Trainwreck Express Assembly Instructions

WARNING! - Please Read this Information Carefully:
Tube amplifiers use **POTENTIALLY FATAL HIGH VOLTAGE AND CURRENT**. If you are not familiar with high voltage circuits, **PLEASE DO NOT RISK YOUR LIFE BY ATTEMPTING THIS BUILD**. If you are in any doubt as to your ability to complete this kit, please contact a qualified technician.

Required Tools and Supplies

Safety Glasses (if you need “reader” safety glasses, order Pyramex brand from www.safetyglassesusa.com)
Soldering station (or 40W soldering pencil)
60/40 rosin core electronic solder (.032-.060" diameter); 63/37 is easier to work with for some
Vacuum De-soldering tool (Soldapult), get one even if you have a vacuum desoldering station
Needle-nosed pliers and locking hemostats
Wire cutters (small flush cutting)
Complete set of nut drivers
Standard flat blade screwdriver
Small flat blade screwdriver
Phillips screwdrivers (#1 and #2)
Multi-gauge Wire strippers
Digital multi-meter (DMM) and leads
Chopstick
5W or greater Cement Bleeder Resistor on Alligator clip leads (for draining caps)
Light bulb current limiter (see startup section)
Steel 12” ruler
Drill Press

Recommended Tools and Supplies

Amp Cradle
Surgical Forceps and tweezers
Soldering Flux
Magnifying bench light
Pressurized Aerosol air
Caig Deoxit contact cleaner
Erasable marker
Pencil and Paper
Parts organizers
Adjustable clamps
Rubber bench pad (keeps you from dinging the amp up while in work)
Rubber Floor pad (prevents you from grounding to a cement floor)
Set of startup tubes
Can of Compressed air
Spring punch
Hammer- metal and rubber

Optional Tools and Supplies

Analog Signal Generator
Oscilloscope and 10X leads
Heated Wire stripper
Dummy speaker load box
Variac
Electronic bench vise
Vacuum desoldering station
Greenlee Chassis punches, Heatsinks for delicate components (Diodes)

Table of Contents

1. Introduction:

My name is Ron Worley and like so many people I was blown away by the tone of the Trainwreck Express, particularly as so ably demonstrated by Glen Kuykedall in his YouTube videos. I decided to write this guide as a way to help me logically figure out how to build a Trainwreck. It took countless hours of pouring through old posts on the Amp Garage Forum, posting lots of annoying questions myself and endless amounts of study of the Francesca and Undocumented '90 Express pictures from the Trainwreck Files section of the forum. By doing all of this, I've gained a pretty good understanding of how Ken Fischer (KF) did what he did and some idea of why. I certainly can't claim that I understand all of the nuances of the circuit itself or why he used the component values that he did. Therein is the magic of the Wreck……

I've taken the liberty of using the pictures and layouts that are what I consider public domain by being posted on the forum. The pictures are from Allyn Meyers (Allynmey) and HeeBGB, the cabinet design is KF's as drawn by me using measurements from a real Wreck cabinet, the wiring layout document is an updated version that I did in Visio to clean things up, and the component board drawings are by Todd Hepler (Preamp board) and Nik at Ceriatone (I edited the layout down to just the PS section), and some great scale Visio layouts by Barry Witt. I also developed the chassis drilling template and the accompanying parts Bill of Material (BOM). The appendix of Dana's Ken Fischer Tribute Amp build notes is directly off the Amp Builders Guild website. Since I'm not using this for profit, and only as a contribution to the Amp Garage community, I did not seek expressed written consent for use of their respective content. I've also likely made numerous mistakes / false assumptions / asserted incorrect information, etc. Feel free to send me a correction e-mail at: flapsjr@hotmail.com

The order of the steps that I used to construct the amp is my opinion of a logical sequence to do things. It was based on a combination of my sense of logic and the way some of my parts happened to flow from suppliers. You can change the order as you like, but there are some obvious steps that have to be accomplished in sequence.

Before you begin, make sure that you are comfortable with proper soldering technique. Always tin your leads with solder for stranded wires- it will make things immeasurably easier as you go. Make sure that you have a proper wattage iron or an adjustable heat soldering station to prevent overheating components and insulation. If you overheat the wire when soldering to a lug, the insulation will melt and shrink / pull away from the wire. This will not only look bad, it can potentially cause shorts and other bad electrical stuff.

Cleanliness during the build pays off… Use a can of compressed air that most computer and big box retail electronics stores sell to clean keyboards with. Bits of insulation, wire, solder, metal shavings, etc. all can get lodged in some electrically bad places… and the results can be catastrophic. Be particularly mindful of the areas under the boards and in the tube sockets.

Sourcing Parts:

Source your parts using the attached BOM; YMMV on components, depending on how accurate you are trying to be relative to a real Trainwreck. Regarding hardware, I suggest using 100% stainless steel everywhere to prevent any future corrosion issues. It's more expensive, but worth it. It does however strip more easily than harder steels, so go easy on the torque. The only things that aren't typically stainless are the Star washers on the pots, the sheet metal screws for the chassis bottom panel and the #4 chassis screws that KF used to attach the Preamp tube sockets (I use machine screws instead).

Here are some component-based comments from members of the Amp Garage forum- they are a matter of personal opinion, so take them as such:

-Some guys usually use 1W carbon film by default for all resistors. Francesca is predominantly 1/2W with a couple 1W in the PI and larger wattages in the PS and V4 / 5 Screen / Grids.

-The 9.1k Dropping Resistors need to be 3 Watt Metal Film. Some have used 2 watt, but the consensus is that it isn't enough. The 1.5k V4 / 5 Grid Resistor is Carbon Film and doesn't need to be 2 watt. 1 watt will probably be sufficient and some use only a 1/2 watt for these with no reported ill effects. The "5W " 1K Screen resistors on V4 / 5 are actually wire epoxy 7W Mouser "Greenie" on Francesca and seems to be the choice of most of the experienced builders.

-The 100K Bleeder resistors need to be 2 watt. They are used to drain the power supply caps when the amp is turned off. Francesca used Carbon Comp, which is OK given that it's not in the signal chain. Some feel though that the better power handling and fire resistance of Metal Film make it a better choice.

-One of the secrets is the right output transformer...Ken liked Heyboer trannies in the later years, but used Pacific and perhaps others in the pre '90's amps. Chris at ToneSlut (www.Toneslut.com) originally provided accurate Heyboer trannys for a reasonable price, but for now RJ at RJ Guitars (www.rjguitars.net) is supplying them (and Pacific trannys) until Chris can take back over.

-The chassis must be aluminum, not steel- ground current flows through the chassis and the metal composition effects resistance. Also a steel chassis would affect the magnetic fields of all the transformers; aluminum does not. Chassis can be sourced through either Allyn Meyers (www.ampbuildersparts.com) or Nick at Ceriatone (www.ceriatone.com). Bud chassis covers are available at Allied Electronics or Mouser. Use 14 #6X3/8" screws to hold the bottom plate to the chassis.

-The 47K Bias resistor can be up-rated to 56K to help get a hotter bias.

-All tubes can be fitted with 2 O-rings per tube to dampen mechanical / microphonic vibration.

-1/8" cork drawer liner w/self adhesive backing can be attacked to the chassis cover (between chassis and cabinet) to help reduce microphonics / mechanical vibration issues.

-Two 6"x1"x1/4" pieces of weather stripping are located inside chassis about an inch apart between preamp (V1/2/3) heater wires and the chassis back, three 3-4" side by side pieces are on the Chassis cover over the PS Cap stack and a 17" inch piece placed between the top and bottom of the faceplate and the cabinet front to fill in the gap space.

-If you look at pictures of real Wrecks you will find all carbon film resistors in the preamp. Carbon Comp are noisy, drift a lot and aren't the best to use in that part of the amp.

-All of the OD caps are rated a 600v when 400v ones would have worked just fine in some sections.

-Fly-back protection Diodes are mounted on the power tubes to increase reliability against voltage spikes.

-A 50 watt OT is used for a 36 watt amp, a 300ma PT is used when 225ma would work fine. By using the over spec'd parts, you aren't putting a strain on the components like you would if you were running a 400v cap at 395v. Plus, the specified trannys just sound right….

-Cabinets can be either bought or built- see the section "Building the cabinet"

-Boards are tough to source- Dana Hall (UR-12) was supplying them, but has indicated that he is not anymore. If you want to build your own boards, the perf board the KF used is seemingly impossible to find anymore, as is the 1/8" thick electrical grade XXX phenolic stuff Dana uses. Here are the dimensions for the holes: The hole size is 3/23" (.130") and the spacing is .265" from center to center. The Turret part that works with these dimensions is Keystone # 1540-4. Mouser has them for $0.16 ea in qty of 100, and you will need to by the special staking tool to set them into the board. RJ at www.rjguitars.net is now supplying great blans and finished boards.

Glen's comments on parts:

"So far my Express appears VERY close to Francesca. The smoothing cap on phase inverter on mine is a brown silver mica looking cap. On Francesca it's the blue one. Mine has "Aerovox Mallorys" not just "Mallory", not sure what's up with the model differences.

My amp seems to have a center tap on the heater circuit, as it has no double resistors on the output tube socket heater leads. Can't find any different values as far as resistors or caps but I can't see everything from the pictures.. The color coding is a bit different on the wiring.

The B+ resistors grouped together on the power supply board has some jumpers underneath, instead of all being visible on top. Mine has the later black OPT. Different brand of output tube sockets, mine are brown not the nicer looking ceramics that appear to be in Francesca.

My "choke" resistor has the lettering face up and it says "8335 TRW PW25 1K 10%". My feedback cap heat shrink-wrapped up at the presence pot appears to be 100k I think, it's covered up on Francesca.

On my amp the bias feed has an additional terminal on the PS board. It seems that the bias supply feeds under the board, has a terminal just on the other side of the big resistor and then the white wire goes from there to the preamp. On Francesca that wire goes straight from the bias cap terminal, then fishes under the big resistor. I don't know what the bright caps on mine are. Ken told me day before yesterday the stronger of the two bright caps is a 500pf.

My original Express uses the cheap plastic Lorlin rotary switch. A 12 throw double pole unit configured for 3 positions. Both poles wired in parallel to optimize the current capability of the cheap switch. As cheap as the Lorlin is I have never had any problems with it in my original Express. Since the part is currently available (Mouser) I went with the Lorlin in my two clones. The only difference is the new ones are all grey, where the original was half black and half grey. The Lorlin in my original was a 12 pole, but configured for 3 positions, with the other 9 switch contacts clipped off flush with the unit. I copied that too in my two clones. With the Lorlin you take them apart to configure how many positions you have.

Question (about his two clones): Out of curiosity, did you get down to the finest detail with things like the Rubycon capacitors, Mallory polyester ODs, sealed potentiometers, etc? I'm hoping I can build an Express this summer, and I've read varying opinions on what REALLY matters and what doesn't as much.

Glen's response: To be honest I really don't know what matters the most either. Though I have my opinions and to a certain extent I think EVERYTHING matters in these things. There are some "knowns" in these things, and some "unknowns". I choose to find everything I possibly could, but probably at the top of the list for me were the Pacific transformers and BUD chassis. Not that other transformers aren't totally fine, but I was specifically copying my original that HAS Pacifics.

I couldn't find any Rubycons and I used CGE pots which aren't sealed but neither were those in my original. I liked the fact that the CGEs were fairly decent and you can solder to them which helps copy the layout more closely. Also I got a vendor to hand pick some that very closely match the values in my original, some of which were a bit different then marked.

I used two original thin-aluminum BUD chassis with screw-on bottom plates, just like the original. Also I used original spec Pacific transformers like my original. A few other details I copied on my original were NOS Cinch tube sockets, Lorlin output selector, Mallory PVC signal caps in the proper .02, .002, and .1 values (instead of the more easily found .0022s and .022s), PVC wire in matching colors, original spec board material and flea clips, NOS 25 watt 1k resistor that matched the original perfectly, Switchcraft jacks, fairly high flux content leaded solder, Cherry cab, two wood chassis reinforcement dowels, window weather stripping.

I matched the layout and lead dress of my original down to within a millimeter or two, and the mechanical placement of everything to at least 1mm, and I used the same tubes I favor in my

original, etc. I only used shielded cable on the input lead, and both amps are 100% stable with all knobs cranked to 10 even with the bottom plate taken off.

Other than just yesterday upping the PI cap to 250pf, they are 100% copies with no other changes. If it weren't for the date codes on some of the caps and the pot and switch brands, these amps could probably be passed off as originals if you saw the chassis inside.

2. Pre-Assembly Steps

Drilling the chassis:

-Drill out the Preamp and PS boards for the standoff bolts (#6 machine screws)- use the pictures in this document and on the Amp Garage forum to make sure you have the correct holes. Also note that a #6 drill bit is not the same size as a #6 machine screw- they have different numbering conventions.

-Emboss the chassis with your chosen name on the back edge by the impedance switch using Harbor Freight (or other supplier) letter punches. To avoid bending the chassis, it might be smart to have a small anvil placed inside the chassis as you punch the letters.

-Layout the chassis holes using the template below. Use the actual component boards and transformers as templates for their mounting holes because your components may vary; use a graphite pencil to mark the hole positions. Use a T-square to insure that things are properly oriented and square with the chassis.

-Check all hole positions and measurements. Check three times, mark twice and drill once. Make sure to set your power tranny about ½" to ¾" from the front edge of the chassis or it will hit the front panel and you won't be able to slide the chassis in all the way.

-Mark the hole positions using a spring set punch, followed by reinforcement with a pointed tip hand punch and hammer.

-Using a drill press, drill out #6 holes for component board standoffs, ground lugs (including V4, V5 tube socket mounts) and #10 holes for transformers. For the boards, I measure and drill one corner hole of each board based on the drilling template. I then use the actual boards themselves as templates by using a #6 machine screw to hold that one drilled corner in place, align the boards parallel with the chassis edges then hit the opposite corner with my spring punch to set the corners. Drill that hole and insert another #6 screw, then mark the rest of the holes with the spring punch. Remove the boards to drill out the marked hole to avoid damaging the boards.

-Transformer wire holes should be sized to match the grommets chosen to fit wire bundles. The PT grommet will be bigger (a 3/4" hole for me), OT grommet holes are smaller (7/16" for me). Based on experience (that of almost ruining a perfectly good chassis), use a Greenlee chassis

punch for these holes to prevent making a mess. #6 machine screw hardware can be used for the preamp tube sockets rather than the #4 sheet metal screws used by KF.

-If you are using the Allyn Meyers chassis and use a normal 16 AWG power cord, you need a larger chassis strain relief. You will have to make the specially shaped hole larger by ***carefully*** using either a file or the appropriate expensive chassis punch.

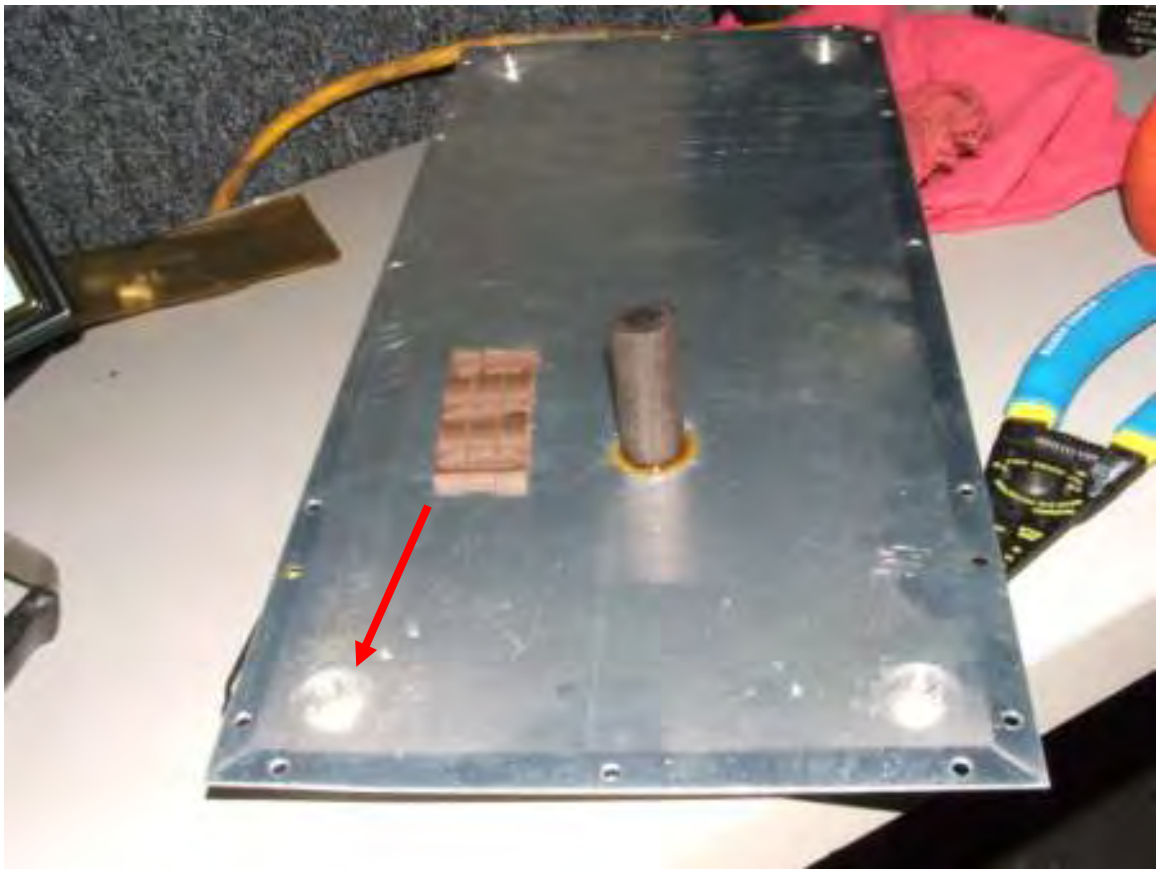
-Two of the PS board standoff holes need to be drilled with a #6 countersink bit, which should use a #6 oval head machine screws (or flat head if you don't care about possible tranny interference). See the diagram below annotating which screws need to countersunk.

-Mount the standoffs to the chassis using #6 machine screws and star-type lock washers. I put a lock washer on both the outside of the chassis and the inside to make things stay tight.

-Dry-mount the boards onto the standoffs. You need to drill out the hole for the #6 machine screw and may have to make minor hole "accommodations" on the boards (unless you are perfect / lucky) - use a reamer to enlarge / clean out the board mounting holes. Don't mount the boards permanently yet- you will want to mount the components and wires that go under the boards outside the chassis to make things easier.

-Mount the Chassis bottom plate at this point to avoid doing it after the amp is done (I forgot to do it myself, and it was rather embarrassing- I had metal chips all over my nearly completed amp). You will have to drill out approximately 8 holes- 3 on the front and rear edges each, and one on each end of the chassis. All those metal filings don't play well with the electronics, so doing this now is crucial. Another thing to beware of is where the holes are drilled relative to the mounted components- the 3/8" #8 metal screw will extend in deep enough to hit components, particularly by the pots. After you drill the pilot holes in the chassis, use a screw to tap the thread into the aluminum. An option to prevent possible electrical shorting is to grind off the tips of the screws flat- this shortens them, and makes them not sharp around wiring.

-Somewhere on the Amp Garage forum I read that KF applied 1/8" adhesive backed cork to the chassis cover to help with vibration induced microphonics when the head was on a speaker cabinet. I don't know if this is right or urban legend- but made sense to me given the instability and sensitivity of the Trainwreck, so I did it anyway. YMMV.



-If you're using an authentic KF-approved Bud Chassis, use "nutserts" for mounting to the cabinet. Use 1/4-20 screws to insert in the "nutserts" through the cabinet if you want it to be TW "Correct". If you're using the Ceriatone or Allyn Meyers chassis, the mounting bolts are threaded through the nuts fastened to the lip of the chassis. You will have to use some metal snips to remove a tab of metal on the bottom plate above where each chassis nut is to allow these machine screws to screw into the nuts. See picture above for details.

Glen's comments on component placement and board mounting:

"The boards in the wreck are tricky to place correctly. Heck everything is tricky mounting-wise. One detail is fitting the power supply caps between the two boards for a little clearance on both sides but still with one of the caps almost touching one of the reverse-mounted power transformer mounting screws but not skewing the cap upwards or something odd.

On the mounting screws that are near the caps you actually mount it with the screw head inside the chassis. Then the Mallory 40uf cap has an indentation ringed area that you align almost over and next to the screw which nets you about 1/16-1/8 more needed clearance.

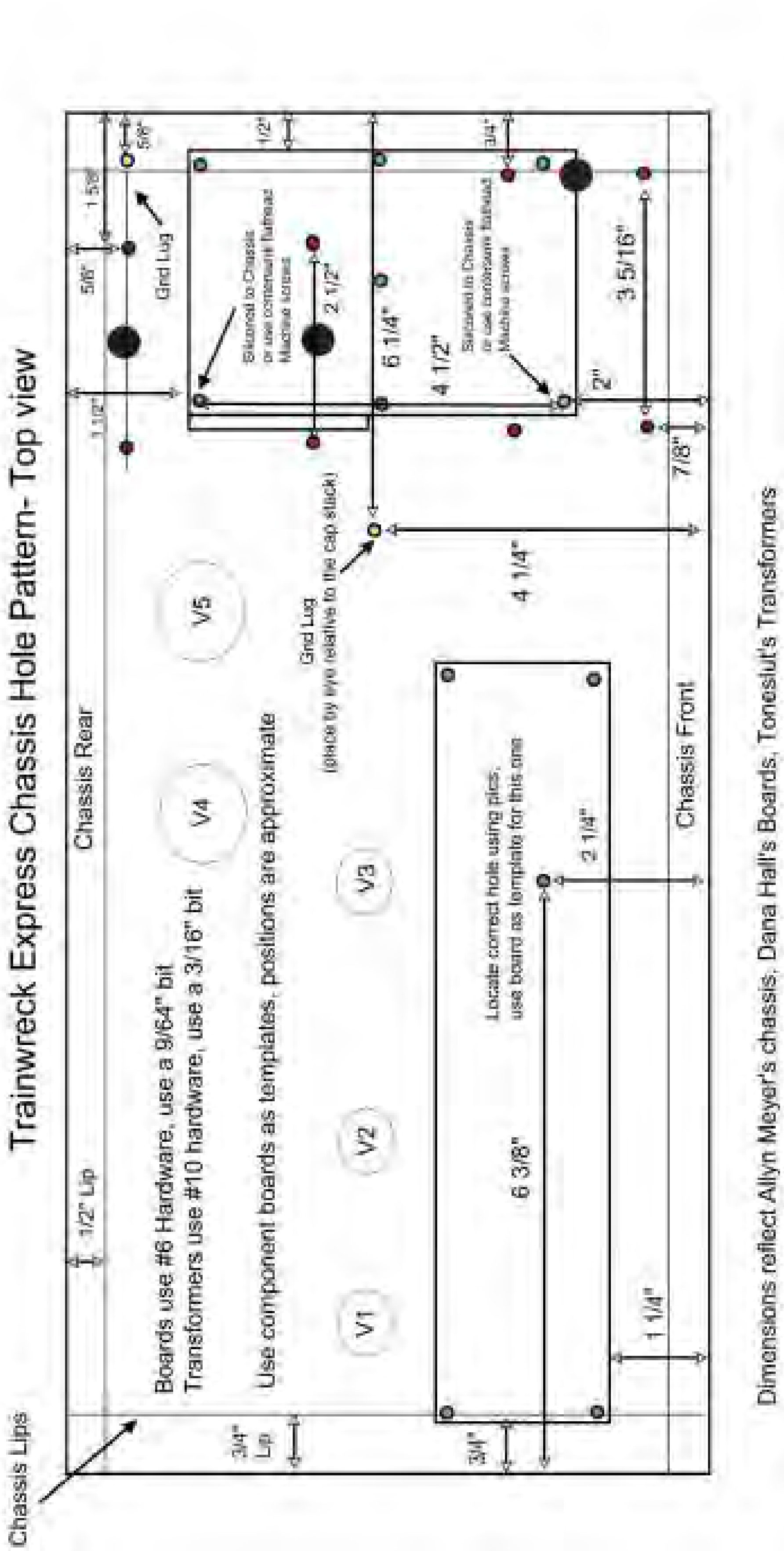
Then you also have to be careful with the transformer bolts where they come though over near where the big power resistors are in a row on the PS board. You don't want the board terminals underneath shorting out against the transformer bolts. Anyway, the only real way to do it is to have the boards cut and the caps and transformers on hand to line it all up.

Truly, on the original wreck things are very tight and if you are copying it, being off by as small as 1/8" could cause issues. I used the original style flea clips and board materials, which have some complications. Mainly that the flea clips extend a bit far underneath the board so you need to make sure that nothing hits a mounting bolt underneath.

Even the layout of the PS board in the bias section is partially the way it is because of clearance requirements underneath. In an original Express some of the transformer bolts go one way and some the other to gain clearance. Also I had issues with the mounting bolts on the transformers coming into contact with the core stack bolts themselves. I didn't think that any contact was good there since the transformer company made effort to insulate the bolts from the metal with insulating washers. So, again I had to carefully work with the exact transformer mounting bolt locations (even egg out the holes to shift things a hair washers are your friend!) so that I had clearance up top at the core stack and clearance underneath the chassis where the boards were.

Anyway, this stuff took a lot of work and almost as much as it took to wire them up. Still you may be able to find easier ways since you are not going for a millimeter for millimeter copy. In some ways Ken did things the hard way, but I questioned nothing and copied it, warts (or at least complications) and all.

Yep, I also have troubles getting clean holes for the transformer leads, but I covered up a little slop with some grommets so you can't see it. In the end I had to file and egg out (slightly) a few mounting holes like for the board standoffs. However the little washers cover it all up so you can't see it once it's all done. And I was using a spring loaded center punch to mark it".


Trainwreck Express Chassis Hole Pattern- Top view
Chassis Rear
Chassis Front
Chassis Lips
1/2" Lip
3/4" Lip
Boards use #6 Hardware, use a 9/64" bit
Transformers use #10 hardware, use a 3/16" bit
Use component boards as templates, positions are approximate
V1
V2
V3
V4
V5
Gnd Lug
Gnd Lug
(place by eye relative to the cap stack)
Locate correct hole using pics,
use board as template for this one
6 3/8"
2 1/4"
1 1/4"
3/4"
4 1/4"
7/8"
3 5/16"
2"
4 1/2"
6 1/4"
2 1/2"
1 1/2"
5/8"
1 5/8"
5/8"
1/2"
3/4"
Dimensions reflect Allyn Meyer's chassis, Dana Hall's Boards, Toneslut's Transformers

Mounting mechanical components:

-If you're using a painted chassis, ensure that all ground points are clean to bare metal before installing any hardware. Use a scraper and small wire brush to remove any coating or overspray on painted chassis. Four areas will need scraping; the speaker jack holes, input jack hole, V4 and V5 mount holes (closest to the preamp board) and the ground holes by the fuse holder and in front of where the cap stack will be located (between the Preamp and PS boards). If you're using the Allyn Meyers bare aluminum chassis, this step is not necessary.

-Install preamp tube sockets. The preamp tubes are mounted with pin 9 facing the preamp board.

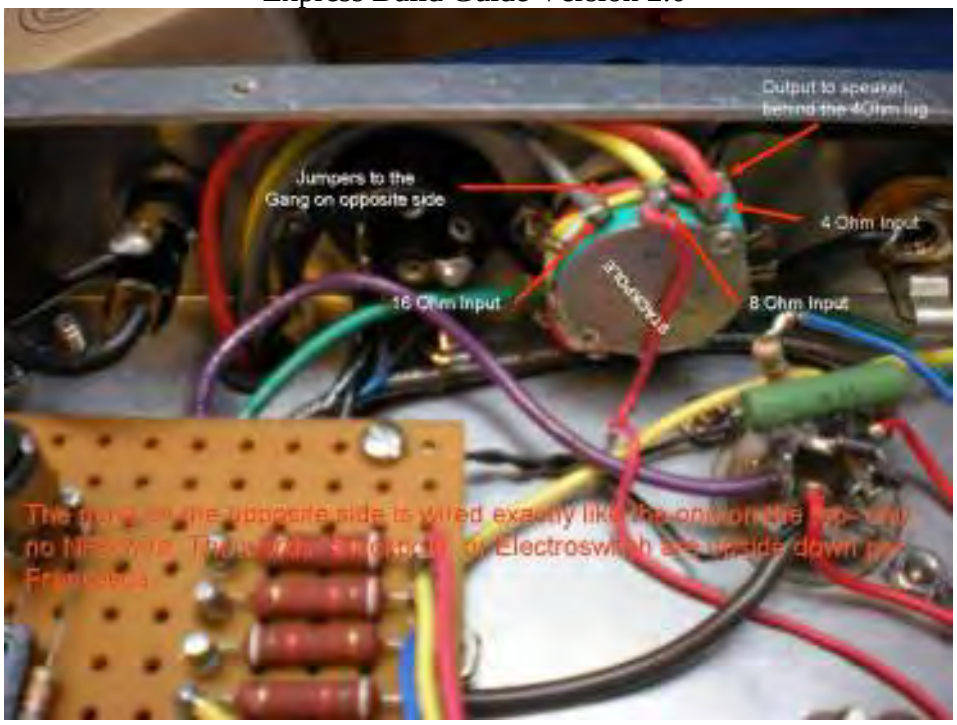
-Install power tube sockets. Power tubes are mounted with the alignment notch and pin1 towards the middle of the chassis. Note that both V4 and V5 have double lead ground lugs that are mounted on the screws nearest the preamp tubes. You don't need one on V5 if your PT has a heater Center tap and you are not installing the 100 Ohm resistors shown below.

-Install the remaining ground lugs by the fuse holder and in front of where the cap stack will be placed. You may wait on this until you set the cap stack to make sure you have it right. Again, use two double lead ground lugs on each one.

-Install fuse holder and speaker jacks in the rear of the chassis. Leave the impedance selector off for now.

-The impedance selector on Francesca was a Stackpole (now Electroswitch) and on Orphan Annie and the Undocumented Express, a Lorlin. Either way, they need to be wired with jumpers from each impedance position and the output wire to the adjacent *gang* (set of 4) lugs on the switch. Use the trimmed remnant of each 3 different impedance wires (grey, red, yellow) and the black common wire that goes to the output jack as your jumper cables. This was done to insure that the switch could handle the voltage. You will find that the lug sizes on the Stackpole / Electroswitch unit are too small to accommodate the heavy multiple wires. I used the tip of one side of a set or forceps to carefully enlarge the lug holes.

-The Negative Feedback wire from the Presence pot is attached to the 8 Ohm wire's lug on the switch- cut a long enough piece of red 20 AWG wire to run from the impedance switch to well past the Presence Pot on the other side of the chassis. Don't solder the main lugs on the top of the switch- you need to wait until you have the speaker jacks in place, and the leads that go to them sized. See the picture below:



-Install the pilot light, switches, and potentiometers in the front of the chassis.

-If you are using the authentic KF copper wire grounding buss and using stainless steel cased pots (PEC, Clarostat), you will need to use the (difficult to find) grounding lugs with long leads that are bent around the pot on the side- one per pot. If you are using non-stainless pots, you will solder the copper wire directly to the pots later. Leave the Pots loose at this point- you *may* have to take them off in the process of wiring them up later.

-***Fit the transformer wire holes with the proper sized rubber grommets***. This is optional, but high voltage wires rubbing against sharp aluminum is a safety hazard in my book. Feed the Transformer wire bundles through these holes (making sure to get the OT oriented correctly- the bundle with the grey / yellow / red / black wires go though the hole closest to the back of the chassis by the fuse holder) and set the transformer onto the chassis. Do them one at a time.

-Using #10 hardware, attach the transformers to the chassis with the screw head on the outside of the amp- except for the 2 inner screws on the OT nearest where the PS Cap stack will go, which are done the opposite way to give a flat surface for the caps. Note that both sides of the Tranny bolts have flat washers on them, unlike the other smaller chassis bolts.

-Fit all of the chassis mounted components- pots, switches, pilot light (be really careful if you are using the authentic plastic lights- they crack very easily), fuse holder, tube sockets, ground lugs, etc.

-The power cord can be attached later to make things less awkward.

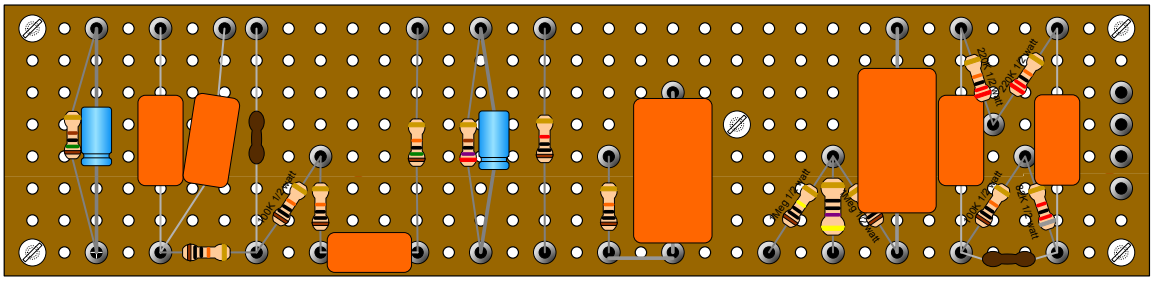
-Attach the board standoff onto the chassis with the #6 hardware; this will help align the tranny wires, etc. as you solder them to their respective components.

-Recheck your work. Make sure that all hardware is securely tightened and that all pots and switches operate smoothly. You don't want to be trying to re-tighten things once the wiring is in place.

Building the Preamp and PS boards:

-Using the layout diagram on page 18, mechanically attach the various components onto the Preamp board. Attach the bias and B+ wires that run under the boards (drawn in red crossing the board) to the appropriate lugs, soldering them into the hollow part of the bottom side of the lug. To prevent them from coming loose as you solder the top components, I strongly suggest that you run the wire up the inside of turret and have some of the wire bent over onto the outside of the turret. Take it from me, I had one come loose and had to almost tear my entire preamp board apart). The RC components can be mounted by placing the leads into the holes of the turret (looks pretty), but I wrap my leads around the turret barrel to ensure a really good mechanical bond before soldering. Again, YMMV.

You can cut the correct color and length of 20 AWG wire for each flying lead and attach them mechanically to the lugs as well at this point- *but I don't recommend it*. Part of getting really good lead dress and neat smooth wires like KF is doing it "in-situ"…. If the wires get all kinked up or bent, they are very difficult to smooth back out. This is a highly personal point- I just found it way easier to get a neat result this way. Using a heated wire stripper makes this really easy- no pulling on the wires with a hand stripper- which usually screws up that nice neat lead dress you just spent several minutes getting just right. Double check all components are in the correct spot and orientation (particularly caps). If you're striving for total "KF-ness", the resistors are also oriented a specific way. Only then solder the topside components on the lugs that don't require a wire lead going off the board. I was told that KF cleaned all component leads prior to soldering with Scotchbrite or perhaps 600 grit paper (no steel wool!), others use isopropyl alcohol.



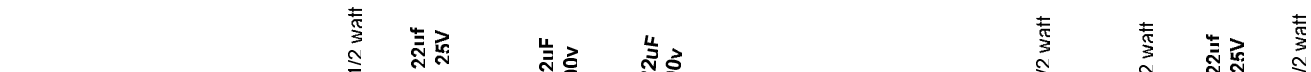
-Using the picture below, perform the same steps for the PS board. Make sure that the diodes and caps are oriented correctly for polarity. On later amps, KF put the bridging wires between the 9.1K dropping resistors below the board.

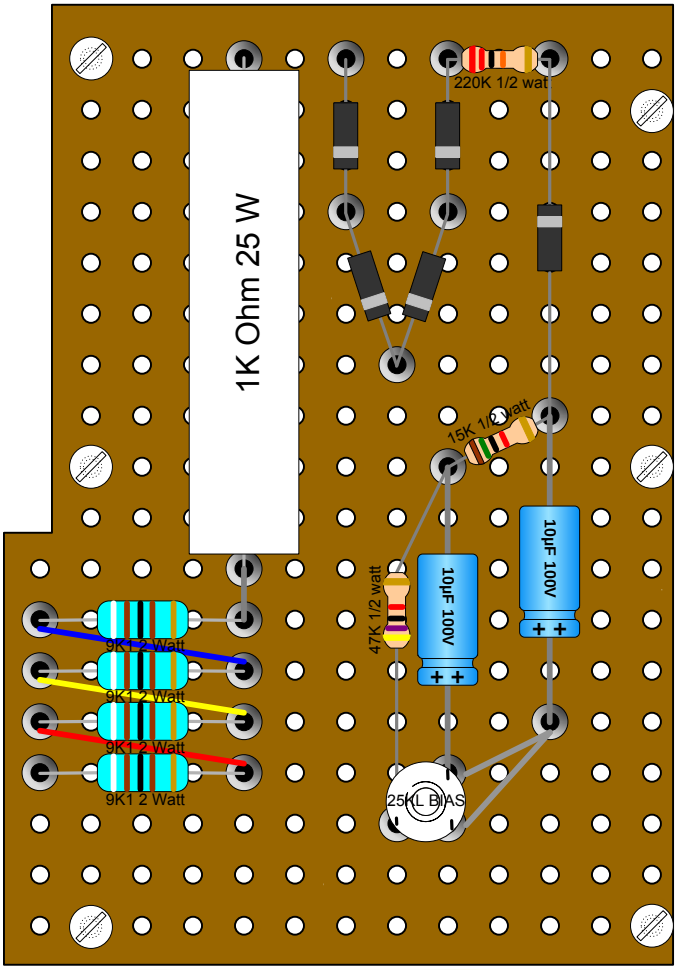
-The Bias pot is 22K in the Ceriatone kit, KF used a 25K. Note that on several layout drawings, the third leg of the Bias Pot is shown as unconnected- this is very wrong. It needs to be connected to ground to prevent damage to the tubes in the event of Bias pot failure.

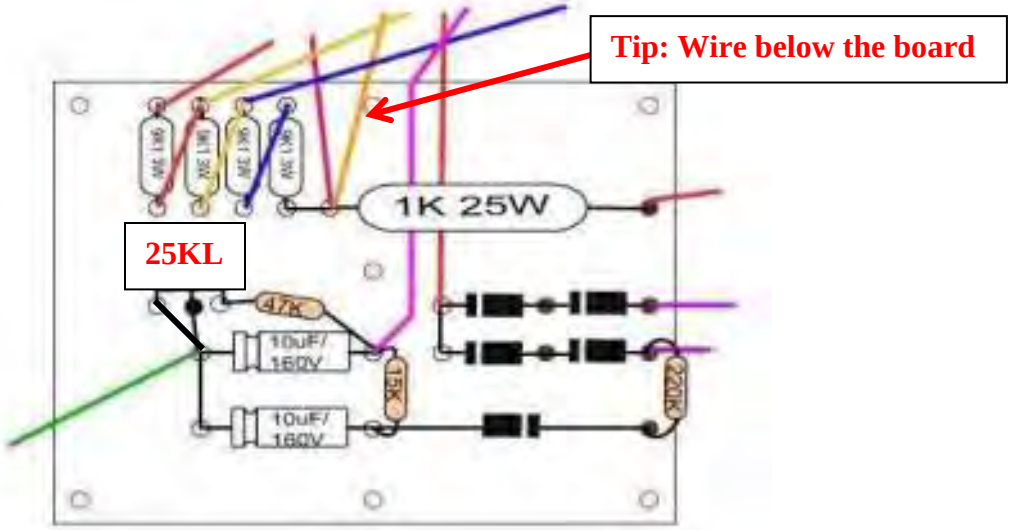
-The 47K Bias Resistor is commonly substituted with a 56K value to allow for hotter bias settings, and it was Carbon Comp on Francesca.

-Wait on the flying leads for the PS board- their lead dress in most cases is best done after it's installed. If you must attach them now, don't solder both ends of the jumper wires on the 9/1K resistors yet- solder only the lugs closest to the bias pot to hold them in place.

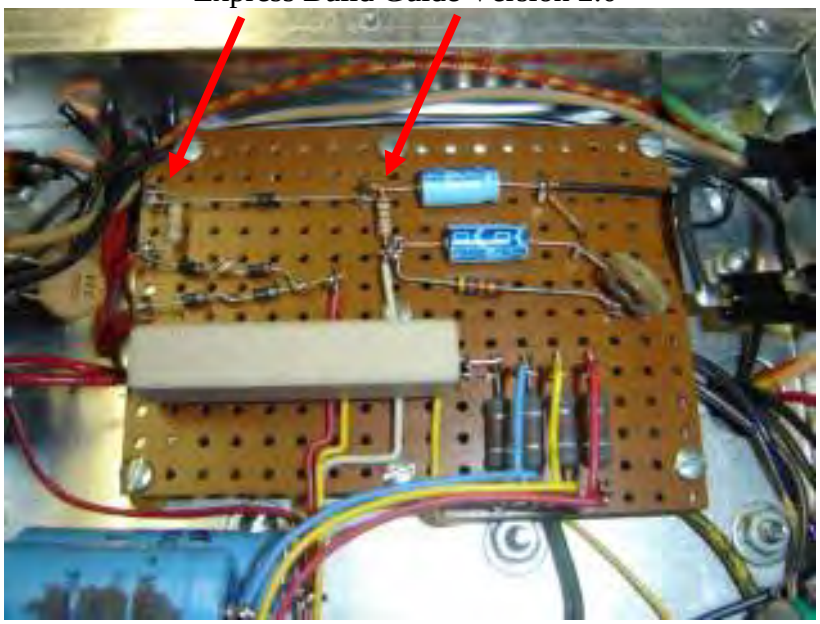
-See the notes below on the wire used for the B+ 1 and B+2 connections- because it seems (to me) that heavier wire is needed, the 25W resistor is difficult to install. If the wire noted below in yellow off the 25W is heavier gage than 20 AWG, it makes it impossible for the 25W to lay relatively flat on the board. An alternative method is to attach this wire (in yellow in the diagram) under the board, relieving that clearance problem. This is expanded upon in the 'Wiring the PS Board" section later. Look at the file pictures to better understand this.







-If you are trying for 100% accuracy, use the file pics to note the way KF mounted some components- some resistors have bent leads curving to lugs rather than soldering them in directly between lugs. See examples below.



-Wait until later to mount the boards; you will want the maneuvering room.

3. Wiring the chassis:

General notes:

-Begin by carefully reviewing the layout pictures of both Francesca and the Undocumented Express for details on exactly how and where KF laid his wires:

Amp Garage Trainwreck Picture Files

Lead dress in a Trainwreck is so important that it will make the difference between tonal nirvana and a howling mess….

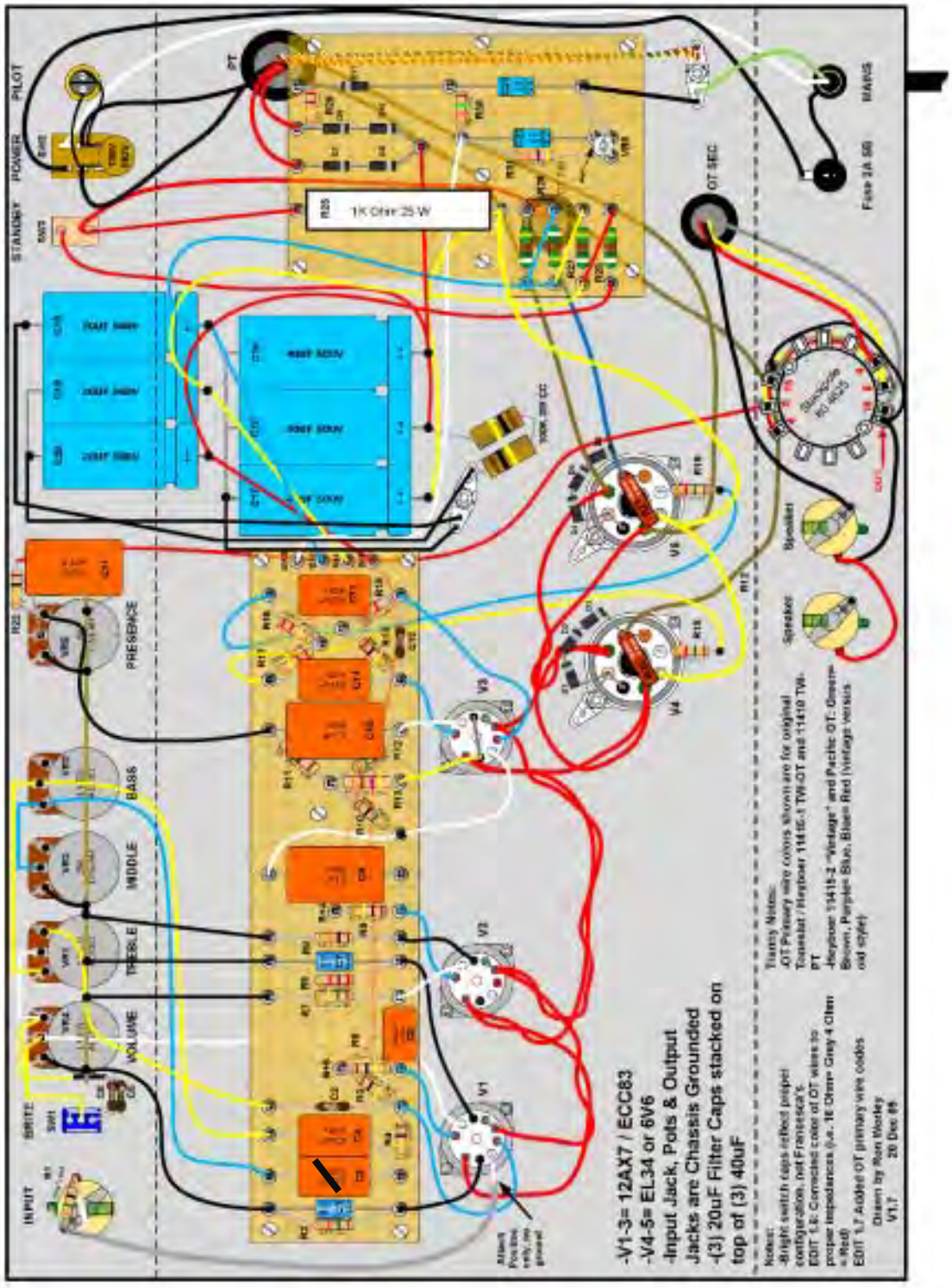
-In general if you are crossing a signal wire over a filament or power wire, it should be at 90 degrees to each other to minimize crosstalk and noise.

-Use 20 gauge solid core wires for all components excepting 18 gauge stranded for the tube / valve heaters. Francesca used 20 AWG stranded red "Colombia" wire, but 18 AWG seems better for the higher current heaters- your choice. Francesca also used 24 or 26 AWG black wire for the pilot light. Colors are not tonally important, only esthetically- again it depends on how detailed you are trying to be. KF was not 100% consistent with colors either; the Undocumented Express uses black and red heater wires versus all red on Francesca and other differences.

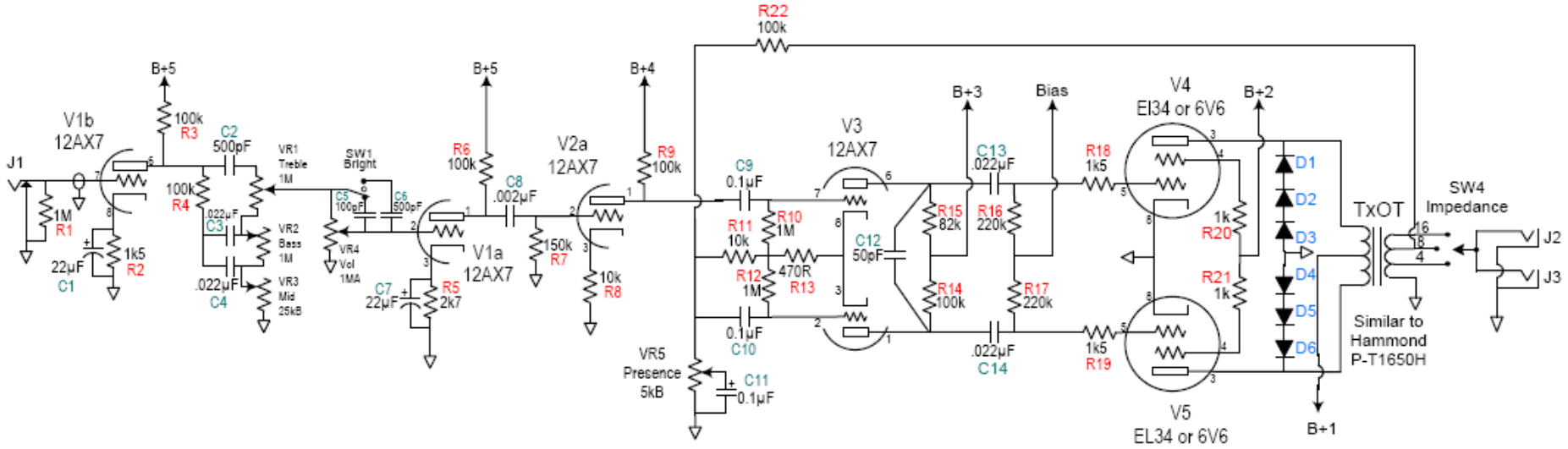
- The Undocumented Express also uses what appear to be Tranny clippings for the B+1 and B+2 leads going from the 25W Cement Resistor on the PS board to the Standby switch, V5 grid and first 40uf PS filter cap. There is probably a really good reason for this- these voltages are 380V+, and the 20 AWG 300V wire used by many is well past rating. I am told that the Undocumented Express is a not a forgery, and there's some logic to what was done there. I also used some of the 18 AWG red and black stranded tranny clippings for the speaker jack wiring.

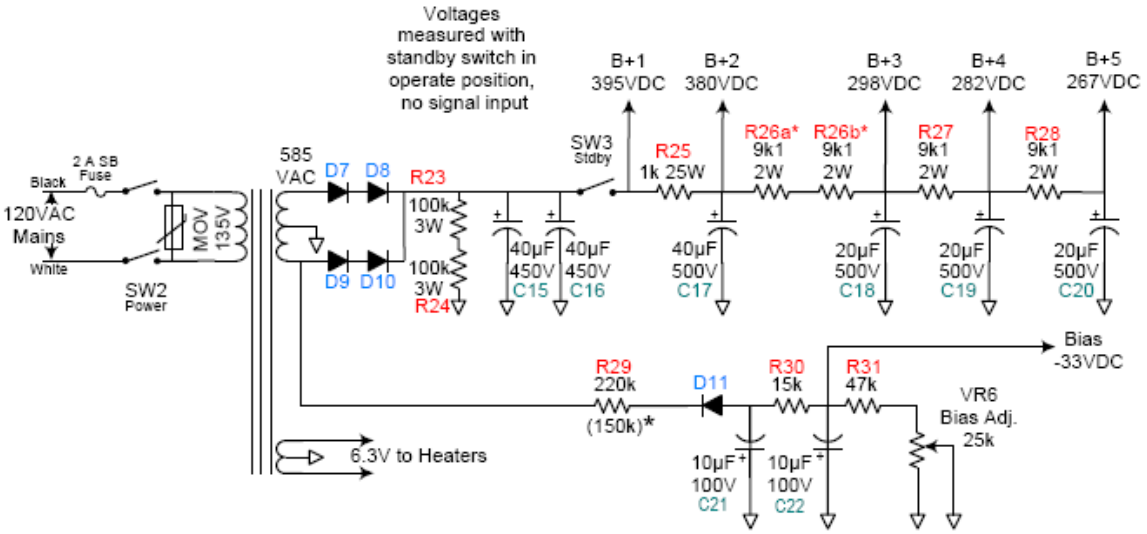
-The undocumented Express chassis has very noticeable pencil lines forming a grid pattern of what looks like an inch square. This may have been done to get very exacting precision on the lead dress of that amp. This is a pretty good idea really; it might help eliminate some of the instability issues that many builders seem to run into- but that's up to you and your sense of accuracy.

-If you are going to use Teflon (PFTE) insulated wire, please be aware that the fumes of it burning are EXTREMELY hazardous- use proper ventilation and / or perhaps a respirator if you do use it.


PILOT
POWER
STANDBY
PT
1K Ohm 25 W
OT SEC
MAINS
Fuse 2A SB
PRESENCE
BASS
MIDDLE
TREBLE
VOLUME
BRITE
INPUT
V1
V2
V3
V4
V5
Speaker
Speaker
-V1-3= 12AX7 / ECC83
-V4-5= EL34 or 6V6
-Input Jack, Pots & Output
Jacks are Chassis Grounded
-(3) 20uF Filter Caps stacked on
top of (3) 40uF

Express Build Guide Version 2.0





Trainwreck Express

Based on the designs of

Ken Fischer

From Kelly '90 schematic
with UR12's revisions
to correlate with
Francesca photos

D- all diodes 1N4007

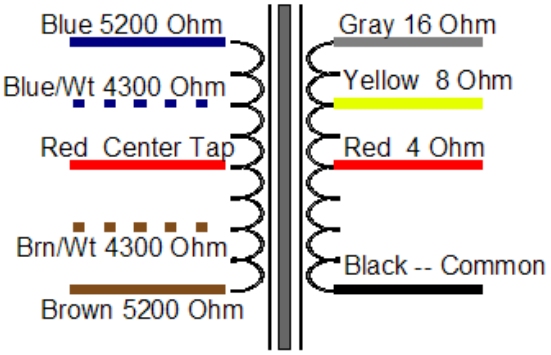
* May need to change values to achieve correct bias. See:
http://ampgarage.com/forum/viewtopic.php?t=1338&highlight=express+bias+resistor

* Show in many TW schematics as a single 18k2 4W resistor, but usually implemented this way

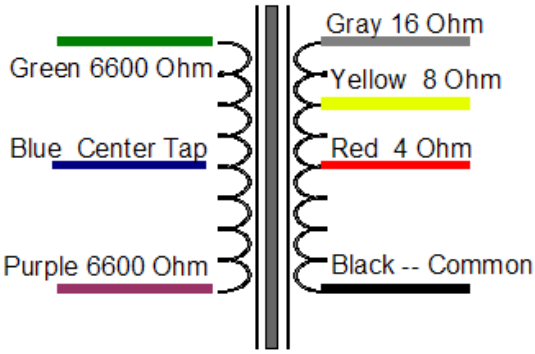
Wiring the Transformers and Power Circuits:

-Wire the transformers to the appropriate components using the diagram below. The PS board is not installed until after this step is completed.

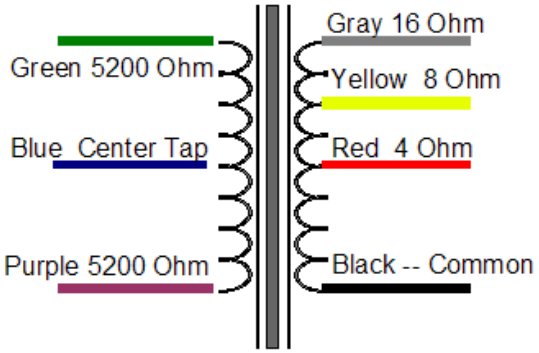
Dual Tap Liverpool/Experimenter's
5200/4300 Ohm Primary
4/8/16 ohm Secondary
M19/26 Steel



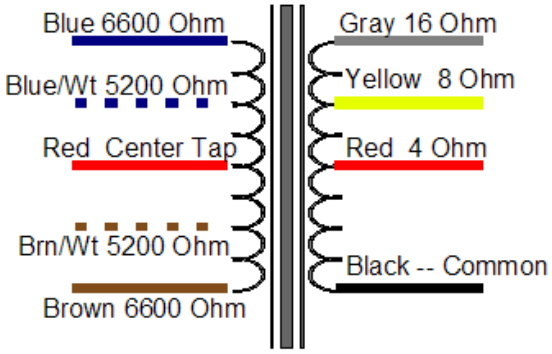
Vintage Spec Express
6600 Ohm Primary
4/8/16 ohm Secondary
M19/26 Steel



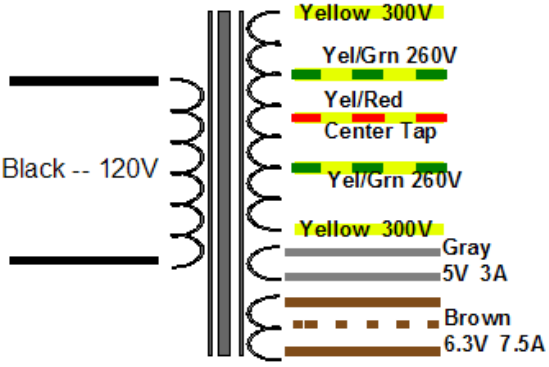
Vintage Spec Single Tap Liverpool
5200 Ohm Primary
4/8/16 ohm Secondary
M19/26 Steel



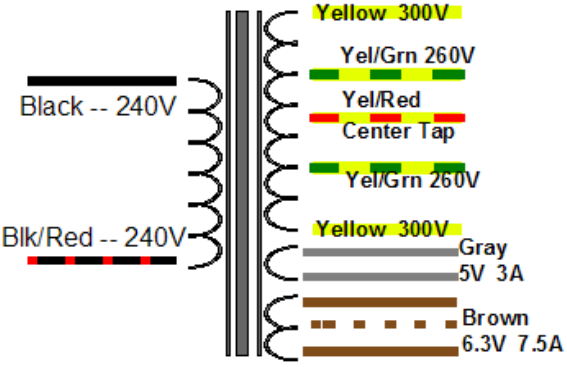
Standard (Old Style)
6600/5200 Ohm Primary
4/8/16 ohm Secondary
M27 Steel



North American Spec
Power Transformer 120V
(Rocket, Pool, Express)



Outside North America
Power Transformer 240V
(Rocket, Pool, Express)

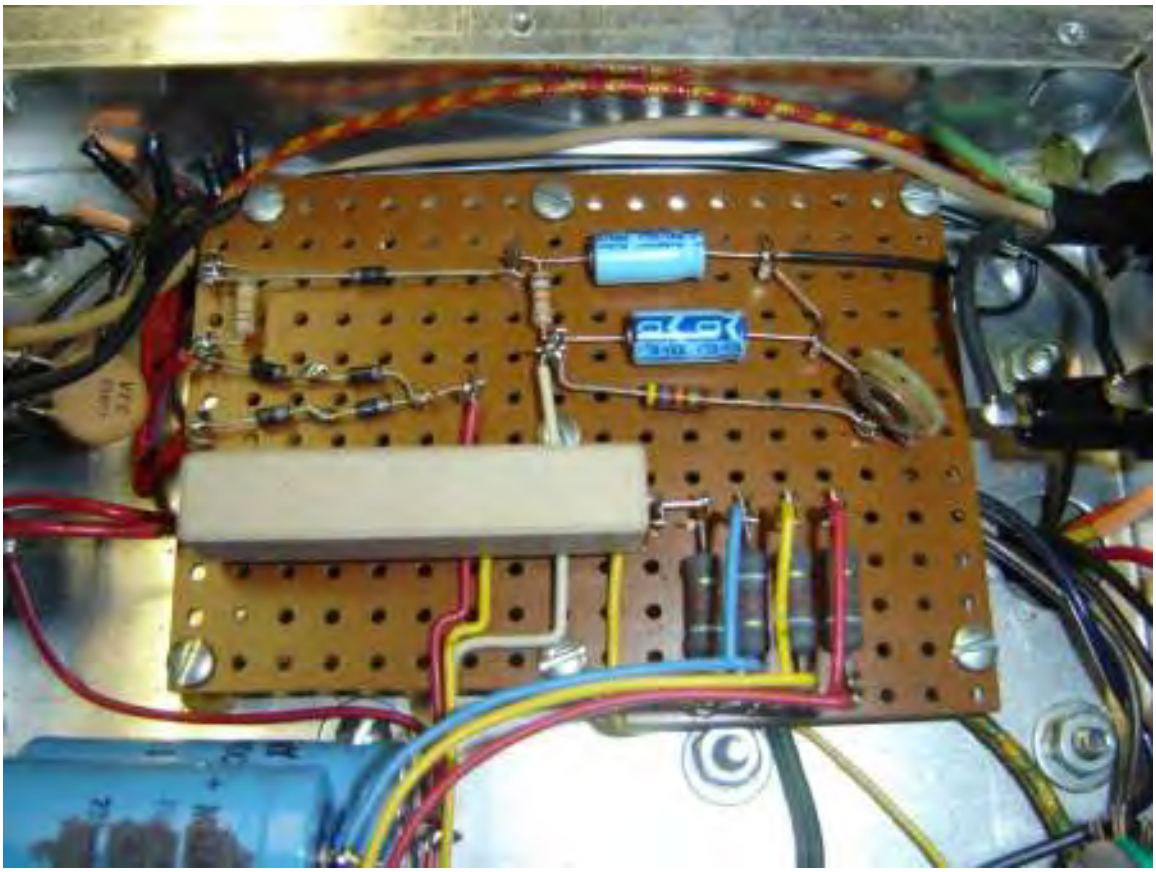


Yellow 300v secondary wires - to diode stack on PS board
Yellow/Green 260v secondary wires - not used
Yellow/Red 0v - to ground lug under power cord
Gray 5v - not used (clip short and heat shrink)
Brown 6.3v - heaters
Brown/White center tap - to ground lug under power cord

OT Wires (Hole under PS board)
Blue wire- to pin3 of V5 (Purple wire on new Toneslut “Vintage” OT)
Brown wire to pin 3 of V4 (Green wire on new Toneslut “Vintage” OT)
Red wire- Center-tap to standby switch (Blue wire on new Toneslut “Vintage” OT)
Blue / White, Brown / White- not used (clip short and heat shrink)

OT Wires (Hole by fuse holder)
Grey wire- to 16 ohm position on Impedance switch
Yellow wire- to 8 ohm position on Impedance switch
Red wire- to 4 ohm position on Impedance switch
Black wire- to ground lug on speaker jack

-Here’s a picture of how Francesca is wired around the PS board for tranny wires. The OT has another wire bundle that comes through the chassis under the PS board that contains the Brown and Blue wires that go to the V4 / 5 power tube sockets and a center tap to the standby switch.

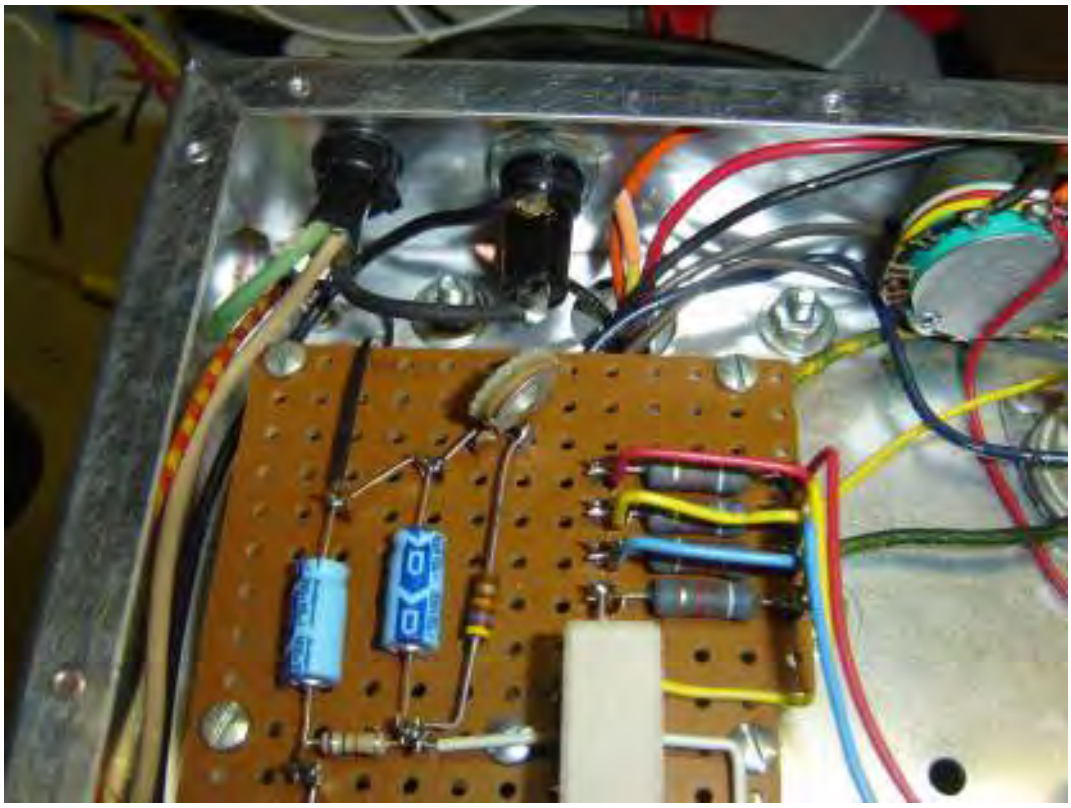


-There are several wires that are not used on the Toneslut OT- the 2 Yellow / Green 260 wires and the 2 Grey 5V wires (which you would use if you were using a tube rectifier- the Express uses solid state diodes for this function). Clip these wires short and use shrink tube (orange if you’re anal!!) to electrically isolate them. See the picture above for details.

-The PT center tap wire on the Heyboer trannys from Toneslut should be grounded to the ground lug by the power cord’s strain relief in the back of the chassis. Francesca’s PT did not have a

center tap, so an artificial tap was made by installing 100 ohm resistors off the V4 socket to the ground lug. It can be done either way… but it's highly recommended to use the Center tap wire if your PT has one.

-Install the power cord at this point. You will have to strip the outer casing back about ~8 inches to have enough white wire to go around the PS board standoffs up to the Power Switch (measure this carefully before you cut!). The black and green power wires will be cut off shorter as appropriate to be attached to the Fuse Holder and ground lug respectively. Save the black wire, you may need it later.



-Wire the power switch, standby switch, MOV (looks like a ceramic cap) and pilot light- extra black wire that connects the fuse holder to power switch is required- you might be able to use PT clipping- the wire from the power cord that you clipped off is too short. Note that the pilot light wires are twisted.

-Run the red OT center tap wire in the middle of the PS board standoffs up to the Standby switch- but don't solder it until after the PS board is installed.

Wiring the OT, Impedance Switch and Output Jacks:

-You've already wired up the Impedance switch with jumpers to the second (lower) gang of the switch. Install the Impedance Switch to the chassis tightly- noting that the 8 ohm lug is at top-dead-center. Install the two shorting speaker jacks to the chassis as shown in the picture below. The shorting part of the jacks are not used, it is presumed that KF used what he had on hand.

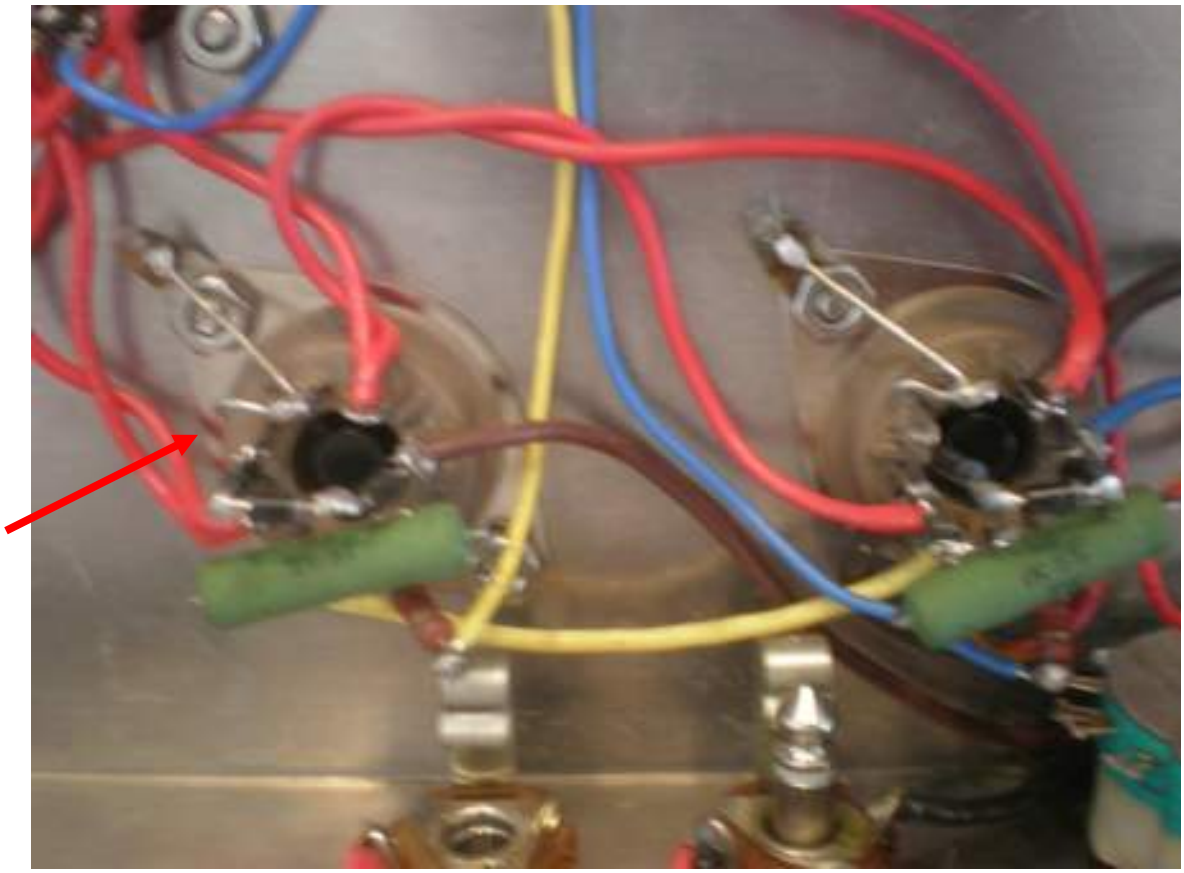
-As noted before, Use 18 AWG stranded wire from the tranny clippings (personal opinion for power handling considerations) to wire the speaker jacks to the impedance switch- note that the right most jack only has a red positive wire; the ground occurs via the chassis. Don't solder the wires on the Impedance switch yet. Solder the black negative OT wire to the ground lug of the first speaker jack.

-Using the picture below, wire the OT leads to the Impedance switch. Solder the lugs at this time. You should have 2 wires per lug (jumper and OT wires on the front 3 lugs and jumper and positive lead to the speaker jack on the back lug). You will also have the NFB wire on the 8 Ohm lug at top-dead-center- This may pose some difficulty getting 3 wires into the 8 ohm lug- I had to take a small screwdriver and enlarge the lug hole.

Wiring the Power Tube Sockets:

-Using the picture below for lead dress guidance, let's begin getting the main valve sockets squared away. Start by soldering a bare wire lead going from the ground lug on the interior mounting bolt / screw of each socket to pin 8 and is then bent over to pin 1. If your tube sockets don't have two lug holes per pin, don't solder it yet. If it does have dual holes, solder both pin 8 and 1 on the bottom hole. This is KF's design, but there's a catch:

If when you're all done building the amp and want to bias the amp using the 1 ohm resistor method you will have to undo all of this. Using this bias method, you must remove the wire bridging pin 1 and pin 8, and then ground pin 1. Rather than redo everything each time you need to bias, I suggest that you run the ground wire from the lug to pin 1, and install a small jumper between pins 1 and 8. This way, you will only have unsolder the jumper from pin 8, bend it out slightly and proceed with the biasing procedure. See below:



-If your PT does not have a proper center tap wire, then you can provide one by soldering 100 ohm resistors from pins 2 and 7 of V5 to the ground lug-see the picture above for details.

-Using (3) 1N4007 diodes for each socket, fabricate the fly-back protection assembly- a semi-circular loop that will "fly over" the middle of the socket, connecting the three diodes between pins 1 and 3. Be very careful not to overheat the diodes when soldering, and ground yourself to something large and metal to prevent any possible damage due to Electro-static discharge (ESD). Also be sure to orient the diodes correctly- the silver band on the black body of the diodes goes on the side of pin 3. If you have single hole lugs on your socket, solder both the ground wire and diode lead to pin 1. If you have dual hole pin lugs solder the ground wire to the bottom hole and the diode to the upper hole. Same goes for other side on pin 3- diode lead on the upper hole, or if it's a single hole, don't solder yet.

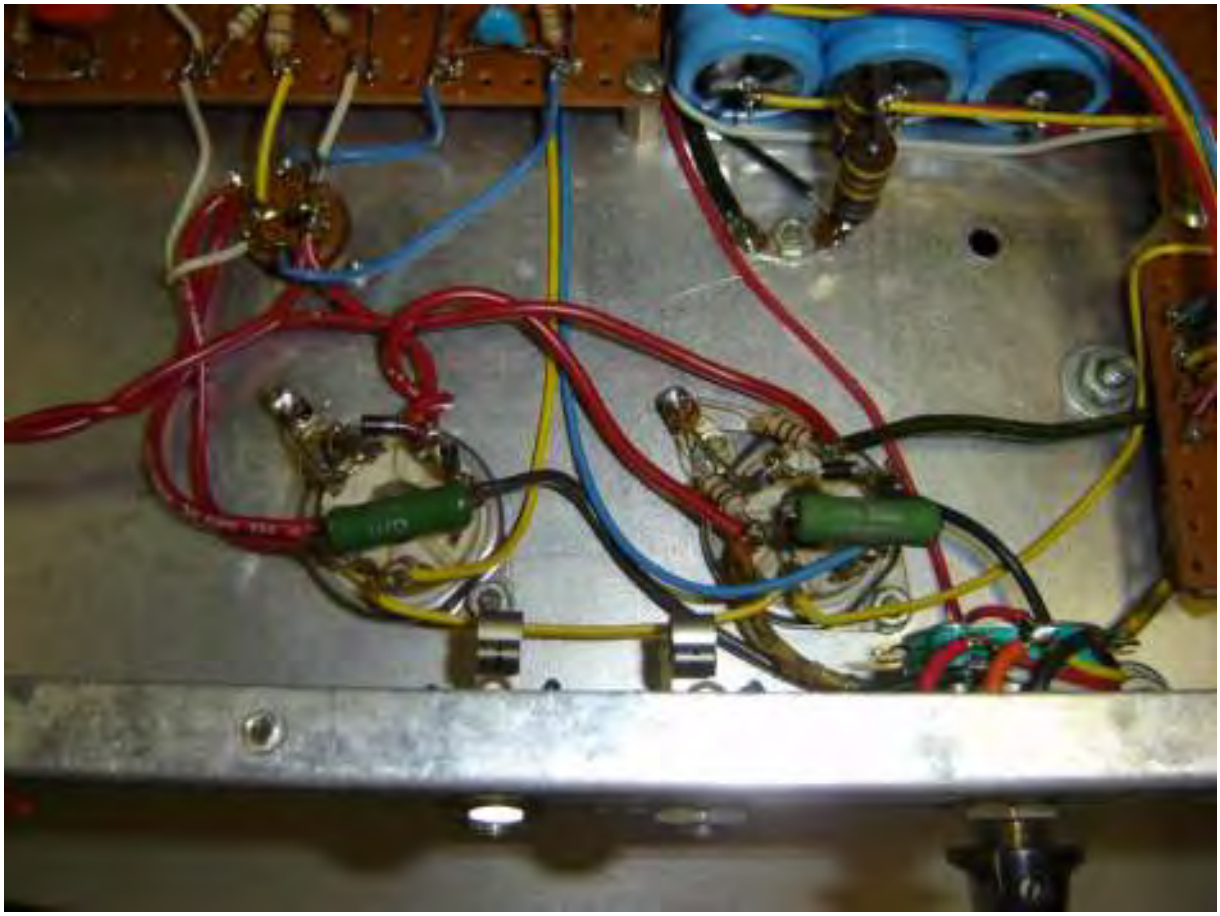
-Solder the OT primary wires to pin 3 of the sockets. Use the pictures below, and make sure that you attach the blue wire to V5 and the brown to V4 for the Heyboer trannys. If you are using some other tranny type, you will have to figure out what wire goes where on your own. If that's the case, consider not clipping these wires to proper length until after you've successfully fired the completed amp up. If all is well, simply unsolder them and clip to length based on proper lead dress. The reason to do this is that if you get it backward, the amp will oscillate and sound very bad.

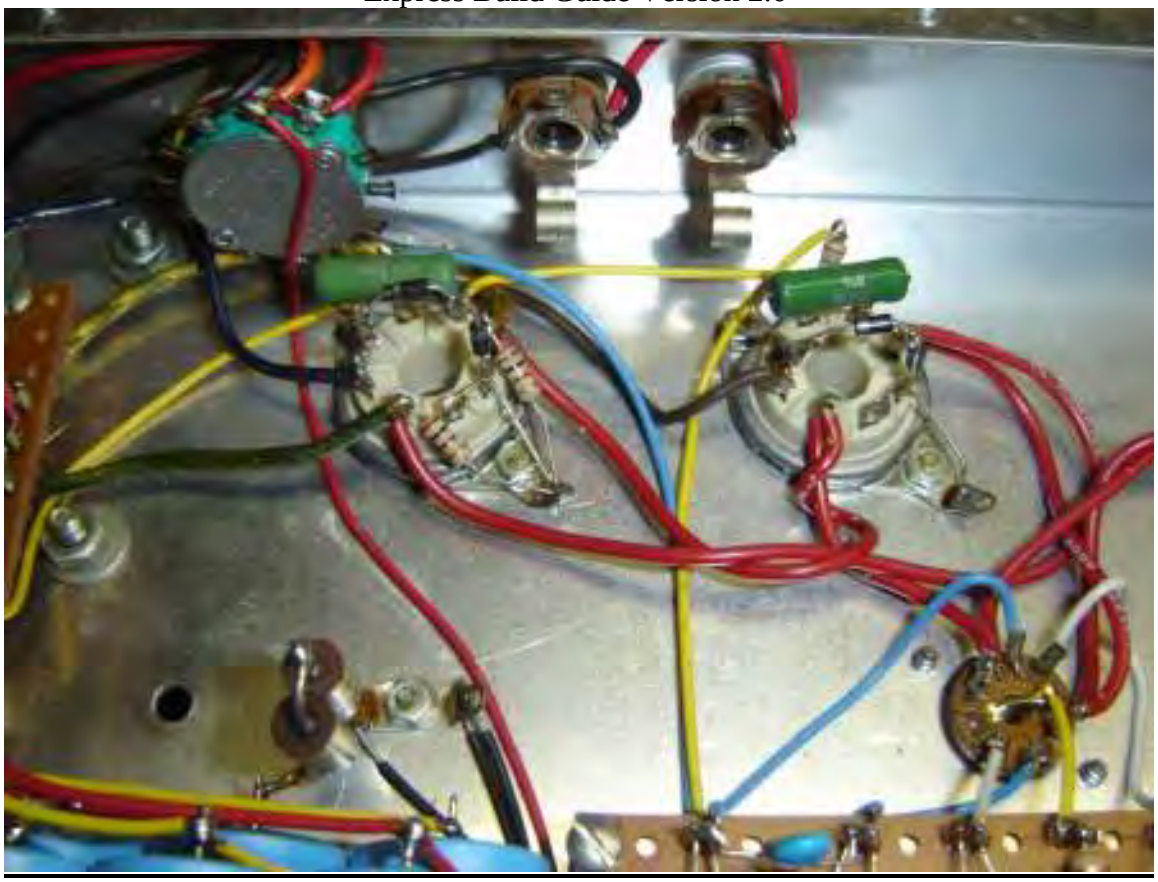
-Solder the large 5 or 7W 1K screen resistor up over top of the socket to pins 4 and 6. Same drill- don't solder the lead on pin 6 yet if you've got single-hole lugs. Use the pictures to show you how to bend the leads under the body of the resistor to fit into the valve socket lugs.

-Run the yellow wire between pin 6 of each socket- same again on V5's pin 6- don't solder yet if you have single hole lugs.

-Solder the 1.5K grid stopper resistors to pin 5 of each socket straight up. You will eventually solder a wire to the other end, but not now.

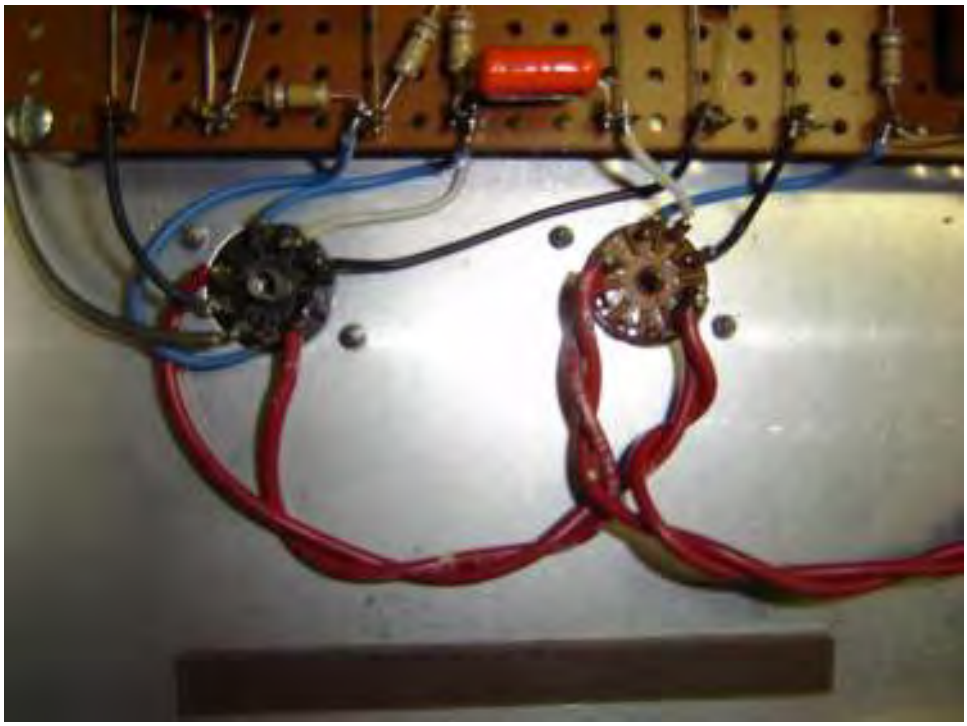
-Run the heater supply wires from the PT under where the PS board will go, taking care to place them between the proper standoffs for lead dress. If you've got the double hole socket lugs, solder them to the lower hole on pins 2 and 7. If not, just thread the wire through the hole temporarily.

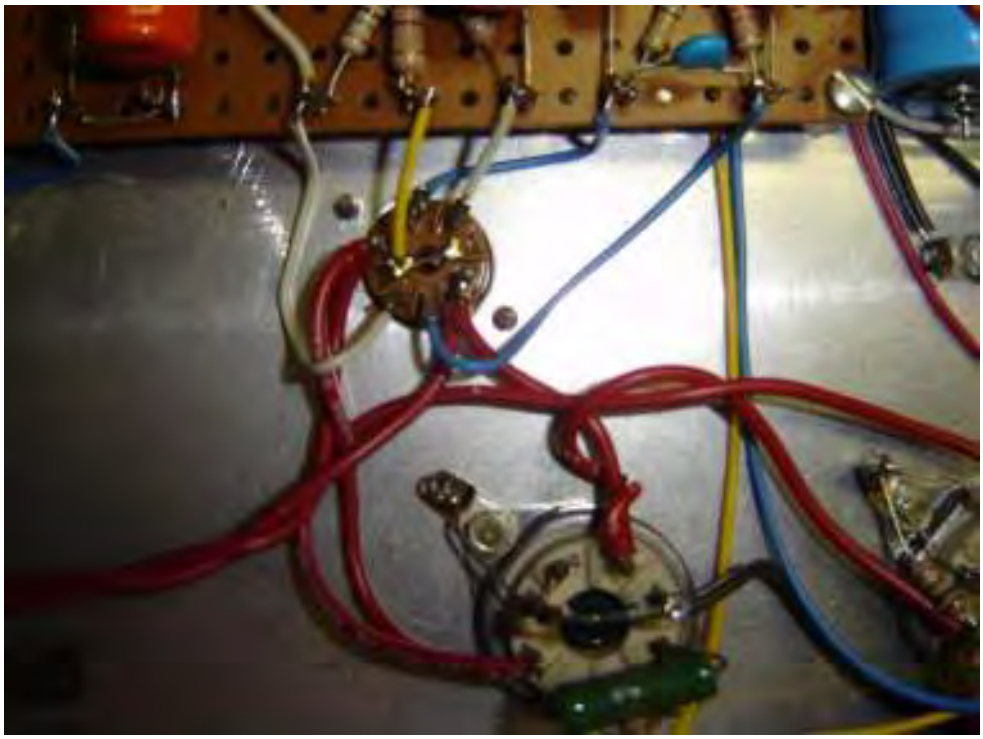




Wiring the Heaters:

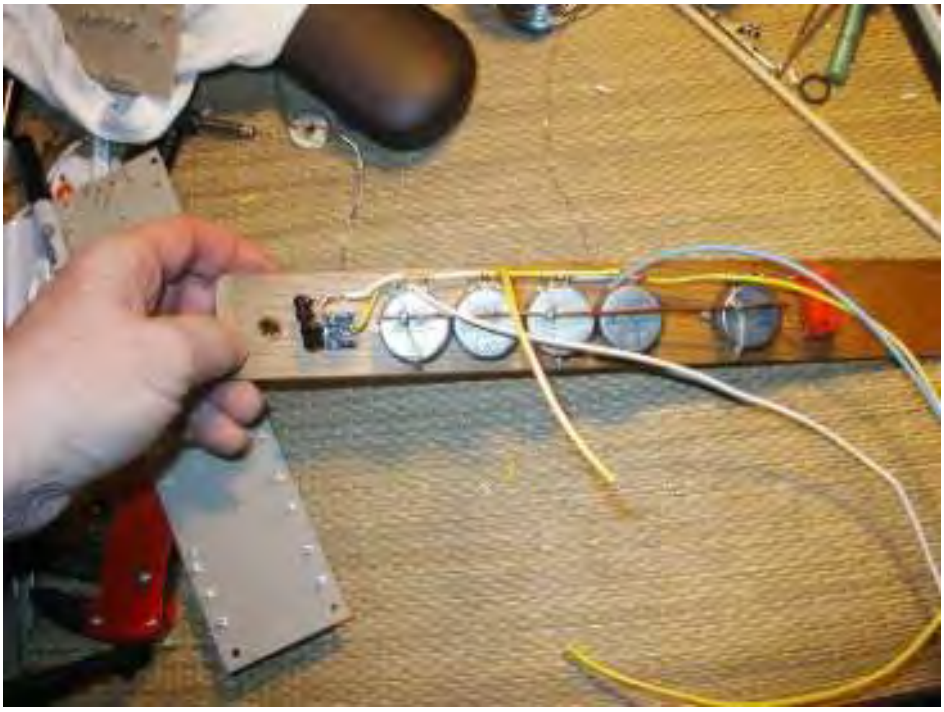
-Using the KF “Lazy Loop” lead dress method and the pictures below, wire the heater wires to the preamp tube sockets. The pictures below of Francesca below detail a potential wiring error- make sure that your filament wire loops go from pin 9 on V1 to pin 9 on V2 and V3, and then to pin 7 on V4 and V5. Likewise, go from pin 4 on the preamp sockets and pin 2 on V4 and V5. For whatever reason, KF wired several of the heaters out of phase; perhaps for some unknown good reason. Lead dress here is very important to minimize hum and noise in the amp.





Building the copper wire grounding buss and wiring the Presence Pot:

-This is best done now before you have the Preamp board and cap stack installed to give you the greatest amount of maneuvering room. The Allyn Meyers chassis have significant “lip”, as you can see in the pictures. One way to avoid the difficulty of wring under the lip is to make a “pot jig” from a piece of wood (like the faceplate). Gearhead on the forum came up with this idea, and it is a good option. If you are using the copper wire buss like I did, this will be stable enough to transfer from the jog to the chassis.



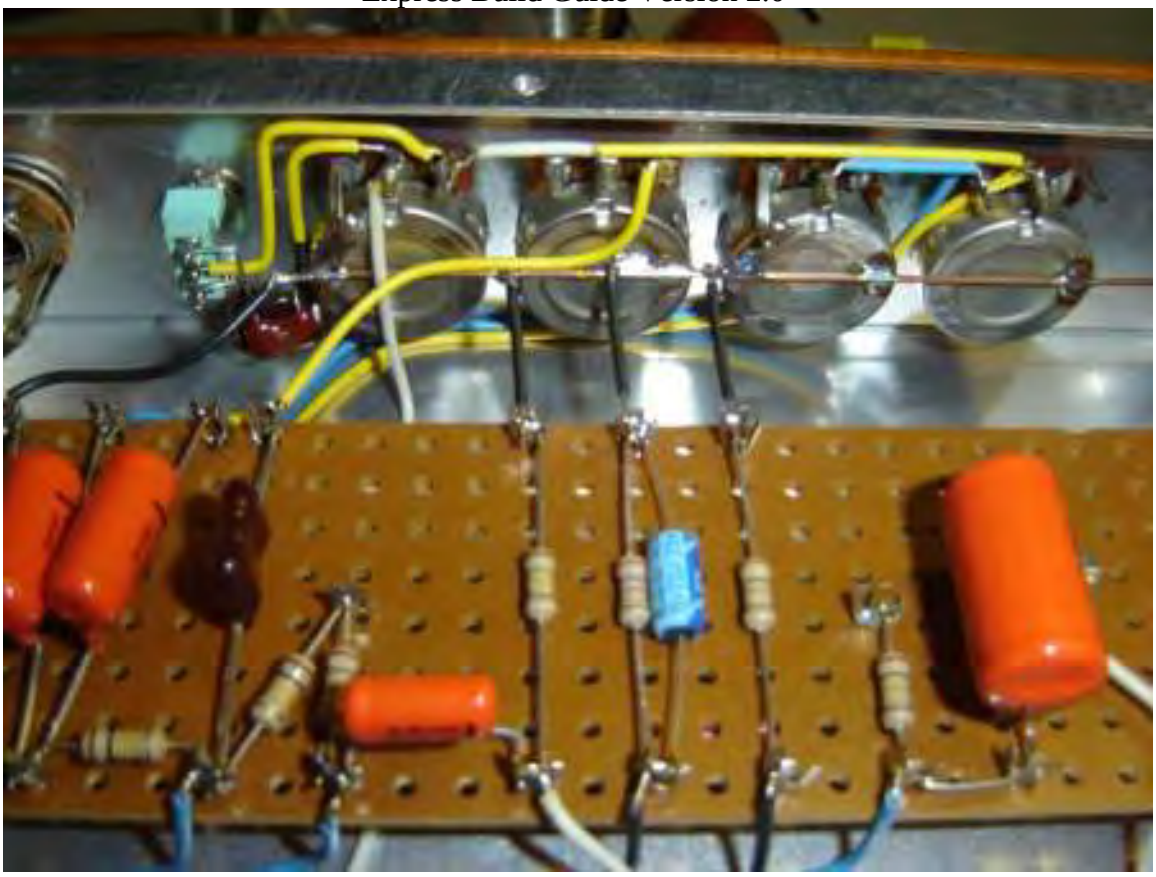
-Attach the .1uf cap to the presence pot per the picture below. The bottom side is grounded to the pot case or copper bus bar if you are using pots with stainless casings.

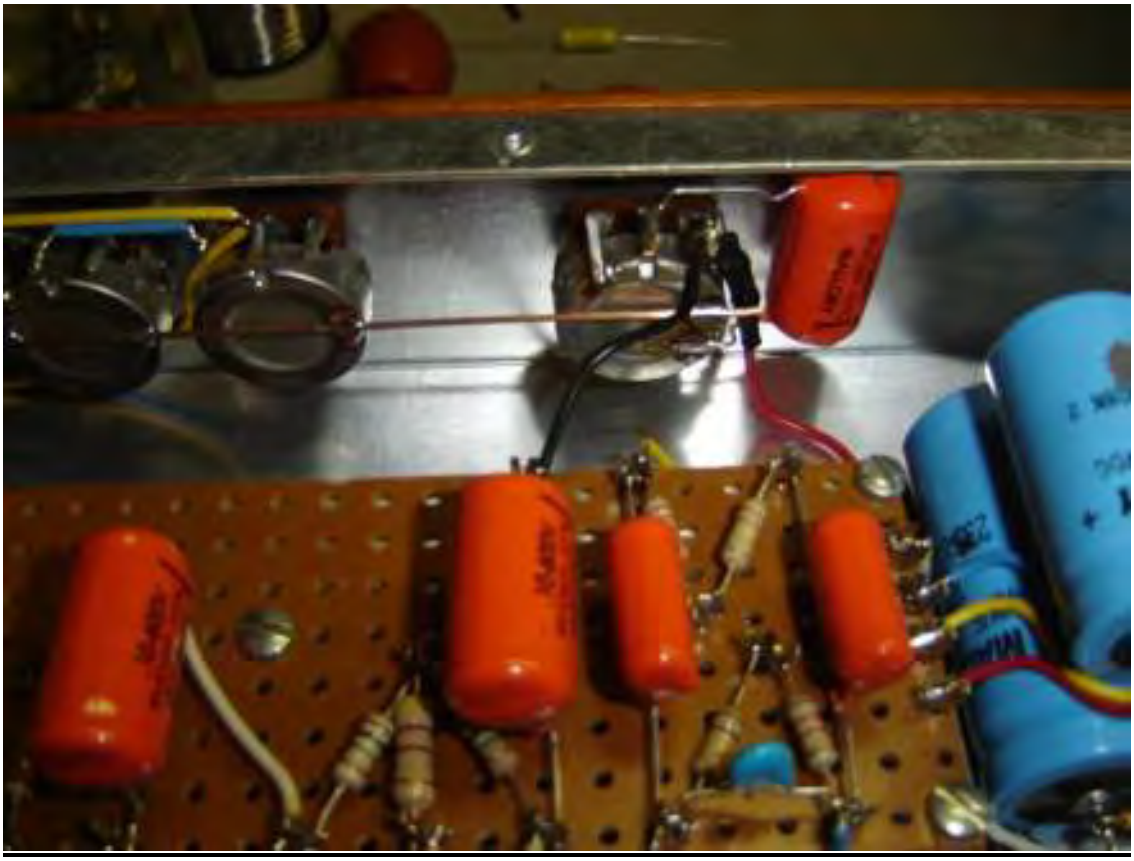
-Feed a ~3/4" piece of shrink tubing over the end of the red NFB wire, then fit the wire to get the proper length to the Presence pot (while maintaining proper lead dress). Using the picture above, in "Wiring the Copper Grounding Buss" for reference. Cut the NFB wire to the appropriate length to allow for a stripped lead to attach to the 100K resistor. Be sure to route the NFB wire outside the Preamp board standoffs before you cut the NFB wire. Solder the resistor to the NFB wire then the other end of the resistor to the presence pot. After it all cools, slip the shrink tubing up over the resistor and bare wires- then use a heat gun to shrink in place.

-If you are using stainless pots and have not attached the ground lugs yet, remove all pots and add the ground lug inside the star washer and the pot. Re-attach to the chassis and tighten.

-Using the #14 or #16 copper wire stripped out from normal Romex household power wire, feed the wire through the ground lugs and solder firmly against the pot casing. The ground right most pot lug of the Presence control (shown in the picture above) is grounded to the pot casing. If you are using stainless pots, you will have to run a very short black ground wire to the copper ground buss wire.

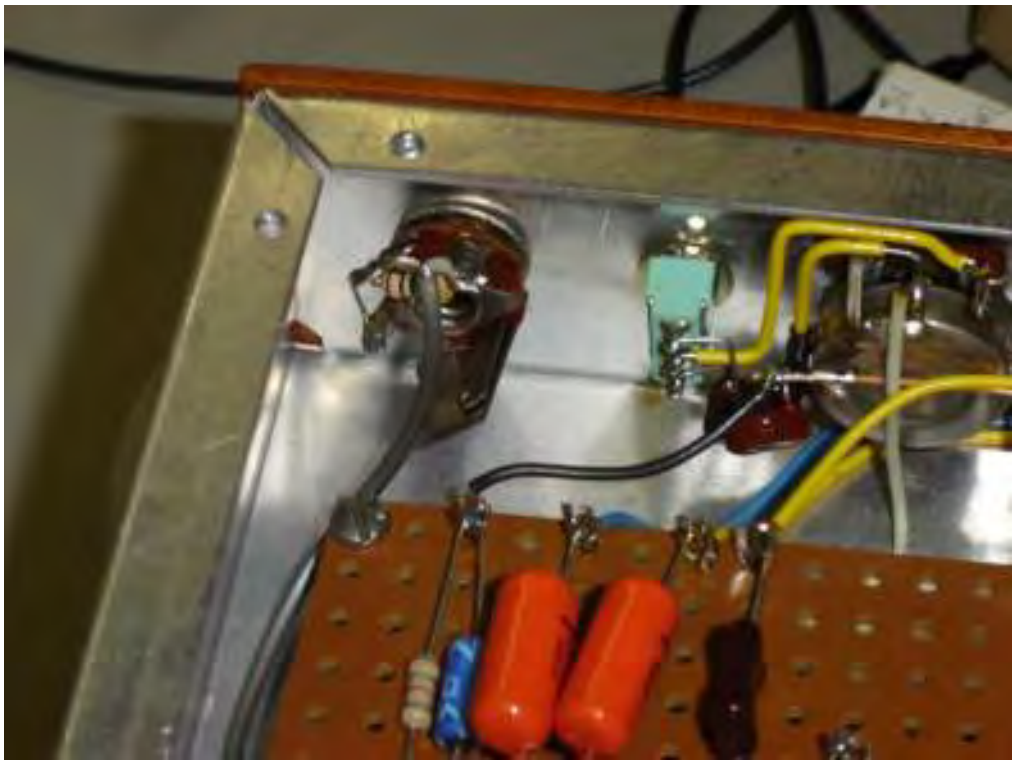
-If you are using non-stainless pots, scrape the desired attach points on the pot casing, and using some flux, solder strongly to each pot casing. Solder the bottom lead of the .1uf cap to the ground point on the back of the Presence Pot. Use the pictures below to help you.

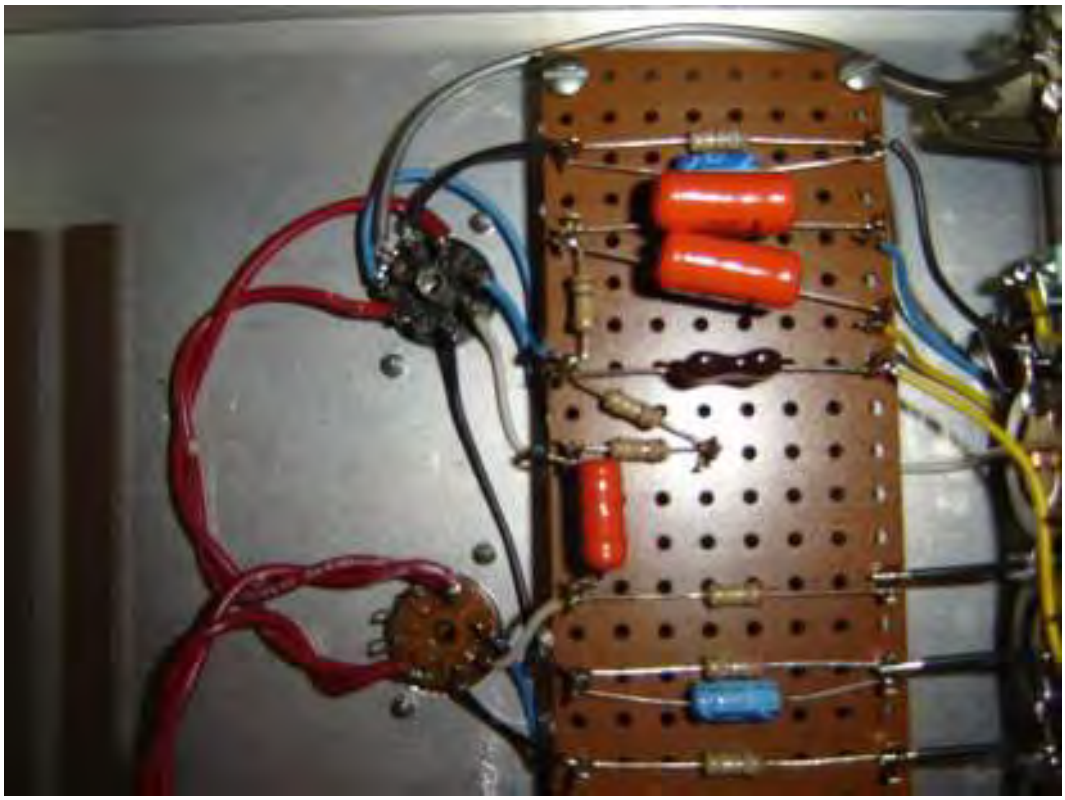




Wiring the Input Jack, Bright Switch and Remaining Pots:

-Wire the shorting input jack with the 1M resistor and shielded cable, making sure to trim the shielding wires back under the insulation on the V1 tube side. Use tinned shielding or stripped 20 AWG wire on the jack side to jumper between the shorting lug and the ground lug. Use the picture below for guidance. Make sure that you use proper lead dress, running the shielded cable outside the standoffs for the Preamp board.



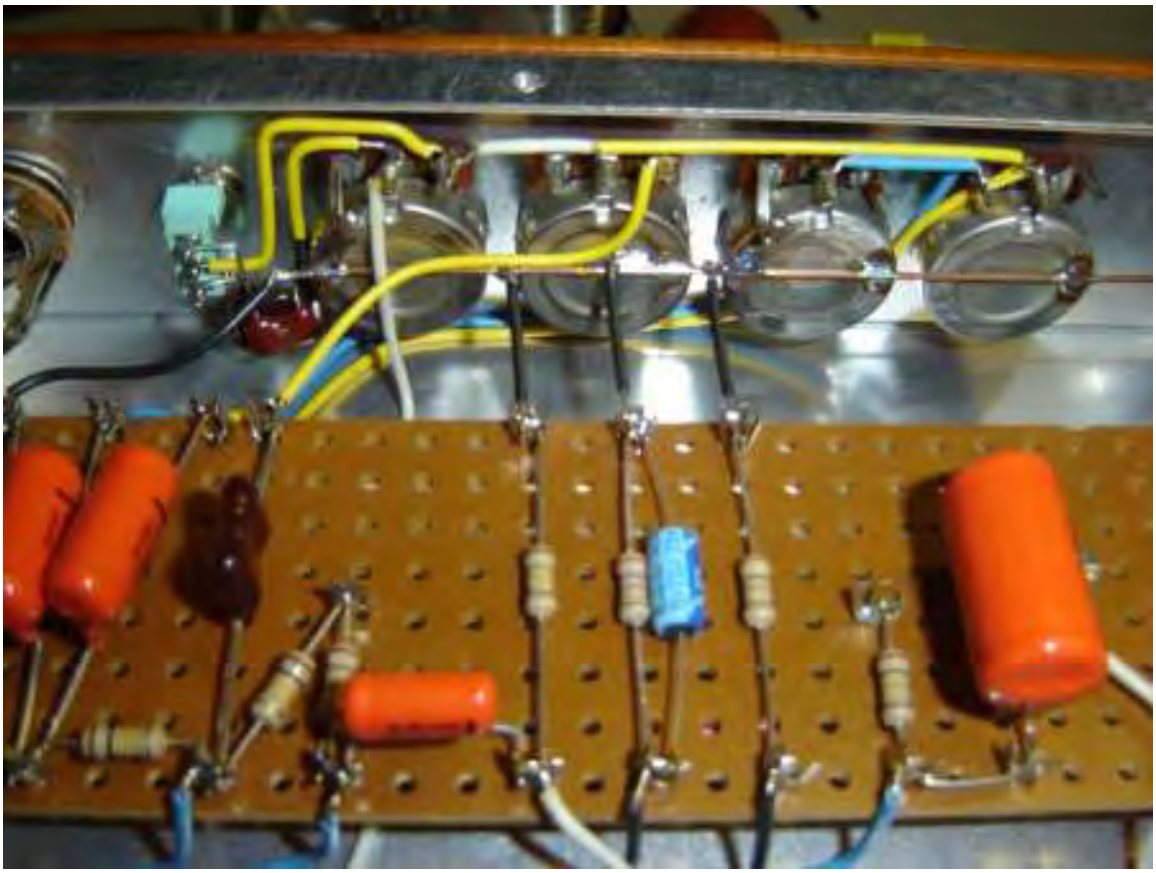


-Silicone the 100 and 500pf bright switch caps together. Put silicone sealant on the back of the bright switch to "glue" the caps to the back of the switch to stop parasitic oscillation- it is reported that KF did this to help with stability. Wire them to the switch as shown in the picture below, using shrink tubing on the leads that go to the volume pot. Make sure that the leads going to the switch from each respective cap do not tough each other. A bit of shrink tubing here would not be a bad idea, but KF didn't do it as far as I know.

-Make sure that you've tightened all of the pots securely to the chassis.

-Install the wires going between the pots at this point to give you maximum maneuvering room. Lead dress here is paramount- even minor variances are reported to cause stability and tonal differences.

- The ground right most pot lug on the Volume and Mid controls (shown in the picture below) is grounded to the pot casing. If you are using stainless pots, you will have to run a very short black ground wire to the copper ground buss wire.



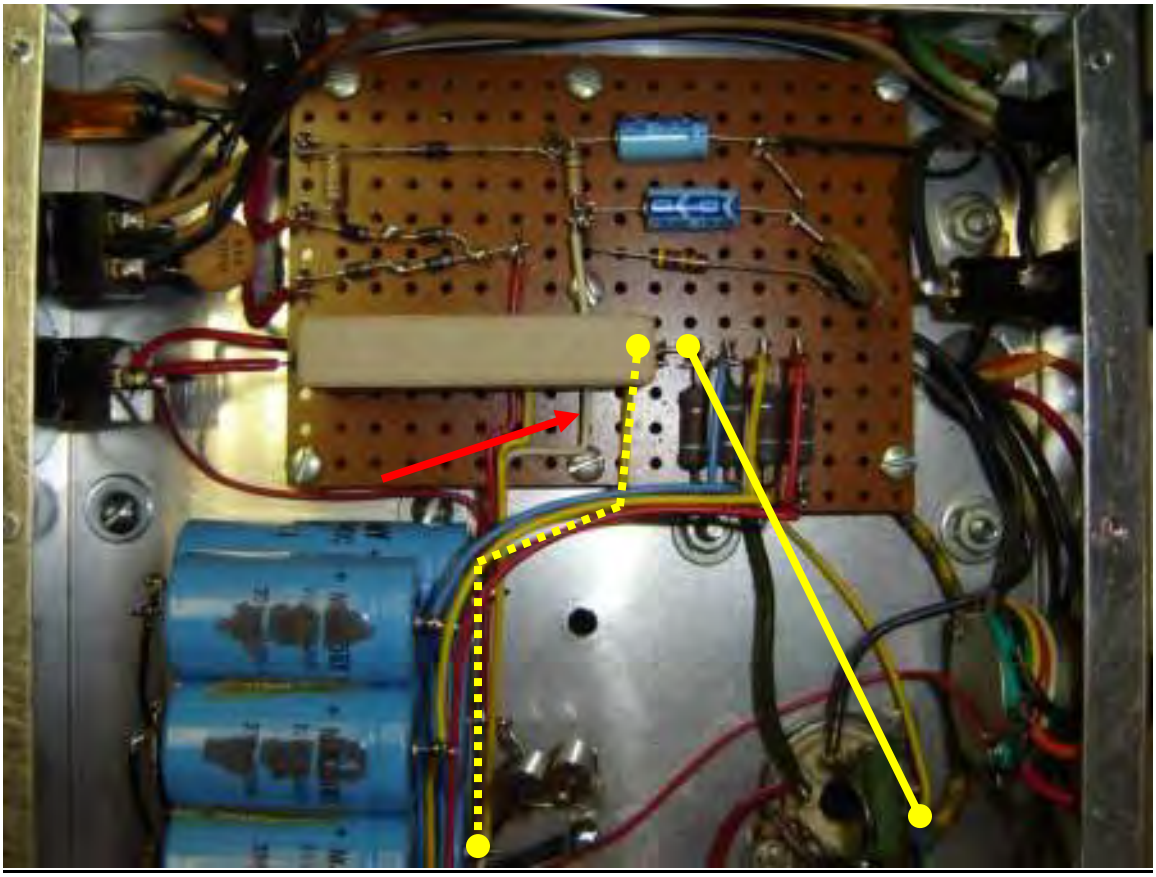
-The leads from the pots to the Preamp board will be installed later after the board is physically in place..

Installing and wiring the PS board:

-Use black 20 AWG for the lead from the ground lug to the 10uf bias caps.

- Use a clipping of red 18 AWG stranded wire left over from the PT for the lead from the Standby switch to cement power resistor- don't solder it yet.

-Carefully measure the length of the PT secondary wires that go to the lugs at the diodes on the PS board. Once you're sure, solder them to the lugs- you don't get a do-over on tranny wires….



-As I will explain in the section on wiring the cap stack, there is an issue on the gauge of the wires used between the PS board and the cap stack- KF appears to have used 20 AWG 300V wire. The B+1 and B+2 are almost 400V- well above the 20 AWG rating. I am suggesting that you use 18 AWG stranded wire- tranny clipping work great. If you buy into my thinking, then you will discover that the wire indicated above causes a real problem if it's 18 AWG lying over the white bias wire (red arrow). The Cement resistor will not lay flat or level on the board, making it difficult to connect on the end by the Standby Switch. My recommendation is to use the 18 AWG, and run this wire under the board and then to the 40uf cap as indicated above with a dotted yellow lines. Of course, don't run it in a straight line as drawn, curve it over to the cap stack and along the front of the 40ufs to the left most cap's lead.

-Using more 18 AWG stranded, run the B+ wire supplying the Power tubes to pin 6 on V5. Solder it to pin 6 and the wire going to pin 6 on V4 if you have single hole socket lugs.

-Now that the PS board is in place, trim and install the red OT Center Tap wire to the top lug of the Standby switch and solder it and the red B+ wire going to the Cement Resistor on the PS Board.

Building and Attaching the Filter Cap Stack:

1. Align the three 40uf caps as you wish to orient the wring on the casings. Use a small clamp or tape to hold them in position. Before "Gluing" them together with silicone, consider soldering their ground leads together. Look at the picture of Francesca; you can see that the left most lead (looking from the positive lead side) is wrapped around the center lead once then over to the right most lead for soldering. The center lead is then soldered around the wrapped lead. You can put a piece of tape on one side to hold them together and then apply some GE Silicone sealer or hot glue into the grooves between the caps. Let sit for about an hour, then GENTLY roll them over and apply silicone on the opposite side. Let cure for a couple hours. A black ground wire goes to the solder lug in front of the cap stack and is soldered to the right most 40uf cap lead- but wait until the whole stack is done to attach the wires.

2. At the same time “glue” the three 20uf caps together like the 40uf, making sure to orient the cap labels on the top like KF did. Then solder the ground leads of two left most 20uf caps together (looking from the positive lead side). The right most lead is just clipped off at about 3/8”. You can put a piece of tape on one side to hold them together and then glue in the same manner as the 40uf set. The ground lead wires to the 20uf caps are ultimately attached to the center and right most (independent) cap.

After both sets of 3 caps have dried, begin assembly of the completed stack by applying silicone to the tops of the 40ufs and the bottom of the 20ufs. Place the 20’s onto the 40’s and affix them with the centerline of the middle caps aligned. Consider squiring some more silicone into the gaps between the caps to get an extra secure stack. Use caution however, this stuff sticks like crazy and is hard to clean up. Use a couple clamps of pieces of tape to hold them in the correct position if you need to. See the picture below for the proper alignment:

Let cure for a couple hours. You should dry fit the finished stack first of course, before proceeding to the next step.

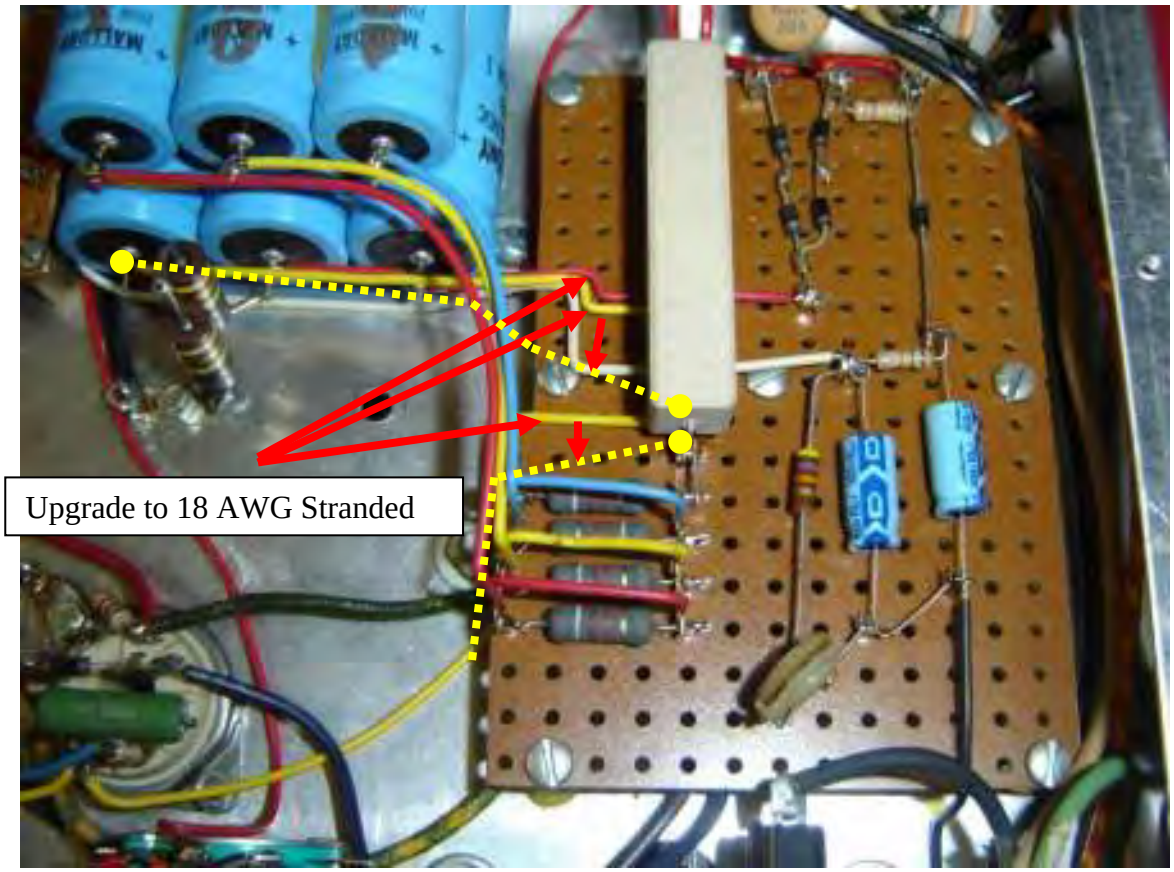
3. Wire up the back wire connections and leads to the back of the cap stack before mounting to the board- it's a bitch to try to wire them in place. The front leads can be done after the stack is in place. See the picture below to visualize the wiring and rear lead setup.

4. Take a hair dryer or heat gun if you have one- The glue will harden slower if you pre-heat the chassis, giving you time to work. Heat the chassis under where you will put the caps...not to hot! Put your hot glue on the chassis and to the two grooves between the three 40uf caps, invert the stack and set it into place. Jiggle them back and forth a little to get maximum coverage and minimum space between the caps and chassis (this will eliminate the caps sticking up too high in the chassis). Align the stack so that the head of the PT attachment bolt sits into the "notch" of the right most 40uf cap. Use the edge of the preamp board to align the back- make the left most 40uf cap sit parallel to the edge. You should have PLENTY of time before the glue hardens. This works great. I was told the vinegary smelling silicon contains acetic acid (hence the smell) and can corrode aluminum over time. I'm not sure but better to be safe. Let cure overnight. This holds the caps very securely and it looks OK unless you got sloppy with the silicone. It's possible to cut and scrape the excess off if you demand total neatness.

Wiring the Cap Stack:

-Mount the Preamp board onto the previously installed standoffs using #6 lock washers and machine screws.

-Wire the cap stack to the PS and Preamp boards using the pictures below (lots of personal opinion here):



-As I noted before, the wires identified above (running under Cement resistor) are 20 AWG on Francesca. If you use the technique of 18 AWG stranded for all B+1 and B+2 wires, the cement resistor will not lay flat on the PS board. The bent yellow wire also lays over the white bias lead- which causes the cement resistor to sit way off the surface on the side by the power switches. I suggested wiring the bent yellow lead under the board to the cement resistor's solder lug, and the lower yellow wire to the lug that the first 9.1K bleeder resistor connects to - not 100% KF, but much easier to work with (and electrically safer IMHO). If you make all three wires 18 AWG, you can run them all under the cement resistor- but it will be well off the board surface. Your call….

-Solder the red jumper wire between the leads of the middle and right most 40uf filter caps.

-Run the red wire from the diodes to the right most 40uf filter cap. This wire carries high B+, so consider up-rating it to 18 AWG stranded tranny clippings.

- Run the white wire from the bias circuit to the preamp board under the cement resistor. Note how the wire is laid across the front of the 40uf caps and wrapped around them then up to the Preamp board.

-Run the flying leads from the 9.1K dropping resistors to the 20uf filter caps. Pay careful attention to how nicely KF arced the wires so smoothly- there are no kinks whatsoever. Also note that they go vertically for ~ ½" before they start towards the cap stack. Don't solder them to the 20uf cap leads yet.

-Run the blue / yellow/ red B+ wires from the 20uf caps to the Preamp board- start with the blue first, then yellow, then red.

-Solder the ground wires from the back of the cap stack to the Ground lug as shown above, then the dual 2W 100K Bleeder resistor assembly between the ground lug and the center 40uf cap's front lead.

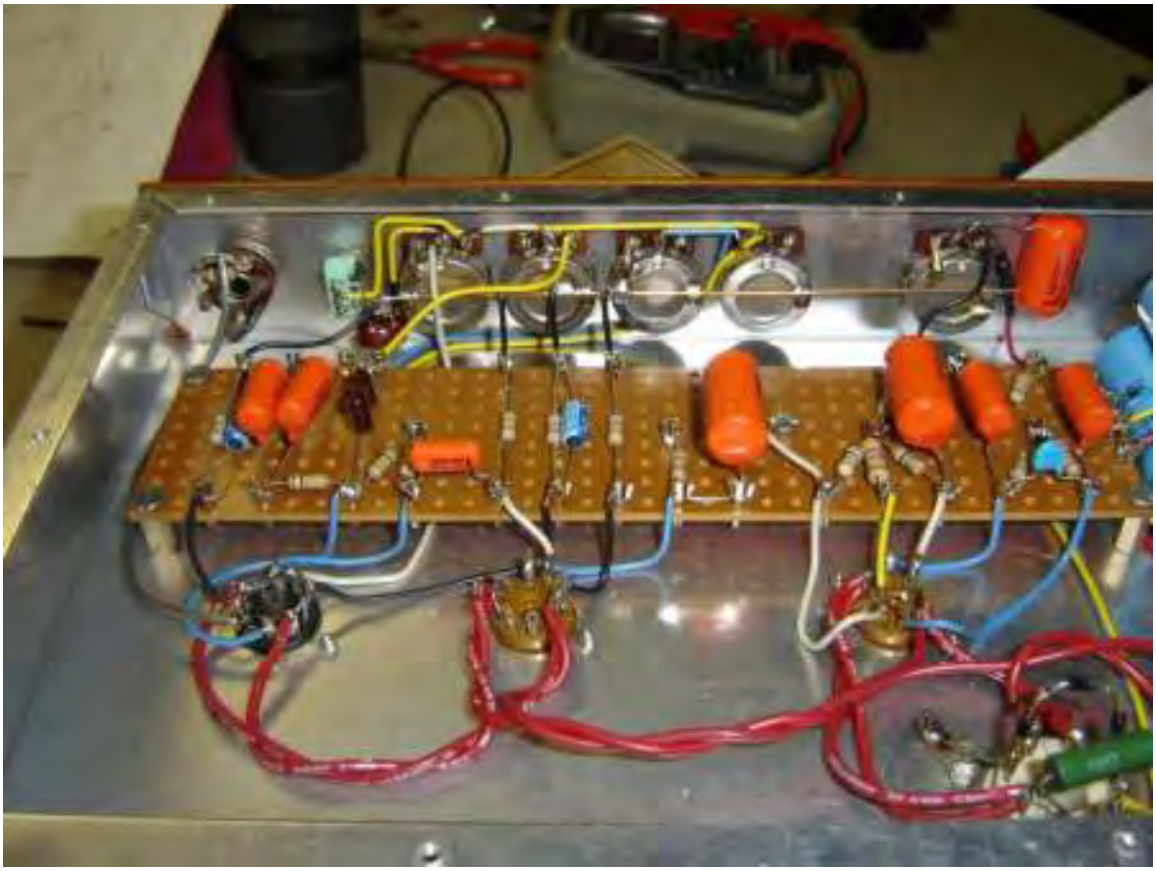
-Install and solder in the 9.1K dropping resistor flying leads now if you haven't already. Be careful, the proximity of these jumpers to the flying leads going to the cap stack makes it very easy to accidently burn their insulation.

Wiring the Preamp Board

-Wire the flying leads to the preamp tube sockets using the schematic and the picture below as guidance. Needless to say, lead dress is vital here….

-Some builders use shielded cable from the center lug of the Volume pot to grid of V1a (pin 2) and a 33K or 68K grid stopper resistor directly on the grid of V1b (pin 7) to help with stability.

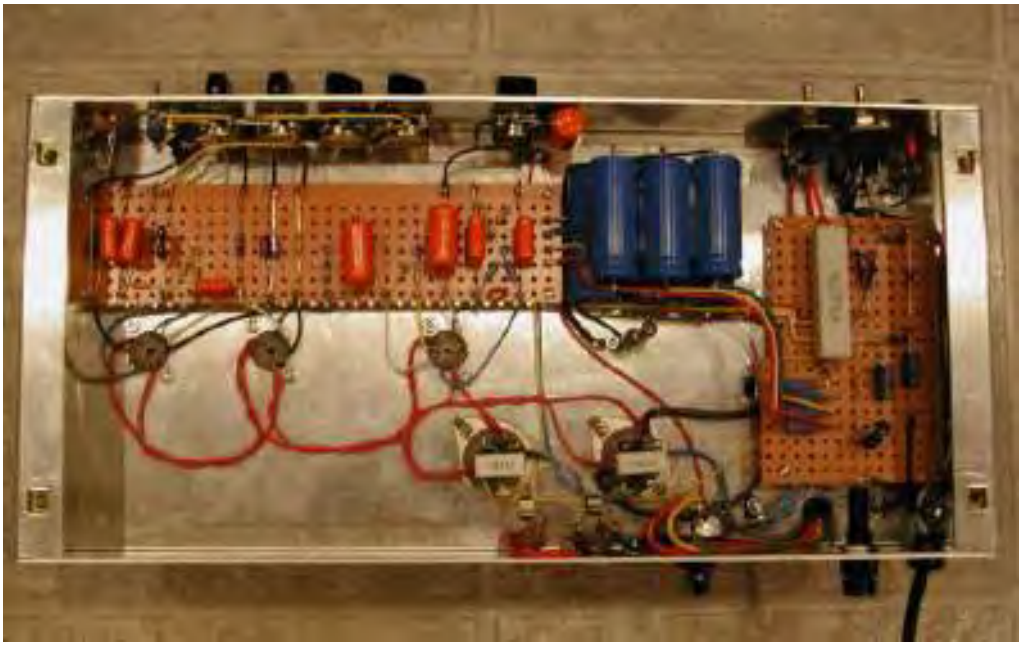
-All of the signal wires off the preamp board go straight down to the aluminum chassis to act as a shielding, and so that they don't run parallel to other wires. You'll even see a few wires that form loops over a filament wire.



-The ground wires from the Preamp board are short and direct to the grounding buss to isolate them from signal wires down on the chassis.

4. Final Construction Details:

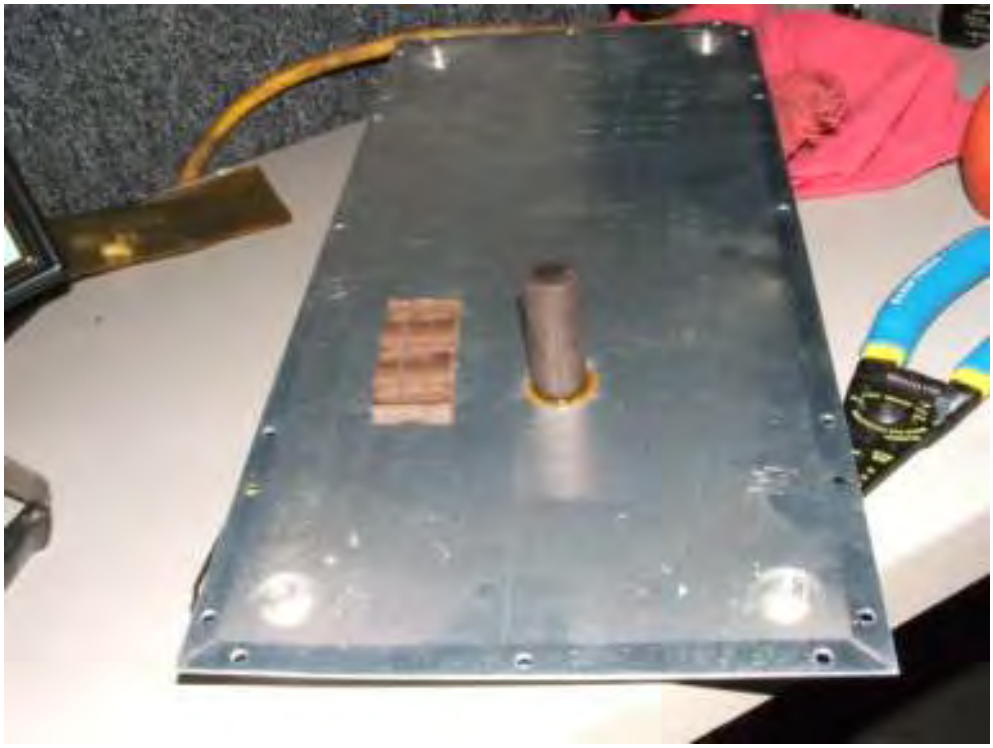
-You're almost done…. Certainly the hard part is over with. Here's what your creation should look like (picture courtesy Dana Hall (UR-12 on the forum)):



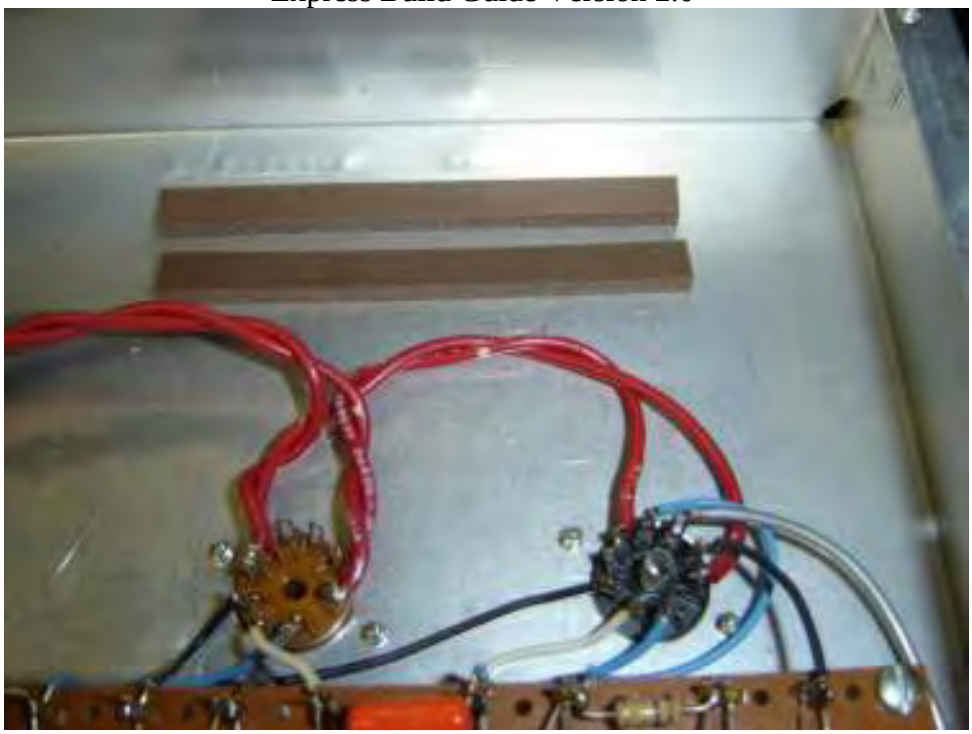
-There are still a good number of things left to do before you're going to take your masterpiece to a gig.

-If you're 100% KF on this, you will do several things differently which are not needed on the Ceriatone or Allyn Meyers chassis (see pictures below):

-You will add a dowel between the trannys for mechanical stability.
-You will attach a hollow dowel that is used with a 1 ½" #10 machine screw to support the bottom plate on the flimsy Bud chassis that KF used.
-You will install the 4 "Nutserts" into the bottom plate that allow the chassis to be attached to the cabinet.



-Attach weather stripping by preamp tube sockets and on the bottom plate where the caps will touch. A piece also goes along the bottom edge of the cabinet's front panel to plug the gap between the chassis and cabinet.



-Label the chassis back panel (and bottom plate support bolt if you are using the BUD chassis) with DYMO label tape per the pictures below (I used a newer technology Brother labeler and it looks great; it's up to you and your desire to be 100% authentic to KF's methods):