-conductor wire: one is for the signal and the other (a big ground braid wrapped around the signal wire) is the shielding, which helps prevent the cable from picking up noise. You should practice stripping some 18g or 22g wire, and then try tinning this wire; this is the process of adding solder to the bare wire so that the invisible coating on the wire is burned off. This makes for easy soldering to a PCB, an RCA connector, or a transformer terminal. So it's a good idea to practice this a little before starting the kit.

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1.4.9 Wire Color

In the earlier sections of this manual, particularly those sections dealing with the Mains transformer and Choke wires, the colors of the wires should match the color of the wires in your kit. If they don't, or if you're unsure about things, contact audionotekits@rogers.com. Later on, at the Interwiring stage, there may be some differences between the descriptions (or pictures) of the color of wires that you will connect and the color of the wires supplied with your kit; for example, depending on inventory, we may supply a Black–Red twisted pair instead of a Green–Red (or vice-versa). Don't worry! Just be sure to check the wiring diagrams carefully and connect the correct points together and all will be well!

1.4.10 Optional Finishing Touches

From time to time we get asked about some of the build details of the ANK Finished Products that you can see in the pictures in the "Assembled Kits Gallery!" (https://ankits.smugmug.com/) on our website. It's important to understand that these stunningly beautiful products were done by an accomplished professional builder with decades of experience and that some particulars of the build may be beyond most of us. However, experienced builders who want to incorporate some of these finishing touches should feel free to do so. While we don't officially support or supply parts for these optional enhancements, there's no reason why you couldn't or shouldn't do them if you want to and feel that you can handle them. Without getting into the details (you're on your own here), what you'll want to get hold of are: heatshrink (to bundle wires), cable ties (to secure large capacitors), stacked (male/female) standoffs and cable clamps (to elevate and secure signal cables), and cable sleeving. You can get some of these from your local hardware store (for example, 1/4" Cable Clamps) and other, more specialized, parts from online distributors such as Grainger, Digi-Key, Mouser, or Cable Ties and More. If you do decide to dress your build with some of these, please send us a picture or two. We'd love to see what you did!

1.5 Build Process

1.5.1 Some Good Rules of Thumb for Building Your Amplifier

- Take your time, prepare, and try and work on a small task each time you start to build the kit.
- Instead of rushing through another section — use the end of your session to check your work. Always ask yourself if the step you are performing makes sense.
- Have fun with your build and savour the experience. Take the time to do a really good job!
- Feel free to contact us via email audionotekits@rogers.com if you have any questions or suggestions during your build — and feel free to send us pictures, etc. We'd be pleased to give you tips along the way.

1.5.2 Organization of this Manual

The Mentor SET Power Amplifier is available with EI-Core or C-Core output transformers. The build process is identical; that said, this manual was developed when building the EI-Core variant so, for the most part, the pictures are of that build — although there are some pictures of a C-Core build.

We've divided the build and the manual into the following sections:

1. Introduction
2. Mechanical Assembly and Initial Power Supply Wiring
3. Power Supply Board Installation
4. Filament Supply Board Installation
5. Driver Board Installation
6. Output Transformers Installation
7. Power Supply Board Interwiring
8. Filament Supply Board Interwiring
9. Chassis-Mounted Output Section Installation
10. Additional Interwiring
11. Testing
12. Finishing Touches
13. Final Thoughts

Appendix

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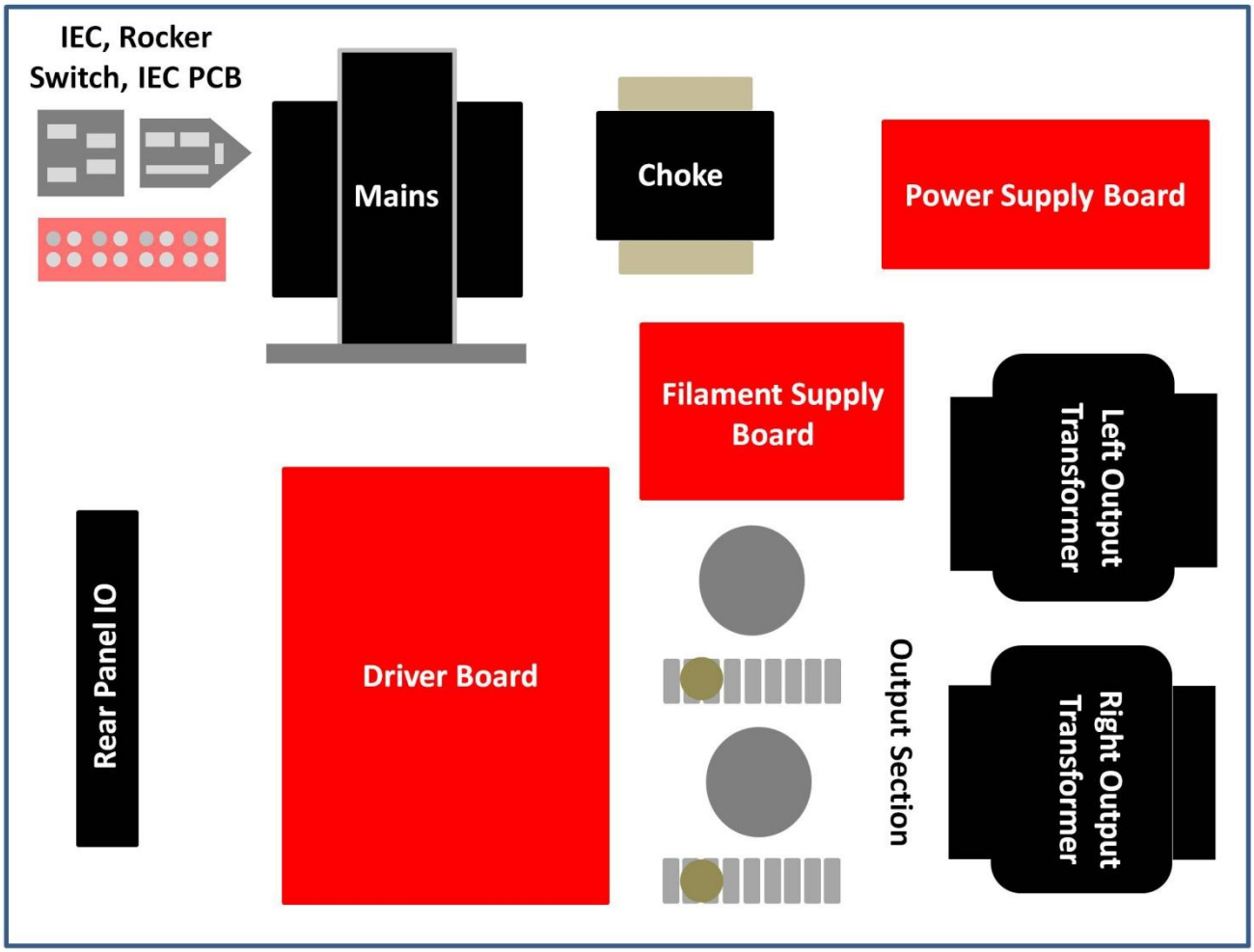
Here's another way of looking at how the manual is organized and how the sections fit into the 'big picture': the manual sections generally mirror how the components are positioned in the amplifier.



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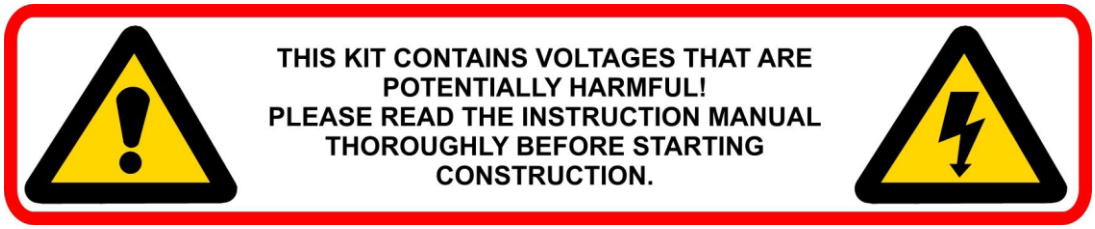
1.5.3 Electrical Safety Warning



Please be aware of proper electrical safety.

There are sufficient voltages in this kit to give you a very nasty and harmful shock, so be very careful when powering on, debugging, and probing around.

Please contact ANK Audio Kits via phone or email (audionotekits@rogers.com) to discuss any precautions necessary when building the kit if you feel unsure about what you are doing at any stage of the build.

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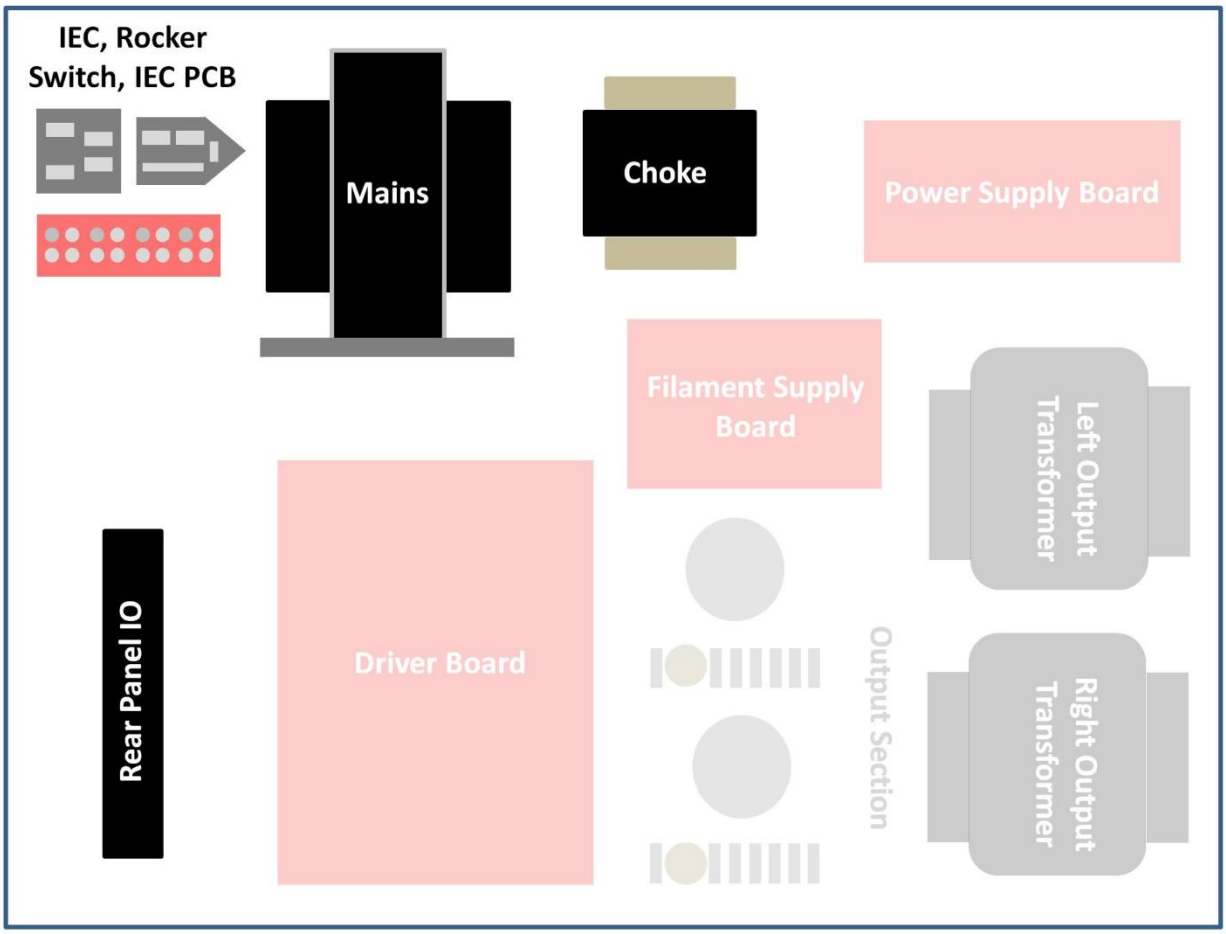
Section 2

Mechanical Assembly and Initial Power Supply Wiring

2.1 Overview

In this section we will install the feet, IEC socket, Rocker Switch, and the Choke, as well as make important initial connections to the Mains transformer and install it in the chassis.



When you receive the kit you'll have a series of kit bags. In the following sections we'll be using the:

- Hardware bag (made up of individual bags for each section of the kit)
- IEC bag (containing the Rocker Switch, IEC, IEC PCB, prepared cables, fuses, etc.)
- RCA jacks bag
- Speaker posts bag

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2.2 Installing the Feet

Let's start by installing the feet on the chassis — this will make it easier to work with as we install the transformers, Choke, etc.

- ☐ Turn the chassis upside down.
- ☐ Take a foot and insert an M4 screw with washer into it — it might be tight but just push it in.
- ☐ Install each foot in the hole in the chassis closest to the corner and secure it with an M4 nut on the inside of the chassis. Don't overtighten the screw; you could damage the foot.

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When completed your feet will look like the picture below. You're on your way!

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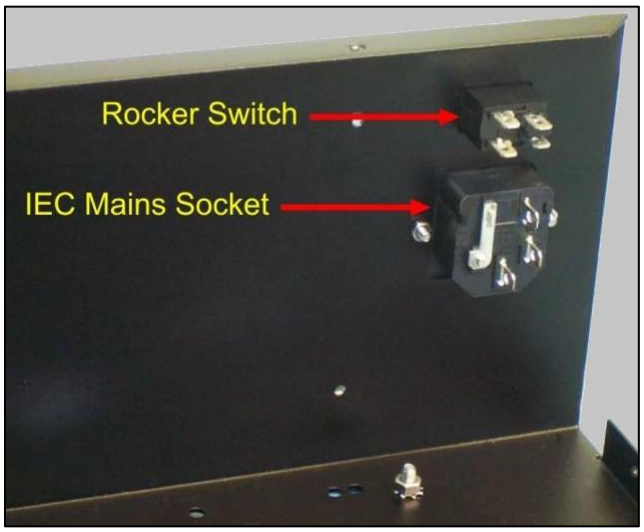
2.3 Installing the IEC Socket and Rocker Switch

- ☐ Take the IEC socket and install it in position as shown below, with the fuse holder on top and the GND lug on the bottom. Use M3 10mm CSK flat head screws and nuts to secure it.

➡ *Have a look at the picture below: Note the orientation of the Rocker Switch with the smaller pair of tabs towards the side of the chassis and the larger pair towards the middle.*

- ☐ Install the self-locking Rocker Switch by pressing it in from the back of the chassis; it will snap into position.



The correct orientation of the IEC and Rocker Switch

Here's a view of the rear of the chassis:

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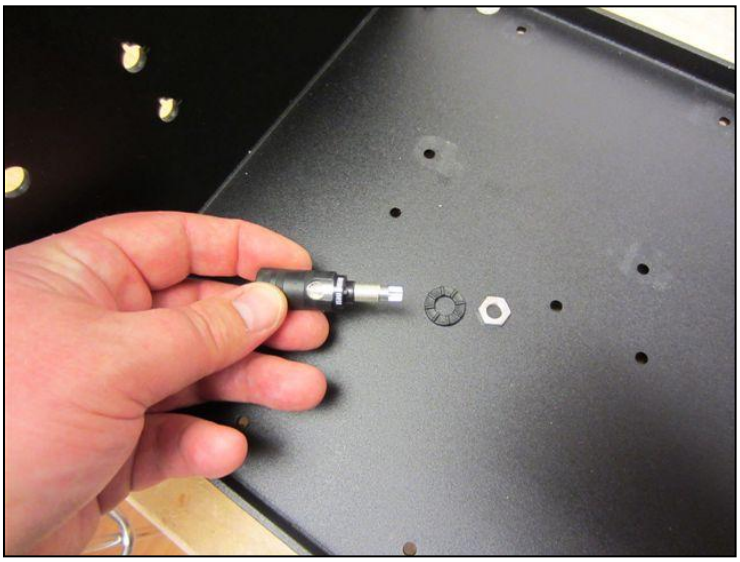
2.4 Installing the Speaker Posts

☐ Install the 2 pairs of speaker posts found in chassis fittings bag. Let's put the Red (POSITIVE) posts on top and the Black (NEGATIVE) posts on the bottom.

To make it easier to solder a wire to a speaker post it's a good idea to orient the center tab facing up.



The view from inside the chassis: *Note the insulation against the chassis*.

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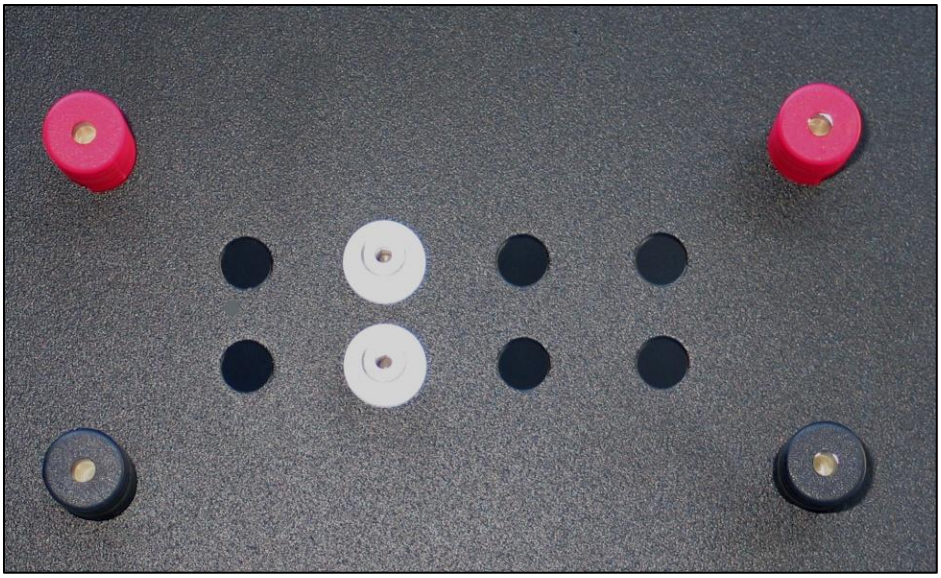
2.5 Installing the RCA Jacks

- ☐ Next, we'll install the RCA jacks for the input to the amplifier. They go in (any pair of) the holes between the pairs of speaker posts, as shown below:



For each RCA jack,

- ☐ Insert into the chassis — from the outside, in the following order:

  - ❖ The white insulating washer with the raised ring facing inwards into the hole
  - ❖ The RCA jack

- ☐ Attach, from the inside, onto the protruding jack:

  - ❖ The other white insulating washer
  - ❖ The ground lug
  - ❖ The nut (don't immediately tighten this more than one or two turns)

- ☐ Bend the ground lug up about 30 degrees and position at about 2 o'clock. *Make sure it is away from the chassis.*
- ☐ Tighten the jack *such that the inner lug is facing up/open*; it'll make soldering much easier.

Make sure everything is snug and well tightened. We'll wire the jacks later.

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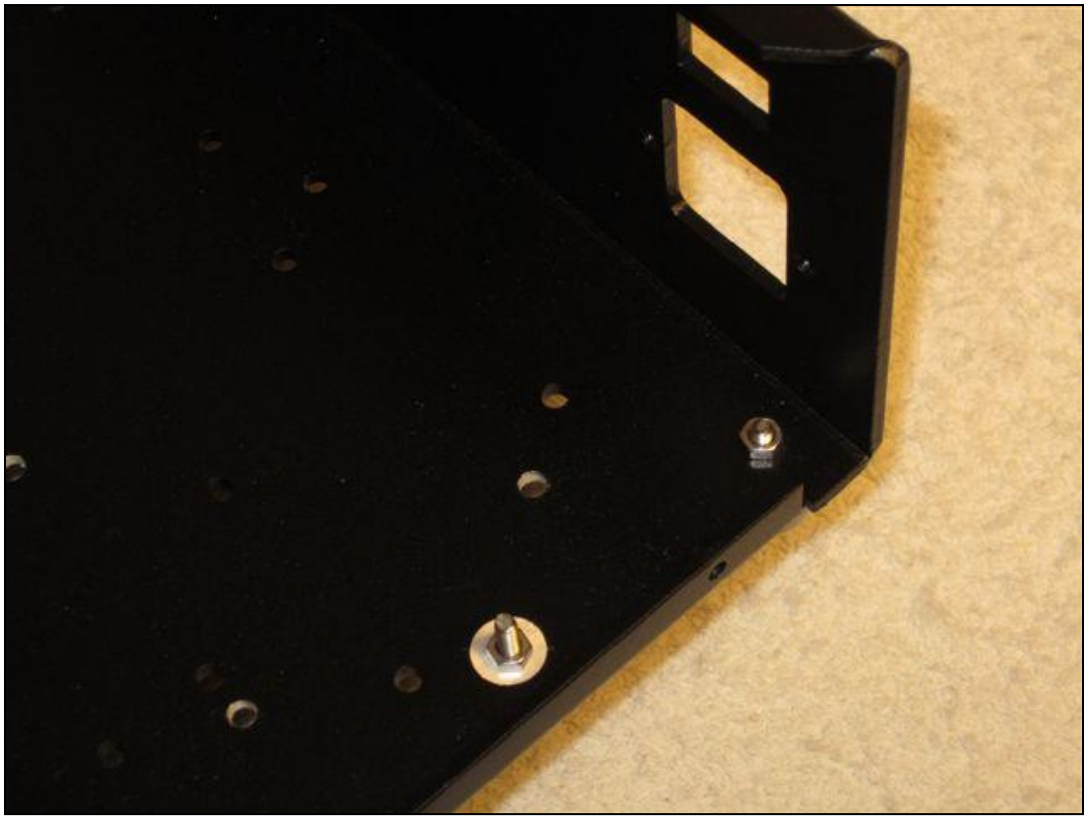
2.6 Installing the Chassis Ground Screw

- ☐ Insert the M4 16mm Chassis Ground screw (from underneath) into the unpainted position near the corner of the chassis, as shown below:



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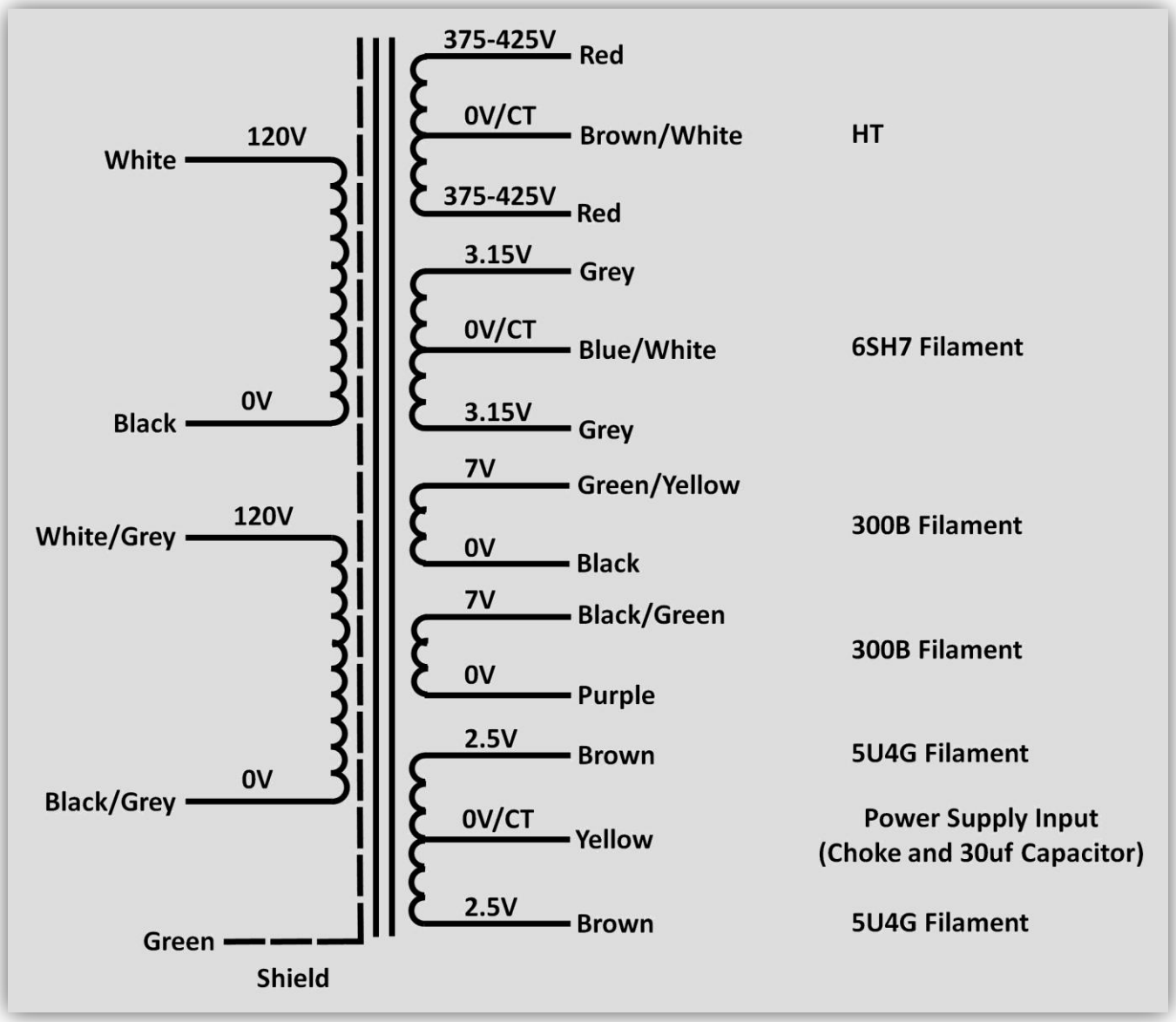
2.7 Installing the Mains Transformer

Now we're going to install the T-195 Mains transformer. We suggest that you read through this entire section to see what you'll be doing before you start.

Let's have a look at the wiring of the Mains transformer:



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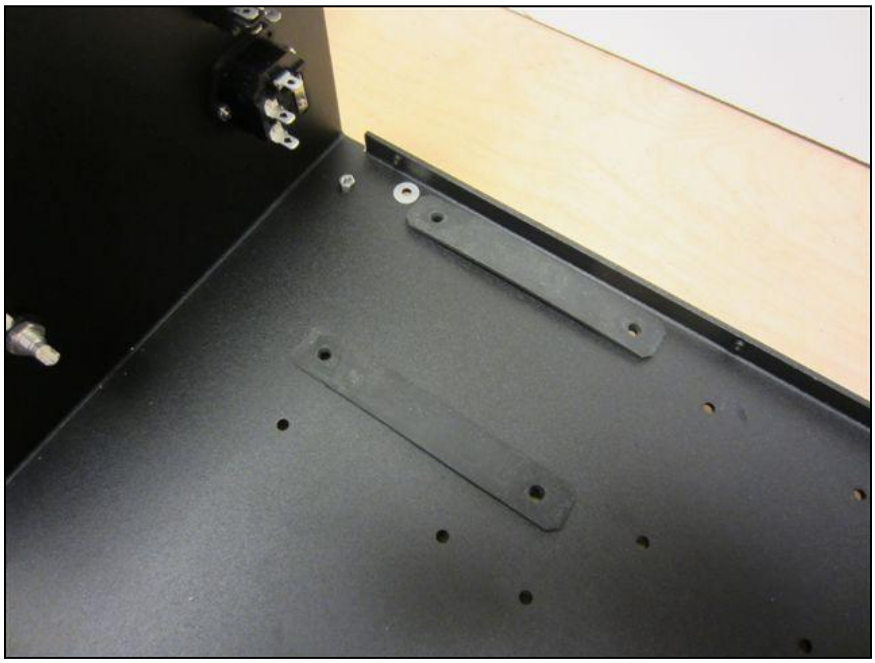
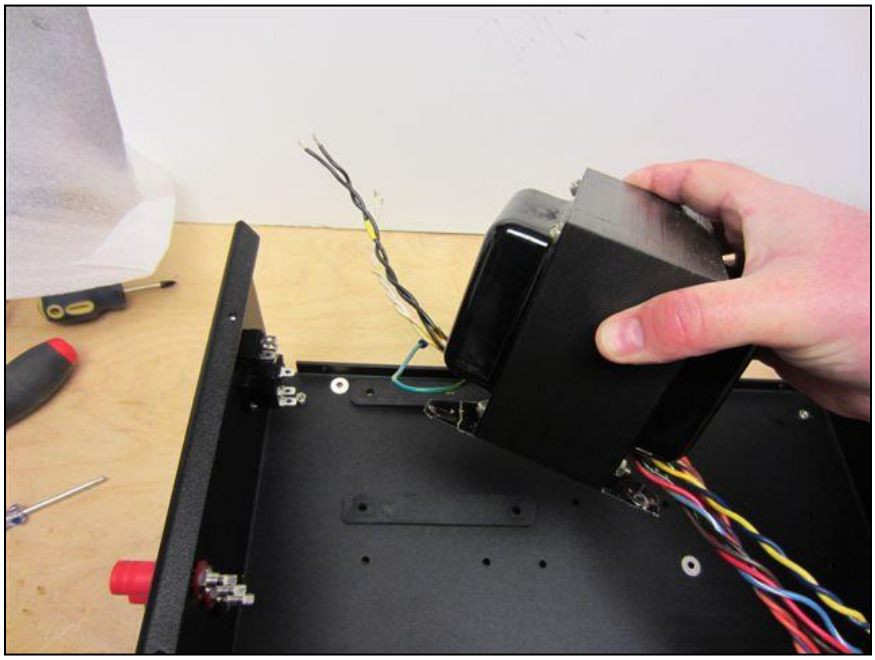
We'll begin by installing the rubber strips:



- ☐ Install the rubber strips on the chassis in the position where the T-195 Mains transformer will go.
- ☐ Next, have a look at the picture below and position the T-195 Mains transformer in the chassis such that the two White, two Black, and the one Green wires go towards the back of the chassis. These wires are the Primary.
- ☐ Secure the Mains transformer to the chassis using the provided hardware in the "Mains" bag.



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2.8 Bundling the Mains Wires

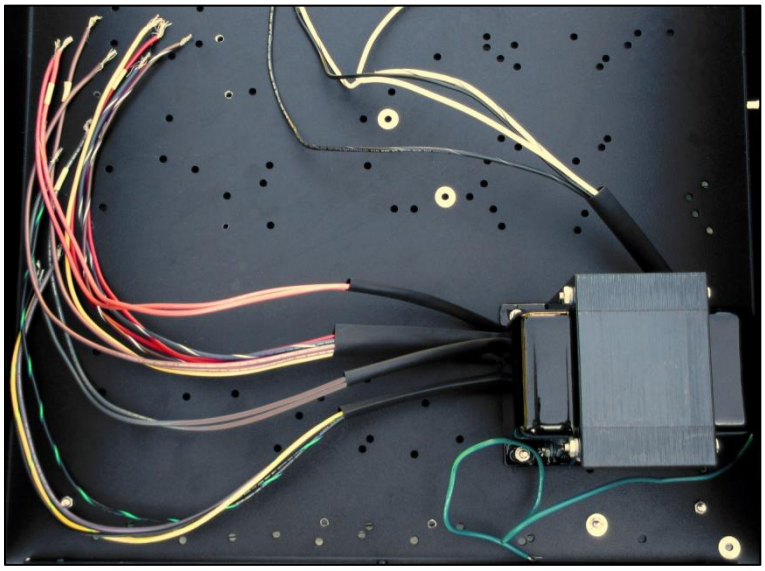
Next, let's organize the Mains wires[4]. A good first step is to twist the White, White/Grey, Black, and Black/Grey Primary wires together. (Let's not bundle the Green wire.)

Next, let's bundle the Secondary wires together in groups according to the different ways they are going to be used in the amplifier. This will make the interwiring between boards and components that we'll be doing later a whole lot easier.

☐ Bundle the following sets of Secondary wires together: (Optionally, as in the picture below, you can use some heatshrink for each bundle BUT don't cut any wires or trim or heat the heatshrink yet as we'll need to carefully measure things later when we actually make the connections to the various points in the amplifier.)

Bundle 1:	2 Red wires, 2 Brown wires, Yellow wire, Blue/White wire, Brown/White wire.
Bundle 2:	2 Grey wires.
Bundle 3:	Black wire, Purple wire, Black/Green wire, Green/Yellow wire.
Bundle 4:	2 Orange wires. These will not be used for a 300B build, so just cut the exposed end of the wire off, cover the ends of the wires with a pair of small twist on wire connectors, coil the wires neatly as you would a garden hose, and tie them with a cable tie[5]. Position them out of the way — between the Mains transformer and the back of the chassis, if you like.

Here's what the bundling should look like, more or less:



[4] Sometimes you may see a yellow sleeve, about an inch long, on a Mains wire; it's just an internal transformer indication of the start of a wire. In terms of the build, it has no significance.

[5] The Orange wires would be used in a 2A3 build. Don't cut much wire off, in case you decide to switch to a 2A3 amplifier at some point.

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2.9 Preparing the Mains Ground Wire

Now let's prepare the Mains (Green) ground wire.

The Mains transformer has a Green wire coming out of it — this is a ground wire that attaches to the Chassis Ground screw on the chassis. We'll trim this wire to the proper length; then strip and tin it.

> This manual was developed while building the first kit. The wire lengths suggested for the Mains and Choke wires — and the interwiring between boards and components — is based on the positions of those elements at that time. As with all products, over time, there will be revisions — most likely to boards, occasionally to the chassis. These revisions might alter the relative positions of these elements and could affect the suggested lengths of wires. *Therefore, we strongly recommend: 1) that you measure wire lengths yourself, <u>for your unit</u>, and 2) that you always 'add a little': having a wire a little too long is far preferable than finding out that it's too short; this is particularly true of transformer wires. While it's possible to splice any wire that, for one reason or another, is too short, it's really not something you'd want to have to do. And, finally, let's remind ourselves of the carpenter's proverb: "measure twice, cut once."*

- ☐ Trim the Green wire to not less than 8", strip 1/2" from the end, and tin it. Insert the Green wire into the provided ground lug and solder it in place. Do this by adding solder through the front of the lug, as shown on the next page.

Add a fair bit of solder and apply heat for possibly as much as ten seconds, as the solder must "take" to bind to the lug. *The lug will get hot so don't touch it for awhile; let it cool!* When you are done you should have a nice smooth solder joint.

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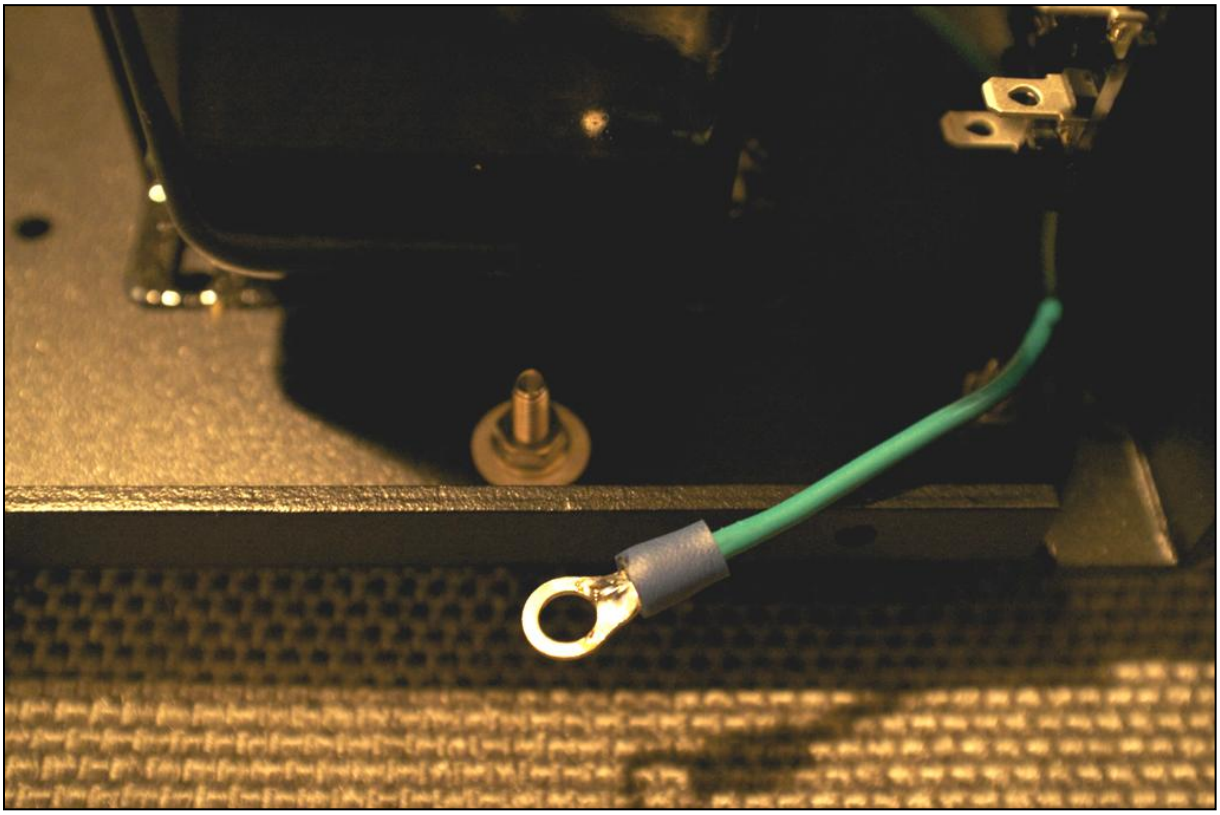
Here's a picture of the completed ground wire:



We'll attach it to the chassis a bit later.

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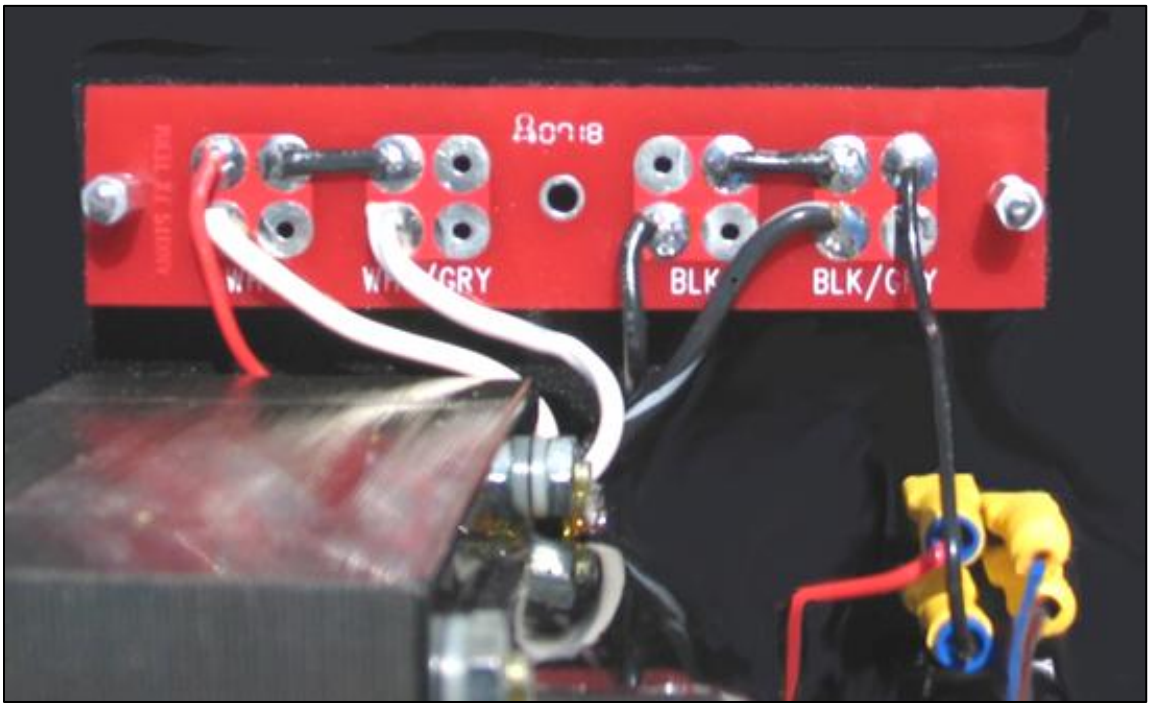
2.10 IEC Board Wiring

Now we'll wire the IEC printed circuit board (PCB), which will make the remaining wiring from the Rocker Switch to the Mains transformer much easier to implement. Before we do so, let's have a look at what we want to accomplish:



After you've read through the steps that follow, if you are in any doubt as to the IEC/Rocker Switch/IEC board wiring, please contact audionotekits@rogers.com

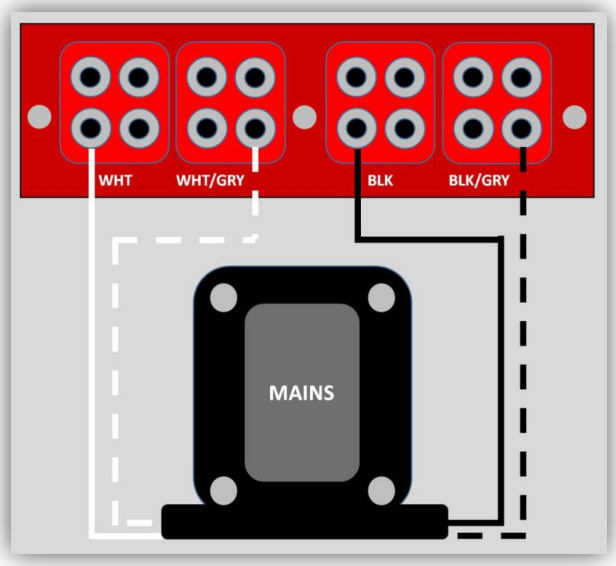
Note that there are 4 pads with 4 solder tabs each. The 4 solder tabs within each of the 4 tabs are electrically equivalent and it doesn't matter which of the 4 solder tabs you use.

TIPS

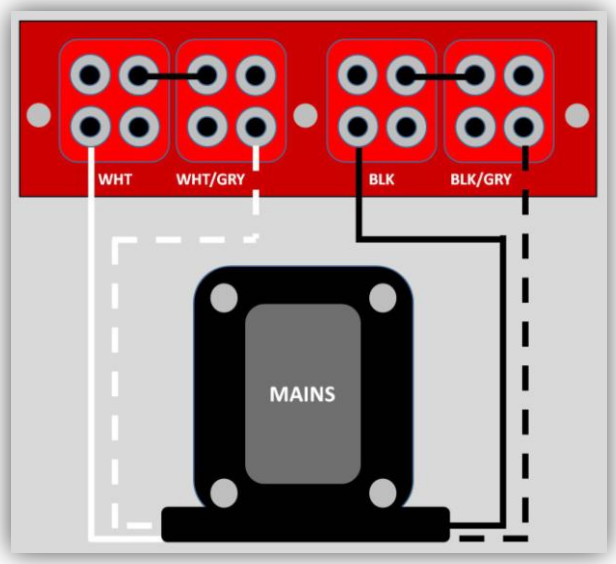
We suggest that when you cut these wires give yourself a little slack, then tin the ends by adding solder to the exposed wire so that the solder melts to it and clip the tinned wire to a length of about ¼" so that it can fit through the hole. Obviously you'll want to make these connections while the Board is NOT secured to the rear of the chassis. We also recommend that you solder on both the top and the bottom, making sure that you leave about 2mm of room for the exposed tinned wire to be visible so that the solder will stick to it. A common beginner mistake would be to push the wire all the way into the hole with the wire insulation pressing against the pad.

Wiring for 120V Operation[6]

- ☐ Cut the four wires (White, White/Grey, Black, and Black/Grey) coming out of the Mains Primary to the lengths you'll need to reach the IEC board when it's situated on the rear of the chassis, as shown above. *Note: you can connect the wires from the top or the underside of the board, as you prefer. In the picture on the previous page they are connected from the top side.*
- ☐ Strip and tin the ends. (You can add some heatshrink if you like.)
- ☐ Connect these four Primary wires to the IEC board, as shown below. Cut off the excess wire.



- ☐ Add the two jumpers as shown. (You can use some left over Black Primary wire or bare wire, as you prefer.)



[6] The wiring for 240V is given in the Appendix.

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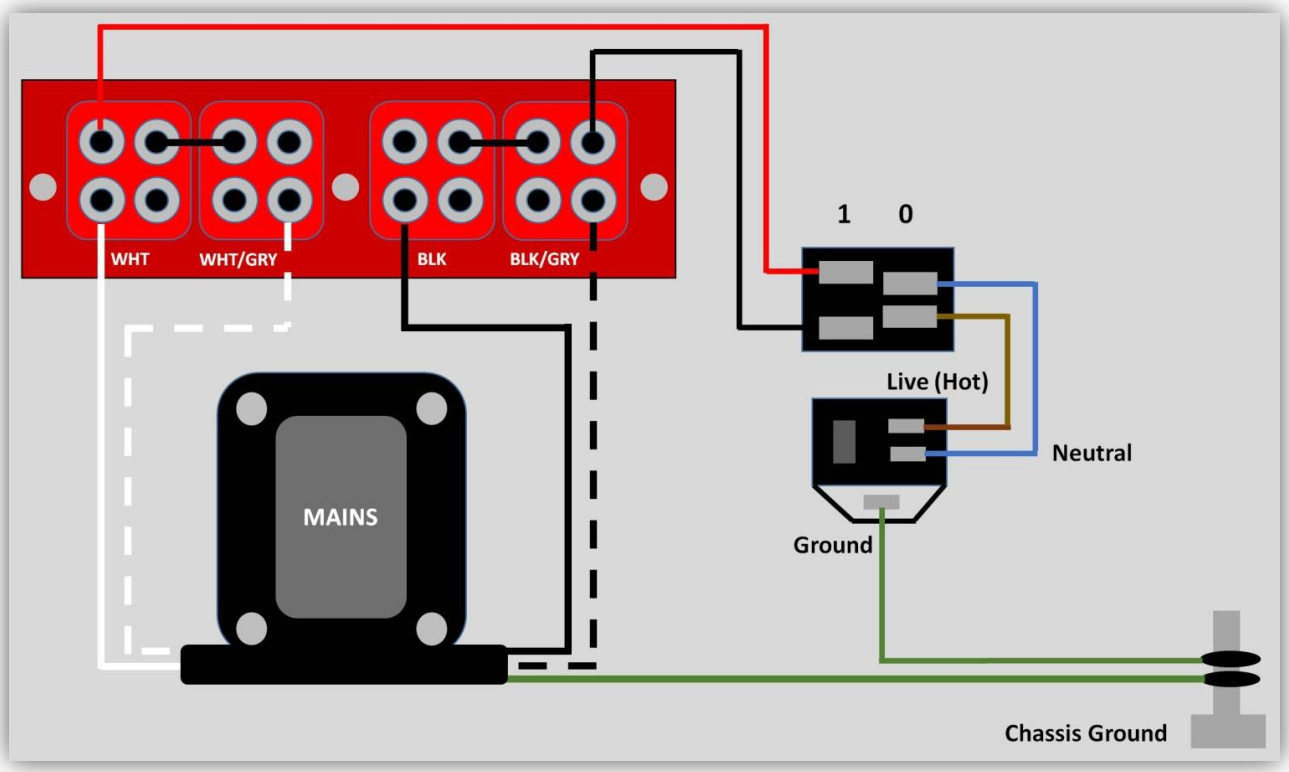
Referencing the diagram below, complete the IEC/Rocker Switch wiring as shown. Regarding the aesthetics, you have several options:

1. Solder the Red and Black wires from the Rocker Switch to the front of the board (see picture above). You can use either of the unused holes on each tab.
2. Solder the Red and Black wires from the Rocker Switch to the underside of the board.
3. Solder the Red and Black wires from the Rocker Switch to the front through the plastic insulating board (by drilling 2 holes in it[7]).

   The choice is yours.

- ☐ If you haven't done so already, peel off the paper covering on the plastic insulating board.
- ☐ Tin and solder the unprepared ends of the half-prepared Red and Black[8] wires in the IEC bag onto the IEC board, as shown.



[7] Peel off the cover first! There's a nice picture of how to do this in the Appendix. *Be aware, though, that the Appendix shows the 240V wiring, so use the jumpers as shown above for 120V.*

[8] Or Orange or whatever we've supplied. The color doesn't matter so long as you make the connections shown.

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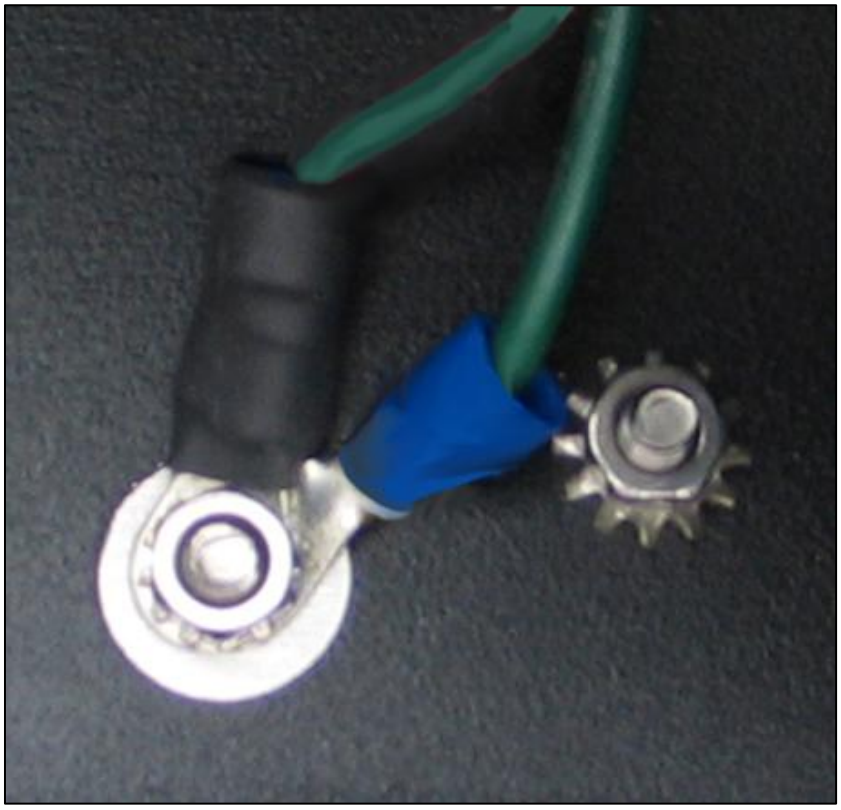
2.11 Connecting and Mounting the IEC Board

Again, referencing the diagrams on the previous page,

- ☐ Push the crimped ends of the Red and Black wires coming from the IEC board onto the left (wider spaced) lugs of the Rocker Switch, Red on top, Black below. Apply the pressure necessary to position the wires correctly onto the lugs.
- ☐ Using the prepared Blue–Brown[9] twisted and crimped pair of wires, connect the IEC socket: Blue (Neutral) from the middle lug, Brown (Live/Hot) from the top lug — to the right (narrower spaced) lugs of the Rocker Switch, Blue on top, Brown below. Again, apply the pressure necessary to position the crimps correctly onto the lugs.
- ☐ Take the Green wire that is prepared at one end with a ground lug and at the other end with a crimp. Attach it to the bottom lug of the IEC socket.

Finally, let's make two Chassis Ground connections.

- ☐ Retrieve the Green ground wire from the Mains transformer and the Green IEC ground wire and, using a nut, loosely secure the two grounds to the Chassis Ground lug, as shown below. We'll add a third Ground wire later.



[9] Or whatever color we've supplied. Again, it's the connections that matter, not the color.

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Next, let's test these important connections. Using your multimeter's Continuity setting, verify the following:

- IEC socket ground to Chassis Ground
- IEC socket Neutral to IEC PCB White solder tab
- IEC Line (Hot) to IEC PCB Black–Grey Solder tab

☐ Finally, peel off the paper covering on the plastic insulating board and, using the IEC hardware, mount the IEC PCB to the back of the amplifier above the Mains transformer as shown in the picture above: use a 30 mm M3 screw, a short standoff, then the PCB, another short standoff, and finally the plastic insulating board and a nut.

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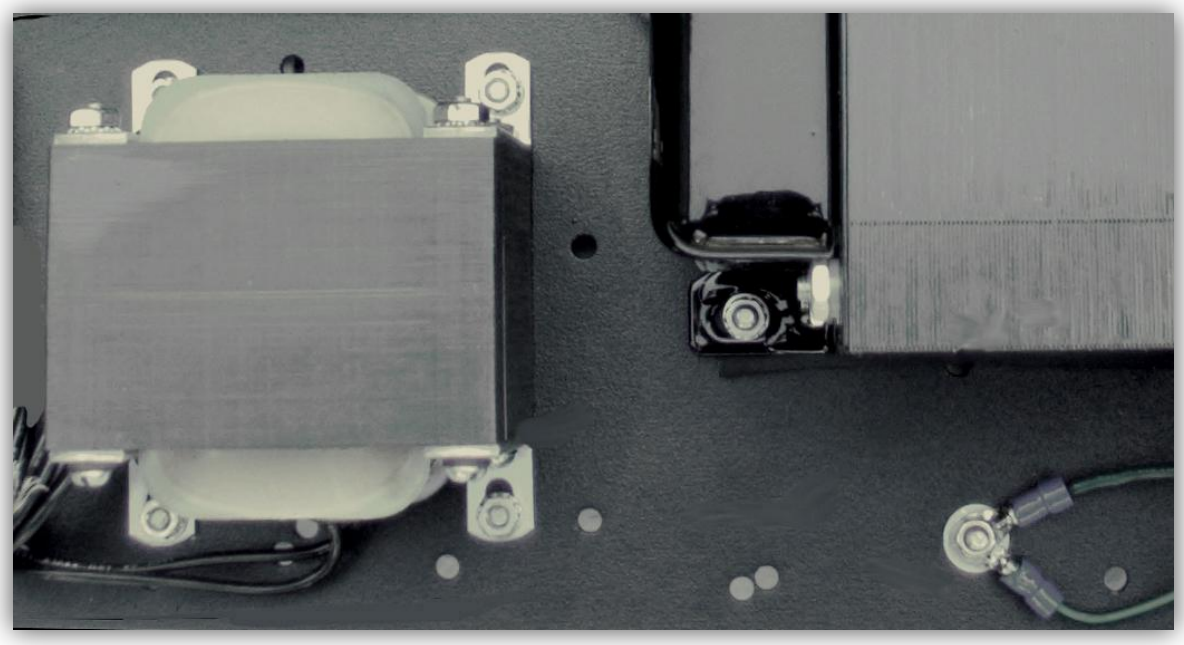
2.12 Installing the Choke

Let's continue by installing the Choke. This is quite straightforward.

- ☐ Neatly lay out the necessary hardware close at hand:
  - 4 M4 screws
  - 4 M4 washers
  - 4 M4 Keps K-Lock Nuts (these are M4 nuts with attached locking washers)

- ☐ Install the Choke as shown below:



Congratulations on completing the mechanical assembly and initial Power Supply wiring! Now we'll move onto the Power Supply board.

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Time for a break!

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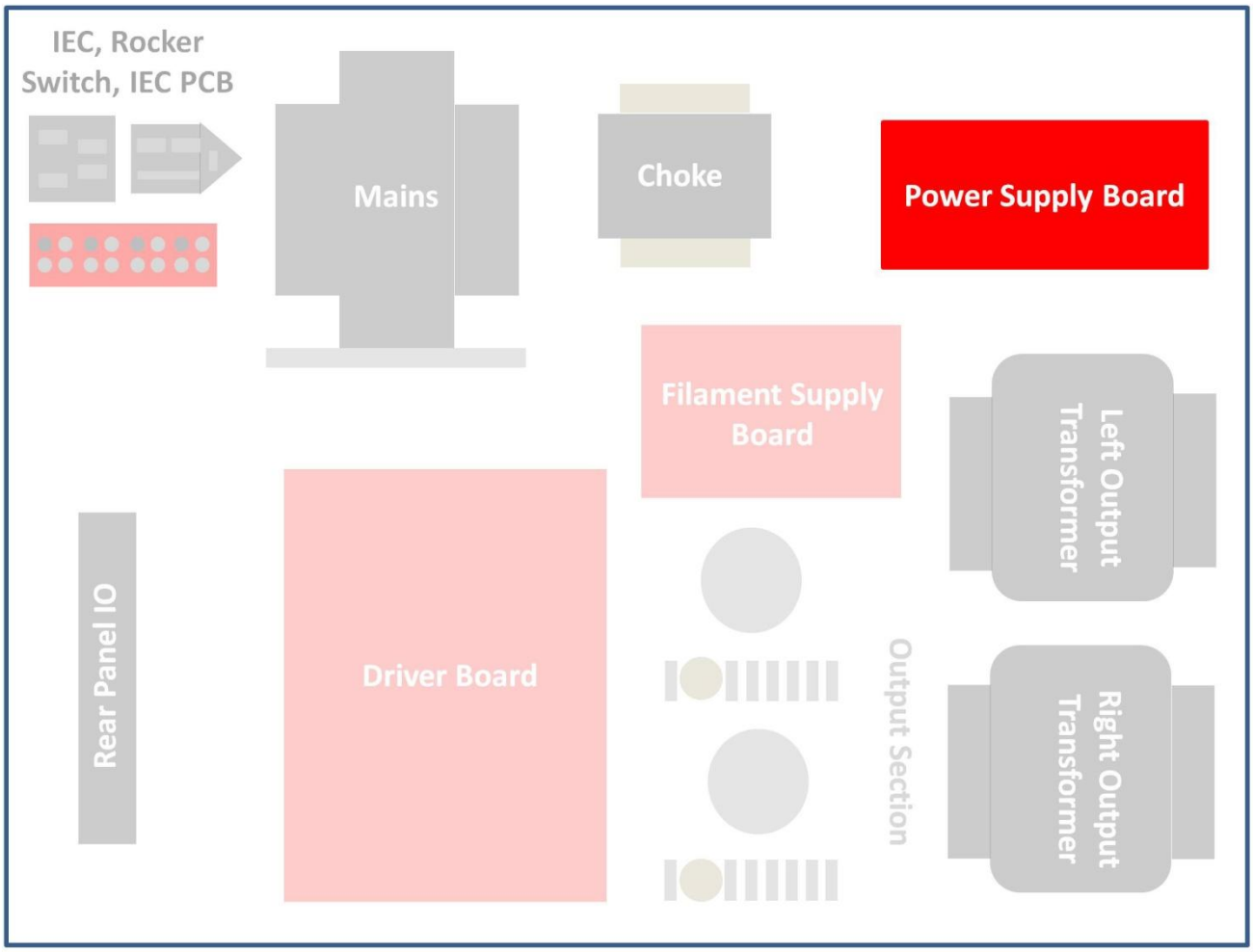
Section 3

Power Supply Board Installation

3.1 Overview



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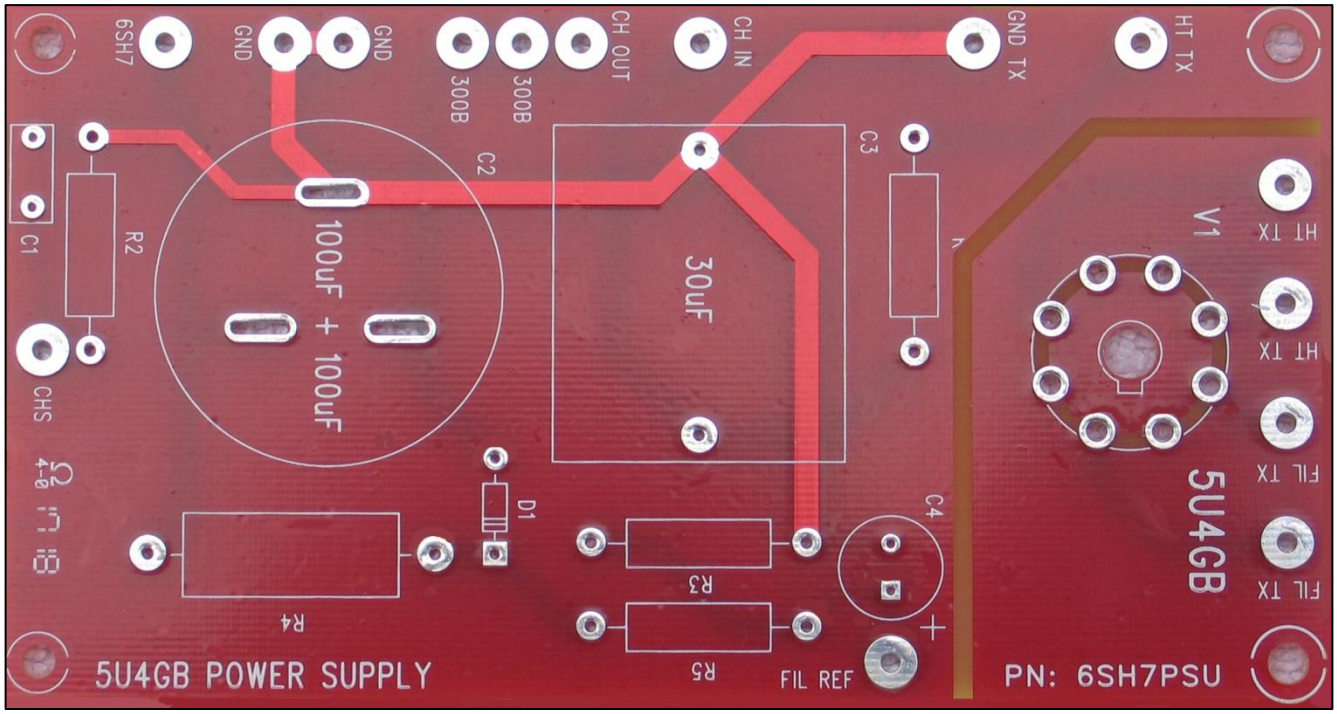
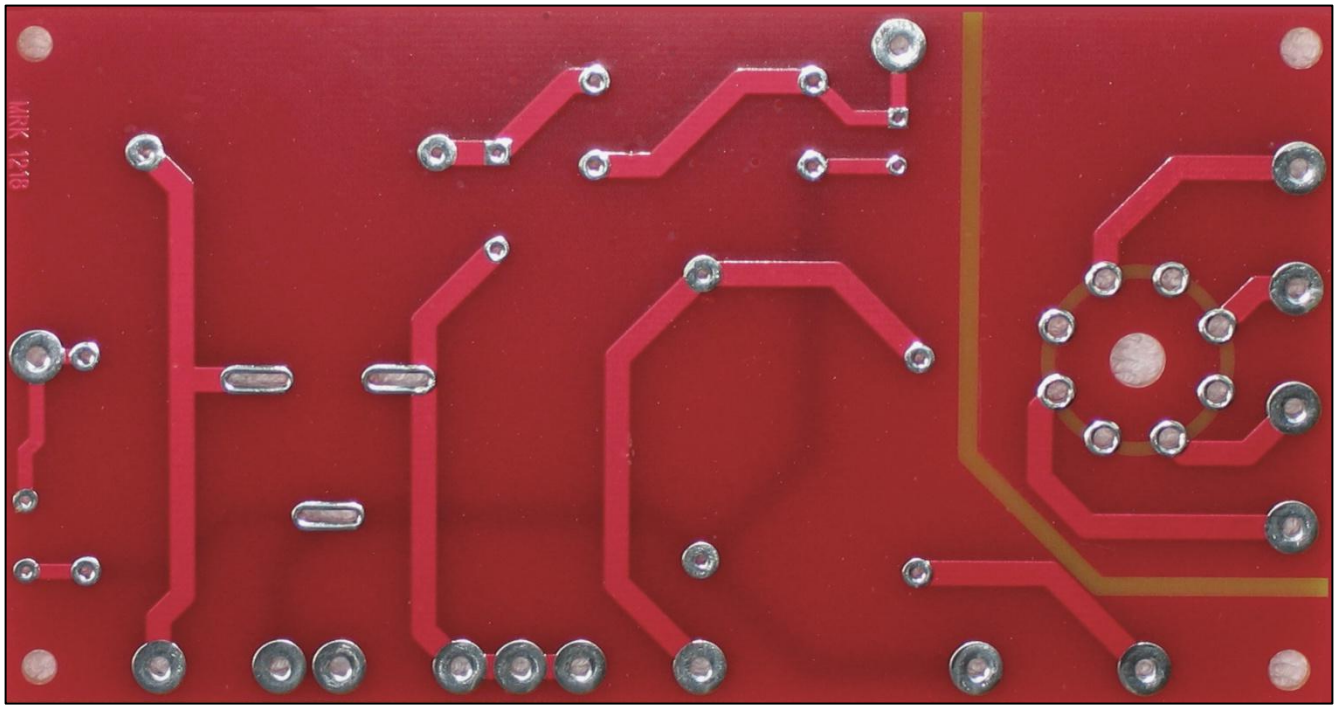
Here, for reference purposes, are a couple of pictures of the front and the back of the board:





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3.2 Parts List

Quantity	Type	Designator
1	10R 1W	R1, located beside C3
1	100R 1W	R2
1	47K 1W	R3
1	10K 2W	R4
1	330K 1W	R5
1	103J (or 104J)	C1
1	Mundorf MLytic HV 100+100uf 500V	C2
1	Mundorf TubeCap 30uf 600V	C3
1	10uf 160V	C4
1	Diode 1N4007	D1
1	5U4G(B) Rectifier Tube	V1
1	8-pin Valve Base	
1	Power Supply PCB	

3.3 Installing the Valve Base

We'll begin by installing the 8-pin valve base for the 5U4G(B) rectifier.

Use masking tape to secure the valve base to the board prior to soldering. *The key is to make sure the valve base is level*: if you have a base that is soldered in on an angle then your tube will lean over! Solder from the underside of the board. Use just a little solder to secure each pin to the board and start with two pins which are opposite to each other to make sure the base stays level — then you can add more solder. In the end you can fill up the entire valve base hole. *Be very careful not to let any solder bridge to the next pin as this will cause a short!* If you wish to — or think you need to, you can 'touch them up' from the top, then back once again to the bottom, and all should be well. When you do the touch ups just give them a very short bit of heat and a tiny bit of additional solder.

- ☐ Install the 8-pin valve base in position V1. *Be very careful to align the tab 'cut-out' on the top of the valve base with the tab stencil on the board.* Take your time soldering on the underside of the board as it requires a fair bit of heat and solder to adhere the pins to the board. No rushing!

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3.4 Installing the Resistors

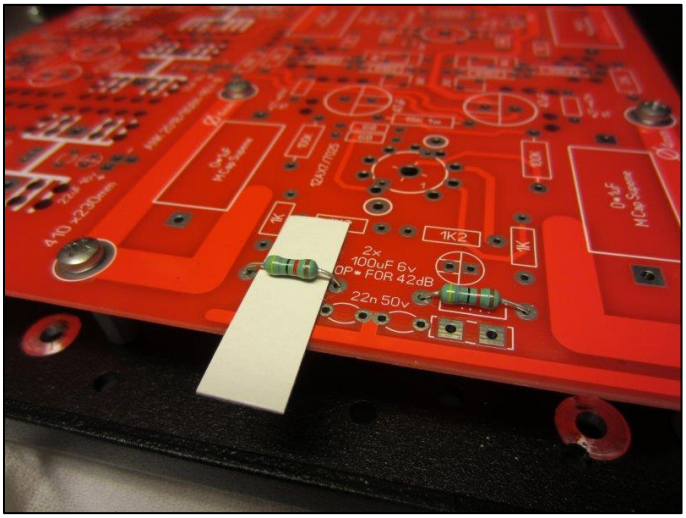
Quantity	Type	Designator
1	10R 1W	R1, located beside C3[10]
1	100R 1W	R2
1	47K 1W	R3
1	10K 2W	R4
1	330K 1W	R5

A quick lesson about resistors:

- A resistor that reads 100R means that it is 100 ohms; the 'R' stands for resistance
- A resistor that reads 2K7 means it is 2700 ohms; the 'R' is assumed and the K (which stands for Kilo or 1000) is positioned like the decimal place, so it's like reading 2.7K ohms (K = multiplied by 1000) — but it's shortened to 2K7
- Another example is the 1M resistor, which is 1 Mega ohms

Use an ohmmeter to measure each resistor to verify its correct value. We've included a resistor chart in the Appendix.

It's a good idea to orient your resistors so that the color codes can be read from left to right; it makes it easier to spot any issues. *It's also a good idea to <u>not</u> have the resistors installed right against the board*, for a couple of reasons: 1) it's better for heat dissipation, and 2) in some cases there are circuit traces running under the resistors — and we really don't want resistors touching them. So, as shown below (on a board from a different kit), we recommend using a narrow piece of cardboard cut to size as a 2–3mm spacer: this will still let you solder while ensuring that the resistor is not pressing against the board.



[10] The stencil may be partially obscured.

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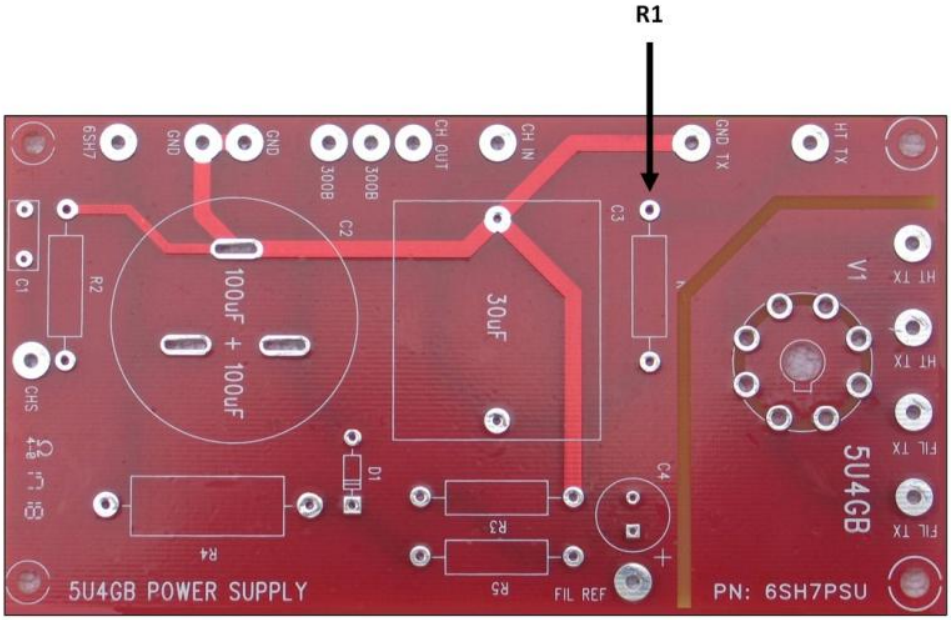
Also, be sure to solder on the underside of the board and check that you have nice little "volcanoes" on each solder joint. (While it's not necessary, you can solder these through hole resistors on the top as well as the bottom. If you hold the heat when soldering on the bottom for about an extra 1/2 second or so, usually just enough solder will flow through the hole to the top so that it forms a nice volcano on the top without the need to touch it up.) When you go to clip a lead be sure to clip above the volcano so that you don't slice off this nice joint. You can also cup your hand over where you're cutting to keep the clipped lead from flying off somewhere — and you can wear protective glasses, which is a good idea! Hopefully we didn't make any mistakes and you got all the right resistors and quantities. If not, just drop me an email (audionotekits@rogers.com) and we'll get it straightened out ASAP!

☐ Install the resistors on the Power Supply board following the parts list above.



Take your time. When you're done, if you want to double check your connections, here's a way to be absolutely sure the connections are good:

1. Set your multimeter to the Ohm position.
2. Touch one end to the lead of a resistor above the PCB (not the PCB solder pad to which it's connected).
3. Touch the other end to a distant point that is directly connected (i.e., with no additional resistance) to the other end of the resistor. (You'll may have to flip the PCB over and back to determine where to position the lead.) You'll be able to read the value of that resistor and assure yourself that both leads are properly soldered. *Note: If some part of this path has a large capacitor in it, it may take a little time to register the value of the resistor you're expecting.*

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3.5 Installing the Capacitors and Diode

Quantity	Type	Designator
1	103J (or 104J)	C1
1	Mundorf MLytic HV 100+100uf 500V	C2
1	Mundorf TubeCap 30uf 600V	C3
1	10uf 160V electrolytic	C4
1	Diode 1N4007	D1

Electrolytic Capacitors

Reminder: Electrolytic capacitors are "polarized", which means they have a + (POSITIVE) and a – (NEGATIVE) lead and need to be installed correctly or else they will likely blow up!

Most electrolytic capacitors will have a wide stripe on the NEGATIVE side. (When they don't, they'll have some other indication of the POSITIVE and NEGATIVE leads.) Always ensure that this stripe (NEGATIVE) is positioned correctly. There are several keys to know how to position the capacitor:

1. There may be a "+" on the PCB indicating where to position the POSITIVE lead.
2. The segmented half of the circular stencil on the PCB shows where to position the NEGATIVE lead. The unsegmented ('half-moon') part of the circle is where the POSITIVE lead goes.
3. The POSITIVE lead goes to a square solder pad while the NEGATIVE goes to a round solder pad.

- ☐ Install the non-polarized 104J capacitor in position C1.
- ☐ Install the 1N4007 diode in position D1. Remember: When installing diodes note that they are oriented with a stripe — *match the stripe on the diode with the banding (|||) stencil on the board.*
- ☐ Install the 10uf 160V electrolytic capacitor in position C4, with the stripe facing the NEGATIVE (round) solder tab.
- ☐ Install the non-polarized Mundorf 30uf 600V TubeCap capacitor in position C3. Since it is non-polarized, it can go either way.
- ☐ Install the 4-pole 100+100uf electrolytic capacitor in position C2 *with the correct polarity.* In this case, the capacitor has two POSITIVE leads and one NEGATIVE lead, so it will only fit one way. Here again, as with the valve base, let's try it get it straight. See if you can find a book or something else to support the board so that the capacitor lies flat against it.

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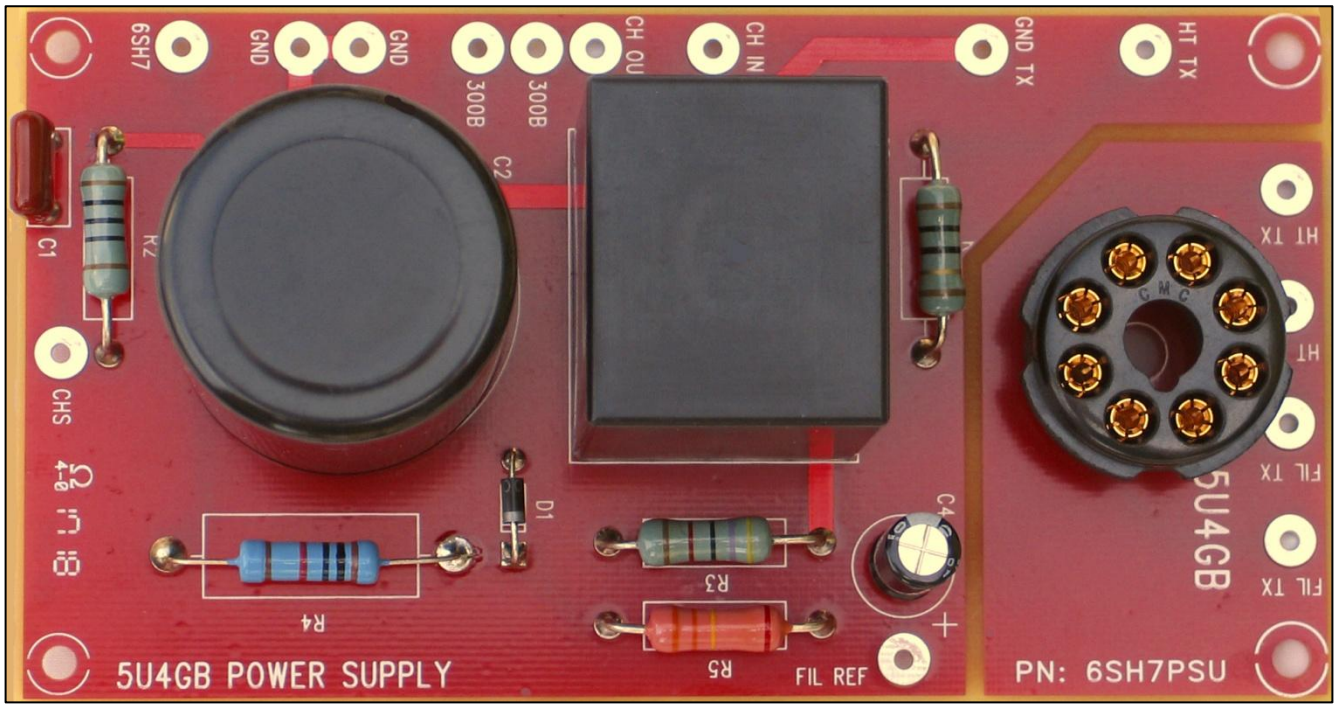
Congratulations! You've now completed the Power Supply PCB.



Place it aside for the moment. We'll install it later when we do the interwiring between it and other components.

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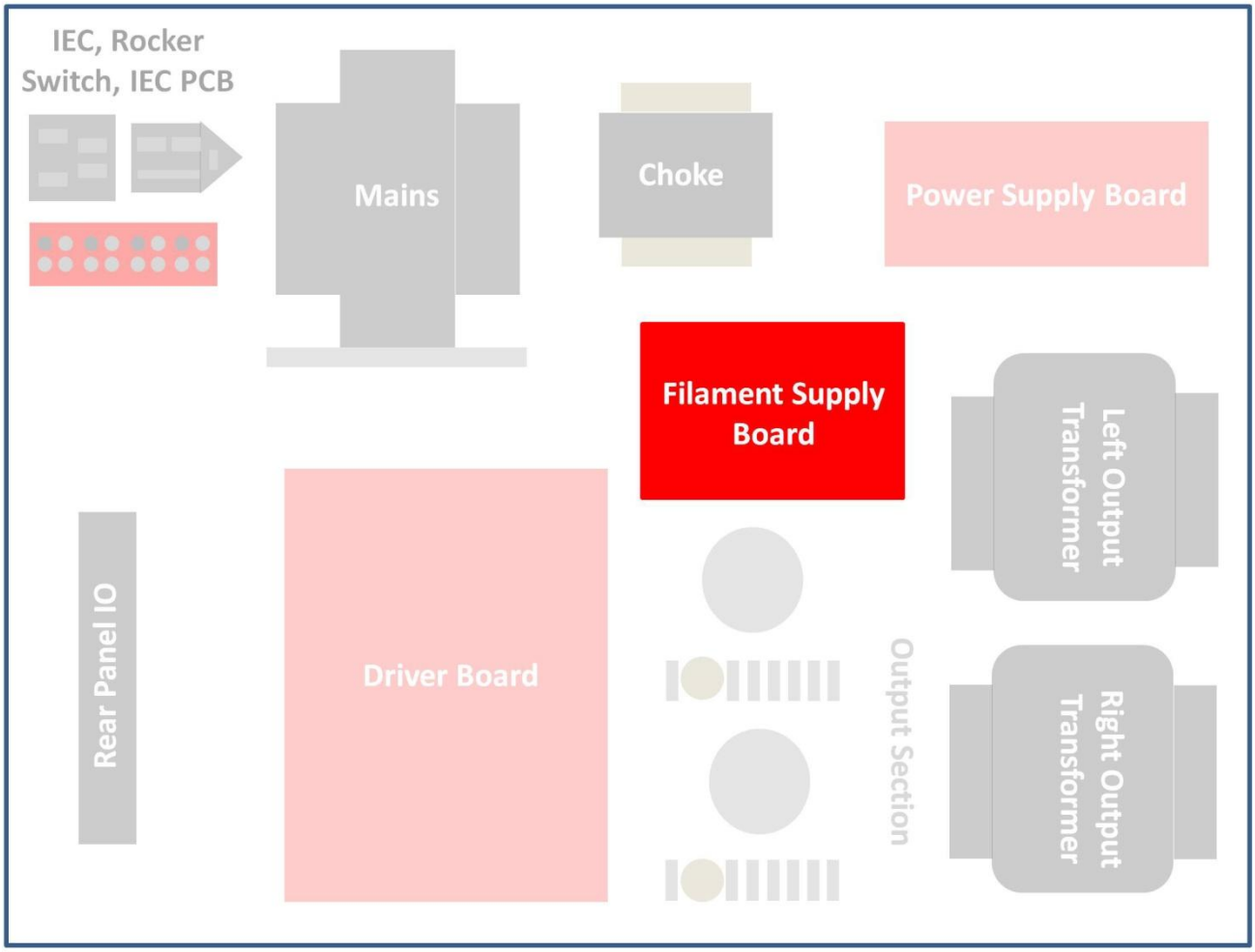
Section 4

Filament Supply Board Installation

4.1 Overview

In this section we'll be populating the Filament Supply board. This board takes 7V AC voltages from the Mains Secondary and DC regulates them to 5V which will be used to supply the 300B filaments.



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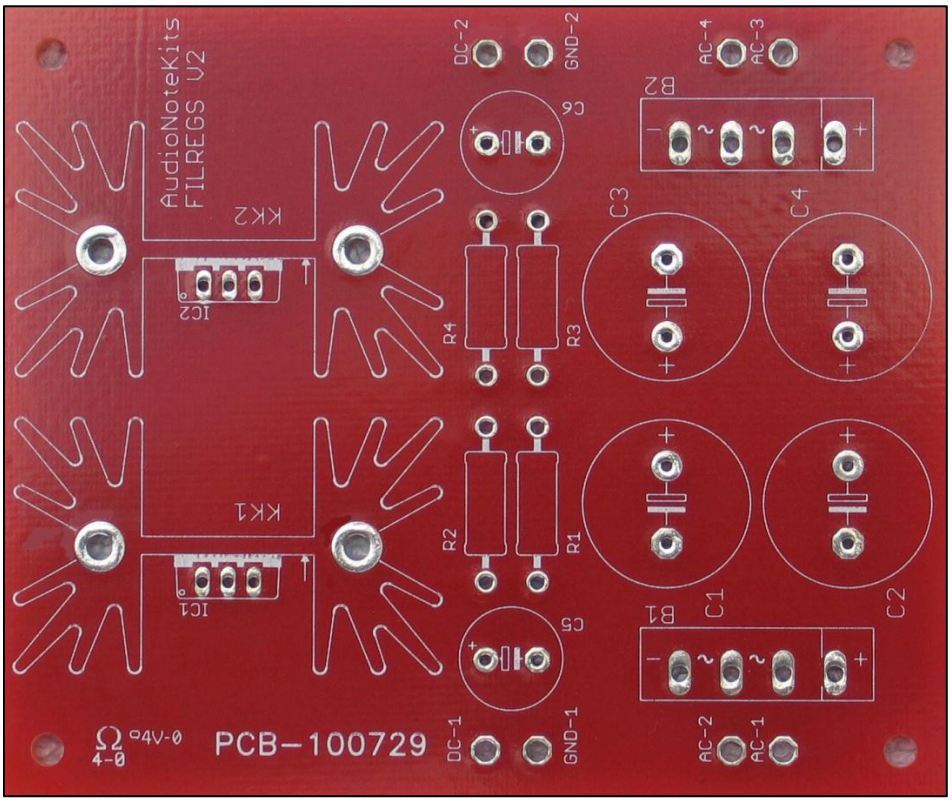
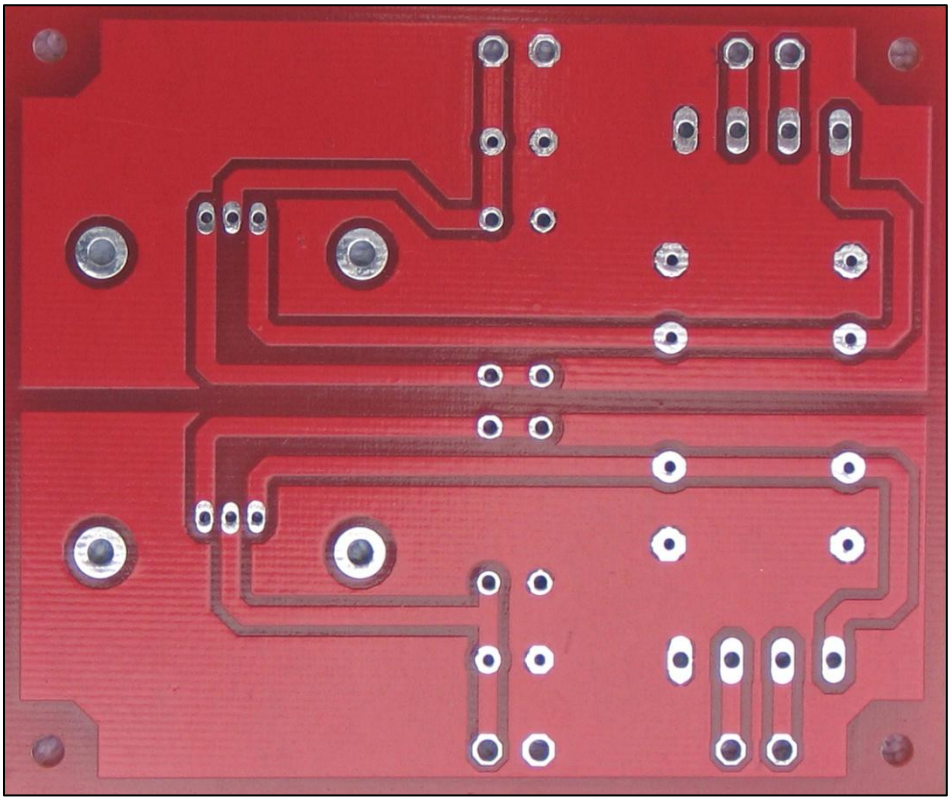
Here, for reference purposes, are a couple of pictures of the front and the back of the board:





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4.2 Parts List

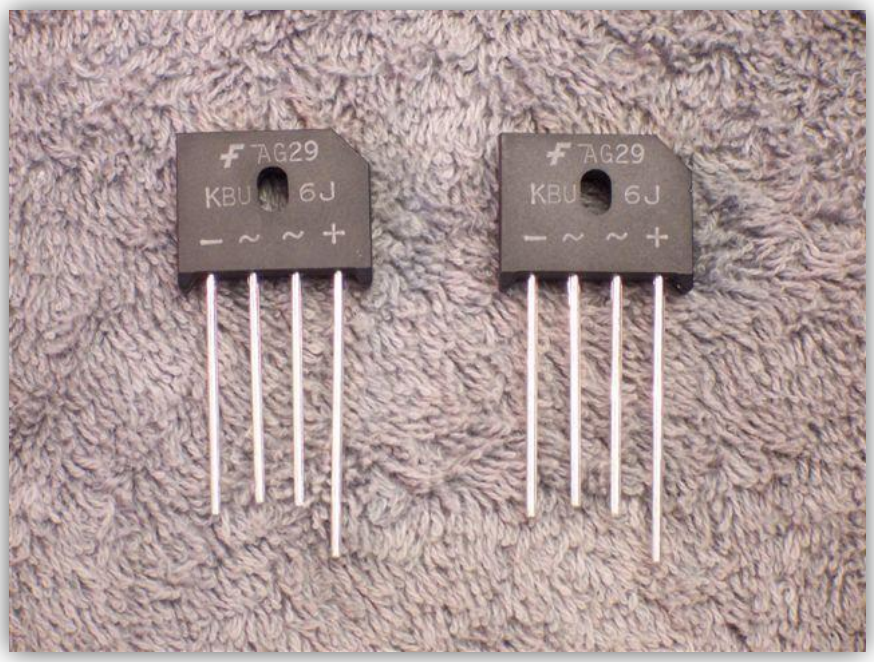
Quantity	Type	Designator
1	Filament Supply Board	
2	Black Heatsinks	
4	4700uf 16V Rubycon Electrolytic Capacitors	C1, C2, C3, C4
2	10uf 16V Nichicon Electrolytic Capacitors	C5, C6
2	KBU6J Bridge Rectifiers	B1, B2
2	LM1084 ADJ 5V Regulators	IC1, IC2
2	300R Resistors	R1, R3
2	100R Resistors	R2, R4

4.3 Installing the Resistors

- ☐ Install the 2 300R Resistors in R1 and R3.
- ☐ Install the 2 100R Resistors in R2 and R4.

4.4 Installing the Bridge Rectifiers

A Bridge Rectifier accepts an AC voltage and generates a DC voltage which, in this amplifier, is used as the filament voltage. You'll see a notch on the Bridge Rectifiers (part number: KBU6J): match the notch with the '+' (POSITIVE) stencil on the board.



- ☐ Install the 2 KBU6J Bridge Rectifiers at B1 and B2.

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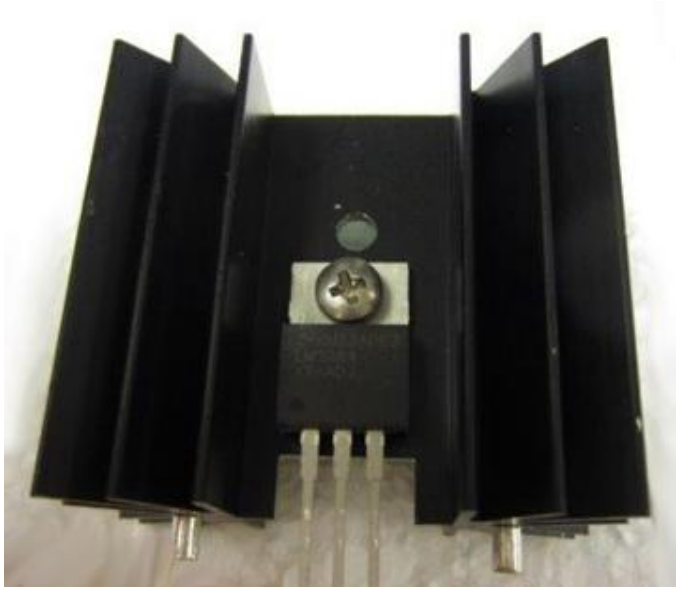
4.5 Installing the Capacitors

Next, let's install the electrolytic capacitors. Remember that the stripe denotes the NEGATIVE lead. On the board you'll see a + sign which denotes the POSITIVE side. Be sure to align the capacitors correctly into position.

- ☐ Install the 2 10uf 16V Nichicon Electrolytic Capacitors at C5 and C6.
- ☐ Install the 4 4700uf 16V Rubycon Electrolytic Capacitors at C1, C2, C3, and C4. Again, use something to support the board so that the capacitors lie flat.

4.6 Installing the Regulators

First, let's have a look at how a regulator is attached to a heatsink.



- ☐ Take an M3 PAN head screw and mount a regulator on a heatsink as shown above. The heatsink is the same front and back.
- ☐ *Insert a regulator and heatsink into the board at IC2*. (If you start with IC1 you won't be able to use a screwdriver to tighten the regulator to the heatsink.) Make sure that the regulator is inserted straight by doing the final tightening of the screw while holding the regular and heatsink in position on the board where it will go. Solder the 3-pin regulator and the heatsink from underneath the board. Again, use whatever props you need to get it straight.
- ☐ Follow the same process and install the other regulator at IC1. Note that they are oriented in the same direction.

Congratulations! You've now completed the Filament Supply PCB.

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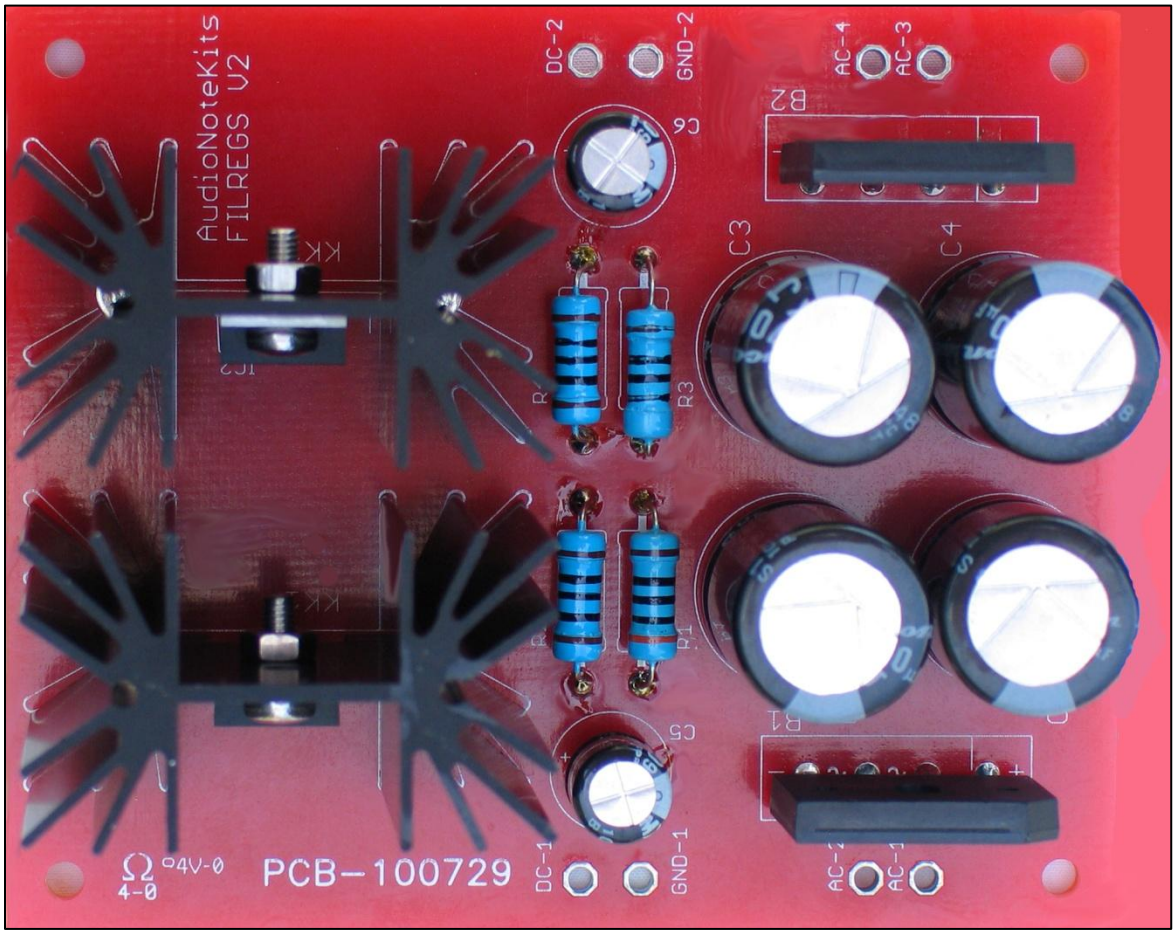

Again, place it aside for the moment. We'll install it later at the interwiring stage.

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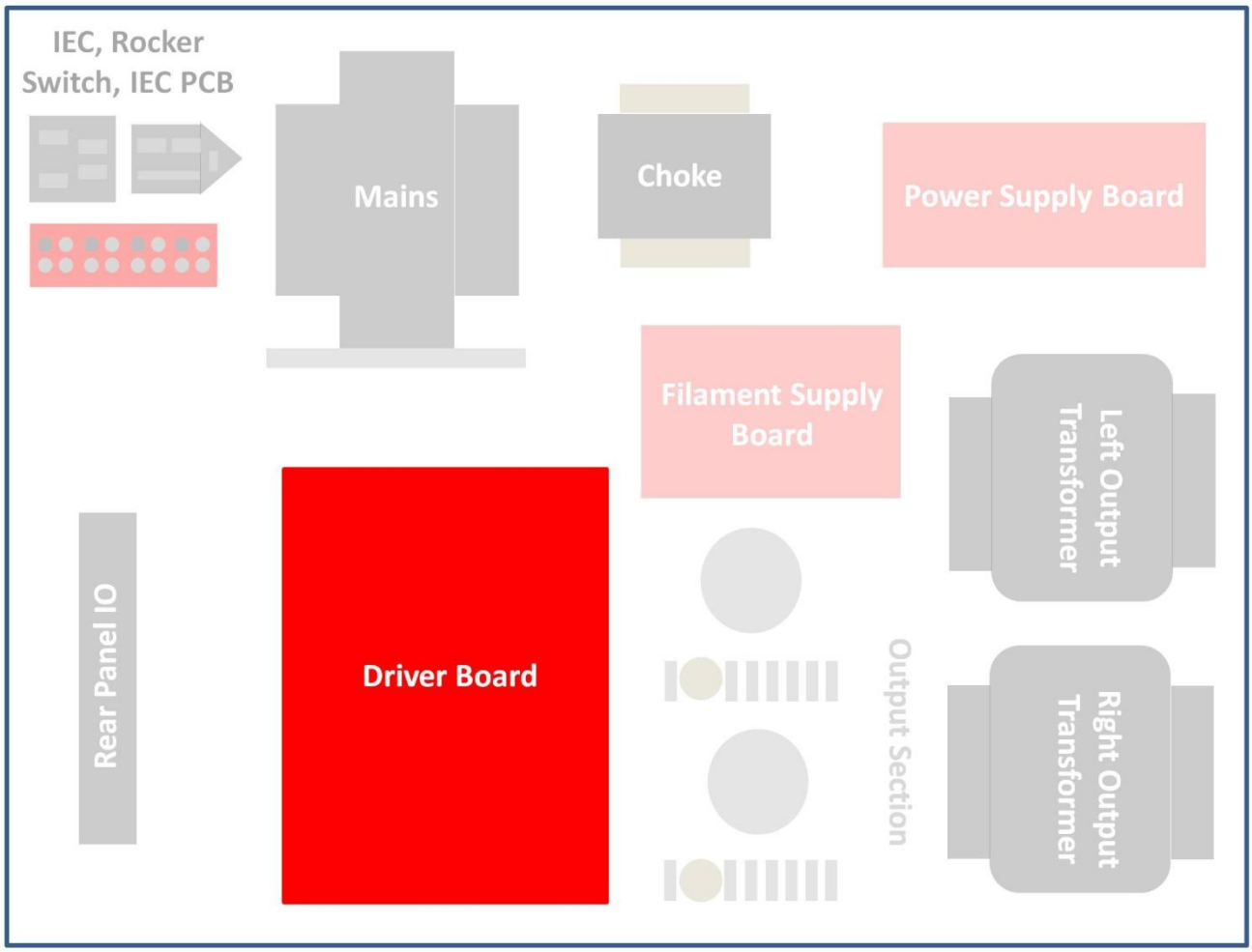
Section 5

Driver Board Installation

5.1 Overview



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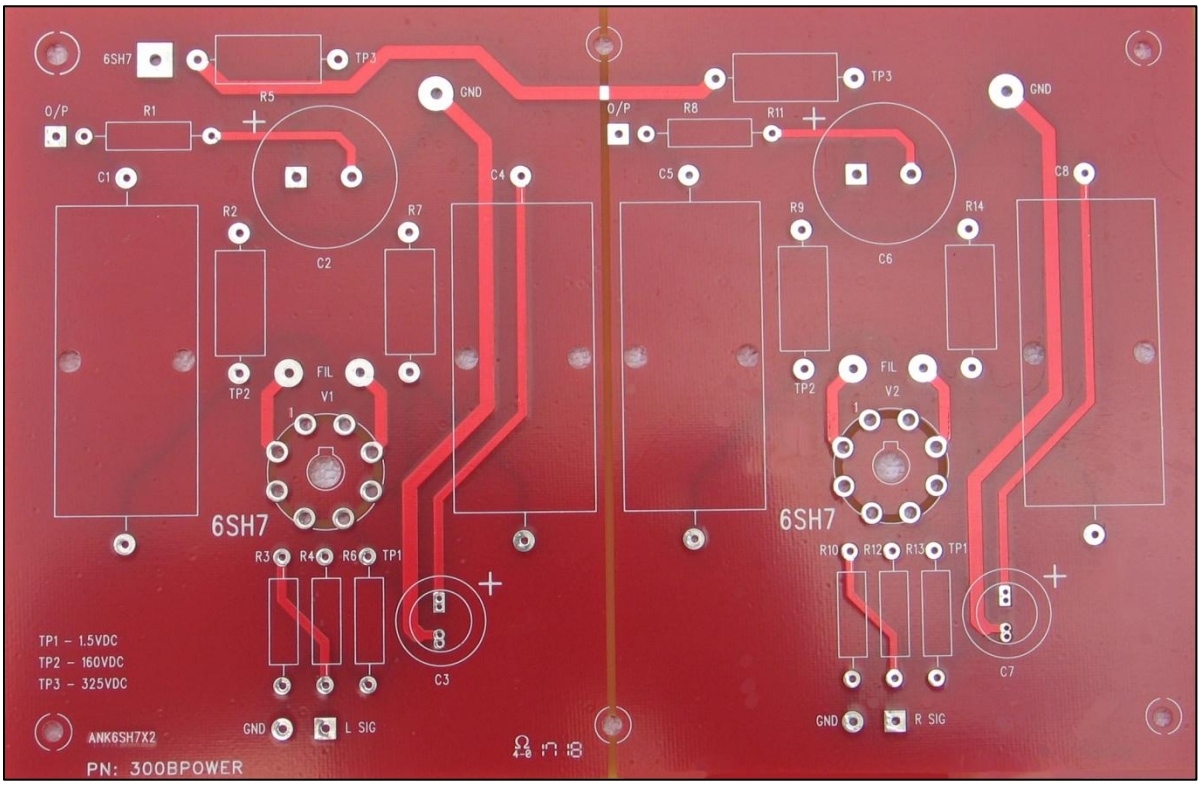
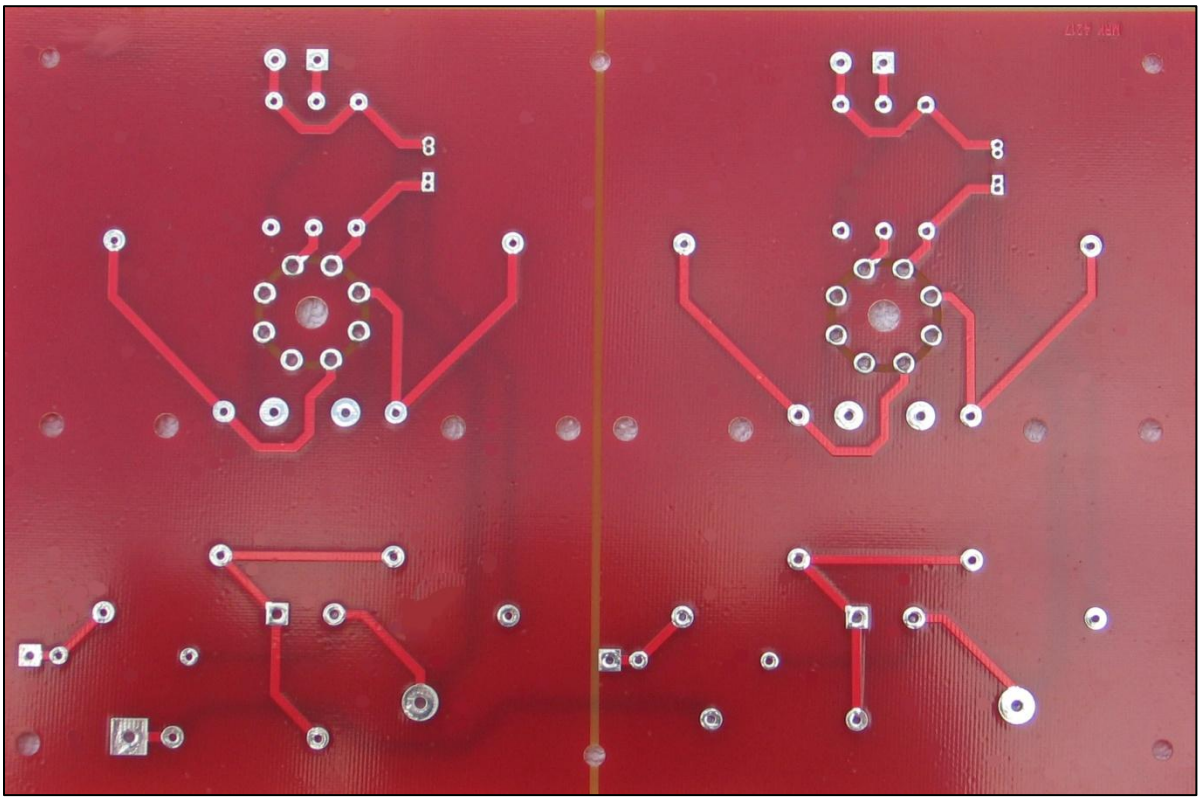
Here, for reference purposes, are a couple of pictures of the front and the back of the board:





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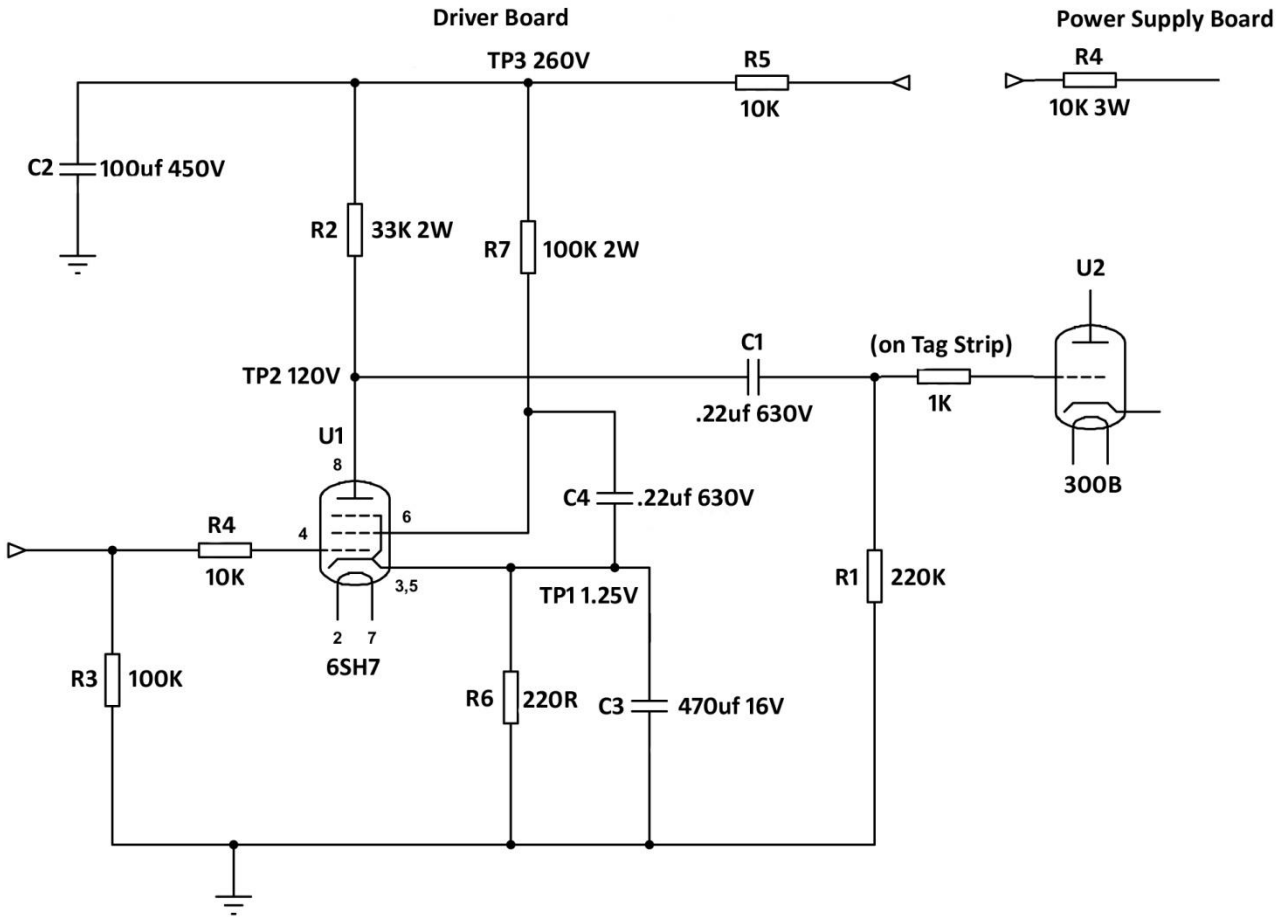
5.2 Schematic

Here is a schematic of the Driver board:



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5.3 Parts List

Quantity	Type	Designator
2	Audio Note Tantalum Non-Magnetic 220K 1W	R1, R8
2	Audio Note Tantalum Non-Magnetic 33K 2W	R2, R9
2	Audio Note Tantalum Non-Magnetic 100K 1W	R3, R10
2	Audio Note Tantalum Non-Magnetic 10K 1W	R4, R12
2	Audio Note Tantalum Non-Magnetic 10K 1W	R5, R11
2	Audio Note Tantalum Non-Magnetic 220R 1W	R6, R13
2	Audio Note Tantalum Non-Magnetic 100K 2W	R7, R14
4	Audio Note .22uf 630V Copper Foil Mylar in Oil Capacitors	C1, C4, C5, C8
2	100uf 450V Rubycon Electrolytic Capacitors	C2, C6
2	470uf 16V ELNA SILMIC II Electrolytic Capacitors	C3, C7
2	6SH7 Driver Tubes	V1, V2
2	8-pin Valve Bases	
1	Driver PCB	

5.4 Installing the Valve Bases

We'll begin by installing the 2 8-pin valve bases for the 6SH7 driver tubes.

As before, you'll want to make sure to use masking tape to secure the valve bases to the board prior to soldering to make sure they are level. It's a good idea to review the tips we offered in the Power Supply installation section.

- ☐ Install the 8-pin valve bases in positions V1 and V2. *Be very careful to align the tab 'cut-outs' on the top of the valve bases with the tab stencils on the board.* Take your time soldering on the underside of the board as they will require a fair bit of heat and solder to adhere the pins to the board. Again, no rushing!

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5.5 Installing the Resistors

Quantity	Type	Designator
2	Audio Note Tantalum Non-Magnetic 220K 1W	R1, R8
2	Audio Note Tantalum Non-Magnetic 33K 2W	R2, R9
2	Audio Note Tantalum Non-Magnetic 100K 1W	R3, R10
2	Audio Note Tantalum Non-Magnetic 10K 1W	R4, R12
2	Audio Note Tantalum Non-Magnetic 10K 1W	R5, R11
2	Audio Note Tantalum Non-Magnetic 220R 1W	R6, R13
2	Audio Note Tantalum Non-Magnetic 100K 2W	R7, R14

☐ Install the resistors on the Driver board following the parts list above.

5.6 Installing the Capacitors

Quantity	Type	Designator
4	Audio Note .22uf 630V Copper Foil Mylar in Oil Capacitors	C1, C4, C5, C8
2	100uf 450V Rubycon Electrolytic Capacitors	C2, C6
2	470uf 16V ELNA SILMIC II Electrolytic Capacitors	C3, C7

Now we'll install the electrolytic capacitors. As always take note that the stripe denotes the NEGATIVE side. On the board you'll see a + sign which denotes the POSITIVE side. Be sure to align the capacitors correctly into position.

☐ Install the 2 100uf 450V Rubycon electrolytic capacitors at C2 and C6.

☐ Install the 2 470uf 16V ELNA SILMIC II electrolytic capacitors at C3 and C7.

Finally, we'll install the non-polarized capacitors, which can go in either direction.

☐ Install the 4 Audio Note .22uf 630V Copper Foil Mylar in Oil capacitors at C1, C4, C5, and C8. These are heavy capacitors: we don't want the leads to strain bearing the load, so it's a good idea to use cable ties fed through the holes in the board to tie them solidly to the board. It'd also be nice to orient them in the same way, just to look good!

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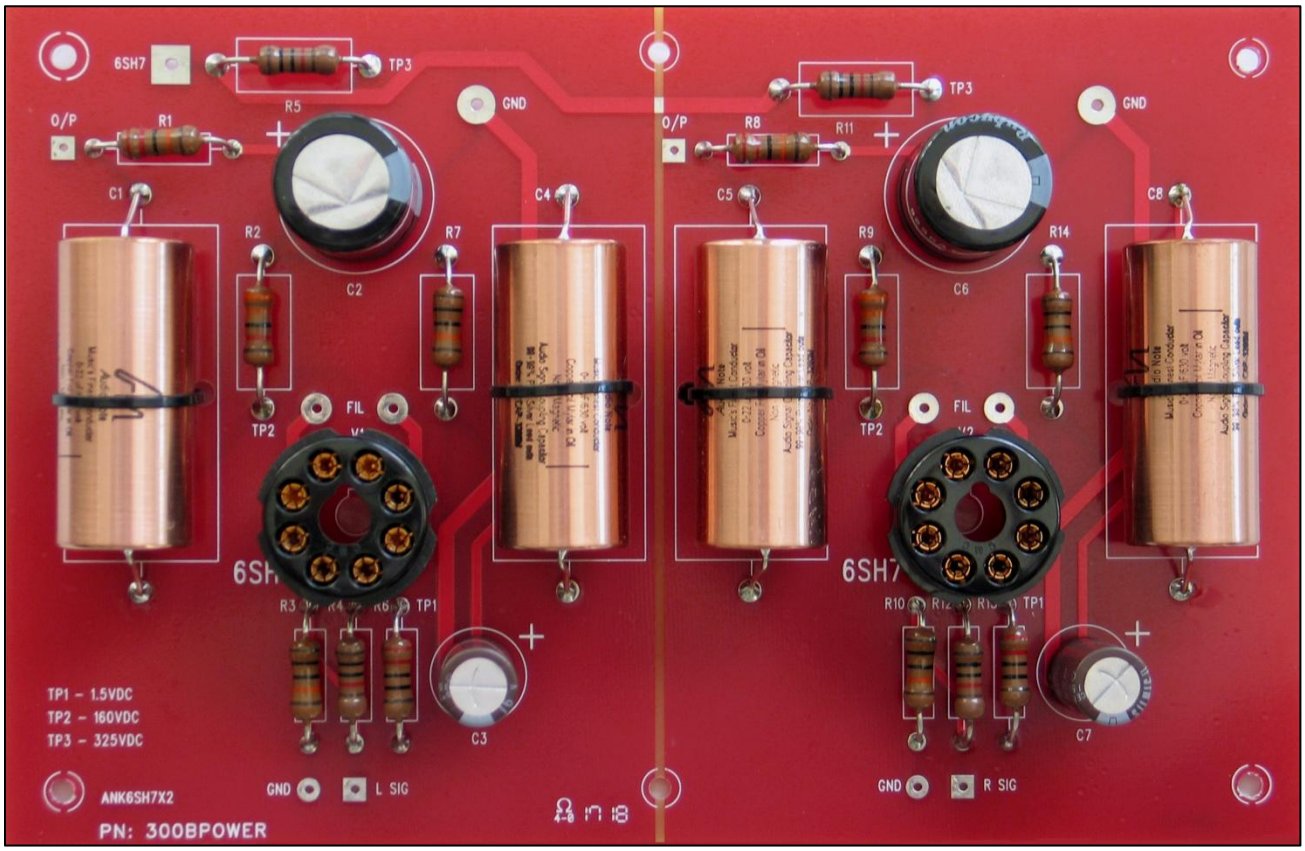
Congratulations! You've now completed the Driver PCB.



As we did with the other boards, place it aside. We'll install it when we do the interwiring.

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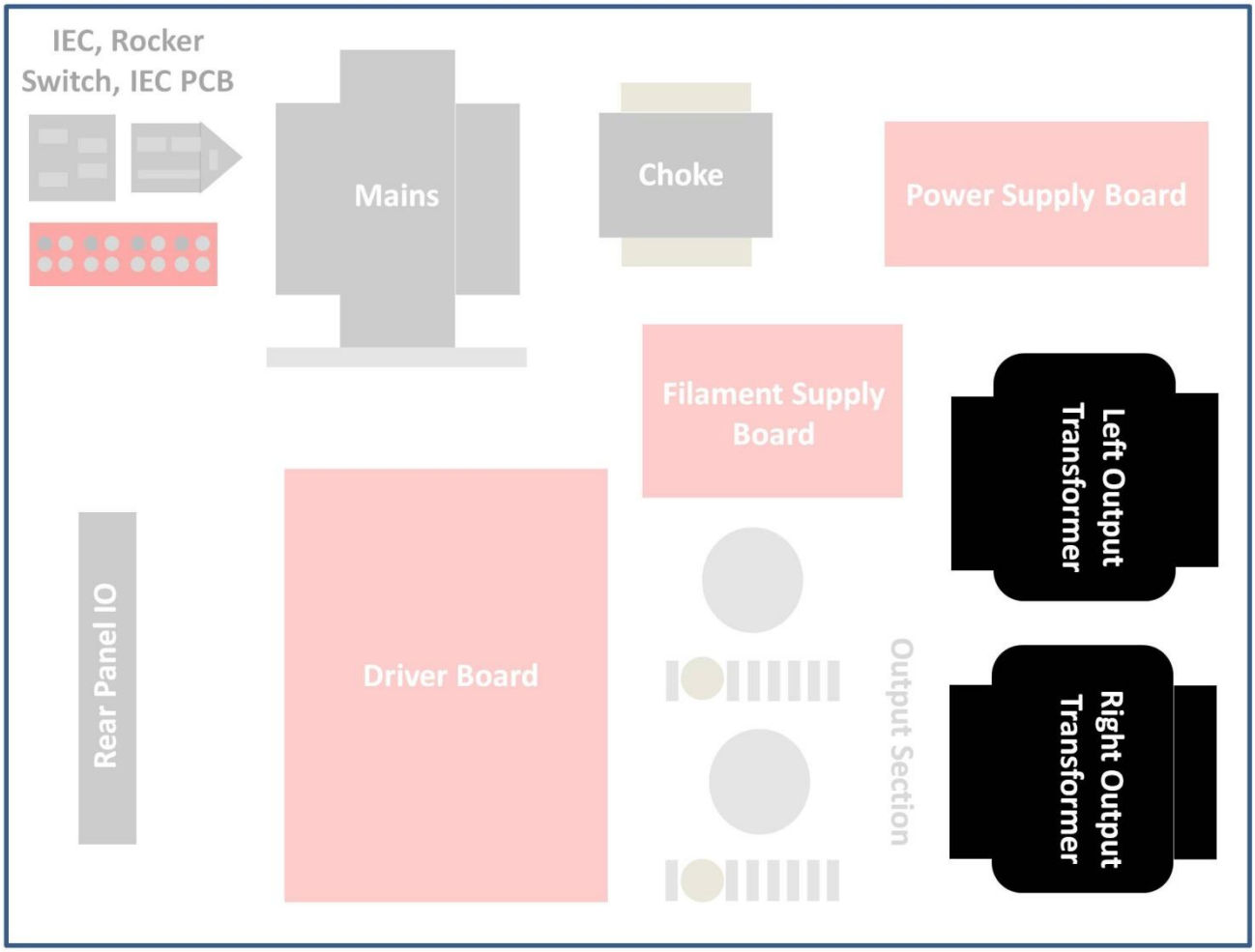
Section 6

Output Transformers Installation

6.1 Overview

In this section we will be installing the output transformers. The installation and wiring is the same for both EI-Core and C-Core variants.

In theory, this installation is really easy: 4 screws and bolts for each transformer. In actuality, it's kinda tricky: in addition to the fact that they're heavy and the chassis will be very heavy as you install them, the spacing is tight and there are issues relating to how to orient them to get things right for interwiring the transformers to the Driver board and speaker posts, so we recommend starting this section when you're fresh and have lots of patience.



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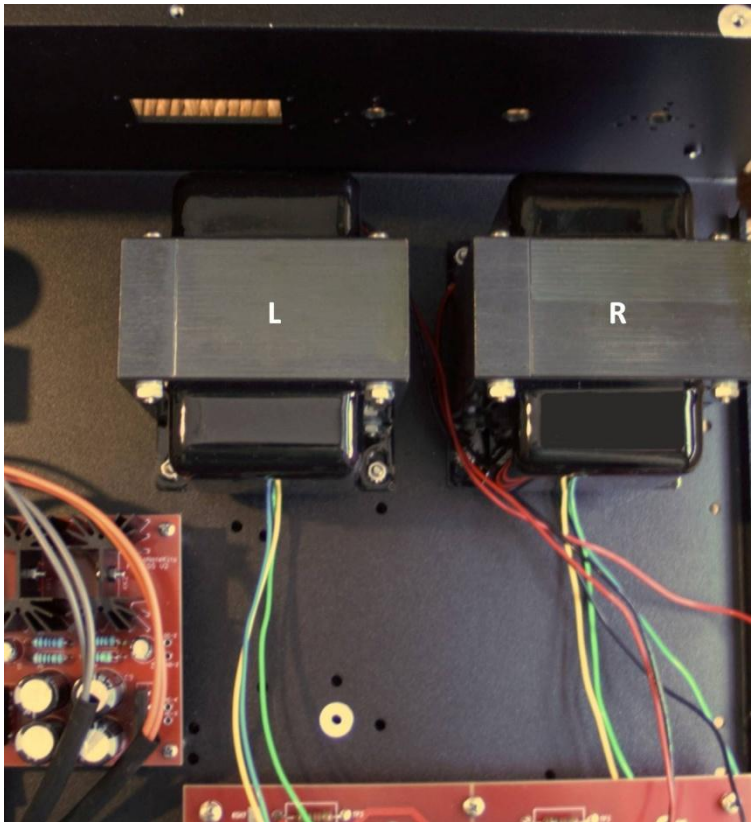
6.2 Installing the Output Transformers

Have a good look at the picture below:



First we'll install the output transformer closest to the side of the chassis.

It may be that one of the 4 holes in the chassis that will be used to install this transformer is the hole for the foot at the rear corner of the chassis. If that's so, temporarily remove the foot.

- ☐ Install this transformer as shown in the picture above with the Green, Yellow, and Blue Secondary wires facing the Driver board. Use 4 M4 screws and Keps K-Lock nuts (these are M4 nuts with attached locking washers).

- ☐ Similarly, install the second transformer as shown above — also with the Green, Yellow, and Blue Secondary wires facing the Driver board. Again, use 4 M4 screws and Keps K-Lock Nuts.
- ☐ Route the Black Primary wires for both transformers along the front of the chassis heading towards the Power Supply board and the Red Primary wires from the back around and through the gap between the transformers and lay them towards the Driver board.

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We'll connect the output transformer wires later.

It's not a bad idea at this point to label each output transformer as to which is for the left channel and which is for the right channel. This way, you can keep your head straight when you do the interwiring. I'd recommend a little bit of masking tape marked 'L' and 'R' attached to each.

That's it. We hope that wasn't too difficult.

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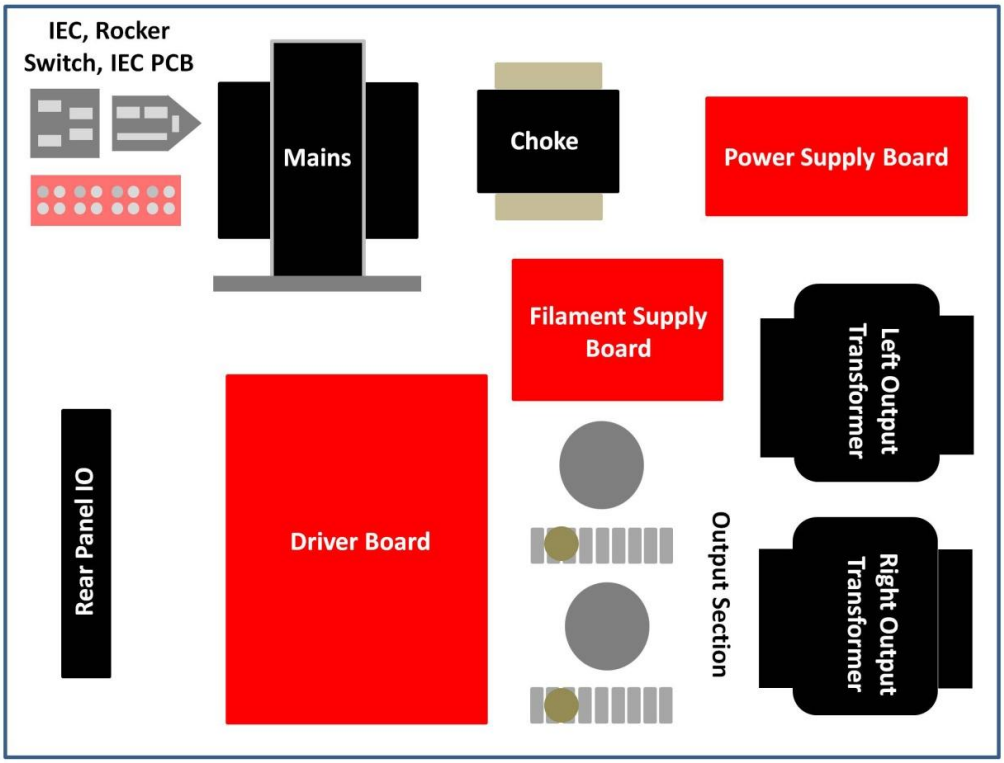
Section 7

Power Supply Board Interwiring

7.1 Overview

Let's have another look at an overview of the amplifier:



We've already completed the mechanical installation and the circuit boards. Now, we have to connect everything up; this is what we call the 'interwiring.' It's really not difficult, but we'll need to be very careful to get it right... and to make it neat.

Undoubtedly, the parts of your amplifier that you've already completed look really good and it'd be a shame not to complete the build as professionally as possible. You can see when you look inside your amp that there are now a lot of wires just 'hanging around'! Don't worry — we'll go about this in manageable steps.

The keys to getting this right are: 1) to do it when you're fresh — and to stop when you feel you're getting tired; 2) to double check 'what goes to what'; 3) to think carefully about how you want to route the wires; 4) to measure the wire lengths carefully; and 5) to use some heatshrink or cable ties to keep things neat.

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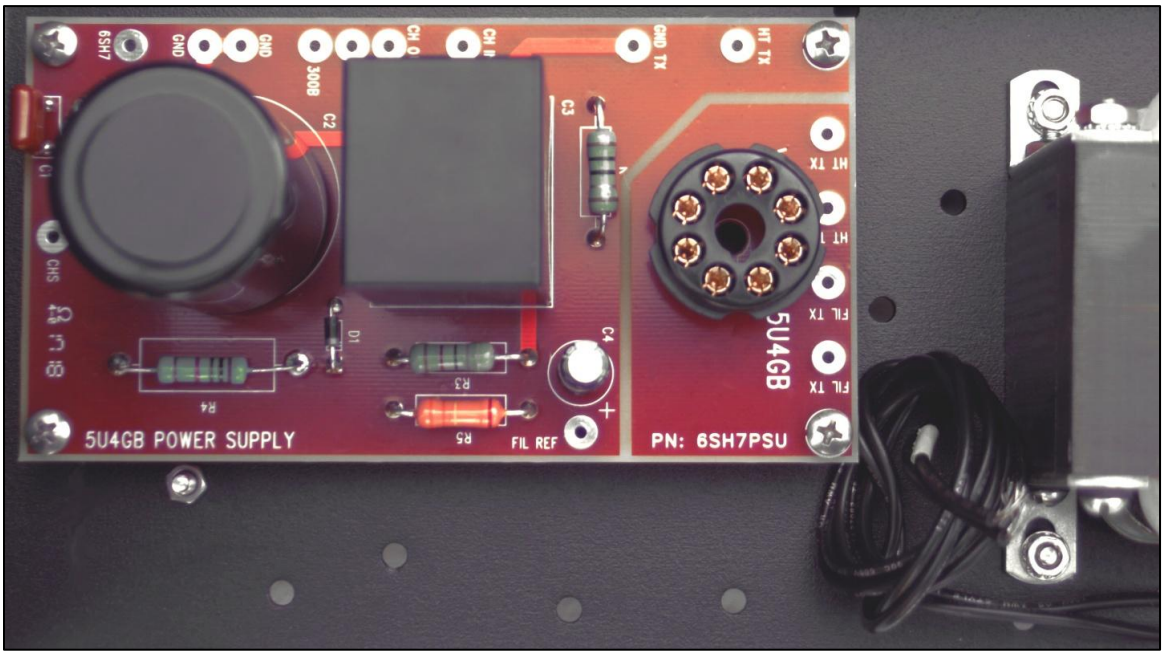
We'll begin with the Power Supply interwiring. First, let's be sure we know where the Power Supply board will be positioned in the chassis:



Power Supply Board (no interwiring shown)

Most interconnections will be made from the underside of the printed circuit boards, so you'll want to turn a board back and forth as needed to see where you'll make those connections.

Here's a picture that shows the wire routing that we're using in our build[11]:

[11] The colors of some wires may be different; it doesn't matter.

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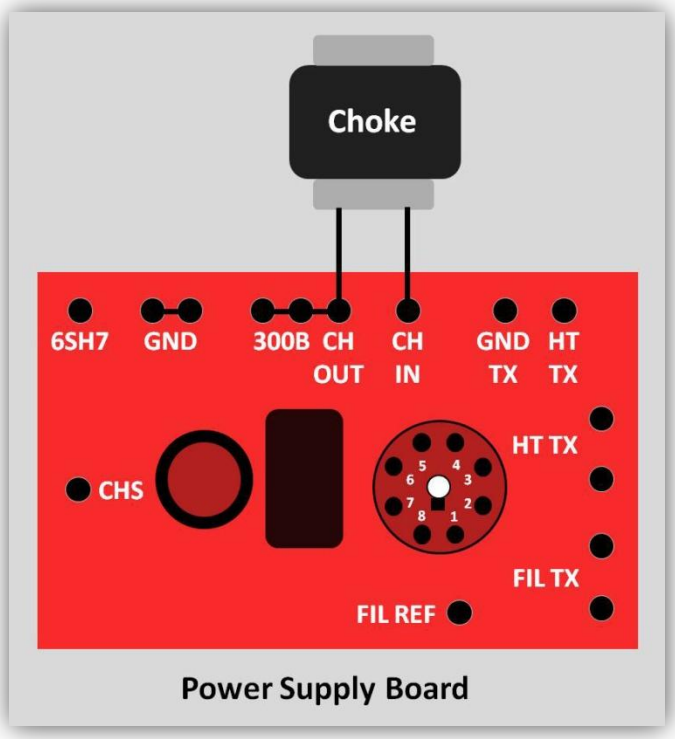
7.2 Connecting the Choke

Let's start by connecting the Choke to the Power Supply board. Use the following graphic as a reference:



As you can see from the picture on the previous page, the Choke wires will be routed along the edge of the chassis, then underneath the Power Supply board (about where R5 is installed) to be connected on the other side of the board, from the underside.

- ☐ Cut the 2 Black wires from the Choke to about 10", twist them together neatly, add about 5" of heatshrink to the part of the wires that will be visible, heat the heatshrink, strip and tin the ends of the wires.
- ☐ Route the wires under the board and connect them to CH IN and CH OUT (from the underside). There is no orientation — either wire can go to either solder tab.

Trim off the excess wires on the top of the board.

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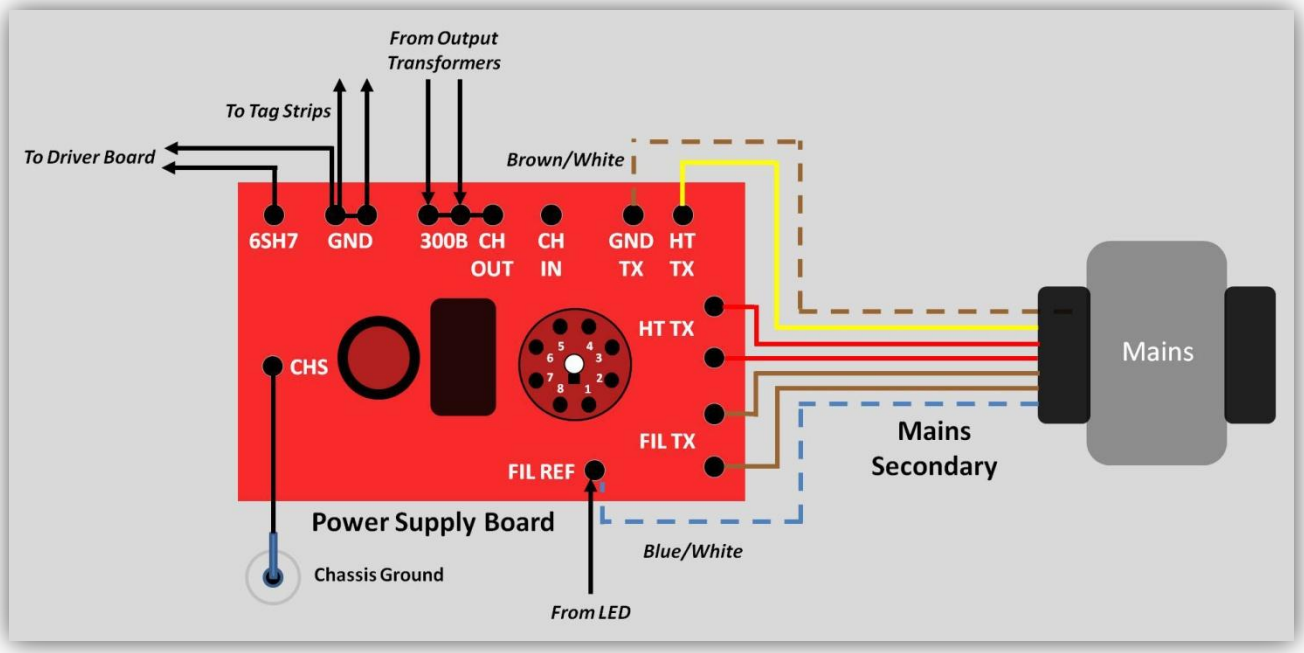
7.3 Connecting the Mains Secondary Wires

Next, let's connect those Mains Secondary wires that will go to the Power Supply board. Referencing the following graphic:



- ☐ Take Bundle 1 (the 2 Red wires, 2 Brown wires, Yellow wire[12], Blue/White wire, and Brown/White wire) and position them for the connections that we'll make. Cut the wires to the lengths needed, approximately as follows:

  - Red wires 6 1/2"
  - Brown wires 7 1/2"
  - Yellow wire 7"
  - Blue/White wire 9"
  - Brown/White wire 7 3/4"

- ☐ If you want to use heatshrink, trim it to a length of about 5 1/2 to 6", position it to cover the leads that will 'show', and shrink it.
- ☐ Strip and tin the wires. Strip about 1/2" of the Blue/White wire; for the other wires, you only need to strip about 1/4".

[12] The stencil on the PCB where the Yellow wire connects is incorrect; it should read "CT" (Center Tap). The Yellow wire is, in fact, the CT of the 5V supply, not, as you might think from the stencil ("HT TX") for the HT supply. In any case, that's our issue, which we'll correct in a future PCB revision. Just make the connection to the physical position shown in the graphic.

As you did earlier with the Choke wires, make the connections from the underside, as follows:

- ☐ 2 Red wires to HT TX. The orientation doesn't matter.
- ☐ 2 Brown wires to FIL TX. Again, the orientation doesn't matter.
- ☐ Yellow wire to the other (mislabelled) HT TX.
- ☐ Brown/White wire to GND TX.

Trim off the excess wires on the top of the board. We won't connect the Blue/White wire just yet.

7.4 The CHS Connection

Now we'll connect the third chassis ground wire.

- ☐ Take some Green (or Black, if you don't have any Green) wire, measure a length sufficient to reach comfortably from the CHS solder tab on the Power Supply board to the Chassis Ground (16" seems about right, as it will go along the side of the chassis); prepare one end by stripping and tinning it and the other end as you did when you prepared the Green Mains Ground wire (that is, with a lug on the end).
- ☐ Connect the end without the lug, from the underside, to CHS on the Power Supply board.
- ☐ Connect the other end to Chassis Ground screw, You should now have 3 wires going to the Chassis Ground screw, as you can see in the picture below:

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7.5 The Blue/White and LED NEGATIVE Connection

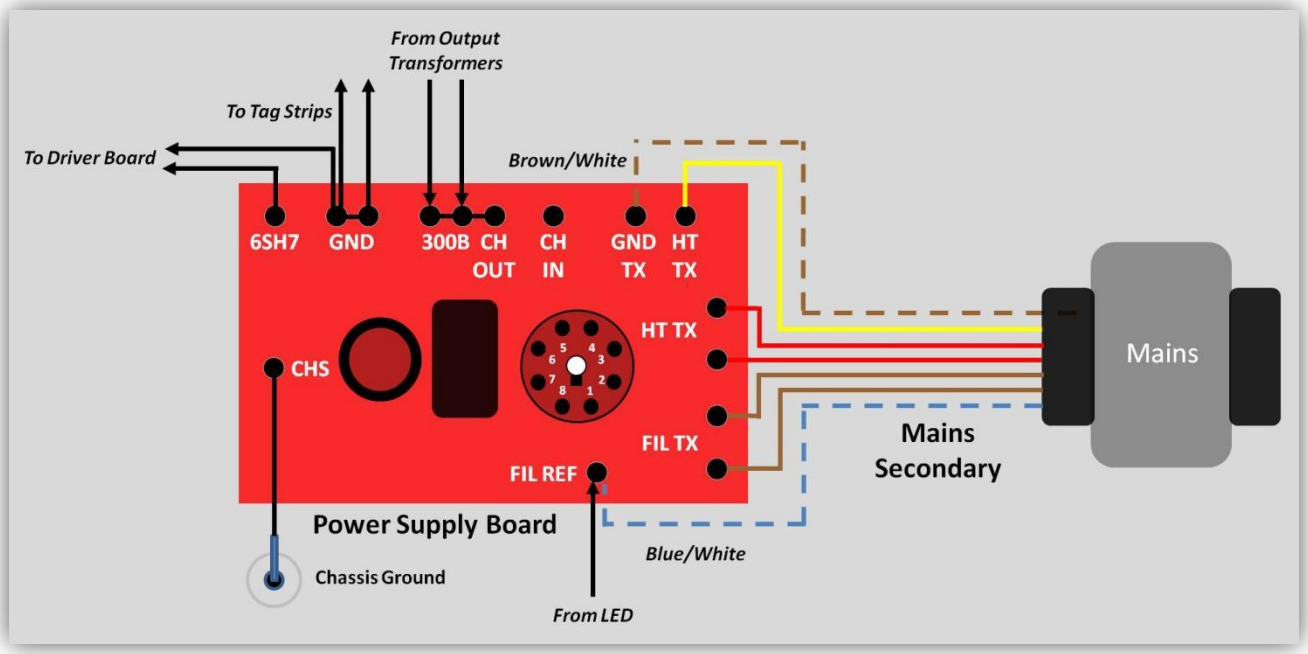
The Blue/White Secondary wire and the Black LED (NEGATIVE) lead will be connected to FIL REF. But there's a problem: the combination of the tinned Blue/White wire and the Black LED wire will not fit through the FIL REF solder hole on the board. So, here's how we solve this:

- ☐ Strip 3/4" of the Black LED wire. Twist it tight but don't tin it.
- ☐ Insert the Blue/White wire into the FIL REF solder tab from the underside so that about 3/8" of it protrudes through on the top of the board. Solder it on the underside only.
- ☐ Twist the end of the Black LED wire around the protruding end of the Blue/White wire *near the board*. Use your needle-nosed pliers, if it helps. Let's not have any stray wires; ensure a clean 'finish' to the wrap.
- ☐ Solder this combination Blue/White–Black LED wire on the top of the board.

Trim off the excess Blue/White wire *WITHOUT cutting into the part that has the Black LED wire wrapped around it.*

7.6 The Remaining Connections

Let's have another look at the wiring diagram.



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Before you prepare any more wires, note that 2 Black wires coming from the output transformers will be connected to the Power Supply board at the 300B solder tabs — and that 4 Black wires will leave the Power Supply board from the 2 GND and 6SH7 solder tabs: 2 headed for the Driver board and 2 headed for the tag strips. All 6 of these wires will be routed along the front of the chassis at the bottom and the 4 wires headed for the Driver board and tag strips will then be routed between the output transformers. To keep things neat, we recommend that you bundle these 6 wires together, using either a couple of cable ties or some heatshrink. Don't worry about any left or right channel issues: the 2 300B solder tabs on the Power Supply board are connected as are the 2 GND solder tabs, so the Left/Right orientation of the wires is not an issue. Also, you can use you multimeter later, in Connectivity mode, to identify which Black lead is the '6SH7' lead.

- ☐ Route the bundle of 6 Black wires along the front of the chassis at the bottom.
- ☐ Cut the 2 wires coming from the Primary of the output transformers to the lengths needed to comfortably reach the 300B solder tabs on the Power Supply board, strip about 1/4" from the ends of each, tin them, and connect them to the 300B solder tabs, from the underside. The orientation doesn't matter.
- ☐ Prepare the 4 Black wires leaving the Power Supply board by cutting them to a length of about 27", then stripping about 1/4" from each end of each wire, and tinning 3 of them (leave one not tinned).

Make the following connections from the underside:

- ☐ 1 Black wire to the 6SH7 solder tab.
- ☐ 1 Black wire to one of the GND solder tabs, as shown above.
- ☐ 2 Black wires to the other GND solder tab, using the same technique you used earlier to solder the Blue/White–Black LED wire: that is, insert the tinned wire from underneath — through the solder hole and soldered on the bottom of the board — and wrap the other wire, not tinned, *around the bottom* of the protruding tinned wire.

Again, trim off the excess wires on the top of the board *WITHOUT cutting into the wrapped wire*. We'll connect the other ends later to the Driver board and tag strips.

Before you install the Power Supply board, we strongly recommend that you go back to the beginning of this section and check every connection carefully! Make sure there are no solder bridges on the underside of the board.

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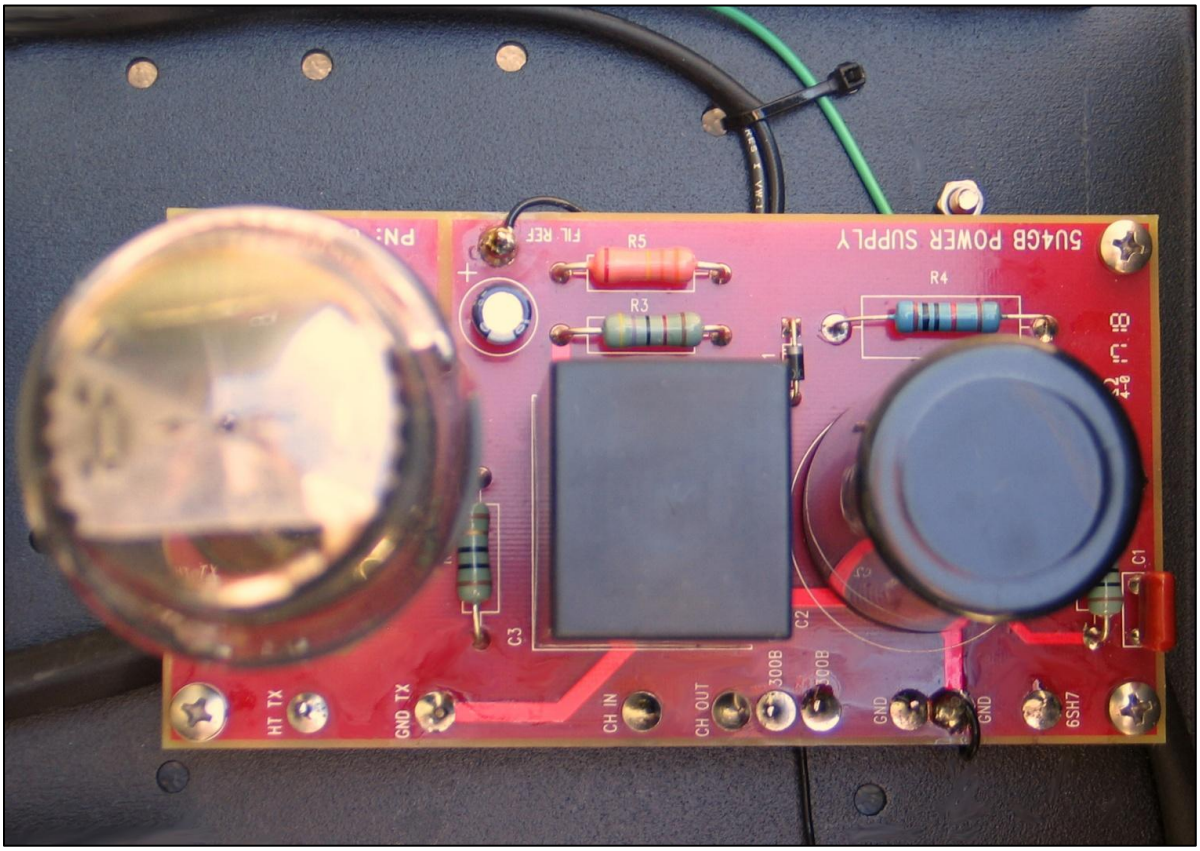
7.7 Installing the Power Supply Board

This is straightforward.

- ☐ Add 4 M4 standoffs to the board.
- ☐ Position all the wires going to — and coming from — the Power Supply board in the positions shown below.
- ☐ Install the board in the chassis by attaching it with 4 M4 screws into the standoffs from the underside of the chassis.



That's it!

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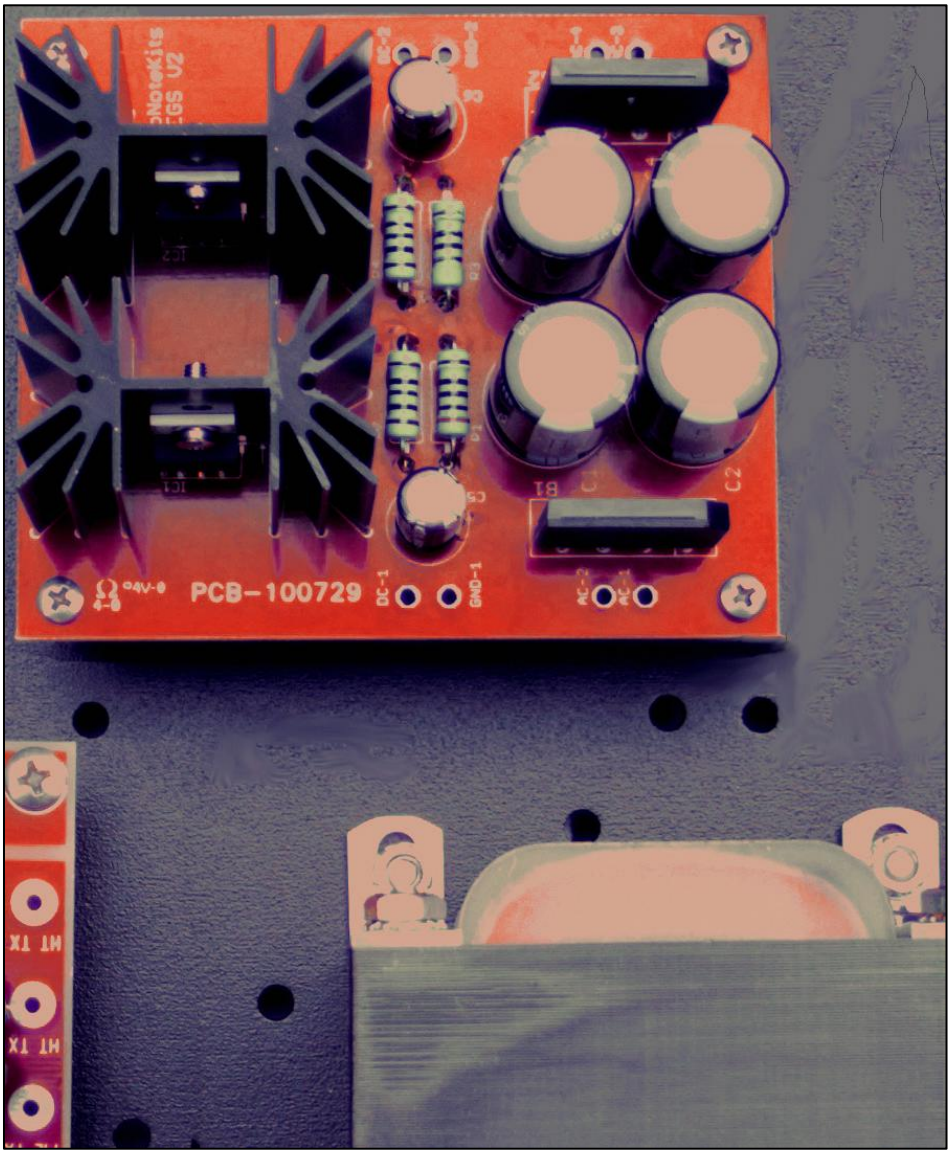
Section 8

Filament Supply Board Interwiring

8.1 Overview

Now let's work on the Filament Supply board interwiring. Have a look at how the Filament Supply board will be positioned in the chassis:



Filament Supply Board (no interwiring shown)

As we did with the Power Supply interwiring, these connections will be made from the underside of the board, so turn the board back and forth as needed to see where you'll make the connections.

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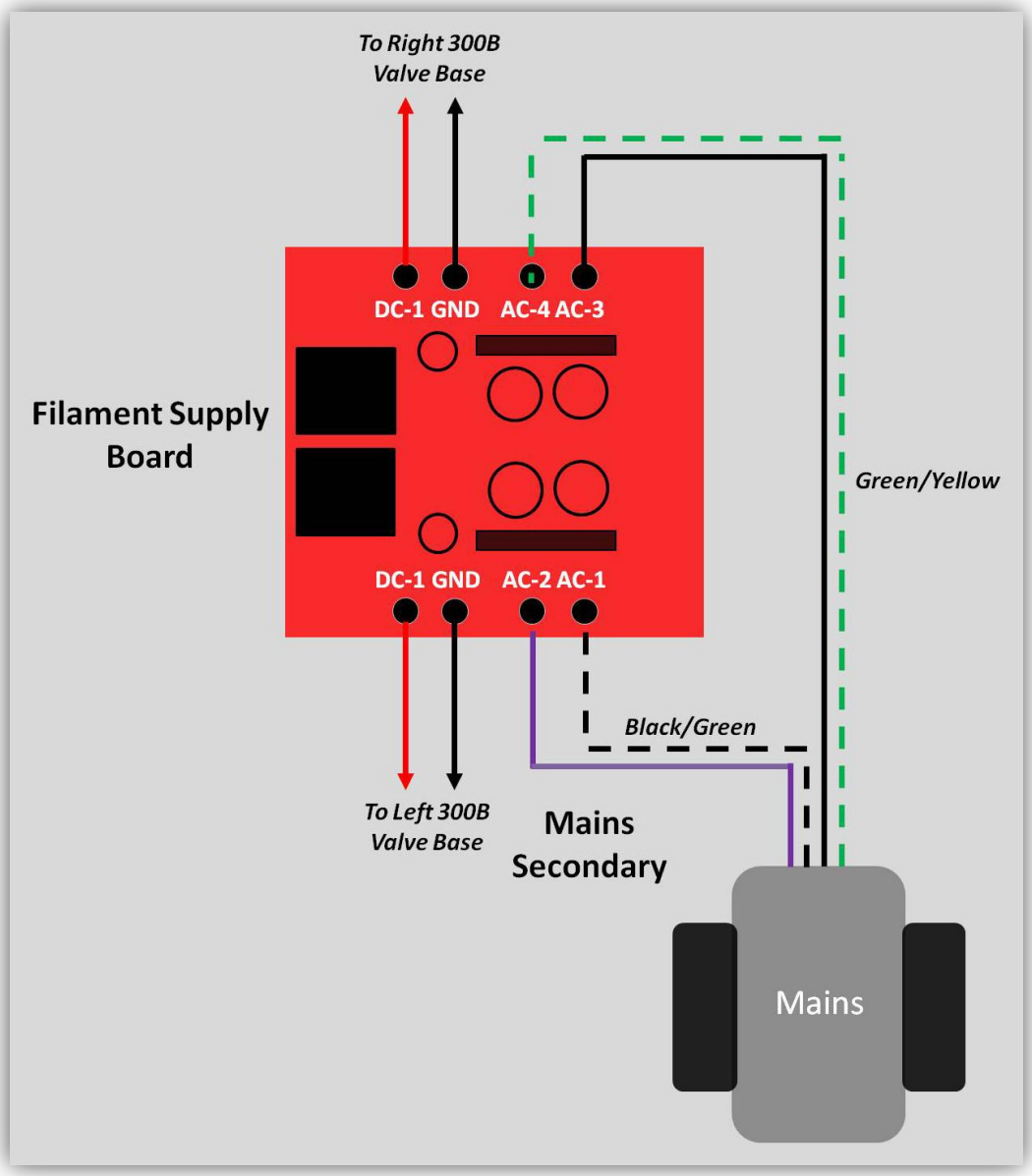
8.2 Connecting the Mains Secondary Wires

We'll start by connecting the Mains Secondary wires that go to the Filament Supply board. Referencing the following graphic:



☐ Take Bundle 3 (the Black wire, the Purple wire, the Black/Green wire, and the Green/Yellow wire) and position them for the connections that we'll make. Cut the wires to the lengths needed, approximately as follows:

- Purple and Black/Green wires 5"
- Black and Green/Yellow wires 6 1/2"

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- ☐ If you want to use heatshrink, trim it to a length of about 3" or less, position it over the leads that 'show', and shrink it. Don't make it too long as it's not very flexible and will not help you make the connections from the underside of the board.
- ☐ Strip about 1/4" of insulation off the wires and tin them.

Make the following connections from the underside:

- ☐ Black/Green wire to the AC-1 solder tab.
- ☐ Purple wire to the AC-2 solder tab.
- ☐ Black wire to the AC-3 solder tab.
- ☐ Green/Yellow wire to the AC-4 solder tab.

Trim off the excess wires on the top of the board.

8.3 Additional Connections

Lastly, we'll connect some additional wires that will be used later in the build. These wires will go from the two DC-1/GND tabs on the Filament Supply board to the valve bases. You can choose to route them 'directly', or, as we've done in our build, use some heatshrink and route them first under the Driver board and then straight out to each valve base. You'll want to take this into consideration when thinking about wire length; *our recommendation, as always, is to allow more than enough wire to get you to where you want to be*.

- ☐ Prepare 2 lengths of twisted Red/Black (or any other color) wire, strip about 1/4" from each end of each wire, and tin them.
- ☐ From the underside, connect the 2 Red wires to the 2 DC-1 solder tabs as shown above.
- ☐ Similarly, connect the 2 Black wires to the 2 GND solder tabs.

Cut off the excess wire and add some heatshrink (4" should do it), if you like. The tabs are quite close on the underside of the board, so it's a good idea to check things after you've solder the wires to make sure you don't have any solder bridges.

We'll connect the other ends later.

Again, before you go any farther, go back to the beginning of this section and check every connection carefully, making sure that there are no solder bridges on the underside of the board.

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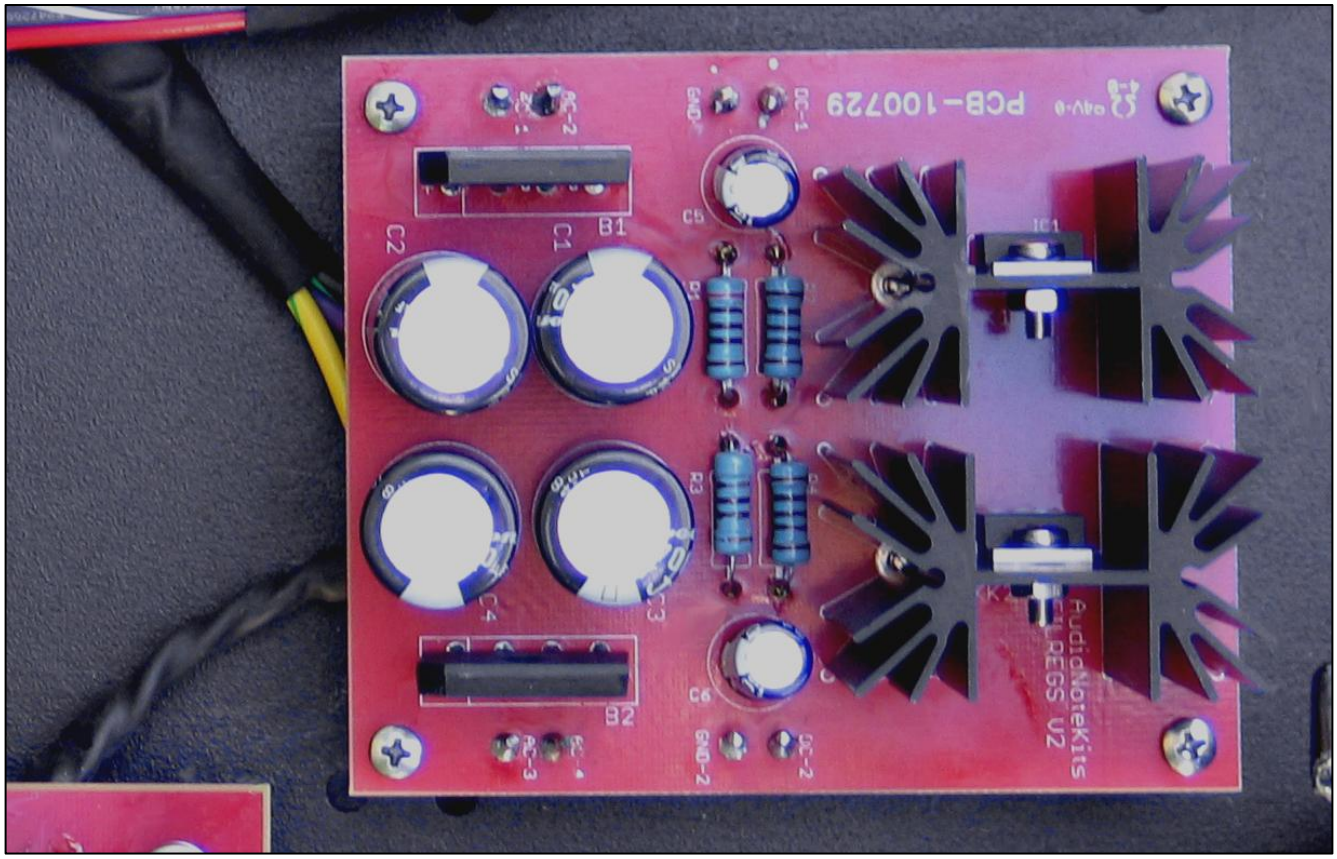
8.4 Installing the Filament Supply Board

- ☐ Add 4 M4 standoffs to the board.
- ☐ Position the wires going to — and coming from — the Filament Supply board as shown below.



- ☐ Install the board by attaching it with 4 M4 screws into the standoffs from the underside of the chassis.

That's it!

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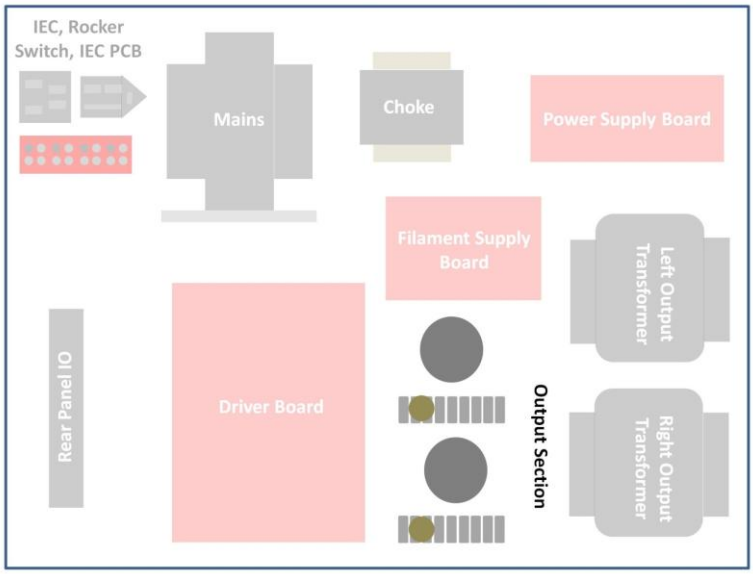
Section 9

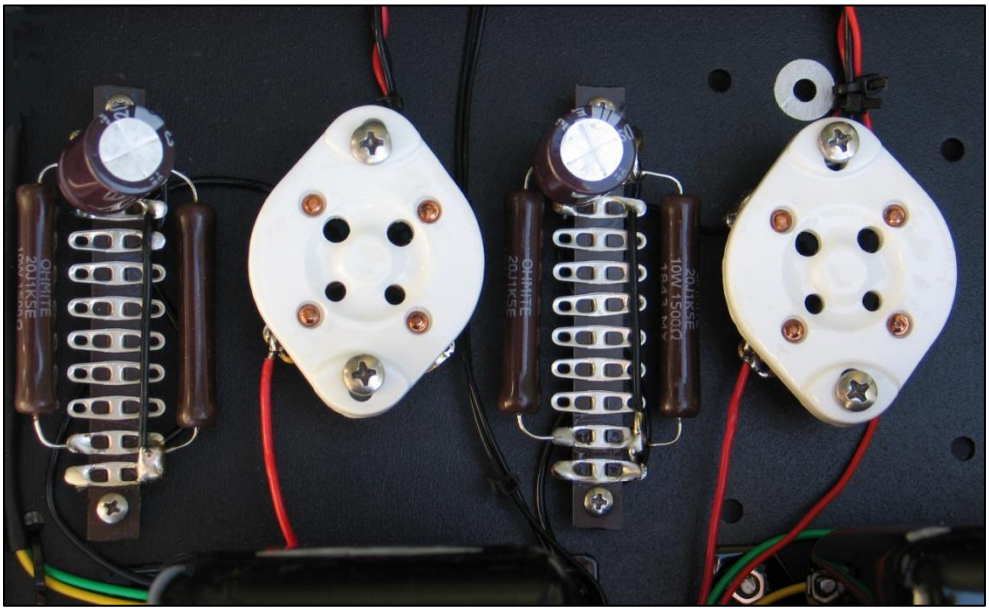
Chassis-Mounted Output Section Installation

9.1 Overview

Now we'll install the chassis-mounted output section: the 2 tag strips and the 2 valve bases.

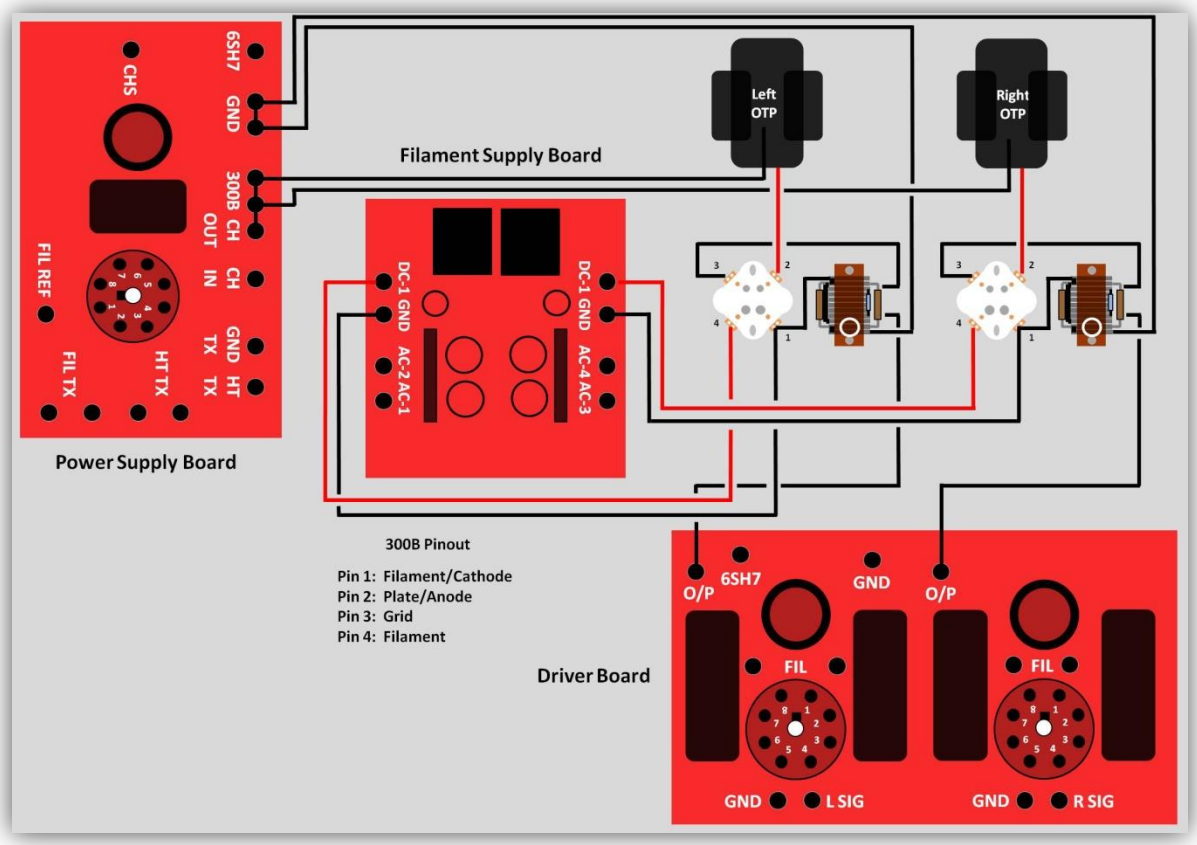


Let's have a look at what we want to do:



As you can see, each 300B is seated in a valve base next to a tag strip, to which are attached 3 resistors, an electrolytic capacitor, and some jumpers. We'll want to take great care to get the wiring correct and neat.

Here's some additional context, showing the interwiring for the 300Bs and the output transformers. This is work we'll be tackling in this and the next sections. (There is a high resolution version of this graphic on your disk.)



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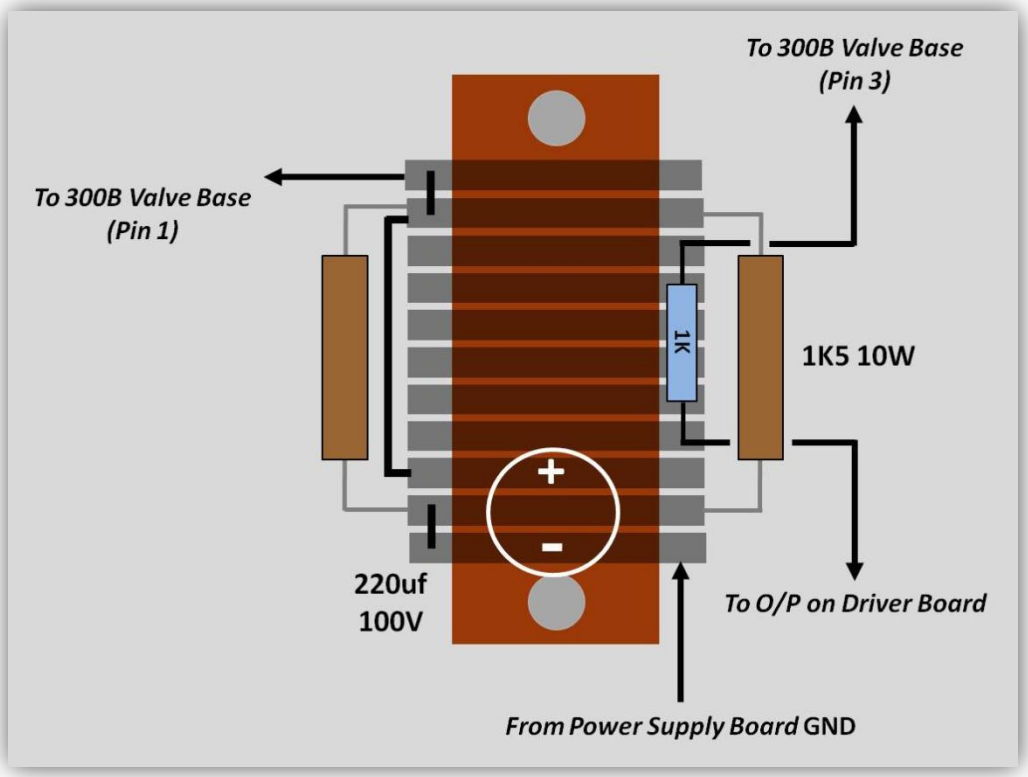
9.2 Installing the Tag Strips

9.2.1 Wiring the Tag Strips

There are two identical tag strips, one for each 300B. It's not obvious from the picture above exactly how the wiring is to be done; in fact, it's a bit tricky, so we'll go step by step. Here's a graphic of a completed tag strip:



The following instructions are for one tag strip; you can either do the two step-by-step/side-by-side or you can just do one tag strip and then repeat the instruction sequence for the second tag strip.

- Bend the resistor leads to create a little tension so that when you insert them in a tag or against a jumper the tension will hold them in place as you solder.
- The 3 connections are a bit of a problem because you can't fit all 3 wires in a tag hole. A resistor lead can be placed (under tension) against a jumper and a small weight will keep the jumper in place as you solder.
- Use 2 short (about 3/8") dressings on the capacitor leads to avoid the possibility of a short. You can use some left over wire insulation.

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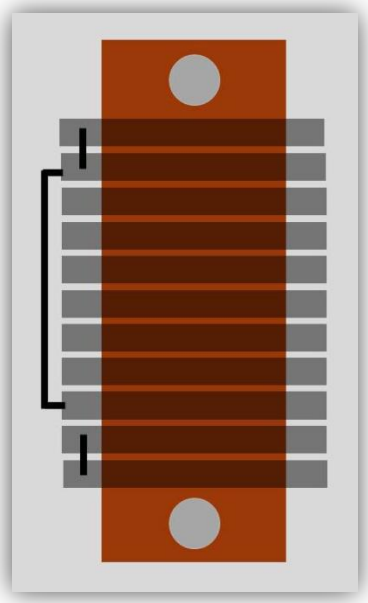
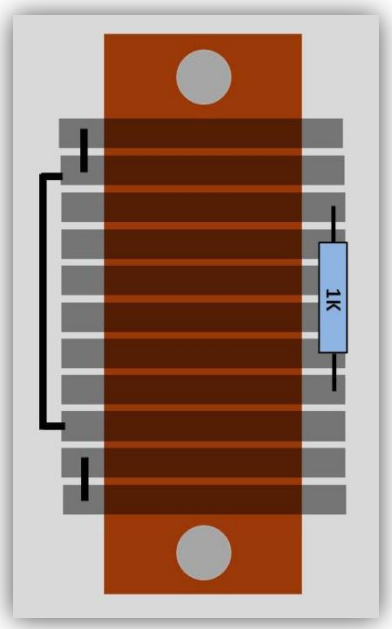
Let's begin with the jumpers:



- ☐ Measure and connect the 3 jumpers, as shown above. You can use some left over wire, not too thick. The 2 short jumpers can be bare ***but do NOT use bare wire for the longer jumper*** as there are intermediary connections to the Grid resistor and you would quite likely create a short.

Now,

- ☐ Add the 1K grid resistor, as shown below.



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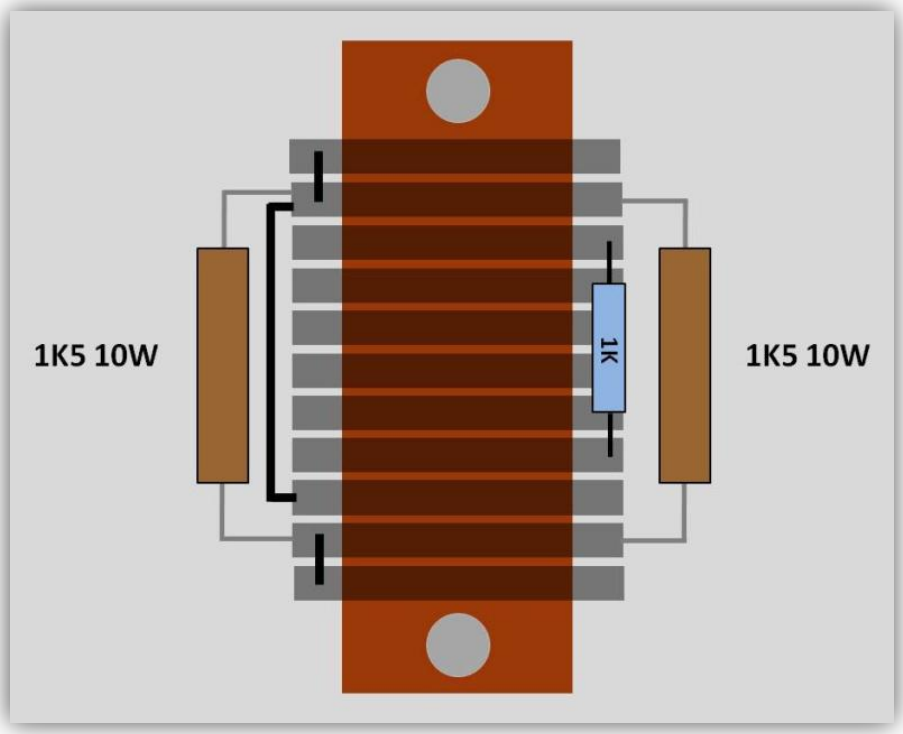
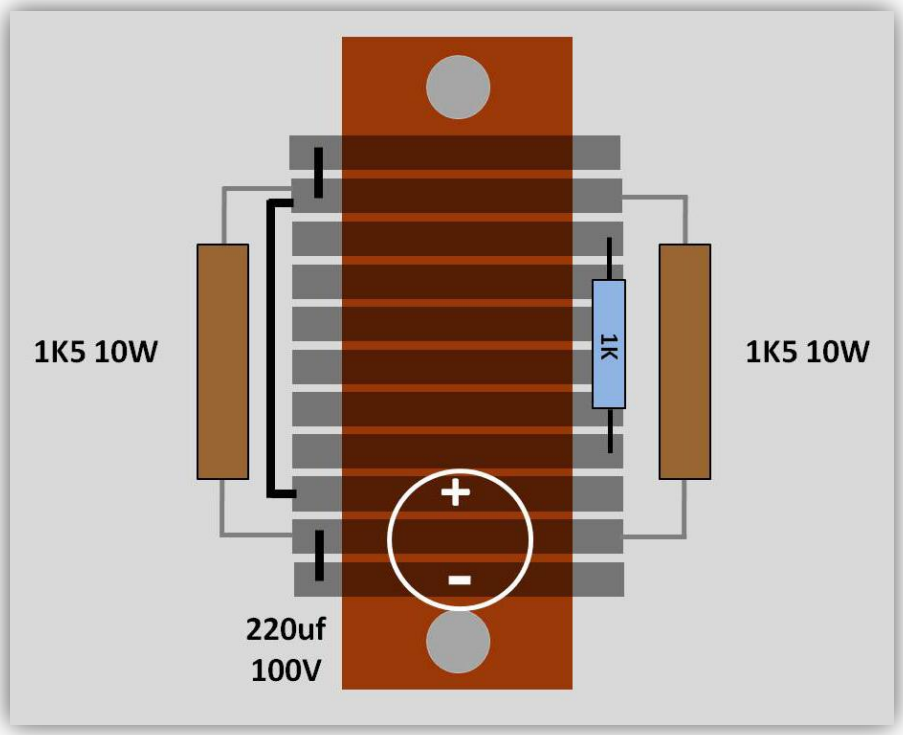
☐ Add the 2 1K5 10W resistors, as shown below.



☐ Add the Nichicon 220uf 100V electrolytic capacitor, as shown below. Be sure to connect the POSITIVE and NEGATIVE leads correctly.



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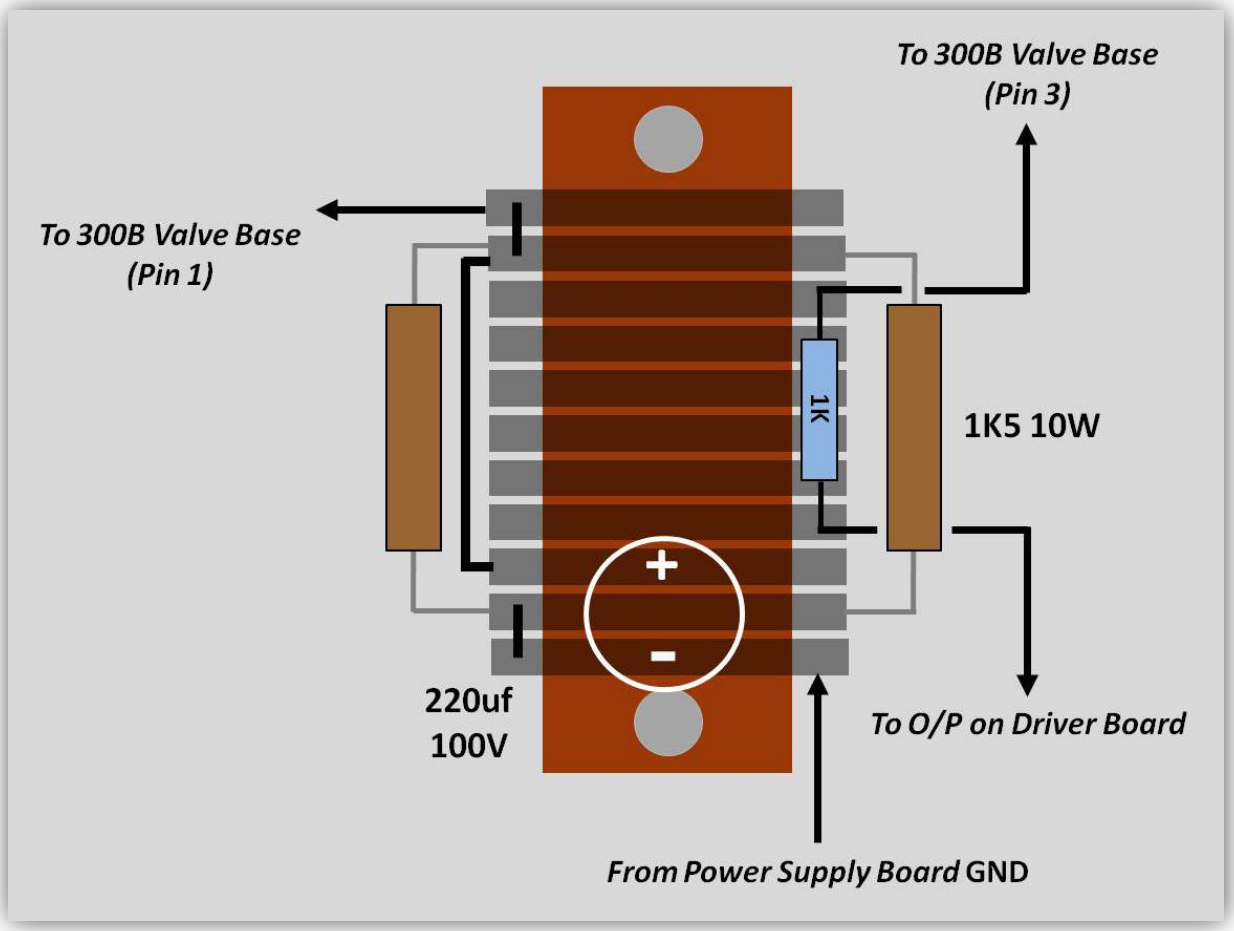
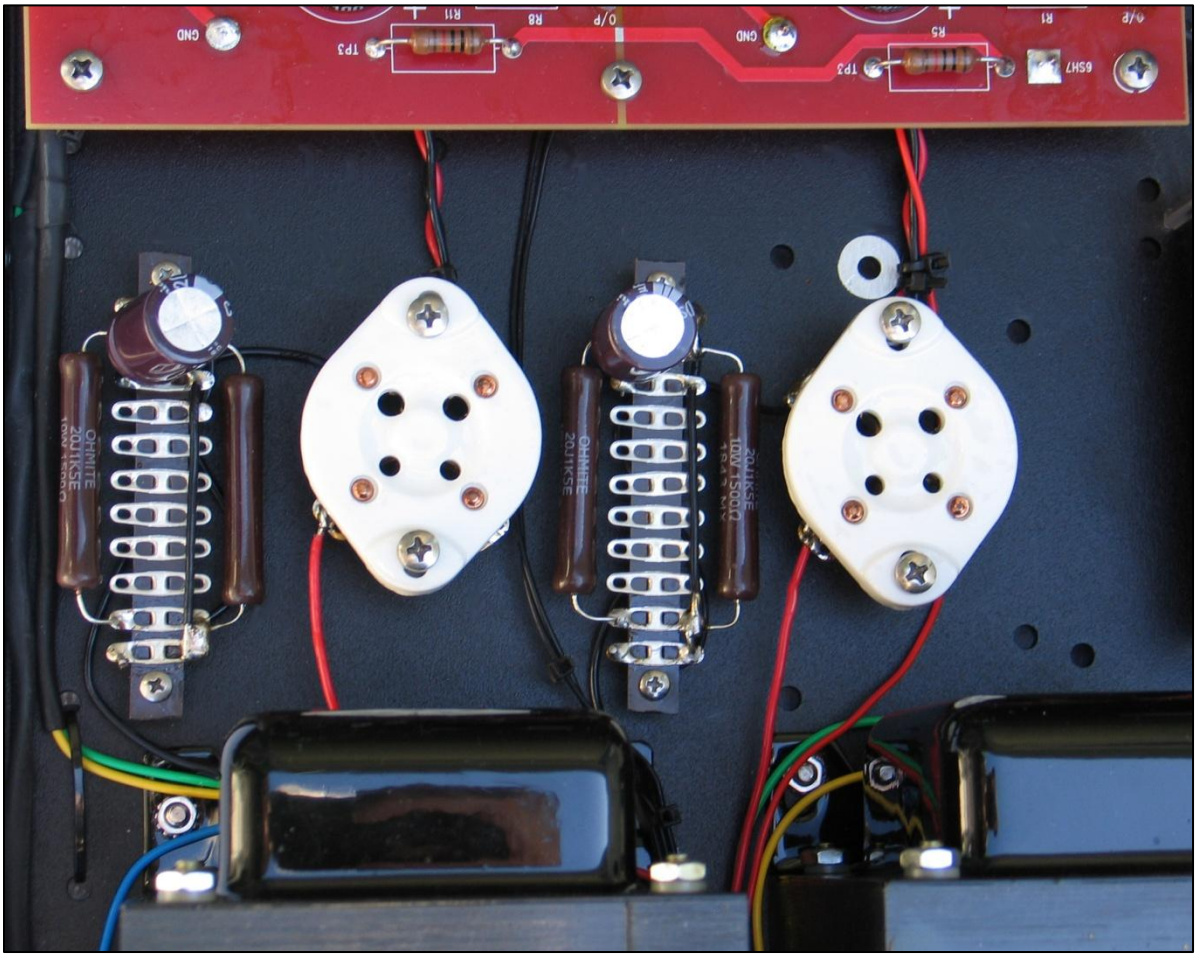
And finally,

- ☐ Add a Black wire to the top tag, as shown below (you can actually use the empty hole in the tag on the right side); it needs to reach pin 1 of the adjacent 300B valve base.
- ☐ Add a Black wire to the third tag from the top (one end of the 1K Grid resistor), as shown below; it needs to reach pin 3 of the adjacent 300B valve base.
- ☐ Add a Black wire to the fourth tag from bottom (the other end of the 1K Grid resistor), as shown below; it needs to reach the Left (or Right) O/P tab on the Driver board.
- ☐ Connect the Black wire coming from the GND tab on the Power Supply board, as shown below. *If you tin the end of the wire, make a small hook in the end and route it from underneath between to tabs and 'over the top' you should be able to get a good mechanical hold.*



9.2.2 Installing the Tag Strips

- ☐ Using the supplied M3 (7mm screws) hardware, mount the tag strips to the chassis, oriented with the capacitors nearest the Driver board, as shown below[13]:



[13] The 1.5 10W resistors get hot, so, if you've routed wires along the side of the chassis and they're close to the 10W resistor, you can bend it up a bit to 'give it more air'.

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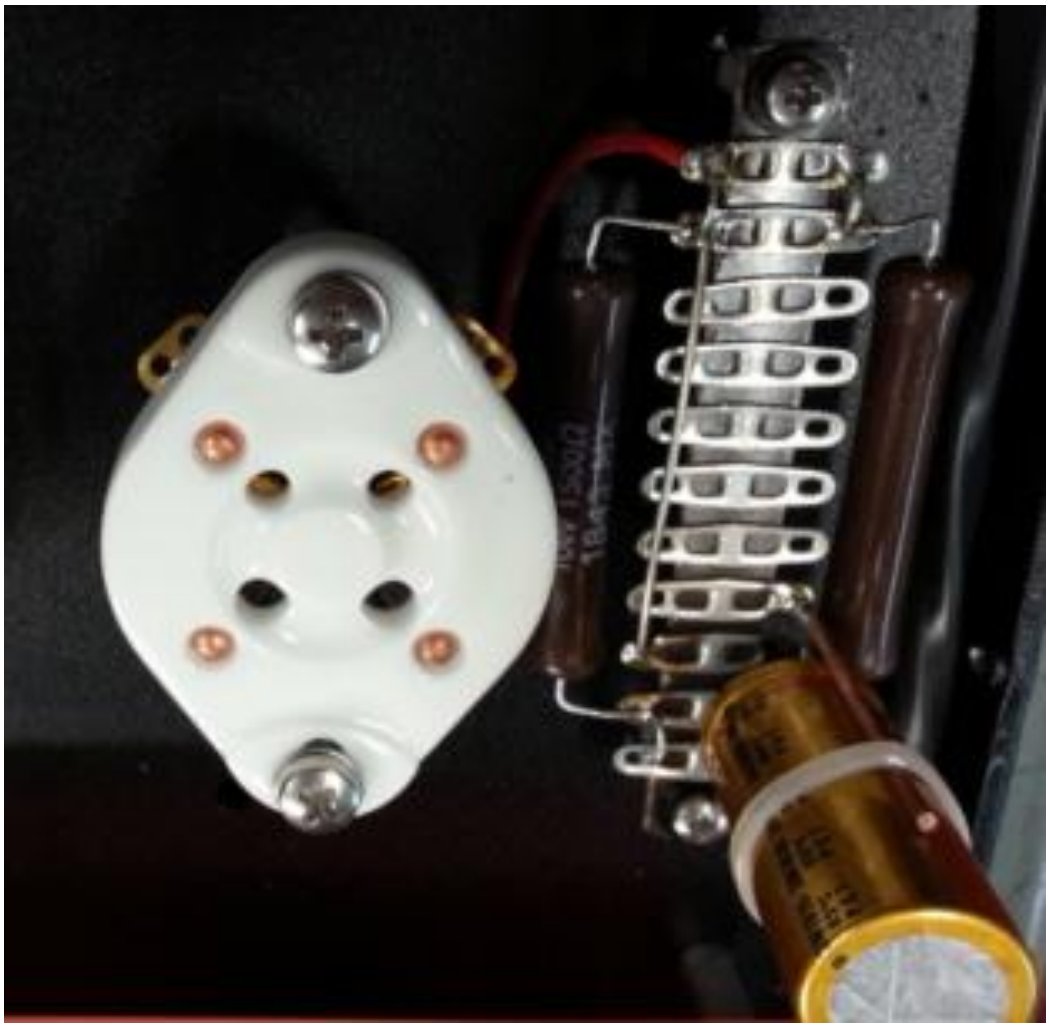
9.3 Installing the Valve Bases

9.3.1 Wiring the Valve Bases

Now we'll wire the valve bases.



As you can see above, the valve base — viewed from the top — has 6 holes. Obviously, the holes at the tips are for mounting the base to the chassis and the 4 holes in the middle are for the 300B pins. Note that the 4 300B pin holes consist of 2 larger and 2 smaller holes: ***this is critical to getting the valve base orientation correct.***

We will install the valve bases with the larger holes nearest the Driver board.

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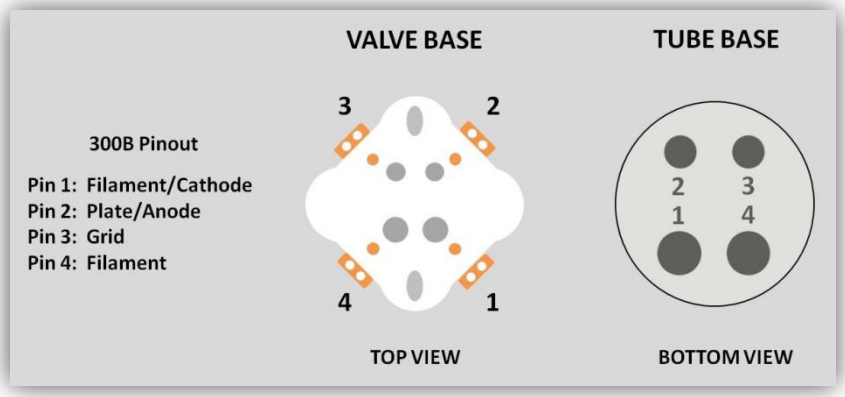
We're going to connect 5 wires to each valve base.

Have a look at the physical layout of the components in the chassis. You can see that the distances from the pins of the two valve bases to their corresponding solder pads on the Filament Supply board look different, as do the distances from the Anode pins to the output transformers; actually, they're not all that different but we'll approach the wiring of each valve base independently as 'Wiring the Left 300B Valve Base' and 'Wiring the Right 300B Valve Base', just to be sure we get things correct as well as neat and tidy.

Another key point, mentioned earlier, is that the pins 'flip' positions depending on whether you're looking at the valve base from the top or the bottom. Some people prefer to do the wiring looking at the underside of the base, then install it; others may prefer to install the valve bases then do the wiring looking at the top of the base. Whichever way you choose to do it, use the following graphic to check the valve base orientation and do this wiring when you're fresh and well caffeinated! LOL

Here's again are the top and bottom views of the valve base:



And, finally, before we start, let's remind ourselves about the cautionary note we provided earlier in the manual with respect to wire lengths.

This manual was developed while building the first kit. The wire lengths suggested for the Mains and Choke wires — and the interwiring between boards and components — is based on the positions of those elements at that time. As with all products, over time, there will be revisions — most likely to boards, occasionally to the chassis. These revisions might alter the relative positions of these elements and could affect the suggested lengths of wires. *Therefore, we strongly recommend: 1) that you measure wire lengths yourself, <u>for your unit</u>, and 2) that you always 'add a little': having a wire a little too long is far preferable than finding out that it's too short; this is particularly true of transformer wires. While it's possible to splice any wire that, for one reason or another, is too short, it's really not something you'd want to have to do. And, finally, let's remind ourselves of the carpenter's proverb: "measure twice, cut once."*

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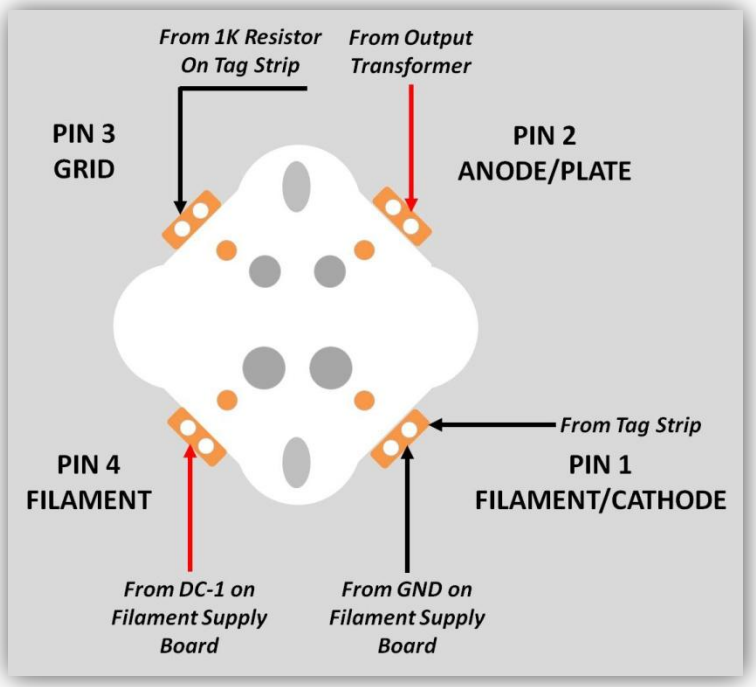
9.3.2 Wiring the Left 300B Valve Base

You can wire the valve base from the top or the bottom. The following graphic uses the top view:



- ☐ Connect the Black coming from the 1K Grid resistor on the tag strip wire to pin 3.
- ☐ Connect the Red wire coming from the Left output transformer to pin 2.
- ☐ Connect the Red wire coming from the Left DC-1 on the Filament Supply board to pin 4.
- ☐ Connect the Black wire coming from the Left GND on the Filament Supply board and the Black wire coming from the top tag on the tag strip to pin 1 (use 2 holes).

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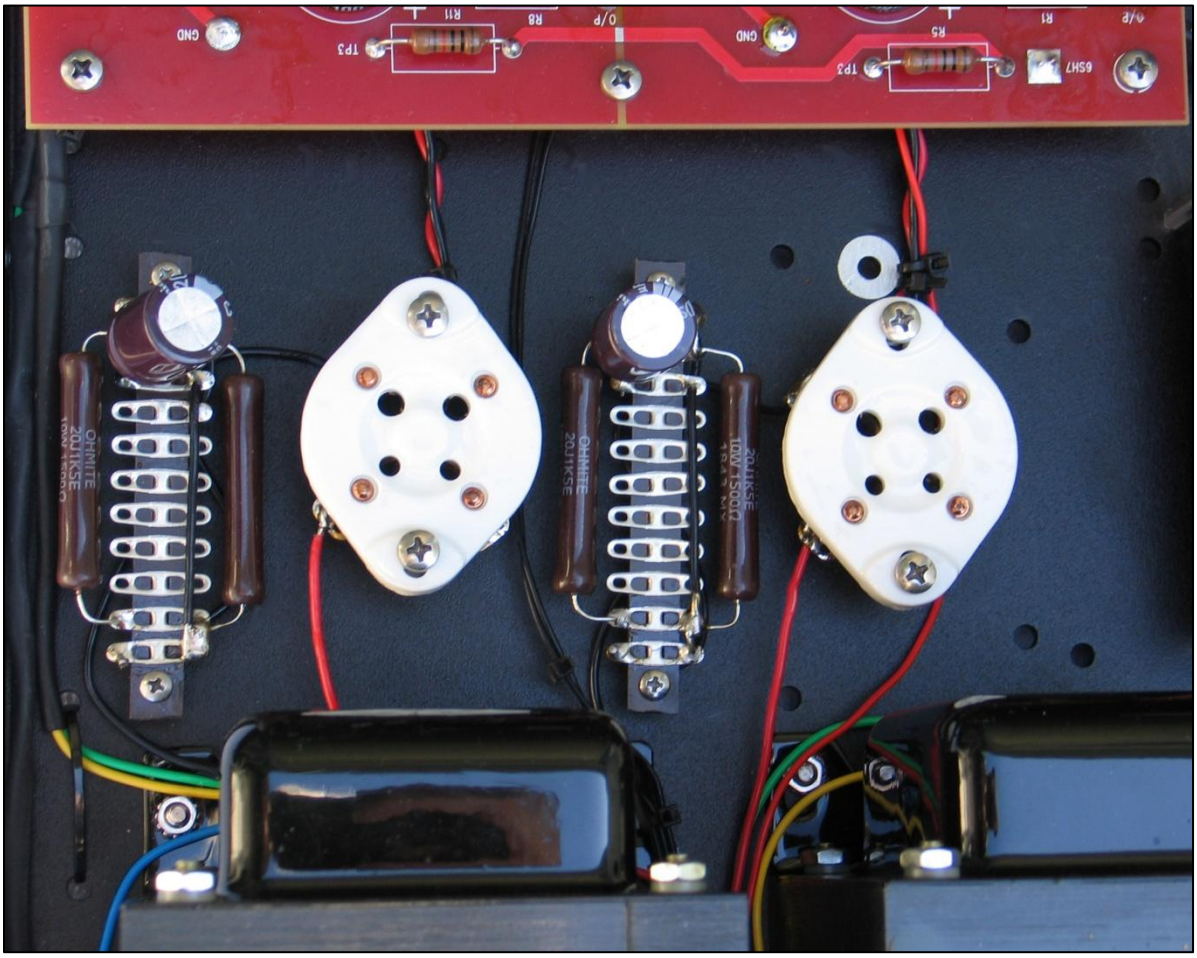
9.3.3 Wiring the Right 300B Valve Base

- ☐ Connect the Black coming from the 1K Grid resistor on the tag strip wire to pin 3.
- ☐ Connect the Red wire coming from the Right output transformer to pin 2.
- ☐ Connect the Red wire coming from the Right DC-1 on the Filament Supply board to pin 4.
- ☐ Connect the Black wire coming from the Right GND on the Filament Supply board and the Black wire coming from the top tag on the tag strip to pin 1 (use 2 holes).

9.3.4 Installing the Valve Bases

- ☐ Using the supplied hardware, mount the valve bases to the chassis, oriented with the larger holes nearest the Driver board, as shown below:



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Section 10

Additional Interwiring

10.1 Connecting the RCA Jacks

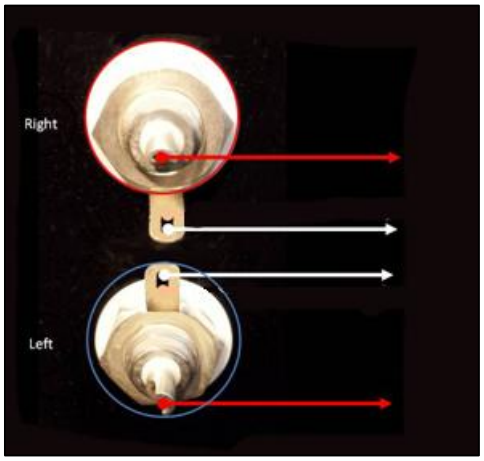
Now let's wire the RCA jacks on the back panel.

- ☐ Prepare 2 pairs of Red and Black wires: one about 6" and the other 7" long. Strip and tin both ends. You can add some heatshrink around the 2 wires if you like.

When working with the RCA jacks we use the following procedure:

- ❖ Tin the RCA Red (signal) lead
- ❖ Tin the RCA Black (ground) lead
- ❖ Put a puddle of solder in the center of the RCA jack
- ❖ Tin the ground tab on the RCA jack
- ❖ Heat the solder puddle and slide the Red tinned lead into the center of it; it should adhere immediately
- ❖ Heat the tinned Black lead as it makes contact with the ground tab on the RCA; similarly, it should adhere immediately

- ☐ Make the Red and Black connections to the lower (Left/Black) RCA jack using the shorter of the 2 prepared wire pairs.
- ☐ Make the Red and Black connections to the upper (Right/Red) RCA jack using the longer of the 2 prepared wire pairs.



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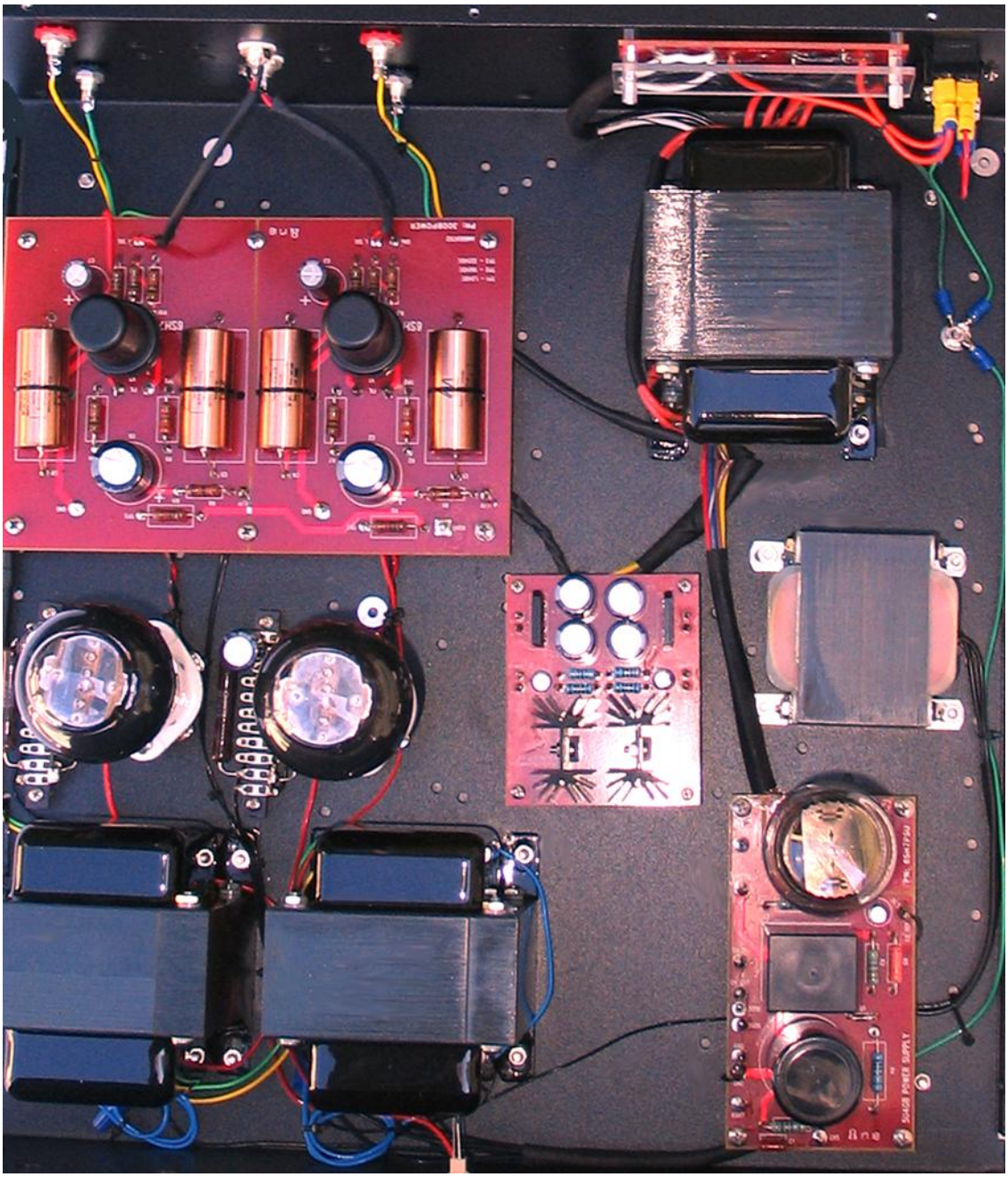
10.2 Driver Board Interwiring

Now it's time to work on how the Driver board connects to other boards and chassis-mounted components, including the RCA jacks.

The Driver board will be positioned at the back of the chassis:



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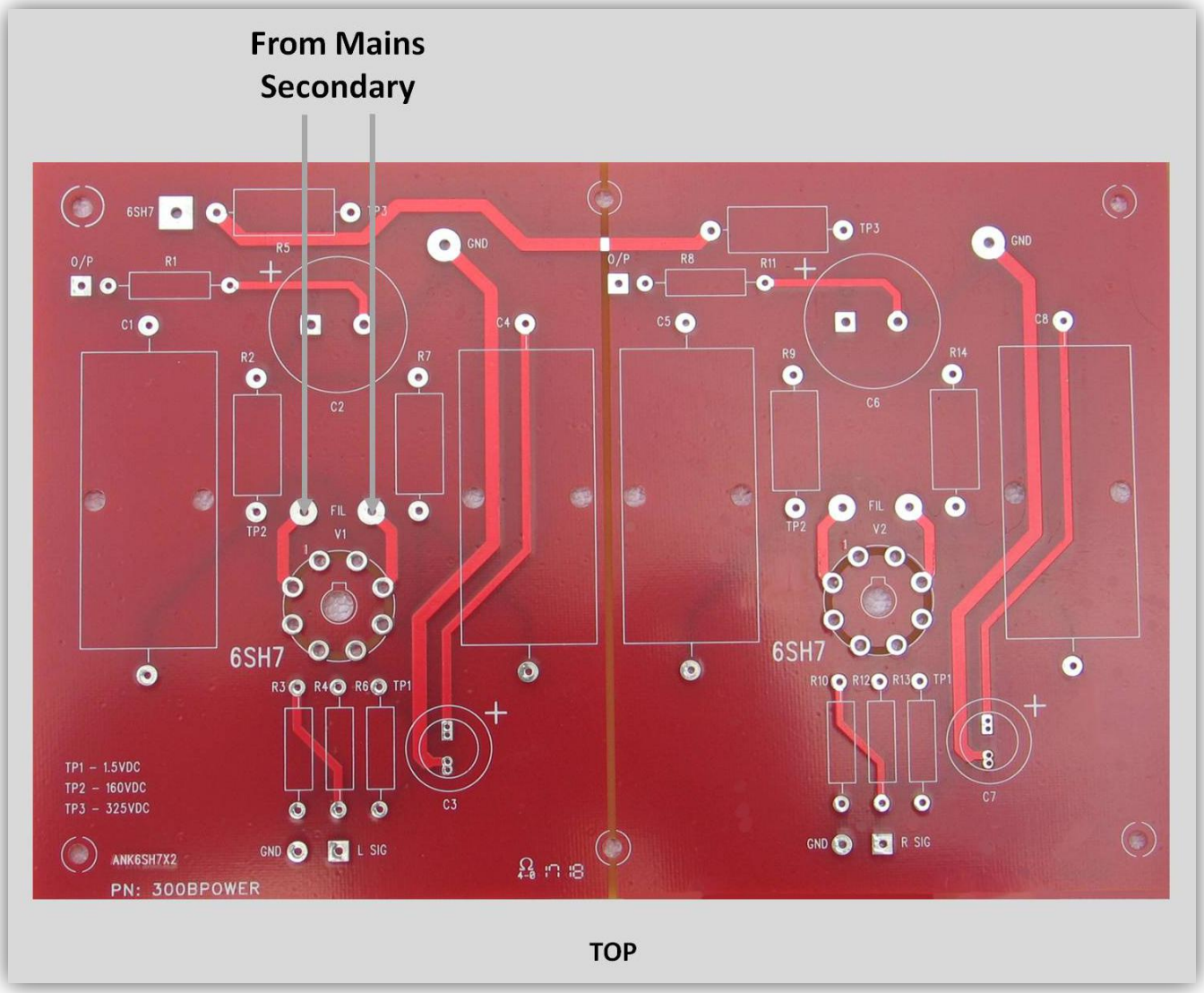
10.2.1 Installing the Filament and Filament Jumper Wires

The filaments of the 2 6SH7 tubes are supplied with 6.3V by the 2 Grey Mains Secondary wires. The issue we face is that we need to make 4 connections (2 for each tube) from the 2 Grey wires. To do this we'll directly connect the 2 Grey wires to the filament pins of one of the 6SH7 valve bases and jumper 2 Grey (actually the color doesn't matter, but we'll use Grey) wires from there to the other 6SH7 valve base. Ideally, we'd have liked to let printed circuit board traces do that, but it just didn't work out — so we'll add jumpers.

The Mains Secondary wires and the jumpers will be connected from the underside of the board, but this top view shows <u>where</u> we'll connect the 2 Grey Mains Secondary wires.



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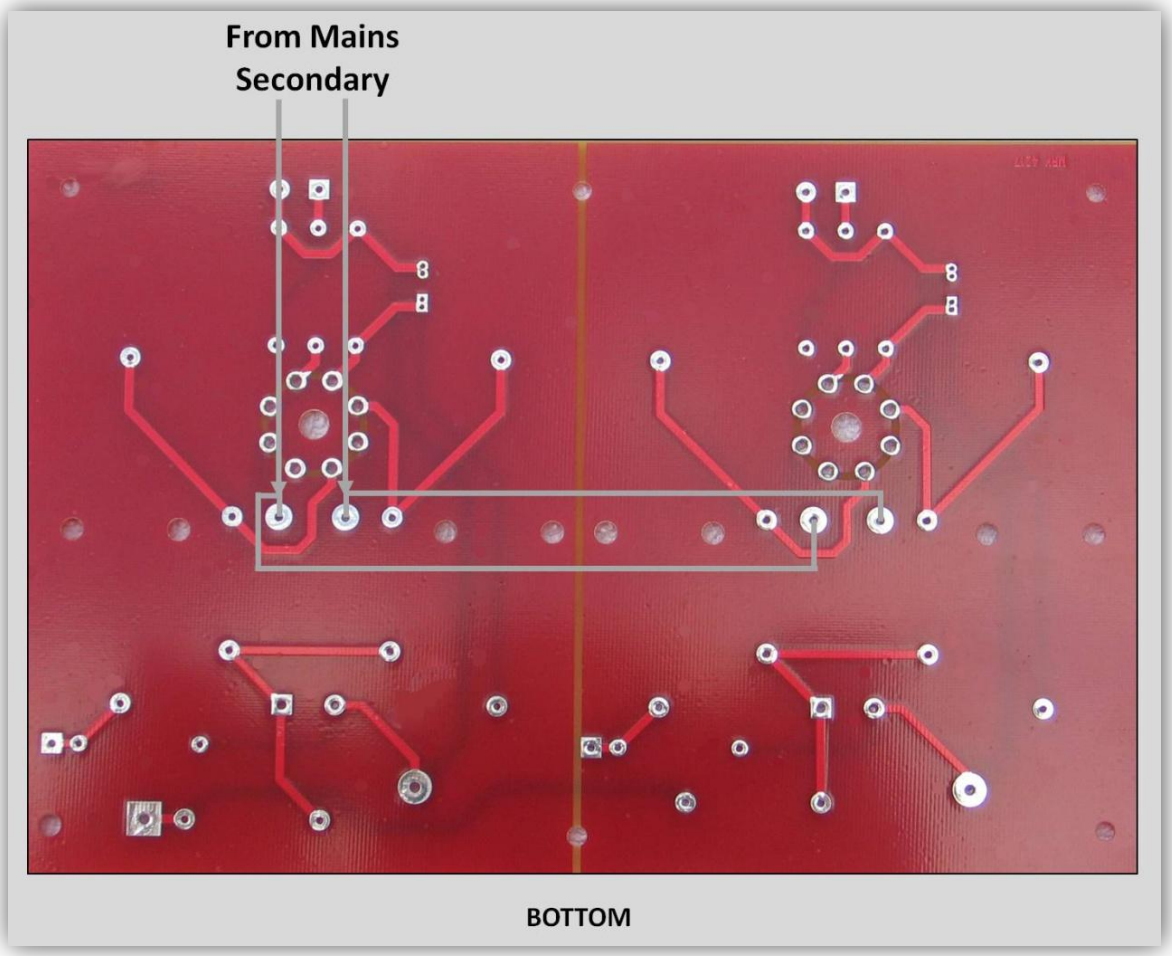
The bottom view (below) shows **how** the 2 Grey Mains Secondary wires and 2 Grey jumper wires will be connected.



The orientation of the Mains Secondary Grey wires doesn't matter, but we'll follow the diagram above when wiring the jumpers.

As we know, we can't fit 2 wires into most solder tabs; here's how we'll solve this instance:

- ☐ Cut the two Grey wires coming from the Mains Secondary to about 8" each. Add some heatshrink if you wish.
- ☐ Strip about 3/8" from the ends of these Grey wires, tin them, and put them aside for the moment.
- ☐ Using left over Grey Mains Secondary wire, cut two 5" lengths. These will be our jumper wires.
- ☐ Strip about 3/8" from each end of each of these Grey jumper wires. *Tin only one end of each.*
- ☐ From the underside of the board, connect the tinned ends of these jumper wires to the right side filament solder tabs, as shown in the BOTTOM view above.

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Now we'll make the connections to the left side filament solder tabs.

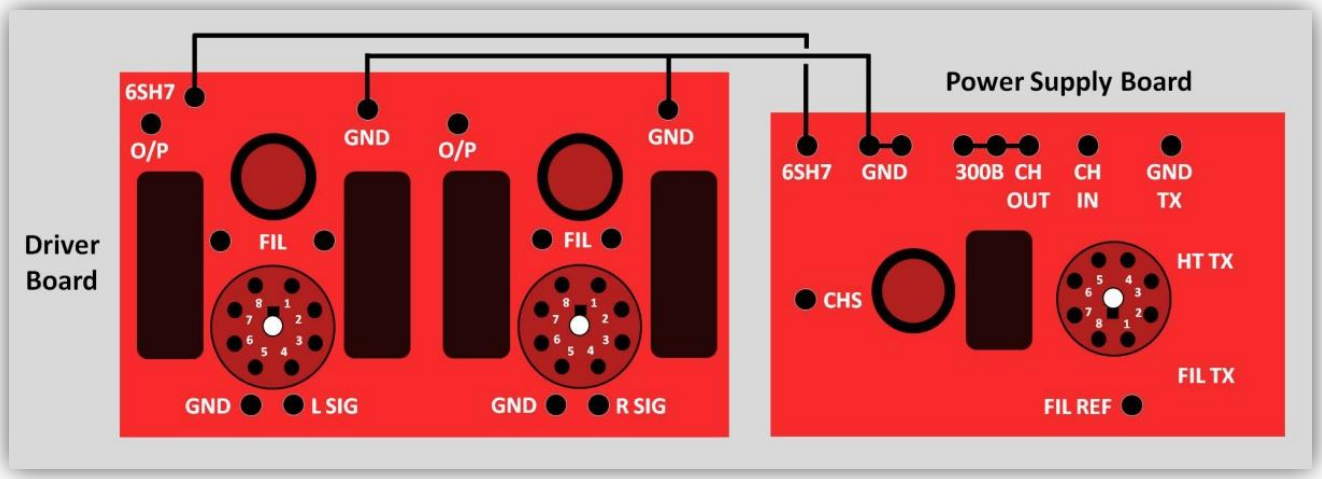
- ☐ Twist the other (not tinned) ends of these jumper wires around the stripped and tinned end of the Mains Secondary Grey wires.
- ☐ From the underside of the board, connect the combination Mains Secondary/jumper wires to the left side filament solder tabs, as shown in the picture below:

Make sure there are no loose strands, then trim off the excess wires on the top of the board.

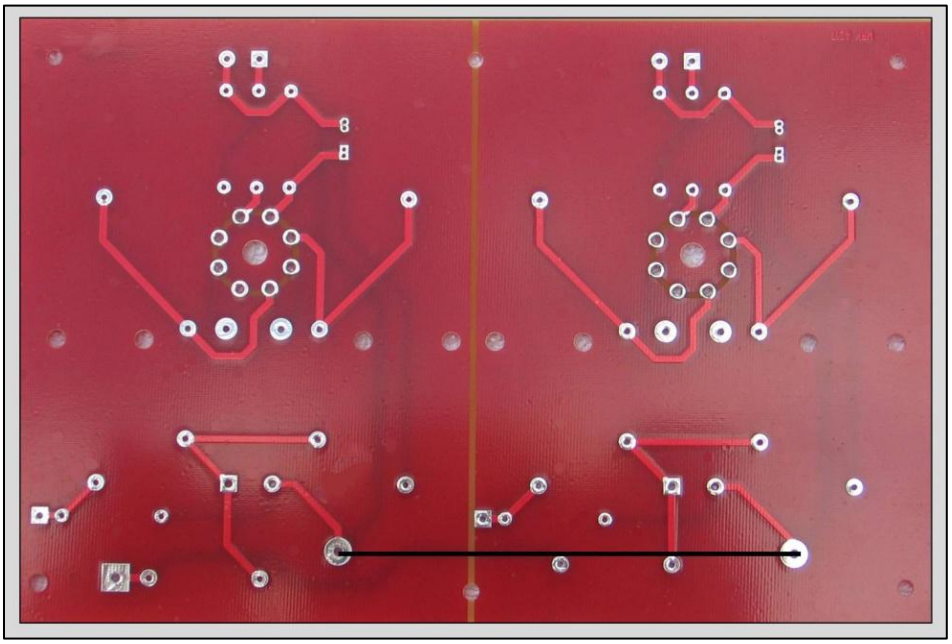
10.2.2 The 6SH7 and GND Connections

Earlier we connected 2 Black wires to the 6SH7 and GND connections on the Power Supply board and we routed those wires along the base of the front of the chassis and between the output transformers.

Referencing the following graphic:



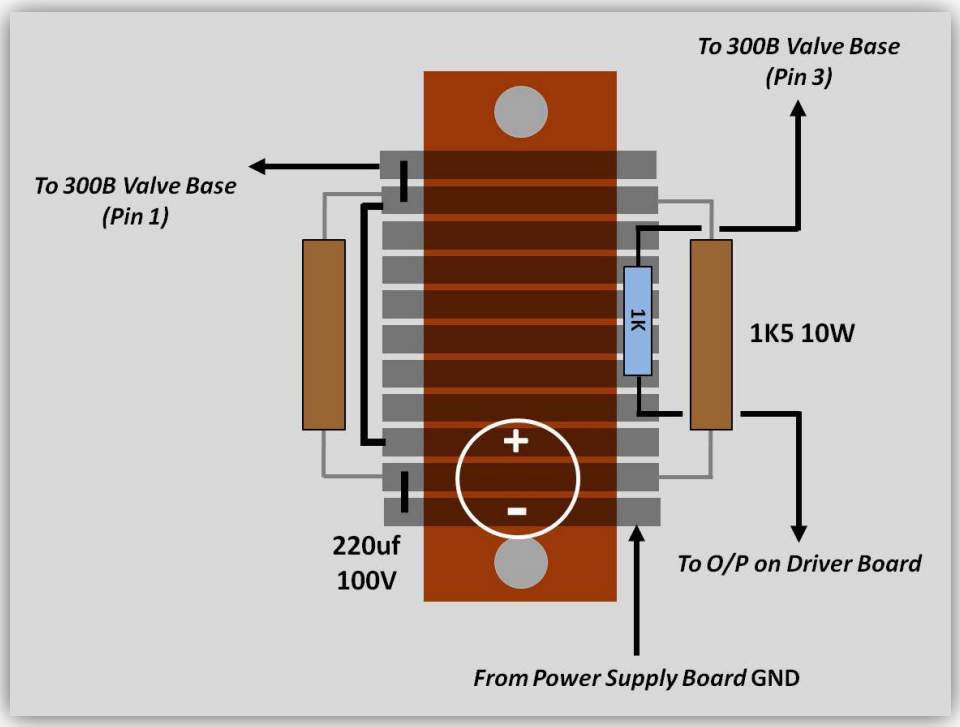
- ☐ Use the Connectivity mode of your multimeter to determine which of these 2 Black wires comes from the 6SH7 solder tab on the Power Supply board.
- ☐ Connect this Black wire to the 6SH7 solder tab on the Driver board, from the underside.
- ☐ Connect the other Black wire to one of the 2 GND tabs on the Driver board, from the underside.
- ☐ Similar to the way in which you added jumpers for the filament wires earlier, add a black jumper on the underside of the board to connect the 2 GND tabs, as shown on the next page:



Trim off the excess wires on the top of the board.

10.2.3 The O/P Connections

We've previously prepared a Black wire coming from each tag strip, marked: 'To O/P on Driver board', as shown below:



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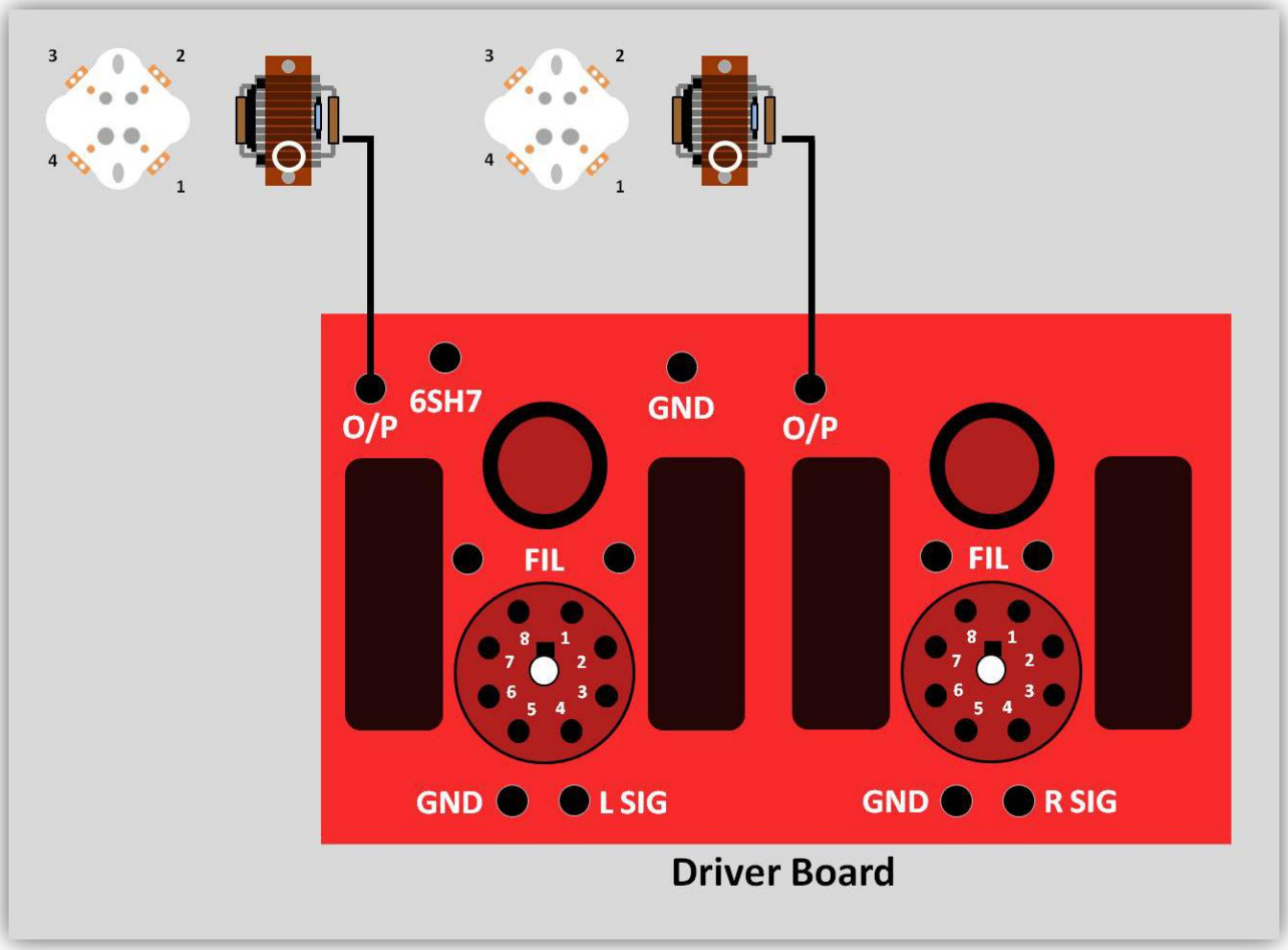
Now, referencing the graphic below:



☐ Connect these Black wires to their respective Left and Right O/P solder pads, from the underside.

Trim off the excess wires on the top of the board.

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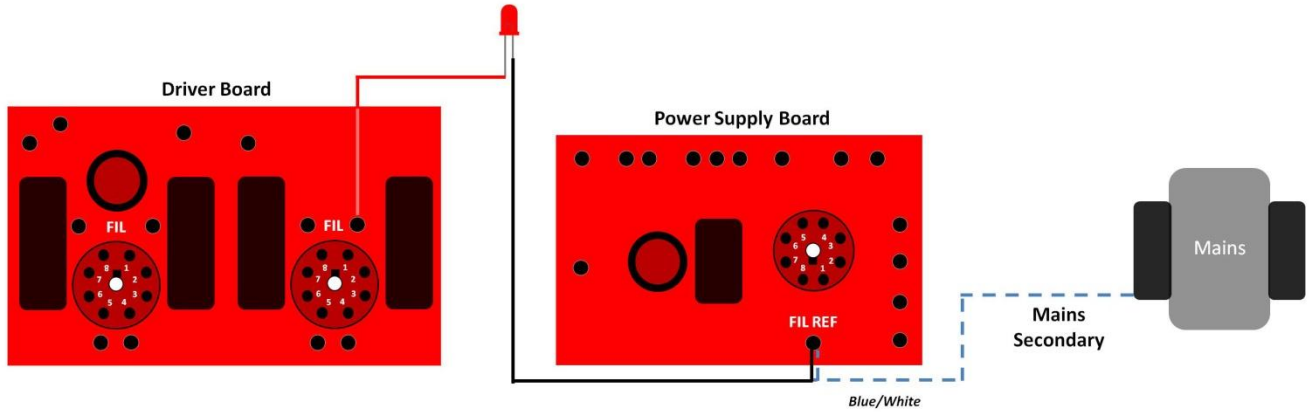
10.2.4 The LED POSITIVE Connection

The wiring for the LED uses 1/2 of the 6SH7 6.3V AC filament voltage (3.15V) for the POSITIVE lead and the Blue/White center tap (CT) for the NEGATIVE lead, as shown below.



We've already connected the Black (NEGATIVE) lead to the FIL REF solder tab on the Power Supply Board. Now,

- ☐ Connect the Red (POSITIVE) lead to the rightmost FIL solder tab on the Driver Board as shown above, from the top.

  Be careful! You've already connected a Grey filament jumper wire to this solder tab from the underside and you don't want to push it down and disrupt a good connection, so:

  - *strip less than 1/8" off the end of the Red LED lead and tin it,*
  - *position it beside the solder 'volcano' for the jumper wire protruding through from the underside, and*
  - *give it a just enough of a dab of heat from the side to make a good connection; don't push down on the jumper connection with your soldering iron.*

Now let's insert the LED into the LED socket. The LED leads are different lengths: the longer lead is the POSITIVE lead.

- ☐ Carefully trim the LED leads so that they are not exposed through the end of the socket (we don't want a short).

  ➡ *Trim the NEGATIVE lead a bit shorter than the POSITIVE lead so that, if you need to remove the LED later for any reason, you'll know which is the POSITIVE lead (the longer lead) and will be able to reinsert it correctly.*

- ☐ Insert the LED into the socket making sure that the POSITIVE and NEGATIVE leads are correctly positioned.

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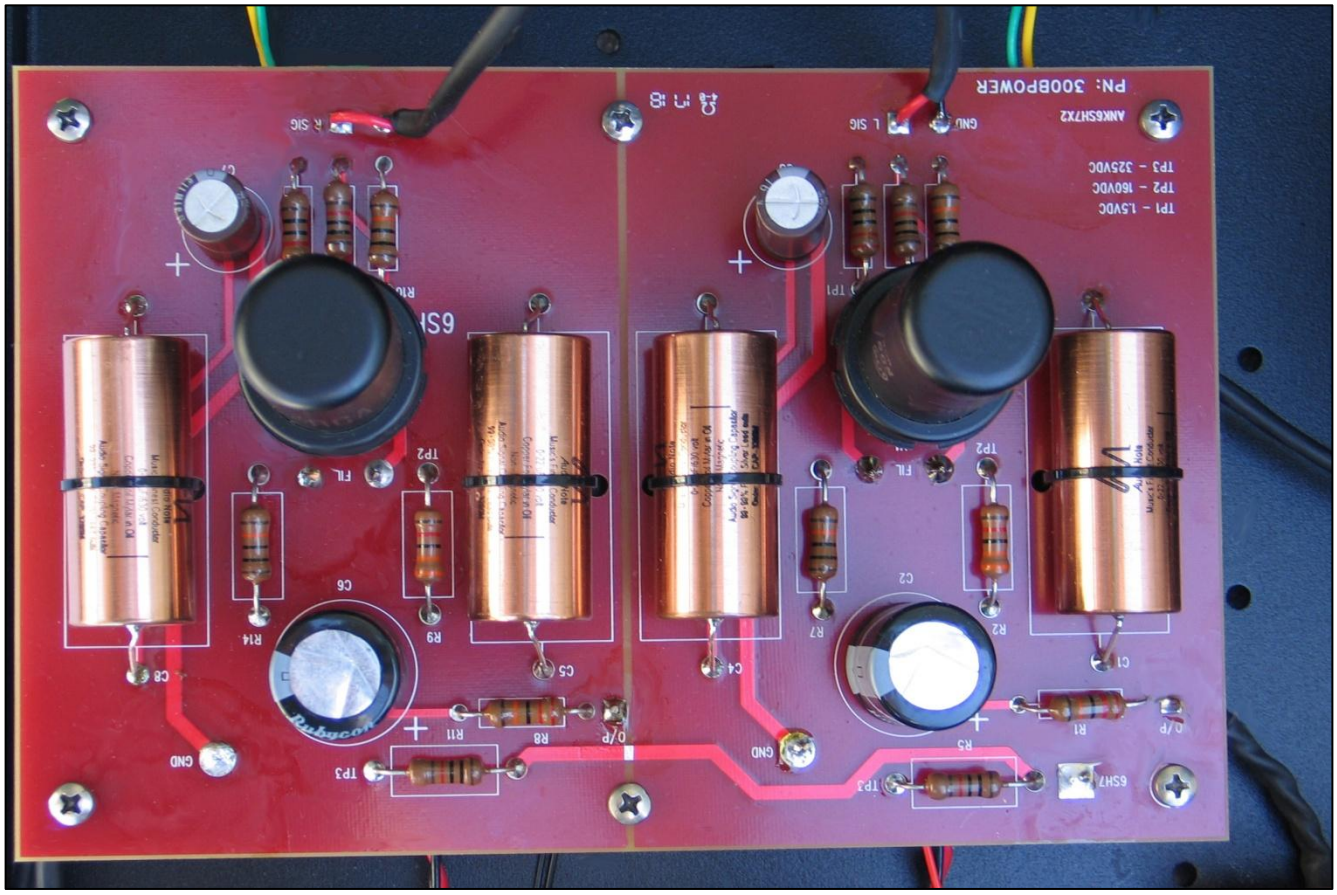
10.2.5 Installing the Driver Board

- ☐ Add 4 M4 standoffs to the board.
- ☐ Position the wires going to — and coming from — the Driver board as shown below.



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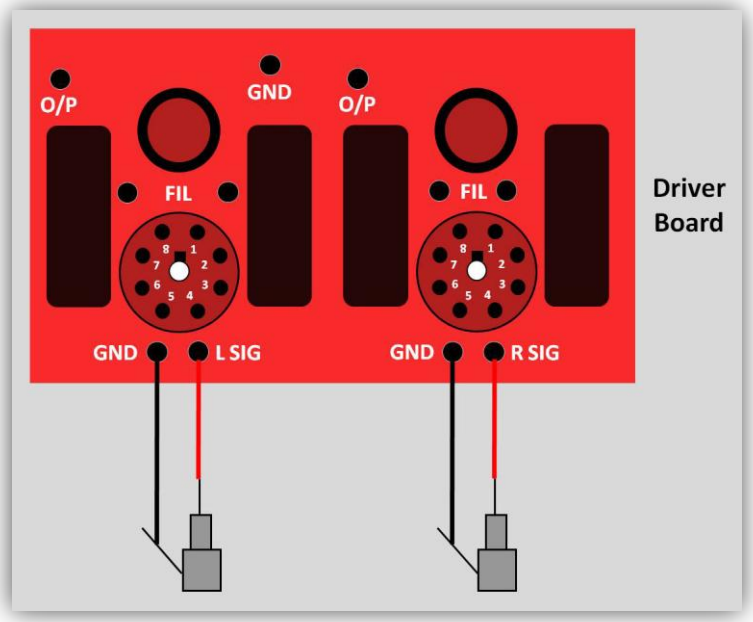
10.2.6 The Signal Connections

Referencing the following graphic:



- ☐ Connect the Red Signal Lead and the Black Ground lead coming from the Left RCA jack to the L SIG and GND solder tabs on the Driver board, from the top. Take care to prepare the wires so that they are straight and just long enough to make a good connection. We don't want any shorts underneath the board.

- ☐ Similarly make the connections from the Right RCA jack.

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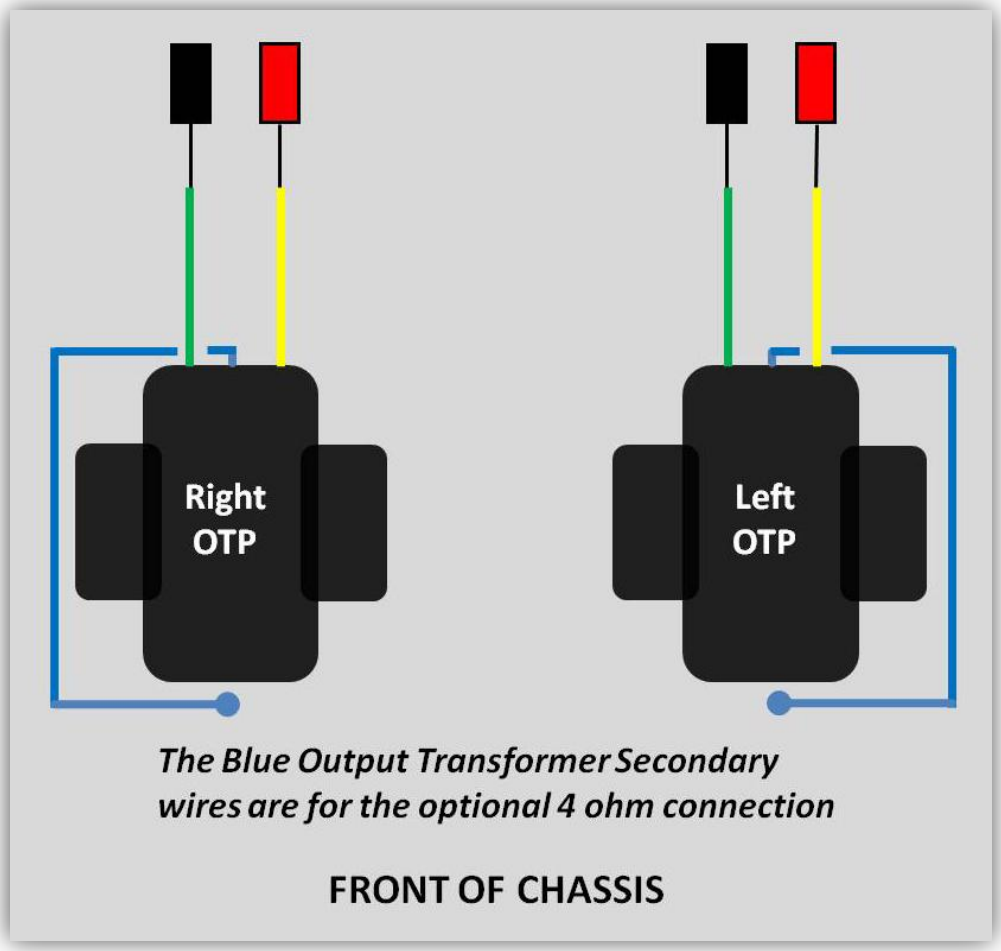
10.3 Connecting the Speaker Posts

☐ Put a puddle of solder in the center of each speaker post.

Both the EI-Core and the C-Core output transformers have three colored wires on the Secondary:

- Green is Ground
- Blue is the 4 ohm tap
- Purple is the 8 ohm tap



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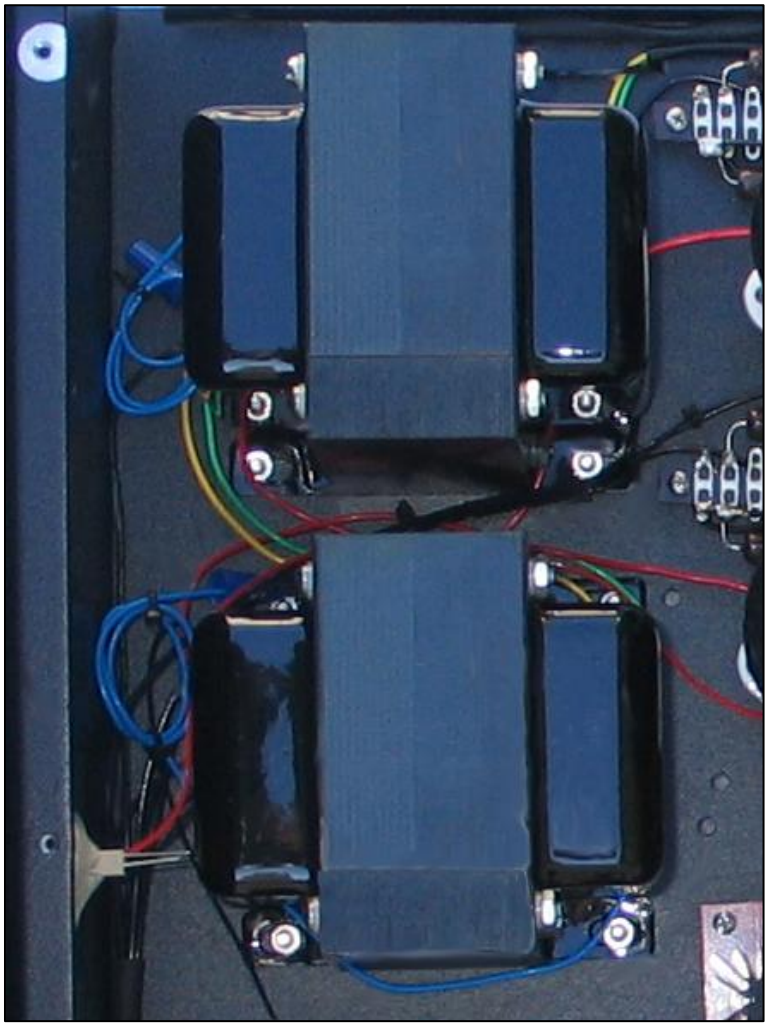
Left Speaker Post 8 Ohm Wiring

- ☐ Cut *just the exposed end* of the Blue wire cleanly, cover it with a small plastic wire connector, and tuck it between the transformer and the front of the chassis.



- ☐ Route the Purple and Green wires from the Left output transformer between the 2 transformers, behind the Right transformer as shown above, and route the 4 wires along the outside of the chassis alongside the Mains Secondary wires (use cable ties and/or heatshrink to keep them together neatly.
- ☐ Connect the Purple wire coming from the Left output transformer to the Left Red speaker post.
- ☐ Connect the Green wire coming from the Left output transformer to the Left Black speaker post.

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Right Speaker Post 8 Ohm Wiring

- ☐ Similarly, make the connections from the Right output transformer to the Right speaker posts.

Left Speaker Post 4 Ohm Wiring

- ☐ Cut *just the exposed end* of the Purple wire cleanly and cover it with a small plastic wire connector, and tuck it between the transformer and the front of the chassis.
- ☐ Route the Blue and Green wires from the Left output transformer between the 2 transformers, behind the Right transformer, and route the 4 wires along the outside of the chassis alongside the Mains Secondary wires (use cable ties and/or heatshrink to keep them together neatly.
- ☐ Connect the Blue wire coming from the Left output transformer to the Left Red speaker post.
- ☐ Connect the Green wire coming from the Left output transformer to the Left Black speaker post.

Right Speaker Post 4 Ohm Wiring

- ☐ Similarly, make the connections from the Right output transformer to the Right speaker posts.

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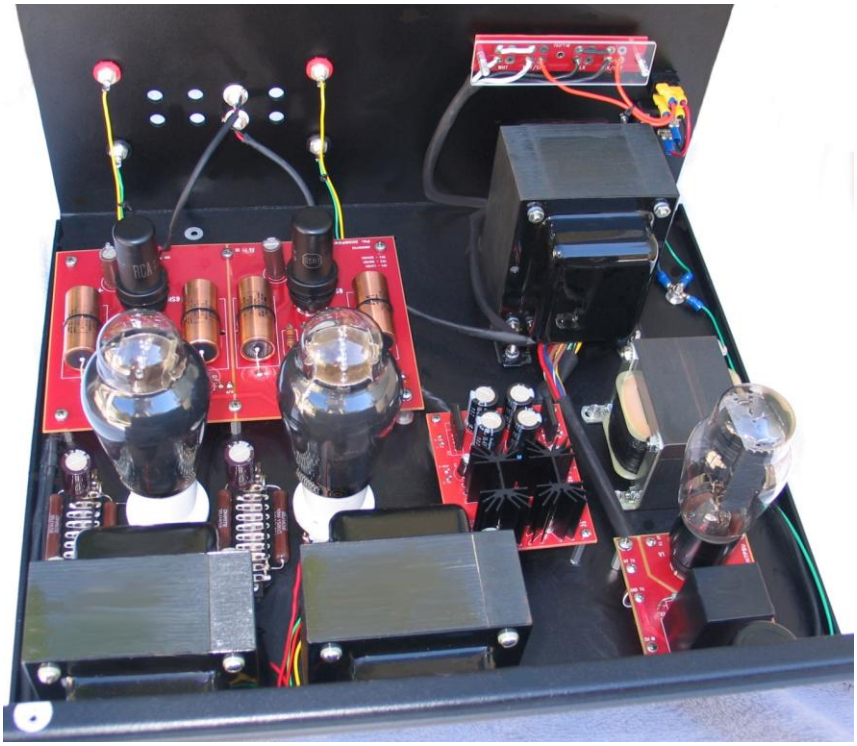
Section 11

Testing

11.1 Overview

It's time do to some testing to make sure that amplifier has been correctly wired and that things are working the way they're supposed to.



Our plan is as follows:

- With no tubes installed, power the amplifier on to verify that the fuse does not blow.
- Install the 6SH7s and the 300Bs, then power on to make sure that the 300Bs glow.
- Install the 5U4G rectifier and measure a number of key AC and DC voltages.
- Test with a 'cheap' speaker for sonics and hum. If all is well, play in a proper system, enjoy!

Before testing, it's a good idea to blow some air into the unit to make sure that there are no small pieces of wire or solder floating around.

11.2 Installing the Fuse

Tubes Installed At This Point: None

Let's start by installing a 1A[14] Slo-Blo fuse from the IEC bag.

- ☐ If the fuse holder is already installed in the IEC plug, use a screwdriver, a flat edge, or your fingers to pull it out; you may need to squeeze it to completely remove it.
- ☐ Install the fuse in the small plastic fuse holder and insert it into the IEC. (You can ignore any lettering like '240V only' — there is only one fuse holder type for all world voltages.)

- ☐ Turn the amplifier on. If the fuse does not blow, continue to the next step. If it does, jump ahead to "Debugging." Turn the amplifier off.

[14] If all is well you can change to a 2A fuse.

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11.3 Initial Tests

Let's begin by doing some basic tests, with the amplifier off.

A good place to start is to measure resistance. Let's have a look at the Chassis Ground, an important (almost) universal ground point in the amplifier. FYI, it's worth noting that a ground is a reference point and, while it is often — even usually — at 0 volts, a "floating ground" can be at higher level.

Try this:

- Place your multimeter in Connectivity mode
- Put one probe on the Chassis Ground
- Check the following points to verify that there is zero ohms or close (a couple of ohms is OK) between these ground points:
  - IEC Socket Ground
  - CHS on the Power Supply
  - GND on the Driver board

Let's move on to our first real power-up.

11.4 First Power-Up

IMPORTANT NOTE

Follow the turn-on procedure carefully. **DO NOT AT ANY TIME ONLY INSTALL THE 5U4G(B) RECTIFIER TUBE WITHOUT ANY OTHER TUBES (SUCH AS THE 300Bs) INSTALLED.** The reason for this is that the rectifier is counting on having a specific load to drive. If the rectifier is used without other tubes installed then the amplifier will 'see' significantly higher DC voltages (around 800V!), which can overextend the Power Supply capacitors. You could possibly start hearing cracking noises and then who knows what, as they are beyond their maximum voltage ratings.

PLEASE BE AWARE OF PROPER ELECTRICAL SAFETY.

There are sufficient voltages in this kit to give you a very nasty and harmful shock, so be careful when powering on, debugging, and probing around.

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If the initial resistance checks are OK then you can install the 6SH7 and the 300B tubes. The 6SH7 tube is keyed and you need to match up the notch on the 8-pin valve base with the tube base. *Make sure you don't mix it up with the 5U4G(B) tube which is also an 8-pin valve base tube.* The 300B tubes can only be installed one way in the 4-pin valve bases.

11.4.1 300B Filament Test

Turn the amplifier on. After a few seconds, the 300Bs should begin to glow. (You may need to look down from the top to see the glow.) Turn the amplifier off. If all is well then let's move on to some more comprehensive testing. If there's a problem skip to the 'Debugging' section below.

11.5 Voltage Checks

If you're using a Variac take into consideration that the voltages you'll be measuring are going to be a percentage of the full DC voltages: for example, with the Variac at 90V AC instead of 120, you can factor in that the DC voltages will be down by 25%.

Install the 5U4G(B) rectifier tube.

Tubes Installed At This Point: All

Turn the amplifier on.

Worst Case Scenario

Installing the 5U4G(B) rectifier provides the amplifier with the various DC voltages (including the HT) that it needs to operate; usually, if there is a problem with the build, it's going to be noticed here. *It's possible that, if there is a major problem, the fuse will blow — or you may get a burning resistor or even see some smoke.* **If anything alerts you that there is something drastically wrong then turn off the unit ASAP, unplug it, and contact us at audionotekits@rogers.com before proceeding.** We'll be happy to provide you with advanced troubleshooting advice. Note: we may ask that you send us high quality digital pictures of the internals of the amplifier.

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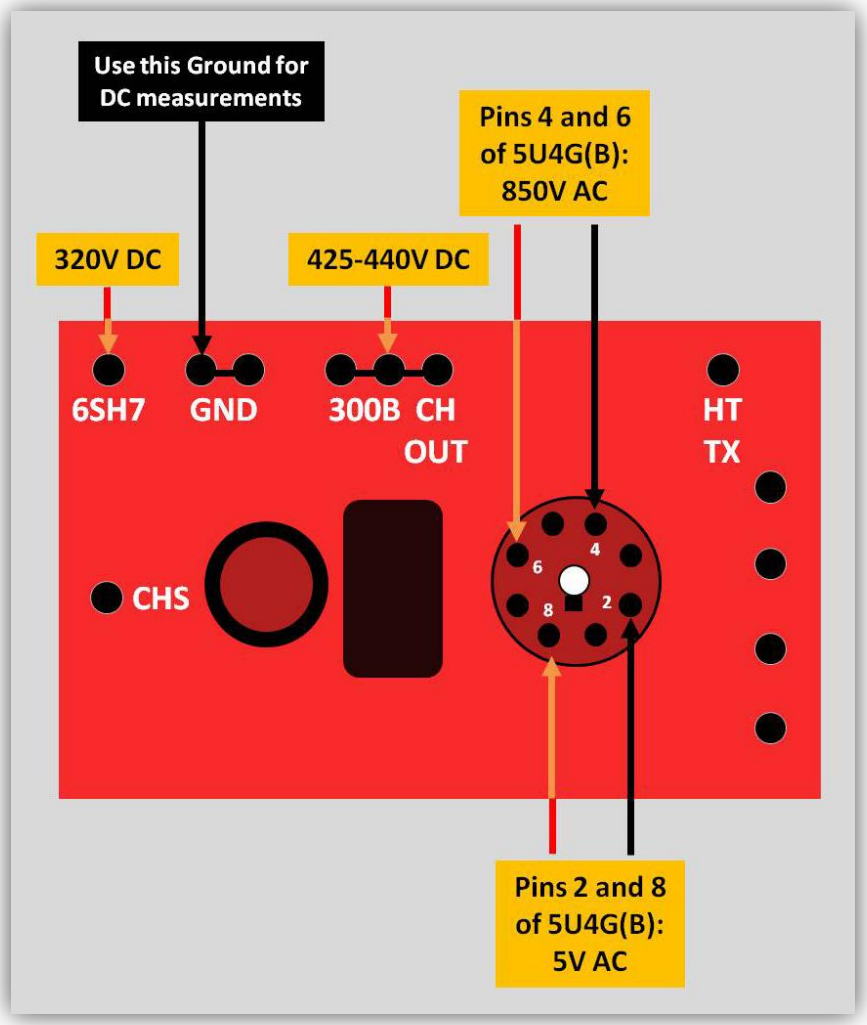
Make the following measurements:

Power Supply Board



Multimeter Setting	Black Lead	Red Lead	Approximate Reading
DC	GND on Power Supply Board	6SH7	325V DC
		300B	425-440V DC
AC	Pin 2 of 5U4G(B)	Pin 8 of 5U4G(B)	5V AC
	Pin 4 of 5U4G(B)	Pin 6 of 5U4G(B)	850V AC[15]

[15] If your multimeter doesn't go this high, you can perform the 2 GND TX to HT TX tests in 'Debugging'; it will amount to the same thing.

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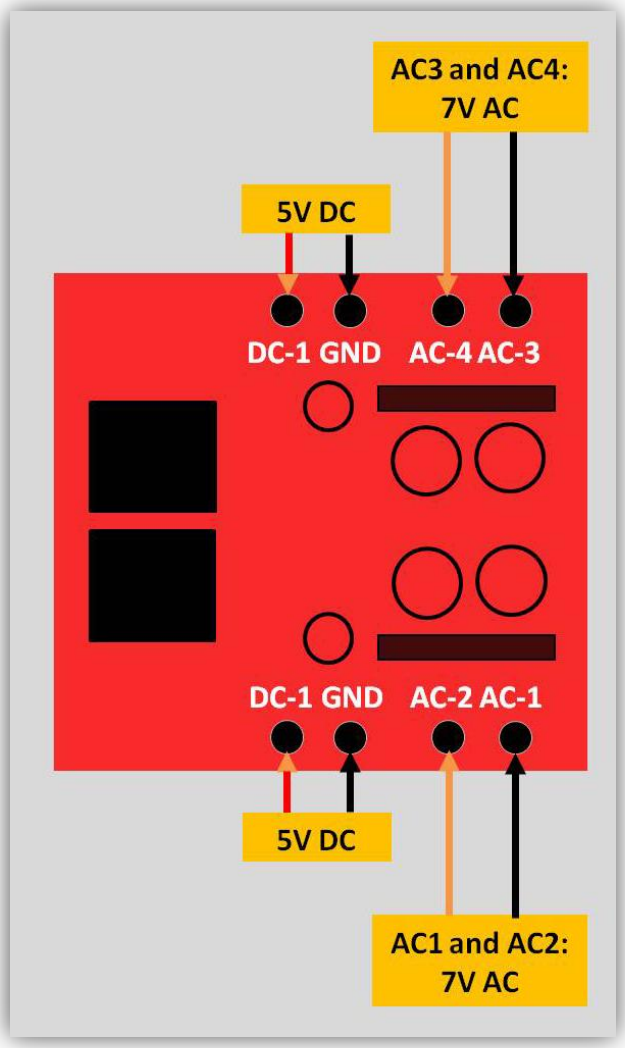
Filament Supply Board



Multimeter Setting	Black Lead	Red Lead	Approximate Reading
DC	GND on Filament Supply Board[16]	DC-1	5V DC
	GND on Power Supply Board[17]	DC-1	70-75V DC
		GND	65-70V DC
AC	AC-1	AC-2	7V AC
AC	AC-3	AC-4	7V AC

[16] Repeat this test on the other 'side' DC-1 and GND. It should also be 5V DC.
[17] This is a good example of a "floating ground".

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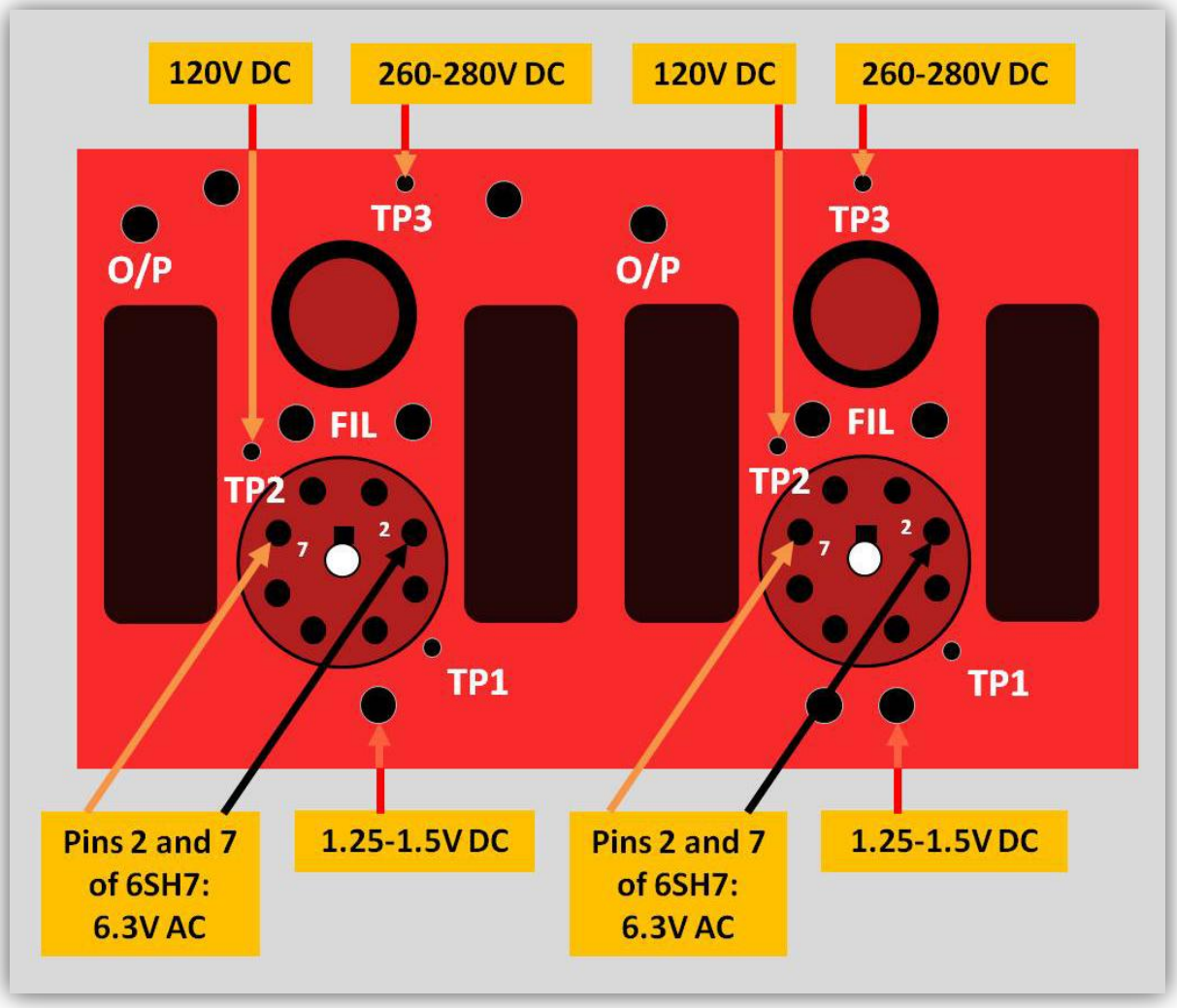
Driver Board



Note: Repeat the following measurements for each channel.

Multimeter Setting	Black Lead	Red Lead	Approximate Reading
DC	GND on Power Supply Board	TP1	1.25-1.5V DC
		TP2	120V DC
		TP3	260-280V DC
AC	Pin 2 of 6SH7	Pin 7 of 6SH7	6.3V AC

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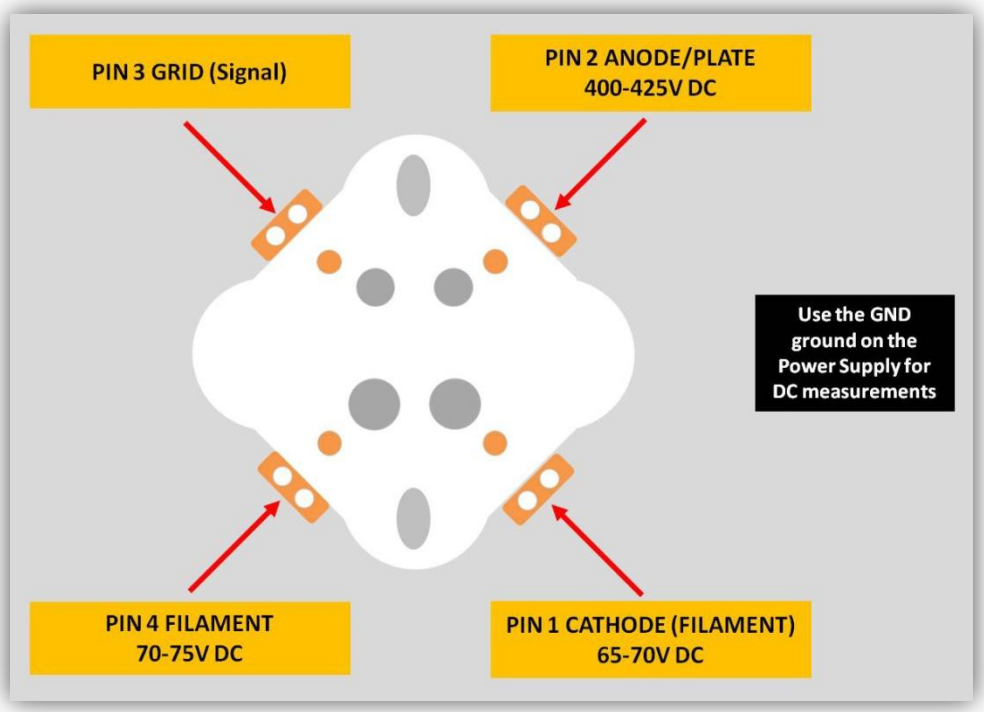
300B Tubes



Multimeter Setting	Black Lead	Red Lead	Approximate Reading
DC	GND on Power Supply Board	Pin 1	65-70V DC
		Pin 2	400-425V DC
		Pin 3	Don't measure
		Pin 4	70-75V DC

The measurement at pin 2 is the HT (or B+). This measurement (which we'd expect to be a little less than the Chassis Ground/300B measurement on the Power Supply board) could be higher or lower if, for example, the AC voltage coming out of the wall is higher or lower than 120V. The 400–425V DC is a key voltage: it means that a key part of the Power Supply is operating properly.

Turn the amplifier off.

Well done if all these voltages are good! Let's move on to the sound check.

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11.6 Sound Check

Now that we have an amplifier with correct DC conditions it's time to see if we can get some sound. We recommend hooking up your CD player or computer to the input of your preamplifier — and a pair of "cheap" speakers! — to verify that it is working correctly.

➡ *When the amplifier turns on you may hear a hum for about 15 seconds; then it will disappear. The reason for this is the voltages are settling: it's kind of like throwing a rock in a swimming pool; it takes a bit of time before the ripples (or, in our real world case, the DC voltages) settle.*

If this checks out, congratulations! You should have a working Mentor SET Power Amplifier. Feel free to contact us to share your excitement.

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11.7 Debugging

If you have no sound coming out of your amplifier then let's start by doing some basic checks:

- Make sure you have a signal entering the amplifier.
- Make sure that your speakers are connected.
- Recheck the wiring in the Power Supply and the interwiring between the PCBs.

If that doesn't fix things, contact ANK Audio Kits at audionotekits@rogers.com. We'll figure things out. Please have a few telling digital pictures ready to share with us.

11.7.1 Mains Secondary Voltages (Optional)

If you'd like to you can also check the Mains Secondary voltages throughout the amplifier. These voltages come directly from the Mains transformer so they should be fine unless — which is unlikely — there is a problem with the transformer. When measuring AC it doesn't matter how the Red and Black probes are positioned, but why not just follow along as we've indicated in our charts?

Power Supply Board

Black Lead	Red Lead	Approximate Reading
HT TX	Other HT TX	750-850V AC[18]
GND TX	HT TX (both)	375-425V AC
FIL TX	Other FIL TX	5V AC
HT TX (mislabeled, Yellow wire)	FIL TX (both)	2.5V AC

Filament Supply Board

Black Lead	Red Lead	Approximate Reading
AC-1	AC-2	7V AC
AC-3	AC-4	7V AC

Driver Board

Black Lead	Red Lead	Approximate Reading
Left FIL	Other Left FIL	6.3V AC
Right FIL	Other Right FIL	6.3V AC
FIL REF on Power Supply Board	Any FIL	3.15V AC[19]

[18] If your multimeter doesn't go to 850V you can just do the next test for both HT TXs; it's really the same test.
[19] This test also doubles as a test for the correct LED voltages.

Section 12

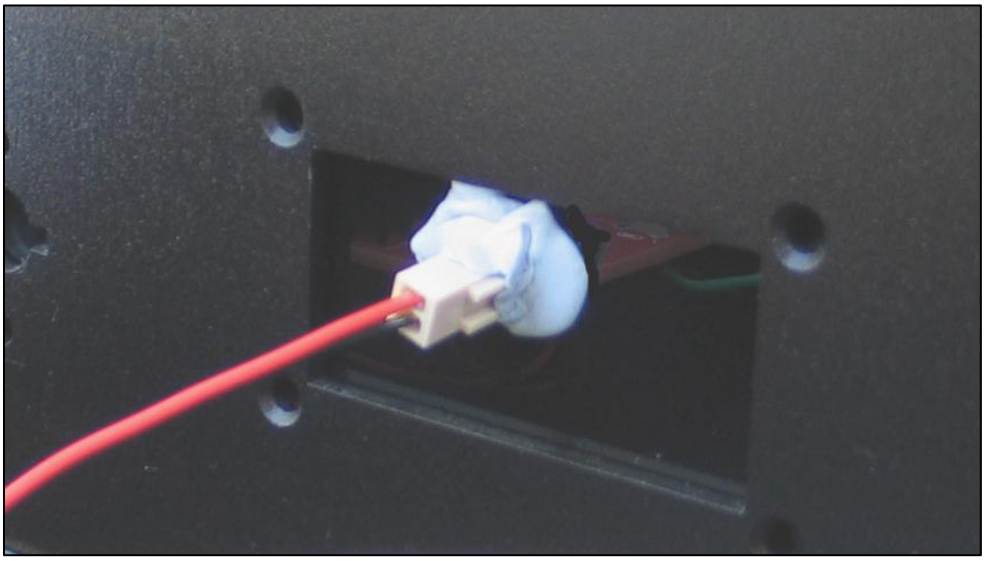
Finishing Touches

12.1 Installing the Front Faceplate

- ☐ Remove the protective films from the front and back of the front faceplate.
- ☐ Install the front faceplate using four Black M4 CSK flat head screws.

12.2 Installing the LED

- ☐ Glue or attach (with some Blu Tack[20]) the LED holder to the front panel so that the LED protrudes through the designated hole, as shown below:



12.3 Last Looks Inside

Before you close things up, it's not a bad idea to do a final visual inspection, particularly to assure yourself that none of the interwiring is too close to things that get hot — like the tubes and the 10W resistors on the tag strips.

12.4 Installing the Chassis Top

- ☐ Install the chassis top using the provided hardware.

[20] Or Stik-Tak, or other adhesive.

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Section 13

Final Thoughts

13.1 Congratulations

If you've made it to this point then CONGRATULATIONS! — you are ready to insert your Mentor SET Power Amplifier into your system and enjoy it.

13.2 Cables

In our experience, a high quality power cable and good interconnects and speaker cables make a noticeable improvement to the sound.

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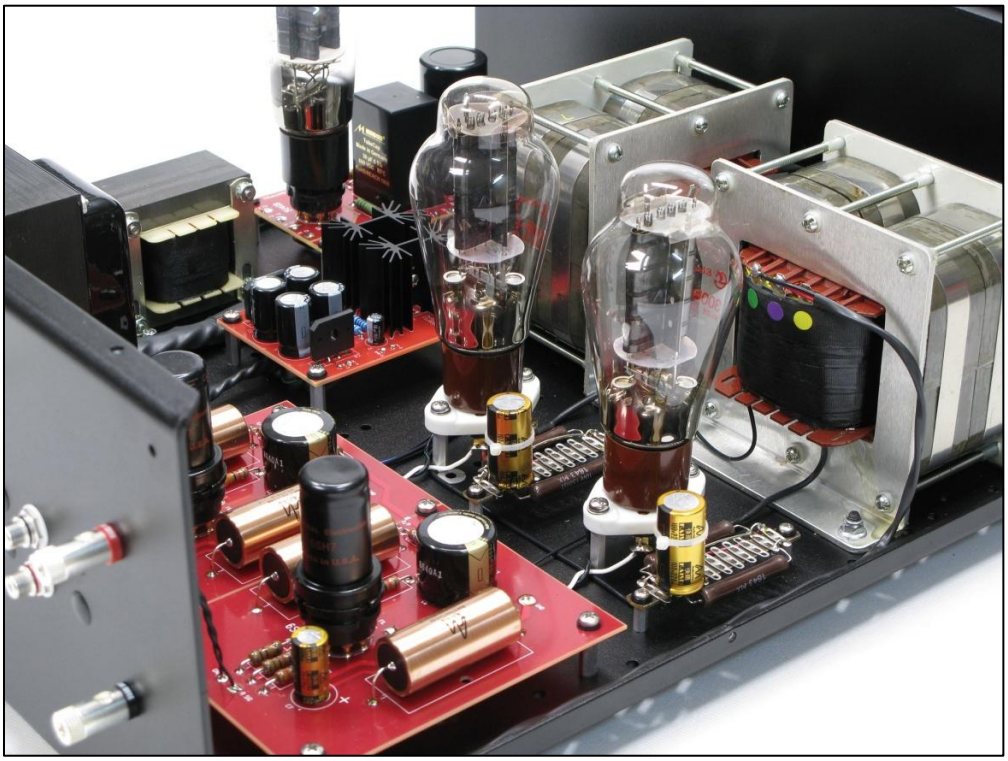
13.3 Tube Rolling

We feel that the sound of the ANK Audio Kits Mentor SET Power Amplifier is truly sublime and that is destined to become a popular kit. It provides a highly detailed and transparent presentation with gorgeous sonics. Rolling some quality new production tubes and/or some nice NOS tubes will allow you to tailor the sound to your particular preferences.



13.3.1 5U4G(B)

The directly-heated 5U4G(B) full-wave rectifier is a 1930s design and there are classic era NOS 5U4G(B) tubes available at reasonable prices. You can use either a 5U4G or a 5U4GB in this amplifier. Of course, audio lore is that the one to have is the Western Electric 274B rectifier, if you can find one and have $1,000 or so burning a hole in your pocket. Alternatively, you can use the Chinese 5Z3P(A); it is a well regarded NOS military grade version made by Shuguang and may still be available. *Beyond these, do not substitute any other 5V rectifier for the 5U4G(B) type for which this amplifier was designed; there are some significant differences between a 5U4G(B) and other rectifiers, with respect to voltage drop and current specifications, and the result of a substitution is unpredictable and could damage your amplifier.*

13.3.2 6SH7

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NOS sharp cut-off 6SH7 (driver) pentodes are readily available at very affordable prices from many tube suppliers. The 6SH7 comes in a glass tube version or with a black metal case. Opinions are all over the map as to which is the one to have!

13.3.3 300B and 2A3

The directly-heated 300B and 2A3 power triodes are in current production and available at various prices. NOS tubes are quite rare and the prices can be astronomical.

13.4 Thanks

Thank you for investing in the ANK Audio Kits Mentor SET Power Amplifier and congratulations on working your way through the build. The kit is new and we would welcome your feedback. Please email us at audionotekits@rogers.com and let us know how everything went: were there any errors in the manual or instructions, parts lists, etc.? Your ideas regarding greater clarity or tweaks will also be truly appreciated.

If you have some suggestions that you feel would help other kit builders please also let us know. We can incorporate them in revisions to the manual and put them on a support page for other users. We'd also like to see some great pictures of your build process and your final build. We can post them on our website or on our Facebook page. And we'd love a review from you regarding the sound.

We hope the unit brings you many years of joy and we look forward to hearing from you.

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Appendix

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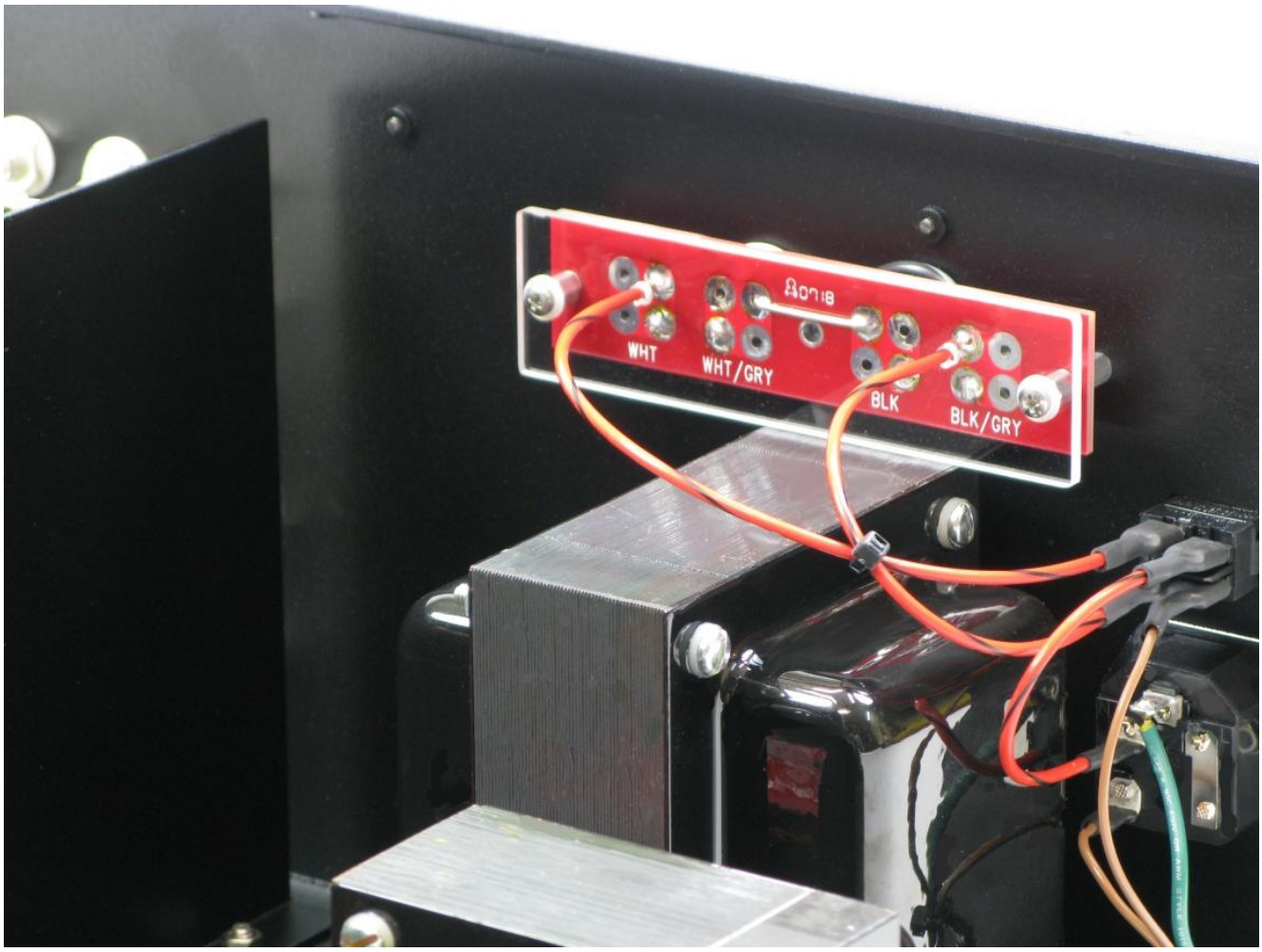
Wiring for 240V Operation

This section describes how to wire the IEC PCB for 240V. Before we do so, have a look at what we want to accomplish:



- ☐ Cut the four wires (White, White/Grey, Black, and Black/Grey) coming out of the Mains Primary to the lengths you'll need to reach the IEC PCB when it's situated on the rear of the chassis. *Note: you can connect the wires from the top or the underside of the board, as you prefer. In the picture above they are connected from the underside.*
- ☐ Strip and tin the ends. (You can add some heatshrink if you like.)

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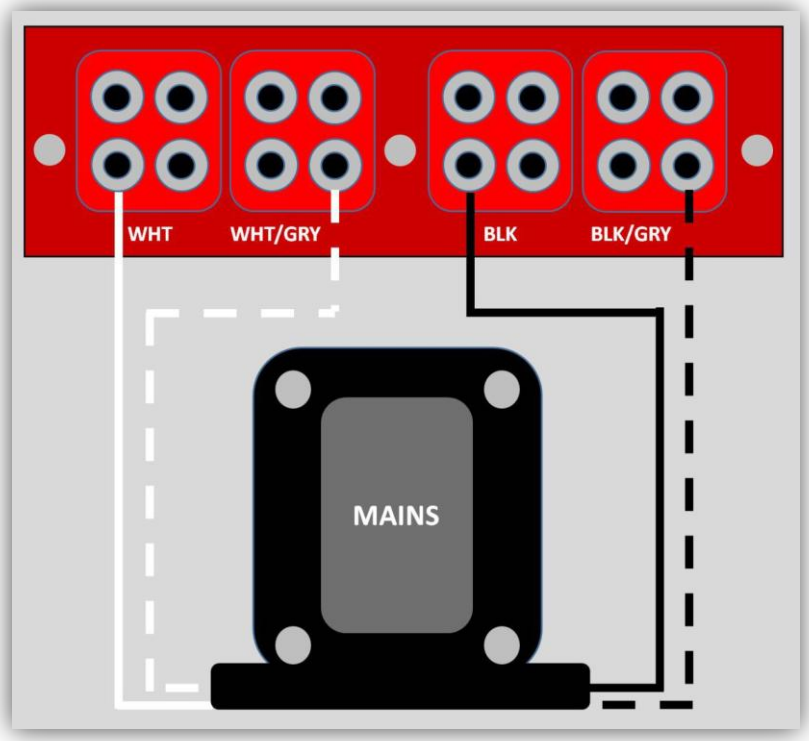
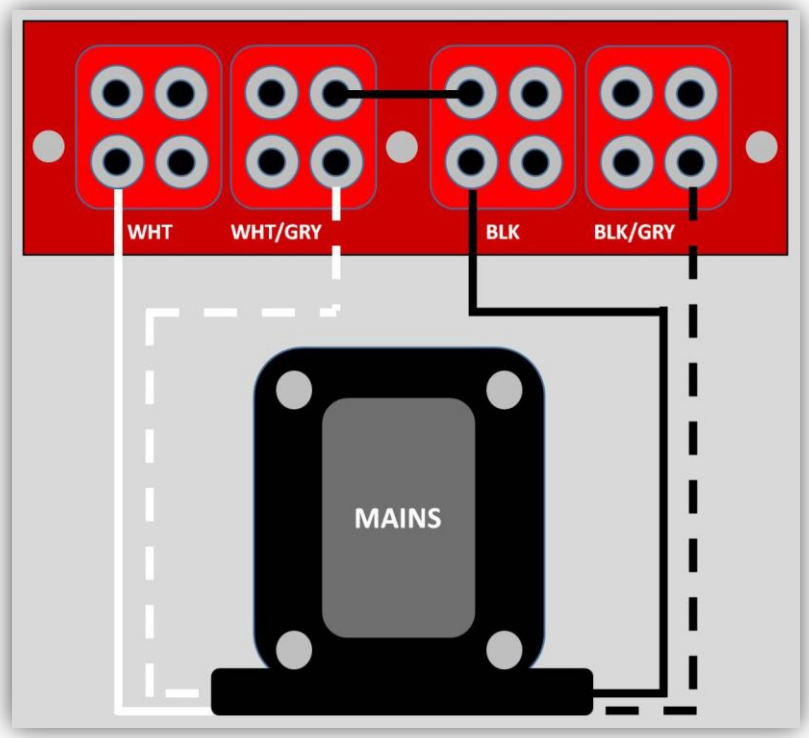
☐ Connect these four Primary wires to the IEC PCB, as shown in the diagram below. Cut off the excess wire.



☐ Add the jumper as shown below. (You can use the left over end of the Black Primary wire or a bare wire, as you prefer.)



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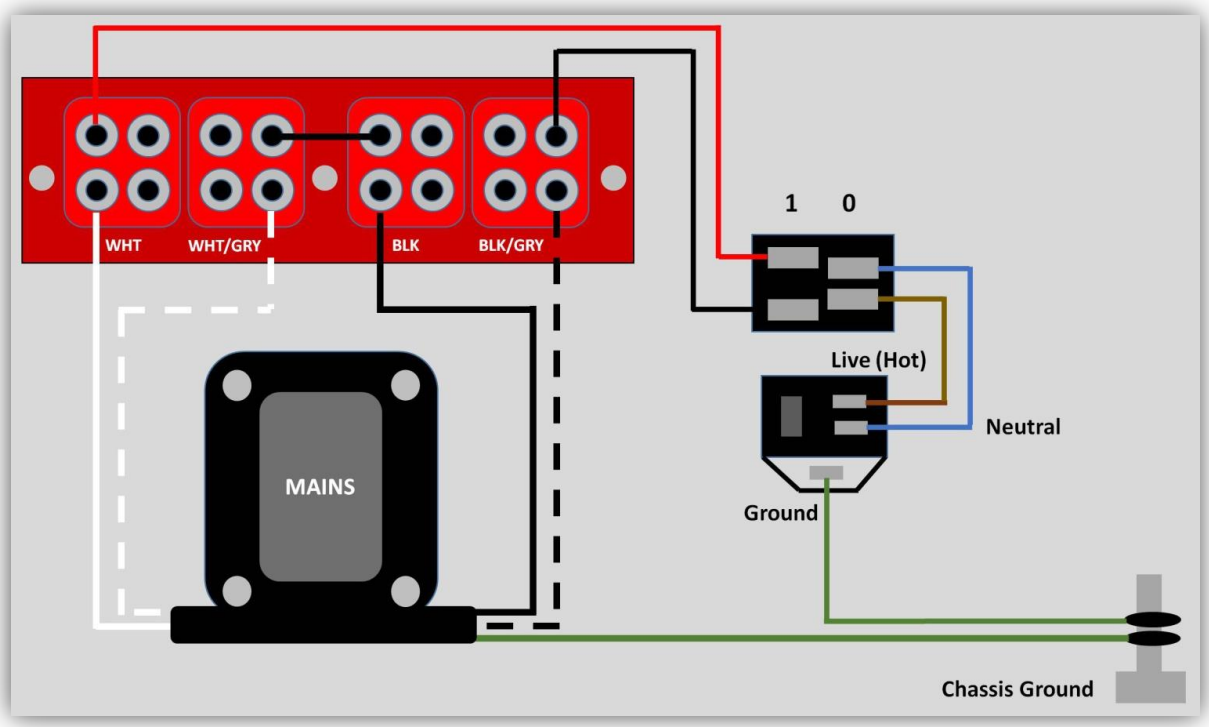
Referencing the diagram below, complete the IEC/Rocker Switch wiring as shown. Regarding the aesthetics, you have several options:

1. Solder the Red and Black wires from the Rocker Switch to the front of the board (see picture above). You can use either of the unused holes on each tab.
2. Solder the Red and Black wires from the Rocker Switch to the underside of the board.
3. Solder the Red and Black wires from the Rocker Switch to the front through the plastic insulating board (by drilling 2 holes in it[21]), as shown in the picture above,

   The choice is yours.

- ☐ If you haven't done so already, peel off the paper covering on the plastic insulating board.
- ☐ Tin and solder the unprepared ends of the half-prepared Red and Black[22] wires in the IEC bag onto the IEC PCB, as shown or in an electrically equivalent position.[23]



[21] Peel off the cover first!
[22] Or Orange or whatever we've supplied. The color doesn't matter so long as you make the connections shown.
[23] Each of the four pads has four connected solder pads so you have some flexibility as to how to do this.

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Resistor Color Codes (5 band)

Black	- 0
Brown	- 1
Red	- 2
Orange	- 3
Yellow	- 4
Green	- 5
Blue	- 6
Violet	- 7
Grey	- 8
White	- 9

Resistor color codes are read from the color that is nearest the edge of the resistor - that is treated as the first column.

The first column of a 5-band resistor is the 100's column, followed by a 10's column, followed by a units column.

The fourth band is a multiplier (or decimal point shifter). The multiplier can use the additional colors silver and gold. These are used for very small values and turn the multiplier into 0.01(silver) and 0.1 (gold). For the standard colors, it determines how many times the column value is shifted to the left (i.e. multiplied by 10)

The fifth column is a tolerance value. These can be quite complex but we will not concern ourselves with these.

Examples

100R	1	0	0	x 1
680R	6	8	0	x 1
820R	8	2	0	x 1
1K	1	0	0	x 10
2K2	2	2	0	x 10
2K7	2	7	0	x 10
3K3	3	3	0	x 10

10K	1	0	0	x 100
68K	6	8	0	x 100
82K	8	2	0	x 100
330K	3	3	0	x 1,000
220K	2	2	0	x 1,000
470K	4	7	0	x 1,000
1M	1	0	0	x 10,000

You can also find an 'Interactive Resistor Color Code Calculator' on our website (available from the Links page).

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