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Assembly Manual

Tweed Champ 5E1 - 5F1

Instructions for Assembling with the:

- Printed Circuit Board (PCB)

with additional modification suggestions and recommended amp settings

version 1.0
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Preface

Short History of the Tweed Fender ™ Champ

With just 4 watts, the first incarnation of the Fender™ Champ was introduced in 1948 and was called the “Champion 800”. It had one 6SJ7 preamp tube, a single 6V6 power tube, and a 5Y3 rectifier tube. Along with an 8” speaker, it was covered in two toned brown and tan vinyl and was beautiful to behold. In 1953 the name changed to “Champion 600™” with a 6” speaker replacing the original 8”. The two toned vinyl remains, however some of the later Champion 600's are covered in the new transition tweed covering. By 1953, all Champion amps were covered in tweed and all still sounded great! These early Champions were the perfect complement to the new Telecaster ™ family of guitars. But all is not finished yet …

The biggest improvements were brewing. In 1955, the “Champ” is born with the introduction of the new 12AX7A as the preamplifier tube (replacing the 6SJ7). This brings the output to 5 watts into a 6” speaker. But there is one more big improvement coming. In 1958, along with a slight component change, the 8” speaker is reintroduced. With this final change, the “mother of tone” is born. It is as if the planets aligned and whispered to Leo Fender what the near perfect amp should sound like. He was listening because here it is.

It is this last, near perfect incarnation that we provide for you here.

The tweed champ is one of my favorite amps. Inside its diminutive size rests the heart of an entire world of music. From blues, to rock-a-billy; from rock-n-roll to soul; from country to jazz, this amp is capable of holding its own across a wide swath of musical history and genres. From humble consideration as a “beginner amp”, this amp has become a standard bearer for what is cool about music.

Therefore imagine my excitement in designing a kit where you can build an incredible amp on which to put your musical mark on the world. Wow … this is going to be fun!

Thank you for purchasing this great kit. You should be able to easily put this kit together in an evening or two … whether you have any prior amp building experience or not. I designed this kit for you to enjoy both building and playing this amp. And once finished, this kit will allow you to make the best music you can … to make your world mark.

Now, let's have some building and playing fun.

Robert W. Hull Jr.
Director of Technical Services
TubeDepot.com

1 Safety

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!!! Read these safety precautions before continuing !!!

ALL tube amplifiers contain **LETHAL VOLTAGES**. Often several hundred volts which **WILL** leave burnt entrance and exit wounds in skin. These voltages have the potential to cause **permanent physical damage and death**. These voltages are present when the amp is turned on and also for some time after the amp has been turned off. **You <u>can</u> still get shocked with a tube amp turned off and disconnected from AC power.**

The above statement is a bit scary, but we want to stress that every piece of electronic equipment must be treated with respect. When AC power is applied, there is always a chance for injury or death. With tube amps, even when the AC power is not applied there is still danger. Being shocked with high voltage is very painful and we do not want anyone finding out the hard way.

When building this kit, we want your experiences to be both enjoyable and safe. There are more kits to assemble and we want you to enjoy building and playing them all.

- DISCLAIMER -

TubeDepot.com, it's employees, officers, shareholders, investors and subsidiaries accept no liability for any damage(s), injury(s) or death incurred from or while building or using this kit.

Throughout this manual at key points in the construction, we have annotated important steps with the below alerts. For your safety and to improve construction quality, It is important that you become familiar with each of these alerts and adhere to their recommendations when they appear.

Explanation of Alerts

WARNING - *Used when identifying an action that may cause physical injury or death.*

CAUTION - *Used when identifying an action that may cause damage to components and/or equipment.*

NOTE - *Used when identifying general points of interest.*

2 Tools and Supplies

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As with any construction project, there are certain tools and supplies that are recommended to complete the project. These are tools and supplies not provided with the kit and are instead provided by the builder.

The following is our recommended list:	***TubeDepot.com part number***
Phillips screwdriver, #1 and #2	TL-VTSCRSET8
Slip joint pliers	
Needle nose pliers	TL-VT33
Wire cutters, diagonal	TL-VT33
Wire strippers, for 18 and 20 awg wire	TL-VT5021
Electric Drill	
Drill bit, 3/16” - Chassis mounting in the cabinet	
Drill bit, 5/32” - PCB and turret board chassis mounting	
Drill bit, 1/8” - Fiberboard mounting	
Masking tape, 2”	
Ruler or scale, 12” w/ 1/16” markings	
Permanent marker, fine tip	
Soldering iron, 25W – 40W (35W recommended)	TL-WP35
Solder, electronics safe (60/40 w/ rosin core recommended)	TS-24-6040-0027
Flux, electronic – liquid or paste (must be safe for electronic work)	TS-83-1000-0186
De-soldering pump extractor	TS-384-1000
Solder wick	TS-1817-10F
Sponge	

The following are really nice to have:

Soldering station w/ temperature control	TL-WTCPT
Multimeter w/ DC range of at least 500V	TL-DVM850BL
Variable AC supply (Variac style)	
Current Limiting AC source (build directions in this manual)	
Needle nose pliers – small size, for electronics work	TL-NN7776
Wire cutters, diagonal – small size, for electronics work	TL-170M
Center punch	
Nutdrivers - 5/16”, 11/32”, 7/16”, 1/2”	
Square, 9”	
Scratch Awl	
heat shrink, 1/4” x 6”	TS-HS-ASST-7
De-burring tool	
Fingernail polish (for holding nuts and screws in place)	

3 Parts Inventory

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It is important to review all the parts that came with your kit. The list below is what you should have received to complete your kit. If you find anything missing, contact us:

TubeDepot.com
1686 Barcrest Dr.
Memphis, TN 38134
(877) 289-7994
info@tubedepot.com

Qty	Description	Application
1	speaker, 8" Jensen MOD, 4ohms	speaker
1	chassis, steel chrome plated champ 5E1/5F1	chassis
1	cabinet, tweed champ 5E1/5F1	cabinet
1	PCB board, 5E1/5F1	printed circuit board
transformers		
1	transformer, power tweed champ	power transformer
1	transformer, output tweed champ	output transformer
tubes		
1	5Y3 rectifier tube	rectifier tube
1	6V6GT beam power tetrode	power tube
1	12AX7 dual triode	preamp tube
panel hardware		
1	knob, vintage pointer	knob
1	fuse holder, conical cap, vintage Fender style	fuse holder
1	fuse, 3AG 2A slow-blow	fuse
1	lamp holder	lamp holder
1	jewel, red	lamp jewel
1	lamp, #47, 6.3 V	lamp
2	jack, 12A, shorting, switchcraft ¼"	input jack
1	jack, 11A, open, switchcraft ¼"	speaker jack
3	washer, lock 3/8"	jack lock washer
1	plug, switchcraft ¼"	speaker plug
power cord hardware		
1	power cord, grounded three prong, 12'	power cord
1	strain relief, heyco	power cord strain relief
1	nylon cable clamp	power cord clamp
1	screw, zinc plated #8 x 5/8", phillips flat head	cord clamp mounting
tube sockets		
1	socket, tube, miniature 9pin	preamp tube
2	socket, tube, octal	rectifier / power tube
hardware		
2	grommets, rubber 3/8" hole	grommets
2	bolt, 1 1/2" 10x32 truss screw	chassis mounting
2	nuts, KEPS 10x32	chassis mounting
6	screw, zinc plated 6-32 x 1/4", phillips pan head	tube socket mounting
9	nuts, KEPS 6x32	tube socket / PCB mounting
1	nuts, 6x32	tube socket w/ solder tab mounting
4	nuts, KEPS 8x32	power / output transformer mounting
2	nuts, 8x32	power transformer w/ solder tab mounting
4	screw, zinc plated 6-32 x 7/8" phillips pan head	PCB mounting
4	standoff, nylon; L = .5"; id = .140"; od = .250"	PCB mounting
2	screw, zinc plated 8-32 x 1/4", phillips pan head	output transformer mounting
2	solder lug, locking, #8 screw	grounding at power transformer
1	solder lug, locking, #6 screw	grounding at preamp tube socket
electronic, resistors		
2	100, 1/2w carbon film	filament pseudo center tap
2	68K, 1/2w carbon film	input resistors
1	1M, 1/2w carbon film	input biasing resistor
2	100K, 1/2w carbon film	preamp tube plate resistors
2	1.5K, 1/2w carbon film	preamp tube cathode resistors

2	68K, 1/2w carbon film	input resistors
1	22K, 1/2w carbon film	feedback resistor
1	220K, 1/2w carbon film	biasing resistor
1	470, 3w metal oxide	cathode resistor
1	10K, 2w metal oxide	B+ resistor
1	22K, 1w metal oxide	B+ resistor
electronic, capacitors		
2	.022ufd / 400v	coupling caps
2	22ufd / 50V	cathode bypass caps
1	22ufd / 450V	power supply filter cap
2	10ufd / 450V	power supply filter caps
electronic, potentiometers		
1	1M pot w/ on-off switch (Alpha)	volume / power switch
1	100K trim pot, horizontal mount	feedback adjustment
wire		
3	wire, 20 awg, stranded, hi-temp PVC – yellow	board, general wiring
2	wire, 20 awg, stranded, hi-temp PVC – red	board, signal / B+ wiring
2	wire, 20 awg, stranded, hi-temp PVC – black	board, ground wiring
2	wire, 18 awg, stranded, hi-temp PVC – green	filament wire
2	wire, 18 awg, stranded, hi-temp PVC – black	speaker wire, -
2	wire, 18 awg, stranded, hi-temp PVC – white	speaker wire, +
shielding		
3	alumimum tape, 3" width, self adhesive	electrical and heat shielding
heat shrink		
5	heat shrink, 1/4" - black, 1" piece	wire dressing / capping

4 Cabinet Preparation

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This chapter deals with preparing the cabinet for installation of the completed chassis. But first, we need to take inventory of the parts that came installed on the cabinet.

1. **Handle w/ mounting hardware** – there should be a single flat brown leather handle with two metal securing ends all fastened to the cabinet with four screws.
2. **Feet, chrome metal glide** – there should be four metal feet attached with screws to the underside of the cabinet.
3. **Back panels, upper and lower with screws** – there should be two back panels. The top back panel should be secured with four panel screws, the bottom panel should be secured with two panel screws.
4. **Baffle bolts with nuts** – there should be four bronze plated bolts attaching the baffle to the cabinet. The baffle is secured with four KEPS nuts, one on each of these bolts.
5. **Speaker bolts with nuts** – There should be four black oxide coated bolts for securing the speaker to the baffle board. Additionally, there should be four KEPS nuts, one on each of these bolts to be used when mounting the speaker.

4.1 Drilling the Two Chassis Mounting Bolt Holes

The cabinet is not drilled for the chassis mounting bolts. Therefore two holes, one on each side of the top of the cabinet opening must be drilled for installation of these bolts.

Step 1 – Remove the amp handle from the top of cabinet

Step 2 – Remove the top back panel (place a small mark on the inside of the panel to indicate which edge is up)

Step 3 – Apply masking tape on each side of cabinet opening (photo 4.1A).

Step 4 – Remove template page from manual (appendix D1) and fold on indicated line.

Step 5 – Place template on top of cabinet, properly centered over the opening (photo 4.1B).

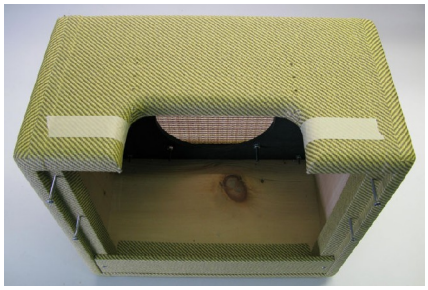

photo 4.1A

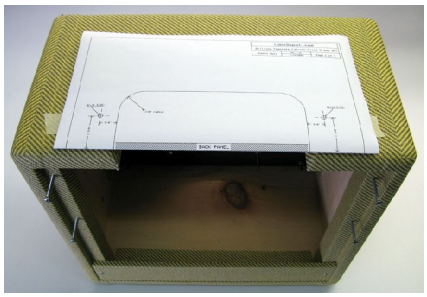

photo 4.1B

CAUTION *Be certain of template placement before drilling. The rounded edges of the cabinet can skew measurements and cause improper placement. Always measure several times before drilling.*

Step 6 – With a pointed tool, make a mark through the template at the cross hair points marked “drill 3/16” (photo 4.1C). Press lightly into the tape and cabinet. This doesn't have to be a deep mark, just enough to see the mark on the masking tape underneath.

Step 7 – Remove the template and with a ruler or scale, check and verify that the marks are properly aligned on the cabinet top as referenced to the measurements on the template.

Step 8 – If the marks are verified correct, it is time to drill. Drill two 3/16” holes, one at each of these two marks all the way through the top of the tweed cabinet.

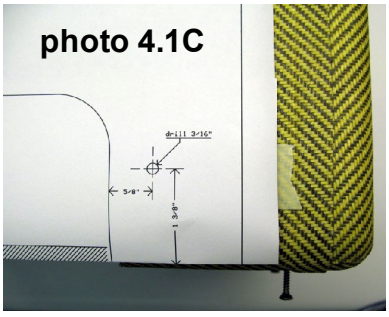

photo 4.1C

Step 9 – Remove the masking tape.
Step 10 – Clean up any loose splinters and / or tweed from the holes and test fit the chassis mounting bolts.
Step 11 – With the chassis mounting bolts in the cabinet, test fit the chassis onto the bolts
Step 12 – Remove chassis and reinstall handle, leaving chassis mounting bolts installed.
Proceed to 4.2

4.2 Installing the Speaker

Step 1 – Remove speaker from its shipping box, inspecting it for any damages
Step 2 – Remove the four nuts from the speaker mounting bolts inside the cabinet.
Step 3 – With speaker in hand, carefully align the speaker mounting holes to these baffle bolts. I recommend installing the speaker with connecting terminals on top.
Step 4 – Slowly press the speaker onto these bolts, being certain that the bolts are proceeding through the mounting holes of the speaker equally (photos 4.2A, B, & C).

CAUTION *Alignment of all holes during installation is important. Otherwise, one or more of the bolts may puncture the speaker cone by accident.*


photo 4.2A

photo 4.2B


photo 4.2C

Step 5 – Once the speaker is installed on the bolts, install and tighten the KEPS nuts.
Proceed to steps 4.3

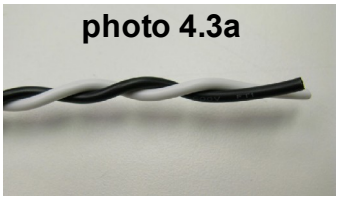
photo 4.3a

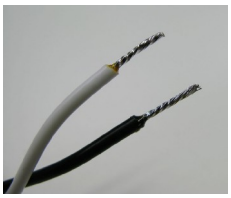
photo 4.3b

4.3 Wiring the Speaker

Step 1 – Twist the two lengths of black and white wire together (photo 4.3a).
Step 2 – At one end, strip the insulation back ½ ” from both wires and tin these two wires (photo 4.3b).
Step 3 – Unscrew the barrel of the ¼ ” phone plug.

NOTE *The ¼” phone plug was invented for use in telephone switchboards in 1878. Although it is no longer used for telephone switching, this great plug has become the standard connection type between musical instruments and outboard equipment.*

Step 4 – Solder the two tinned wires to the plug; white to center and black to shield (photo 4.3c). Reinstall plug barrel.
Step 5 – At the opposite end of the twisted wire pair, strip back the insulation ¼” and tin these two wires.

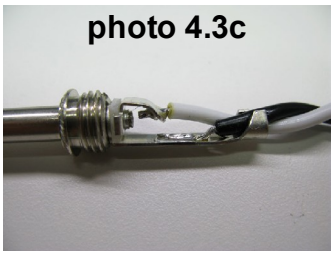
photo 4.3c

Step 6 – Solder these wires to the solder terminals of the speaker; the white wire to the "+" terminal and the black wire to the "-" terminal (photo 4.3e).
Proceed to 4.4

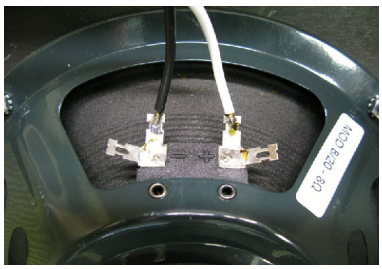

photo 4.3e

4.4 Installing the Shielding Tape

Step 1 – Place the removed back panel with the tweed side toward the desk and the wood side facing up.
Step 2 – Cut the 30" aluminum shielding tape strip into three equal lengths of 10"
Step 3 – Remove the backing from the first of the three shielding tape strips.

CAUTION *Once the backing is removed from the aluminum tape, the tape will have a tendency to curl. Be sure to keep the tape straight to avoid having the tape stick permanently to itself.*

Step 4 – Apply the aluminum tape to the back of the panel, 1/8th of an inch from the top of the panel and centered between the two side panel edges (photo 4.4A).
Step 5 – Remove the backing from the second shielding tape strip and apply the tape to the back of the panel similar to the first strip. Place it just below the first strip, over lapping by 1/8th of an inch and centered on the panel.
Step 6 – Remove the backing from the final shielding tape strip and apply the tape to the back of the panel similar to the previous two strips. Align the edge of the tape along the bottom edge of the panel, offset by 1/8th of an inch from the bottom edge of the panel and overlapping the second strip (photo 4.4B).
Proceed to chapter 5

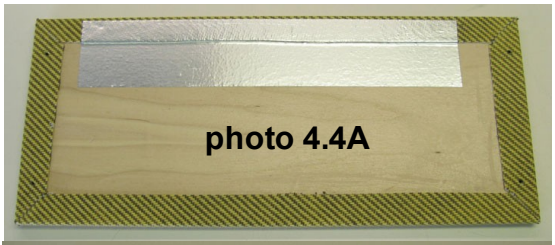

photo 4.4A

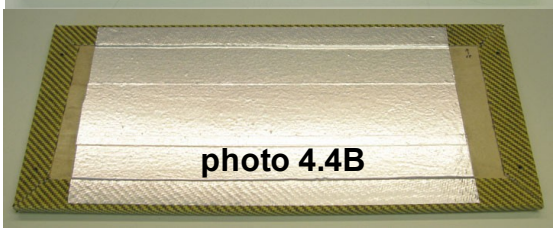

photo 4.4B

5 Circuit Assembly

Here is where good soldering skills and attention to detail will pay off. By following these directions, you should have no trouble in completing the circuit assembly quickly and without errors.

I encourage you to first read all steps to familiarize yourself with not only the installation flow, but also the components to be used. Appendix A has explanations on how to read the value codes found on both the resistors and capacitors. Appendix B has helpful hints on improving soldering skills.

5.1 Printed Circuit Board (PCB) Assembly

This PCB was designed to sound great and to maximize your customizing ability in a compact, easy to assemble package. This PCB layout closely follows the original point-to-point layout in order to duplicate any tone shaping created by component and wiring proximity interactions. With over-sized traces and through-hole plating, this board will provide years of trouble free life.

Step 1 – Gather all components necessary to complete the PCB. Separate the components by type; the resistors in one pile, the capacitors in another, the trim pot in a third. The resistors will be installed first. They have no polarity and can therefore be installed in either direction safely.

NOTE *For great hints on improved soldering skills, review Appendix B at the end of this manual. Additionally, visit: http://www.youtube.com/user/TubeDepotTV and watch "How To Solder".*

Step 2 – Install a 1.5K / ½ watt resistor (brown, green, red, gold) in R6 position.
Step 3 – Install two 6.8K / ½ watt resistors (blue, gray, orange, gold) in positions R1 & R2.
Step 4 – Install two 100K / ½ watt resistors (brown, black, yellow, gold) in positions R4 & R5.
Step 5 – Install a 22K / ½ watt resistor (red, red, orange, gold) in position R8.
Step 6 – Install a 220K / ½ watt resistor (red, red, yellow, gold) in position R9.

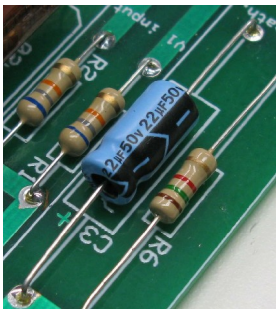

photo 5.1A

Step 7 – Install a 1.5K / ½ watt resistor (brown, green, red, gold) in position R7.
Step 8 – Install a 470 / 3 watt resistor (yellow, violet, brown, gold) in position R10.
Step 9 – Install a 22K / 1 watt resistor (red, red, orange, gold) in position R12.
Step 10 – Install a 10K / 2 watt resistor (brown, black, orange, gold) in position R11.

CAUTION *Electrolytic capacitors DO have a polarity and must be installed into the circuit according to the markings on the component and the PC board.*

Step 12 – Install a 22ufd/50V electrolytic capacitor in position C3. This component has a polarity, therefore it must be installed according to case and board markings (photo 5.1A).
Step 13 – Install a 22ufd/50V electrolytic capacitor in position C4. This component has a polarity, therefore it must be installed according to case and board markings.
Step 14 – Install the 100K trimmer pot.
Step 15 – Install the two .022 ufd coupling capacitors in positions C1 & C2. These capacitors do not have a polarity and can be installed in either direction.

Step 17 – Install the two 10ufd / 450V electrolytic filter capacitors in positions C8 & C7. These components have a polarity, therefore they must be installed according to case and board markings (photo 5.1b).

CAUTION

If using the 16ufd/475V Sprague Atoms in the C6 position, the positive end of the capacitor must be mounted as close toward R11 as possible. In this way, the negative end of the Sprague Atom 16ufd/475V cap will clear the pilot lamp assembly without shorting out.

Step 18 – Install the 22ufd / 450V filter capacitor in position C6. This component has a polarity, therefore it must be installed according to case and board markings (photo 5.1b).

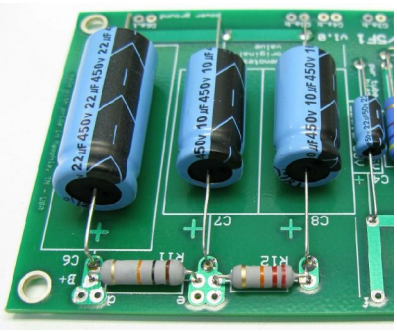

photo 5.1b

5.2 Installing the Wires to the Board

Black Wires (Grounding)

Step 1 - Strip back the insulation from the end of the black wire 1/8" and tin the end of the exposed strands. Insert the tinned end of this wire into the pad labeled "G1a" and solder to this pad. Measure and cut this wire to a length of 3" from pad G1a (photo 5.2a).
Step 2 – Repeat above for pad G3a & G3b.
Step 3 – Repeat above for pad G4a except extend wire to 4".
Step 4 – Repeat above for pad G6a.

Red Wires (Circuit B+ and Preamp Tube Inputs)

Step 5 - Strip back the insulation from the end of the red wire 1/8" and tin the end of the exposed strands. Insert the tinned end of this wire into the pad labeled "d" and solder to this pad. Measure and cut this wire to a length of 3" from pad d.
Step 6 – Repeat above for pad e.
Step 7 – Repeat above for pad m.

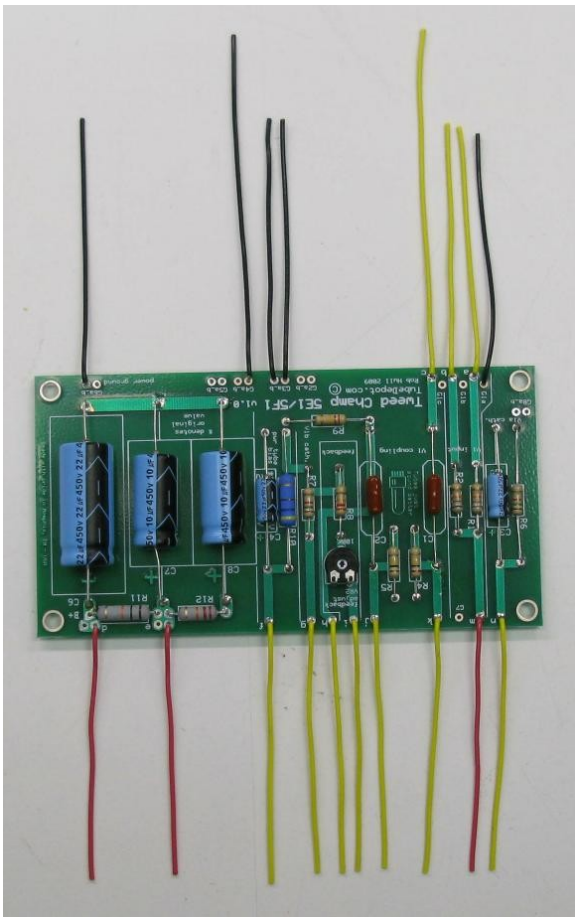

photo 5.2a

Yellow Wires (General Signal Routing)

Step 8 - Strip back the insulation from the end of the yellow wire 1/8" and tin the end of the exposed strands. Insert the tinned end of this wire into the pad labeled "a" and solder to this pad. Measure and cut this wire to a length of 3" from pad a.
Step 9 – Repeat above for pads b.
Step 10 – Repeat above for pad c except extend wire to 4".
Step 11 – Repeat above for pads f through k.
Step 12 – Repeat above for pad n (photo 5.2a).
Proceed to Chapter 6

6 Chassis Preparation

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6.1 Drilling Mounting Holes for the Printed Circuit Board (PCB)

Step 1 – Locate the template labeled "drilling template chassis/5F1" in Appendix D1A.
Step 2 – Situate the chassis with the large chrome side facing up and the printed control panel facing toward you.
Step 3 – Place the template onto the chassis. Make sure the template markings line up with the actual chassis cutouts.

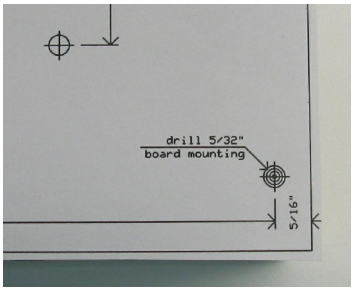


photo 6.1a

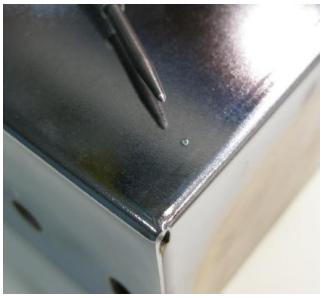


photo 6.1b

Step 4 – On the template, locate the four concentric circular drill indicators (photo 6.1a).
Step 5 – With a sharp, hardened tool (center punch is great), make a mark at the center of these drilling indicators, leaving an identifiable indentation / mark on the chassis (photo 6.1b).

NOTE *A sharp, large nail and hammer make a great make-shift center punch. By placing the nail on the template mark and firmly tapping the head of the nail with the hammer, the resultant mark in the metal is great for accurately guiding the drill bit into the chassis.*

Step 6 – Utilizing the printed measurements from the template, verify that these marks are correctly situated on the chassis.
Step 7 – Once verified, drill four, 5/32" holes, one hole at each of these marked spots.

NOTE *Use a new drill bit when drilling this chassis. Go slowly through the steel at a low rotational speed. A little drop of light oil at each drilling point helps too. These practices will allow the metal to be cut cleanly with minimal formation of burrs.*

Step 8 – Remove any burrs around holes. A de-burring tool is very helpful here.
Proceed to step 6.2

6.2 Installing the Power Transformer

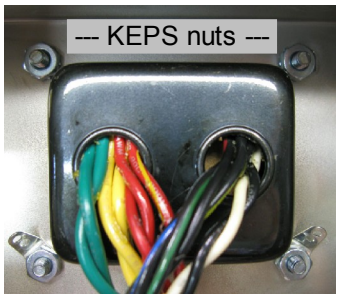


photo 6.2a

Step 1 – Loosely twist all wires together.
Step 2 – Situate the transformer so that the primary wires (black wires) will be nearest the fuse holder and the secondary wires (reds, yellows, greens) will be nearest the tube socket.
Step 3 – Guide the wire bundle through chassis opening.
Step 4 – Install and tighten two #8 KEPS nuts on the transformer bolts nearest the edge side of the chassis (photo 6.2a).
Step 5 – Bend the #8 solder tabs at a slight angle (photo 6.2b).
Step 6 – Install two solder tabs on the remaining two transformer bolts, oriented at angles toward the chassis edges (photo 6.2a).
Step 7 – Install and tighten the two #8 standard nuts on these last two bolts with the solder tabs (photo 6.2a). As the nuts are tightened, be careful to keep the solder tabs from changing position.
Proceed to 6.4

Photo 6.2b

6.3 Installing the Rubber Grommets

Step 1 – locate the two rubber grommets from the parts provided . Then locate the two corresponding holes on the chassis.
Step 2 – Insert the two rubber grommets in the chassis holes (photos 6.3a and 6.3b).
Proceed to 6.3

photo 6.3a

photo 6.3b

6.4 Installing the Output Transformer

Step 1 – Twist the red and blue primary wires together.
Step 2 – Twist the yellow, green, and black secondary wires together.
Step 3 – Feed the two wire sets into the grommets (photo 6.4a). The red and blue wires go into the grommet nearest the power transformer.
Step 4 – With both wire bundles pulled through the grommets and the transformer flush on the chassis, locate the two #8 KEPS nuts and the two #8 x 1/4" screws.
Step 5 – Secure the output transformer to the chassis. The two KEPS nuts should be mounted on the inside of the chassis.
Proceed to 6.5

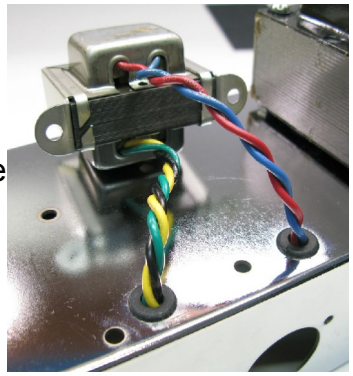


photo 6.4a

6.5 Installing the Octal Tube Sockets

Step 1 – Prior to mounting, slightly bend the solder terminals on the back of the socket outward (photo 6.5A).

CAUTION *The terminals of these sockets will break if bent too far. It is recommended to use the needle nose pliers for better control when bending these terminals.*

Step 2 – Insert the socket from the outside of the chassis. Rotate both sockets so that Pin 2 is closest to the chassis opening edge.(photo 6.5b).
Step 3 – Secure the socket to the chassis with two #6 x 1/4" screws and two #6 KEPS nuts per socket.
Proceed to 6.6

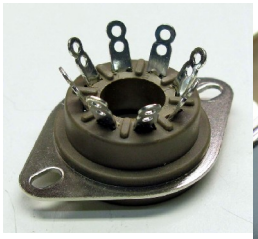


Photo 6.5A

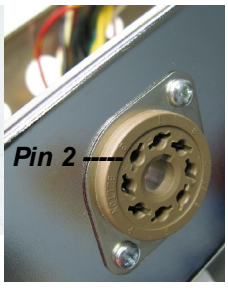


Photo 6.5B

6.6 Installing the 9 pin Tube Socket

Step 1 – Prior to mounting, slightly bend the solder terminals 1 - 3 and 6 – 9 on the back of the socket outward, leaving pins 4 and 5 alone for now.

CAUTION *The terminals of these sockets will break if bent too far. It is recommended to use the needle nose pliers for better control when bending these terminals.*

Step 2 – Using a pair of needle nose pliers, carefully bend terminals 4 and 5 together. The holes of each of these terminals should meet flush against each other (photo 6.6a).

Photo 6.6A

Step 3 – To provide a flush mounting surface for the screws, use a pair of needle nose pliers to carefully bend the edges of the shield near the screw mounting holes in toward the socket (photo 6.6B, C, and D).

Step 4 – Insert the tube socket from the outside of the chassis and rotate the socket so that pin 8 of the tube is closest to the chassis edge (photo 6.6E).

Step 5 – With a #6 x 1/4" screw and #6 KEPS nut, secure the tube socket to the chassis with the outside hole (photo 6.6E).

Step 6 – Now bend the #6 solder tabs at a slight angle.

photo 6.6B


photo 6.6C

photo 6.6D

Step 6 – Insert a #6 x 1/4" screw into the remaining chassis hole.

Step 7 – Install the #6 solder terminal onto the screw on the inside of the chassis. Secure with the #6 standard nut. Locate the solder end of the #6 solder terminal away from the socket (photo 6.6E).

Proceed to 6.7

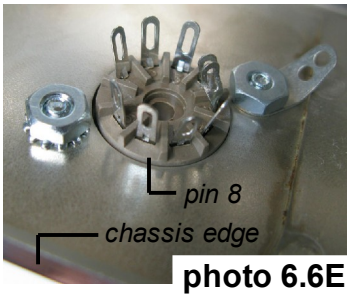


photo 6.6E

6.7 Installing the Electronics Assembly

Step 1 – Install the four #6 x 7/8" bolts into the drilled mounting holes.

Step 2 – With masking tape, tape down the heads of these screws to the chassis to hold them in place while completing the following steps.

Step 3 – Install the four 1/2" standoffs onto the four #6 x 7/8" bolts.

Step 4 – Mount the electronics assembly onto the four #6 X 7/8" bolts and standoffs, each hole of the board corresponding to a bolt.

Step 5 – Apply four #6 KEPS nuts on the remaining exposed four #6 x 7/8" bolts and tighten them all down finger tight. The assembly can be centered as needed.

Step 6 – Remove the masking tape and finish tightening the nuts down tightly to the board.

Proceed to 6.8

6.8 Installing and Wiring the Input Jacks

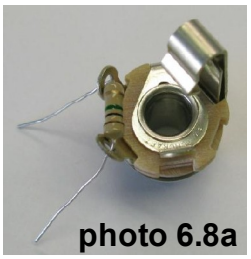


photo 6.8a


photo 6.8b

Step 1 – With the 1M resistor (brown, black, green, gold), bend both leads and insert this resistor between the "tip" and the shorting contact terminals of jack 1. Situate resistor on the inside of the jack (photo 6.8a).

Step 2 – Run the component lead coming from the shorting contract terminal over to the neighboring "sleeve" or ground terminal (photo 6.8b).

Step 3 – Thread the remaining component lead coming from the "tip" terminal over to the second jack's "shorting switch" terminal (photo 6.8b).

Step 4 – Solder the two terminals of these jacks together (photo 6.8c).


photo 6.8c

NOTE *The two input holes on the outside of the chassis can be used as a temporary holding place and spacing template while working with the input jacks. In this way, the proper spacing is guaranteed when soldering the jacks together (photo 6.8c).*

Step 5 – From inside the chassis, install this dual jack assembly into the appropriate chassis holes. The jack with the 1M resistor goes into input 1. The lock washers go on the inside of the chassis. Tighten down the assembly.
Step 6 – Strip and tin the end of the 3" black wire coming from pad "G1a" and connect the wire to the sleeve / ground terminal of the input 2 jack.
Step 7 – Strip and tin the end of the 3" yellow wire coming from pad "a" and connect this wire to the "tip" terminal of the input 2 jack.
Step 8 – Strip and tin the end of the 3" yellow wire coming from pad "b" and connect this wire to the point where the two jacks are soldered together.
Step 9 – Strip and tin the end of the 3" black wire coming from pad "G3a" and connect the wire to the sleeve / ground terminal of the input 1 jack.
Proceed to 6.9

6.9 Installing and Wiring the Volume Control

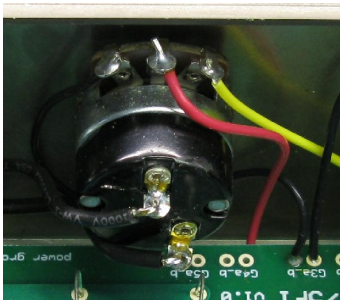


photo 6.9a

Step 1 – Feed a red wire 8" in length starting from the volume control location, behind the electronics assembly board, coming out between the preamp tube and the speaker output jack.
Step 2 – Strip and tin the preamp tube end and connect the wire to pin 7 of the preamp tube.
Step 3 – Strip and tin the volume control end of the wire and connect the wire to the middle lug of the volume control.

CAUTION *When wiring the volume control, the terminals to use are the three in line terminals at the edge of the control. The two terminals on the rear of the control are for the power switch.*

Step 4 - Strip and tin the end of the 4" yellow wire coming from pad "c" on the electronics assembly and connect it to the volume control far right terminal (photo 6.9a).
Step 5 – Strip and tin the end of the 3" black wire coming from pad "G3b" on the electronics assembly and connect it to the volume control right far left terminal (photo 6.9a).
Proceed to 6.11

6.10 Wiring the Power Grounds from the PCB

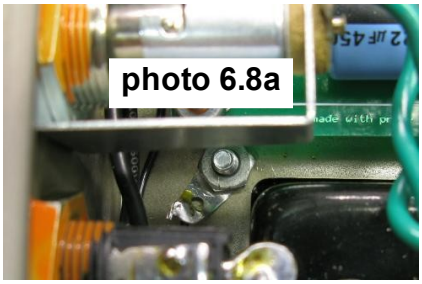


photo 6.8a

Step 1 – Locate the black grounding wire at the upper left corner of the electronics board (near the indicator lamp assembly) coming from pad G6a. Trim this wire to 2" length. Strip the insulation 1/4" from the end of the wire and tin the exposed strands.
Step 2 – Bend a small hook in the stripped and tinned end and connect this wire (do not solder just yet) to the nearby terminal lug attached to the power transformer mounting bolt nearest the fuse holder (photo 6.8a).
Step 3 – Locate the next black grounding wire coming from pad G4a. Strip the insulation 1/4" from the end of the wire and tin the exposed strands.
Step 4 – Bend a small hook in this stripped and tinned end and connect this wire (along with the wire from above) to the nearby terminal lug attached to the power transformer mounting bolt nearest the fuse holder (photo 6.8a).
Step 5 – Solder both stripped ends to this lug.
Proceed to 6.9

6.11 Installing the Indicator Lamp

Step 1 – With the indicator lamp in hand, remove the nut from the bezel holder.
Step 2 – With the nut removed, remove the lamp holder.
Step 3 – Place the bezel holder through the corresponding opening in the chassis.
Step 4 – Install the lamp holder on the threaded end of the bezel holder.

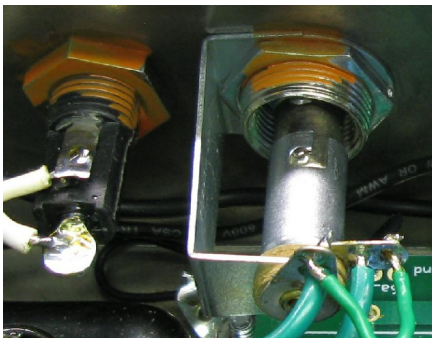


photo 6.11a

CAUTION *When installing the indicator lamp, be certain that no part of C6 on the electronics assembly touches any part of the lamp holder. This may require repositioning C6 on the board.*

Step 5 – Thread the nut onto the threaded end of the bezel holder.
Step 6 – Position the indicator lamp with the frame toward the fuse holder (photo 6.11a).
Step 7 – Tighten the nut to firmly secure the assembly to the chassis.

NOTE *The nut that secures the lamp assembly can be firmly tightened by placing the point of a center punch on one of the corners of the nut. Firmly tap the center punch to tighten the nut.*

Step 8 – Secure the nut by painting the exposed threads with fingernail polish (photo 6.11a).
Proceed to 6.12

6.12 Installing the AC Power Cord

Step 1 – locate the cut end of the power cord and strip off the outer black PVC insulation approximately 7 1/2" from this cut end.

CAUTION *The black PVC jacket of the power cord is thin and very easily cut. Be very careful not to cut so deep as to accidentally cut the insulation of the inside wires.*

Step 2 – With the three wires (white, green and black) exposed, trim the white wire to a length of 5", the green wire to 4" and leave the black wire at its 7 1/2" length.
Step 3 – Wrap the strain relief around the black PVC jacket of the power cord approximately 1" from where the stripped jacket begins. Note the alignment of the strain relief (photo 6.12a).

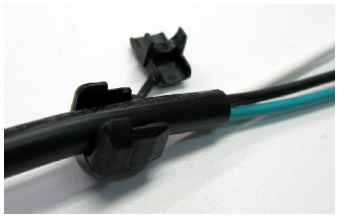


photo 6.12a

Step 4 – With a pair of slip joint pliers, firmly squeeze the strain relief into place around the power cord.
Step 5 – With these same pliers, grasp the strain relief and feed the stripped end of the power cord into the corresponding hole in the chassis.
Step 6 – While still grasping the strain relief with the pliers, guide the strain relief into the chassis hole. By firmly pressing the compressed strain relief into the hole, the strain relief should slide into place (photo 6.12b).

Photo 6.12b

NOTE *There is a specific tool that makes installing strain reliefs simple. If you find yourself installing strain reliefs on a regular basis, this tool is worth owning. See TubeDepot.com p/n TL-R-29*

Step 7 – Once the strain relief is installed, tug on the power cord to verify that it is indeed firmly mounted.
Proceed to 6.13

6.13 Installing and Wiring the Fuse Holder


Photo 6.13a

Step 1 – Remove the nut from the fuse holder.
Step 2 – Insert the fuse holder into the corresponding chassis opening. The rubber gasket should be situated on the outside of the chassis.
Step 3 – Reinstall the threaded nut on the fuse holder and tighten it against the chassis.
Step 4 – Lock the nut down by painting the exposed threads with fingernail polish (photo 6.13a).
Step 5 – Wire the AC main power source to the end terminal of the fuse holder (photo 6.13a).

WARNING *By wiring the fuse holder as recommended, shock hazards associated with changing a fuse are reduced because the source AC is at the far end of the fuse holder and not at the cap end.*

Step 6 – Wire the power transformer's appropriate primary wire to the solder terminal on the fuse holder nearest the faceplate (photo 6.13a).

CAUTION *It is important to choose the correct primary wires based on the mains voltage appropriate for your location in the world. Incorrect wiring can lead to power transformer damage and/or fire hazards.*

CAUTION *The correct wire choices as per the mains voltages are as follows:*

If your mains voltage is ...	*then the wires to use are ... wire #1 (to fuse holder)*	*wire #2 (to power switch)*
100	*black with blue stripe*	*black*
117/120	*white*	*black*
220	*black with yellow stripe*	*black*
230	*black with green stripe*	*black*
240	*black with red stripe*	*black*

Step 7 – Once both wires are attached, neatly arrange excess wire close to the chassis.
Proceed to 6.14

6.14 Wiring the Power Switch

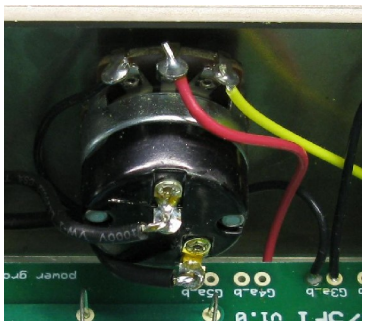


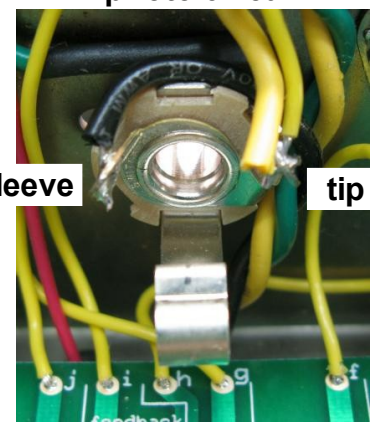
photo 6.14a

Step 1 – Solder the black wire from the AC power mains power cord to the bottom terminal of the power switch on the back of the volume pot.
Step 2 – Solder the black wire from the power transformer to the remaining terminal of the power switch on the back of the volume pot (photo 6.14a).
Proceed to 6.15

6.15 Installing and Wiring the Speaker Jack

Step 1 – Install the 1/4" Switchcraft 11A jack into the appropriate chassis hole. Place the lock washer on the inside of the chassis.
Step 2 – Trim the black wire from the output transformer to the edge of the chassis. Strip and tin the end of this wire and solder it to the "sleeve" terminal of speaker jack (photo 6.15a).
Step 3 – Strip and tin the end of the 3" yellow wire coming from pad "i" on the electronics assembly. Connect it but don't yet solder it to the "tip" terminal of the speaker jack (photo 6.15a).
Step 4 – Choose the appropriate output transformer tap wire for the impedance you are building this amp for (see below caution).

photo 6.15a



CAUTION *For 8 ohm impedances, use the green wire. For 4 ohm impedances, use the yellow wire. Running this amp into an incorrect load can damage the output transformer and the power tubes.*

Step 5 – Trim, strip and tin the end of this wire and solder it, along with the previously mounted yellow wire to the "tip" end of the jack.
Step 6 – Cap off the end of the unused output transformer tap with a small piece of electrical tape or heat shrink tubing (photo 6.15b).
Proceed to 6.16

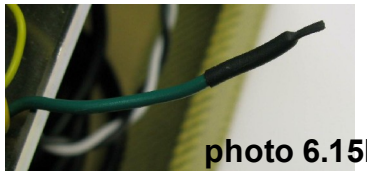


photo 6.15b

6.16 Wiring the Rectifier Tube

photo 6.16a

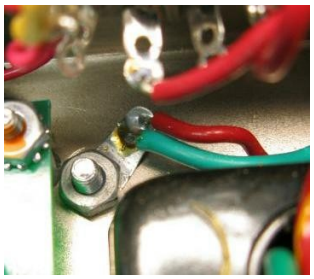
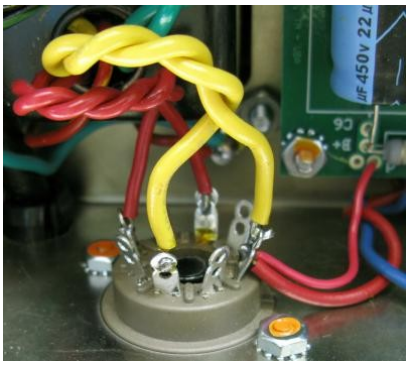


photo 6.16b



Step 1 – Strip and tin the end of the red wire with the yellow line on it coming from the power transformer. Solder this wire to the solder terminal nearest the rectifier socket. This same terminal has the green wire from the power cord connected to it (photo 6.16a).
Step 2 – Strip and tin the two yellow wires from the power transformer. Connect these two wires to pins 8 and 2 of the rectifier tube socket. Apply solder to pin 2 but do not apply solder to pin 8 (photo 6.16b).
Step 3 – Strip and tin the two solid red wires from the power transformer. Solder these to pins 4 and 6 of the rectifier tube socket (photo 6.16b).
Step 4 – Trim the red wire from pad "d". Strip and tin this wire and connect it to pin 2 of the rectifier tube socket. Do not solder just yet (photo 6.16b).
Step 5 – Trim the red wire from the output transformer to the edge of the chassis. Strip, tin and solder to pin 8 of the rectifier tube socket (photo 6.16b).

photo 6.16c

Step 6 - The remaining unused wires from the power transformer should be trimmed and capped off with either electrical tape or preferably heat shrink tubing (photo 6.16c).
Proceed to 6.17

6.17 Wiring the Power Output Tube

Step 1 – Trim, strip and tin the blue wire from the output transformer. Solder this wire to pin 3 of the output tube socket (photo 6.17a).
Step 2 – Trim, strip and tin the red wire from pad “e”. Solder this wire to pin 4 of the output tube socket (photo 6.17a).
Step 3 - Trim, strip and tin the yellow wire from pad “f”. Solder this wire to pin 8 of the output tube socket (photo 6.17a).
Step 4 – Trim, strip and tin the yellow wire from pad “h”. Solder this wire to pin 5 of the output tube socket (photo 6.17a).
Step 5 – Neatly organize all wires tightly against the chassis.
Proceed to 6.18

photo 6.17a

6.18 Wiring the Preamp Tube

Step 1 - Trim, strip and tin the yellow wire from pad “g”. Solder this wire to pin 8 of the preamp tube socket (photo 6.18a).
Step 2 – Verify that the red wire that runs from the center (wiper) contact of the volume control is soldered to pin 7 of the preamp tube socket (photo 6.18a).
Step 2 – Trim, strip and tin the yellow wire from pad “j”. Solder this wire to pin 6 of the preamp tube socket (photo 6.18a).
Step 4 – Trim, strip and tin the yellow wire from pad “k”. Solder this wire to pin 1 of the preamp tube socket (photo 6.18a).
Step 5 – Trim, strip and tin the red wire from pad “m”. Solder this wire to pin 2 of the preamp tube socket.
Step 6 – Trim, strip and tin the yellow wire from pad “n”. Solder this wire to pin 3 of the preamp tube socket (photo 6.18a).
Step 7 – Neatly organize all wires tightly against the chassis.
Proceed to 6.19

photo 6.18a

6.19 Installing and Wiring the Filaments

Step 1 – Trim, strip and tin the two green wires from the power transformer. Solder these wires on the two terminals of the installed indicator lamp. Use the inside mounting holes of the terminals (photo 6.19a).
Step 2 – Take the green 18awg stranded wire and fold it in half. Tightly twist together the two cut ends and chuck this into an electric drill (photo 6.19b).
Step 3 – Wrap the other end around a screwdriver and pull tightly the wire tightly between the drill and screwdriver (photo 6.19c).

photo 6.19a

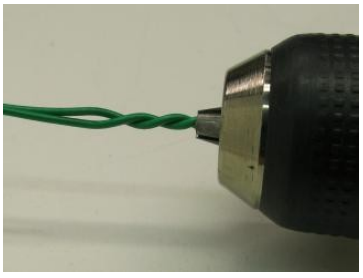


photo 6.19b

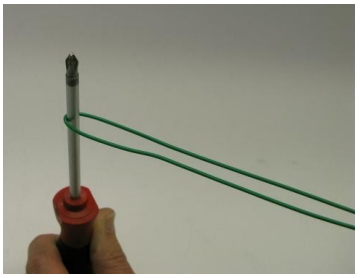


photo 6.19c

Step 4 – Slowly engage the drill, twisting the wire tightly and evenly together (photo 6.19d).
Step 5 – Unwind about 1” of the cut ends of the twisted wire. Strip and tin these ends and solder them to the indicator lamp terminals (photo 6.19a).
Step 6 – Measure approximately 4” of the twisted wire from the indicator lamp and cut. Unwind about 1” from the cut ends of this twisted wire. Strip and tin these ends and connect to pins 2 and 7 of the power tube socket. Do not solder just yet.

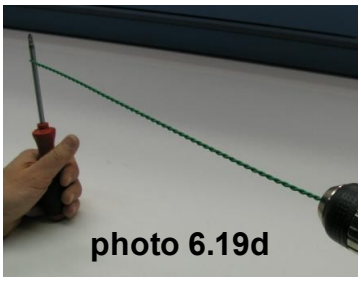


photo 6.19d

Step 7 – Unwind about 1” of the cut ends of the remaining twisted wire. Strip and tin these ends and connect them to pins 2 and 7 of the power tube socket. Apply solder to pins 2 and 7 of the power tube socket (photo 6.19e).
Step 8 - Measure approximately 6” of this twisted wire from the power tube socket and cut. Unwind about 1” from the cut ends of this twisted wire. Strip and tin these ends and connect to pins 9 and 4/5 of the preamp tube socket. Do not solder just yet.


photo 6.19e

Step 9 – Take the two 100 ohm resistors and twist the two leads together (6.19f).
Step 10 – Bend the end of the other two opposite leads of the resistors away from each other (6.19g).


photo 6.19f

Step 11 – Connect these two bent resistor ends to pins 9 and 4/5.
Step 12 – Apply solder to pins 9 and 4/5 (photo 6.19h).
Step 13 – Trim the twisted ends of the resistors to half length. Bend a small loop in the twisted ends.
Step 14 – Cut a 3” length of black wire. Strip and tin both ends.
Step 15 – Solder one end of this black wire to the loop of the two resistors (photo 6.19h).
Step 16 – Solder the other end of this black wire to the solder tab mounted to the screw of the preamp tube (photo 6.19h).


photo 6.19g

Proceed to Chapter 7


photo 6.19h

7 Final Assembly

7.1 Installing the Chassis Mounting Bolts and Chassis

Step 1 – Press the two truss bolts into the cabinet holes.
Step 2 – Mount the chassis onto the bolts, holding the chassis against the cabinet top.
Step 3 – Install the two #10 KEPS nuts, one on each bolt, and loosely tighten chassis against top of cabinet.
Step 4 – Slide chassis to rear of cabinet, away from speaker.
Step 5 – Press back panel into position, pushing the chassis against the panel. This will properly align the chassis with in the cabinet and provide good contact with shielding foil.

NOTE *Proper alignment of chassis within cabinet is when the chassis contacts the back panel shielding tape without distorting the flatness of the back panel.*

Step 6 – Place back panel to the side and firmly tighten chassis into the cabinet.
Proceed to next step

7.2 Installing AC Power Cord Clamp

Step 1 – Properly align the 5/16” nylon cable clamp around power cord (photo 7.2A).
Step 2 – With a #8 x 5/8” screw, secure the cable clamp and power cord to the inside cabinet wall. (photo 7.2B).
Proceed to Chapter 8

photo 7.2A

photo 7.2B

8 Testing

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8.1 You are almost finished. And although the first temptation is to plug up the amp and turn it on, I want to caution you to instead take the time and review all your connections. This will be time well spent as it ties together all the construction steps. Any errors are more likely to stand out at this time. It is not uncommon to find two or three errors.

After verifying all of the above connections are correct, read through all of the following steps before completing any of them. Once you have finished reading these steps, it is time to begin.

Step 1 - Install a 2A, fast blow fuse into the fuse holder.

WARNING *When changing or installing a fuse, always remove the AC source by unplugging the amp. Never use fingers to remove or insert a fuse into a fuse holder. Instead, use the fuse cap to hold the fuse when removing or inserting into the holder.*

CAUTION *Use of any fuse larger than 2A is not recommended and could cause severe and costly equipment damage in case of an internal component failure.*

Step 2 – **With the amp unplugged and no tubes installed**, turn on the amplifier's power switch. The power switch will remain on until all tests are finished.
Step 3 – Plug the amp's AC power cord into AC power at the wall.

NOTE *I personally recommend using a variable AC with separate current and voltage meters. This allows bringing the voltages up very slowly and provides more accurate monitoring capabilities.*

NOTE *If you are uncomfortable with just turning on the amp and watching for smoke, I recommend building an inexpensive Dim-Bulb tester to monitor and control current flow into the amp. A quick internet search on "Dim Bulb tester" will give several diagrams and plans.*

CAUTION *It is good practice to use a power strip with a circuit breaker and an on/off switch between the wall power and the amplifier power cord as an improved electrical safety measure.*

WARNING *In case of any troubles, quickly disconnecting the power cord from the wall (or turn off the power strip). You should not touch the amp or the amp's power switch until the amplifier's power cord is no longer connected to AC wall power.*

Step 4 – The panel indicator should illuminate. Monitor for any unusually smoke or smells or a blown fuse or hot power transformer. If anything unusual occurs, disconnect power immediately and review connections.
Step 5 – If there is nothing unusual after a couple of minutes, remove AC power by disconnecting the AC power cord from the AC source.
Step 6 – With the amp disconnected from power, install the rectifier tube.
Step 7 – Plug the amplifier's AC power cord into the AC power source at the wall.
Step 8 – The panel indicator should illuminate. Visually verify that the filament inside the rectifier tube is glowing. Monitor amplifier for any unusual smoke or smells or blown fuse. If anything unusual occurs, disconnect power immediately and review connections.

NOTE *Within a minute or two, the rectifier will have heated up and provided a slowly increasing high voltage to the power supply. This voltage will have properly formed the high voltage filter caps.*

Step 9 – With your multimeter on the 500 volt range, carefully connect the meter's black lead to chassis ground and the red lead to the positive end of C6 (B+). The voltage here should be something close to +450 volts (photo 8.1A).

WARNING *Whenever testing voltages, it is recommended to keep your free hand off of the chassis. In this way, there isn't a path for significant current to flow through the body to ground in case the measuring hand accidentally comes in contact with high voltages.*

Step 10 – Remove AC power by disconnecting the AC power cord from the AC source.
Step 11 – Install the preamp tube.
Step 12 – Plug the amplifier's AC power cord into the AC power source at the wall.
Step 13 - The panel indicator should illuminate. Monitor for any unusual smoke or smells or blown fuse.

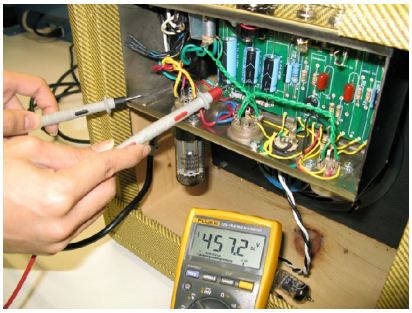


Photo 8.1A

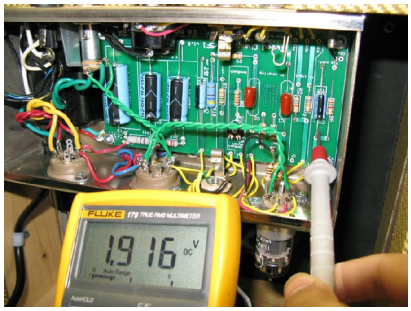


photo 8.1B

If anything unusual occurs, disconnect power immediately and review connections.
Step 14 – Let the amplifier warm up for 2 minutes. With a multimeter on the 20 volt range, carefully connect the meter's black lead to chassis ground and the red lead to the positive side of C3. If C3 is not installed, the red lead can be connected to pad “n” instead. The

voltage here should be close to +1.8 volts (photo 8.1B).

NOTE *The presence of voltages at steps 14 & 15 indicates that the two halves of V1 are correctly sourcing current.*

Step 15 – Move the red lead to the positive side R7 (pad “g”). The voltage here should be close to +1.8 volts.
Step 16 – If these measurements are correct, remove the AC power by disconnecting the AC power cord from the AC source.
Step 17 – Install the power tube.
Step 18 – Connect speaker to output jack.
Step 19 – Turn volume to minimum position, leaving the amplifier power switch to “on”.
Step 20 – Plug the amplifier's AC power cord into the AC power source at the wall.
Step 21 – The panel indicator should illuminate. Monitor for any unusual smoke or smells or blown fuse. If anything unusual occurs, disconnect power immediately and review connections.

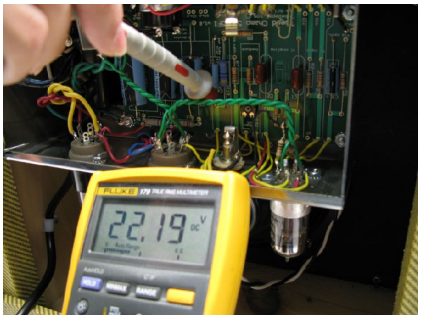


photo 8.1C

Step 22 – Let the amplifier warm for 2 minutes.
With a multimeter on the 200 volt range, carefully connect the meter's black lead to chassis ground and the red lead to the positive side of C4. The voltage here should read close to +22 volts (photo 8.1C).

NOTE *The presence of voltage at step 22 indicates that V2 is correctly sourcing current.*

Step 23 – If all these measurements are within specifications, and the speaker is connected, and there no signal source connected to either input, turn up the volume control and listen for a low level hiss from the speaker. There will be a slight hum, but anything drastic indicates wiring troubles.

Step 24 – If the above hiss is heard, turn the volume control back to minimum and connect a signal source into input 1.

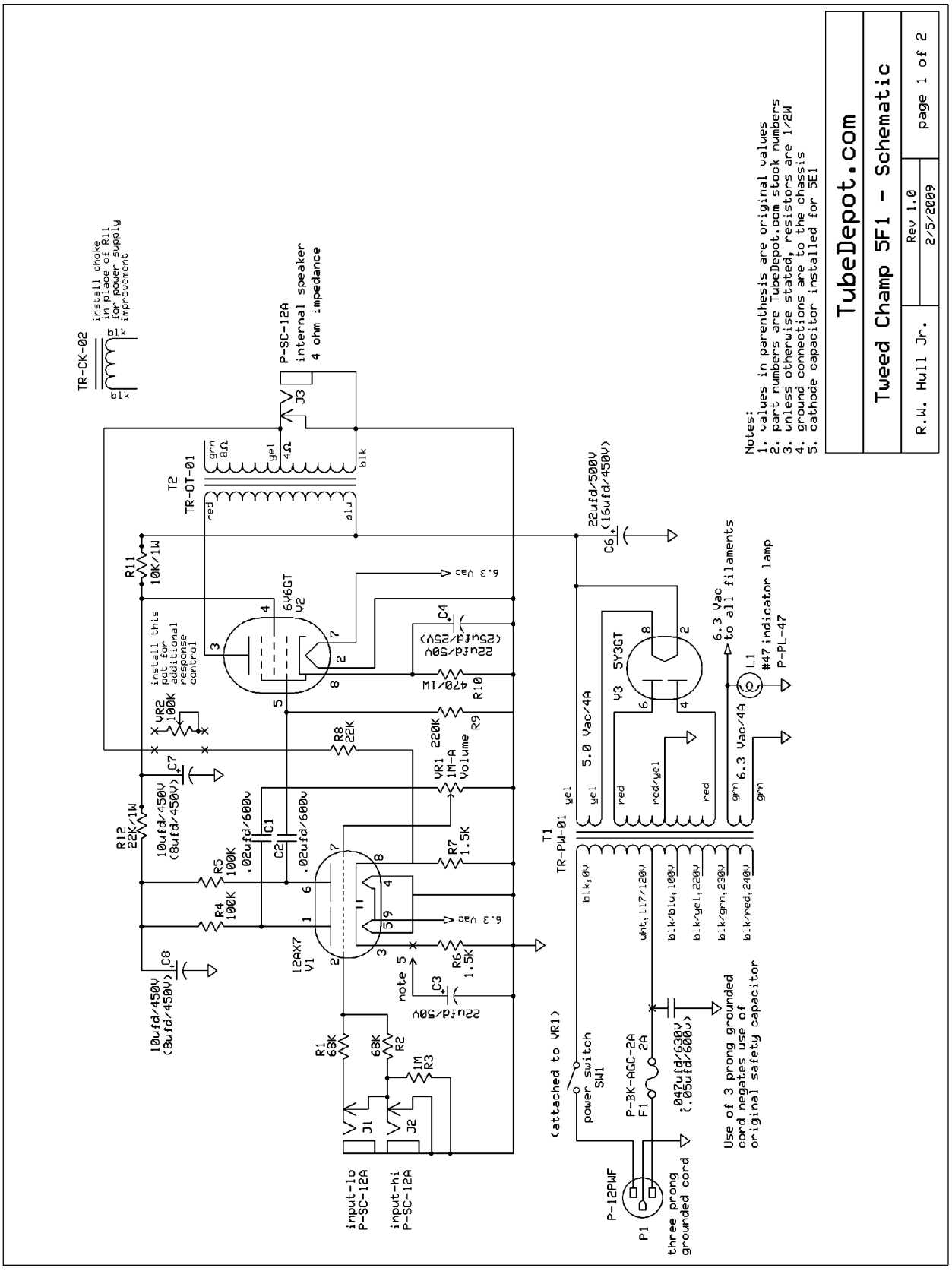
NOTE	*A signal source can be a guitar or high impedance microphone or even a low level CD or MP3 player. A speaker output from another amp is not recommended.*

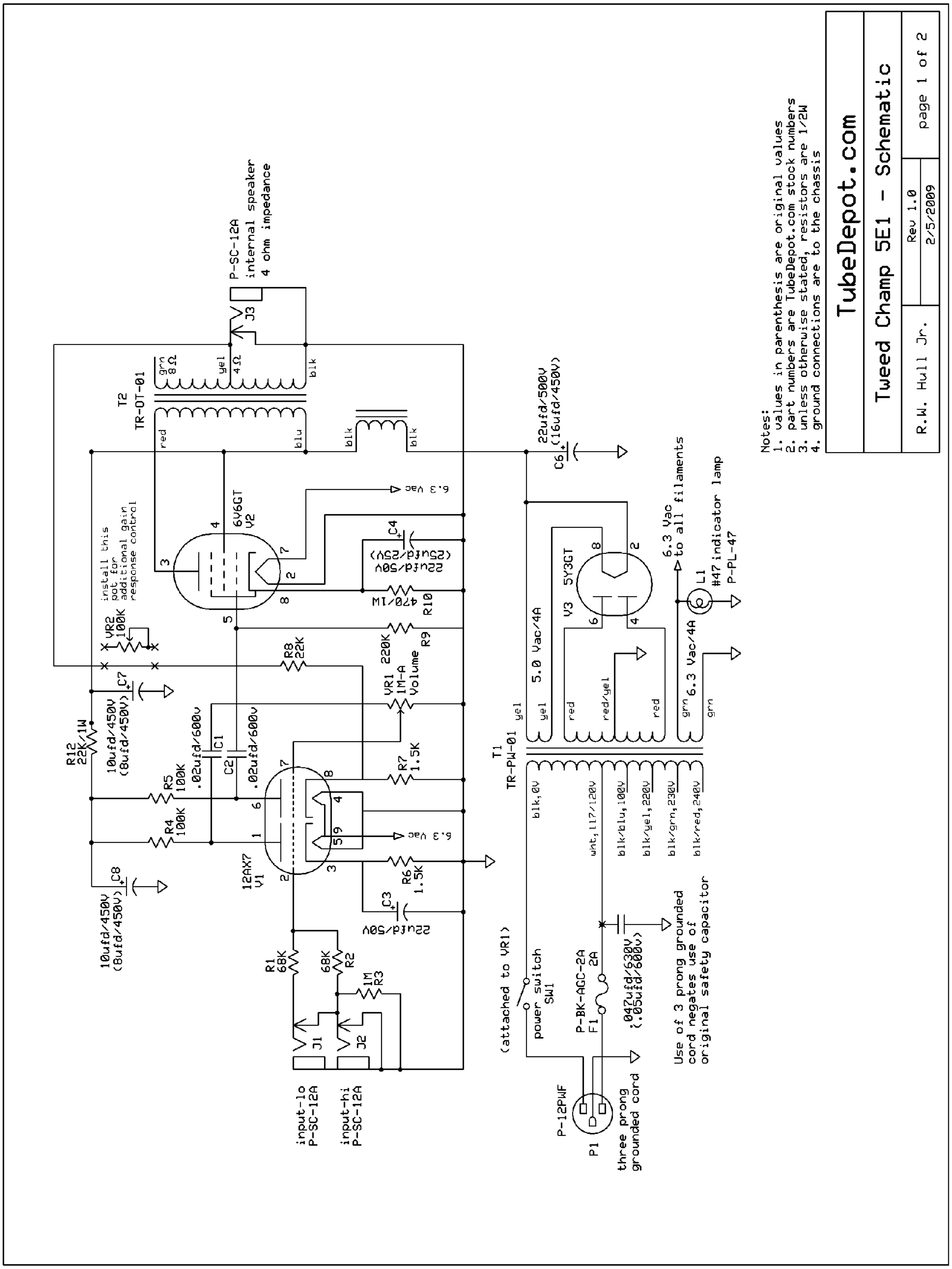
Step 25 – Turn up the volume on the amp and the signal source (most likely a guitar or harmonica microphone) and verify that the signal is coming from the speaker.

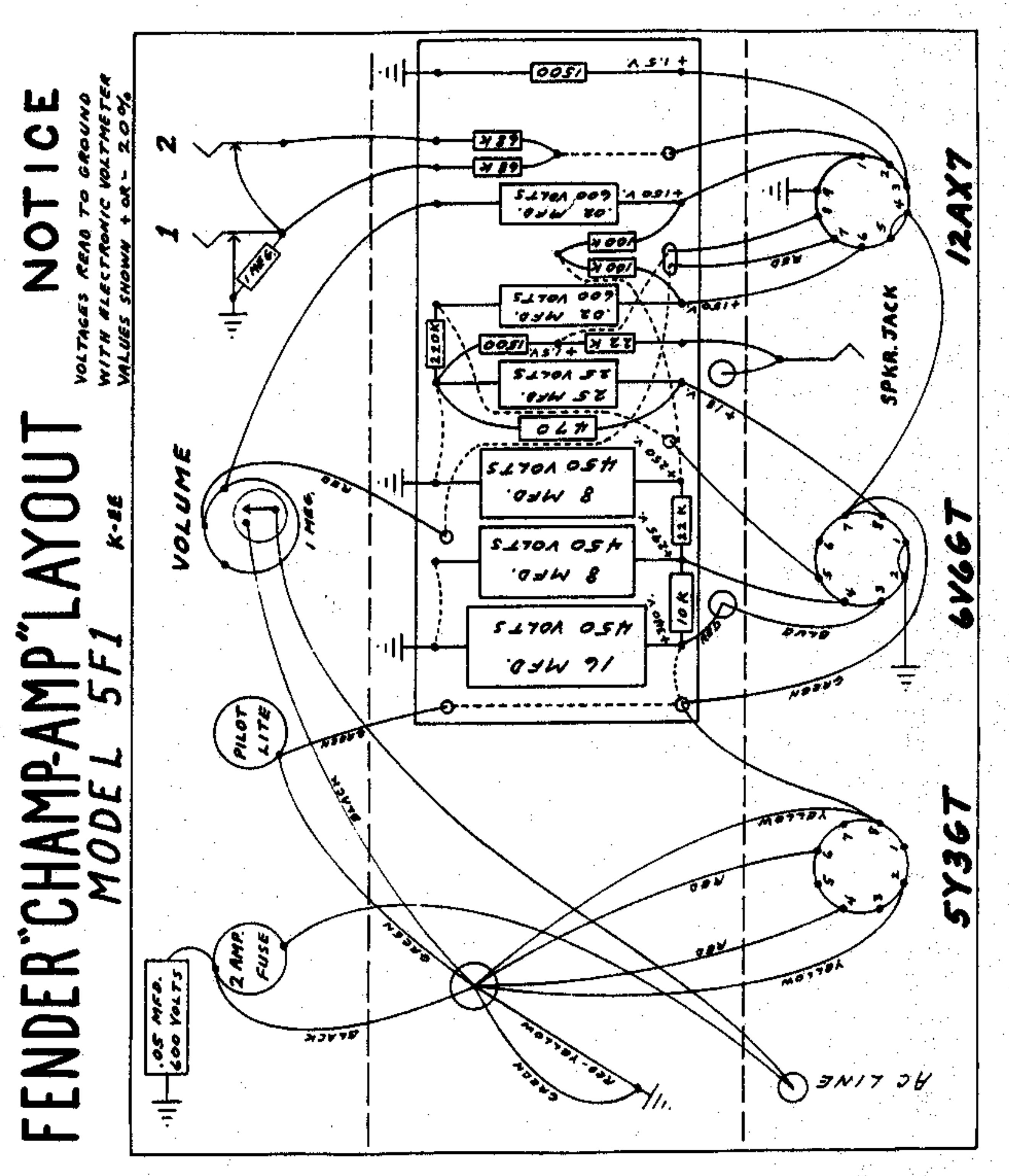
Step 26 – If everything checks good, turn off amp and install the back panel.

Step 27 – Now the time has come to rock out … your amp is done!

The End


TubeDepot.com
Tweed Champ 5F1 - Schematic
R.W. Hull Jr.
Rev 1.0
2/5/2009
page 1 of 2
Notes:
1. values in parenthesis are original values
2. part numbers are TubeDepot.com stock numbers
3. unless otherwise stated, resistors are 1/2W
4. ground connections are to the chassis
5. cathode capacitor installed for 5E1
TR-CK-02
install choke in place of R11 for power supply improvement
P-SC-12A
internal speaker
4 ohm impedance
T2
TR-OT-01
R11
10K/1W
6V6GT
V2
5Y3GT
V3
6.3 Vac
to all filaments
#47 indicator lamp
P-PL-47
L1
C6
22ufd/500V
(16ufd/450V)
C4
(25ufd/25V)
22ufd/50V
470/1W
R10
R9
220K
VR1
1M-A
Volume
R8
22K
VR2
100K
install this coil for additional response control
C7
10ufd/450V
(8ufd/450V)
R12
22K/1W
C1
.02ufd/600v
C2
.02ufd/600v
R5
100K
R4
100K
R7
1.5K
R6
1.5K
C3
22ufd/50V
note 5
12AX7
V1
T1
TR-PW-01
5.0 Vac/4A
6.3 Vac/4A
R1
68K
R2
68K
R3
1M
J1
J2
input-lo
P-SC-12A
input-hi
P-SC-12A
(attached to VR1)
power switch
SW1
P-BK-AGC-2A
2A
F1
.047ufd/630V
(.05ufd/600v)
Use of 3 prong grounded cord negates use of original safety capacitor
P-12PWF
P1
three prong grounded cord

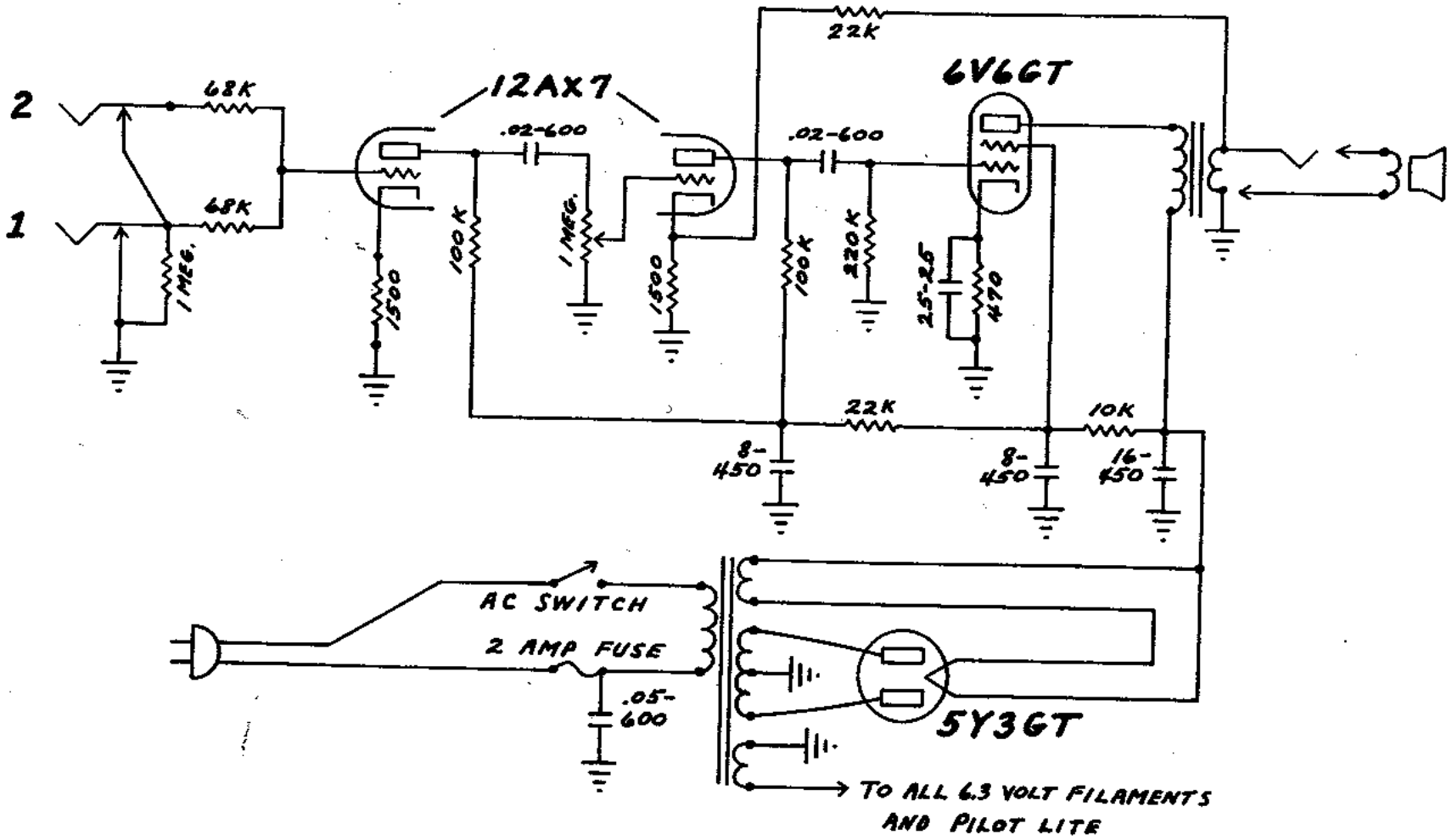

Notes:
1. values in parenthesis are original values
2. part numbers are TubeDepot.com stock numbers
3. unless otherwise stated, resistors are 1/2W
4. ground connections are to the chassis
TubeDepot.com
Tweed Champ 5E1 - Schematic
R.W. Hull Jr.
Rev 1.0
2/5/2009
page 1 of 2
P-SC-12A
internal speaker
4 ohm impedance
J3
T2
TR-OT-01
grn 8Ω
yel 4Ω
blk
red
blu
22ufd/500V
(16ufd/450V)
C6
install this pot for additional gain response control
VR2 100K
6V6GT
V2
6.3 Vac
C4
22ufd/50V
(25ufd/25V)
470/1W
R10
220K
R9
R8 22K
VR1 1M-A Volume
R12 22K/1W
10ufd/450V
(8ufd/450V)
C7
R5 100K
R4 100K
.02ufd/600v
C1
C2
.02ufd/600v
R7 1.5K
12AX7
V1
R6 1.5K
C3
22ufd/50V
C8
10ufd/450V
(8ufd/450V)
R1 68K
68K R2
1M R3
J1
J2
input-lo P-SC-12A
input-hi P-SC-12A
T1
TR-PW-01
yel
5.0 Vac/4A
V3 5Y3GT
red
red/yel
6.3 Vac/4A
grn
6.3 Vac to all filaments
L1
#47 indicator lamp
P-PL-47
blk,0V
wht,117/120V
blk/blu,100V
blk/yel,220V
blk/grn,230V
blk/red,240V
(attached to VR1)
power switch
SW1
P-BK-AGC-2A
F1
2A
.047ufd/630V
(.05ufd/600v)
Use of 3 prong grounded cord negates use of original safety capacitor
P-12PWF
P1
three prong grounded cord


FENDER "CHAMP-AMP" LAYOUT
MODEL 5F1
K-EE
NOTICE
VOLTAGES READ TO GROUND
WITH ELECTRONIC VOLTMETER
VALUES SHOWN + OR - 20%
1
2
VOLUME
PILOT LITE
2 AMP. FUSE
.05 MFD. 600 VOLTS
12AX7
6V6GT
5Y3GT
SPKR. JACK
AC LINE

FENDER "CHAMP-AMP" SCHEMATIC

MODEL 5F1

K-EE



10 Cool Modifications

TUBEDEPOT
ANALOG IN | TUBEDEPOT.COM

Once you have the amp working and sounding good, here are a few ideas to “shape” the tone to suite your tastes.

1. Change both C1 and C2 to .01ufd or .0047ufd to reduce low frequency response at high gain settings. Gives the amp the ability to “cut through” better.
2. Install 22ufd/450v caps in C8 and C9 positions - tightens power supply and provides quicker dynamics.
3. Experiment with 22ufd/50v cap in C3 position - increases gain with it installed.
4. Change out 6V6 for an EL84 by fabricating your own cover plate adapter and installing a 9 pin tube socket – allows installing EL84s vs. 6V6.
5. Change out 6V6 for 6AQ5/6005 by fabricating your own cover plate adapter and installing a 7 pin socket – allows installation of 6AQ5s vs. 6V6.
6. Change out 6V6 with 5881. It is recommended to disconnect the 5.0V filament and use a solid state rectifier. This additional power transformer over head will be needed for the increased 6.3V filament requirements of the 5881. Additionally, the filter caps will have to be upgraded to +500V.
7. Install solid state rectifier in place of tube rectifier – tightens up dynamics and power output. Filter caps must be upgraded to +500V types.
8. Run amp without neg. feedback altogether by disconnecting feedback line from speaker output jack – provides much more overall gain and distortion with the volume up.

Appendix A

Resistor and Capacitor Codes

Most electronic components are so small that printing the actual values, ratings and tolerances on the individual component is nearly impossible. Therefore, codes were invented early in electronic history and printed on the components to describe what they were. Many of these codes are still in use today.

Below I've listed some of the more common codes that you are likely to come across while building this project.

How to Identify Power Ratings and Resistor Value Color Codes.

This project uses different types of resistors. The diagrams below will assist you in locating and identifying resistor values, tolerances and ratings for the various circuit requirements for your project.

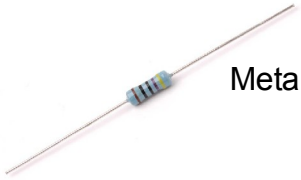
Resistor Power Ratings

Not only are resistors graded by their values but also by their power ratings. Power ratings are determined by how much heat (power) can be safely dissipated by the resistor. Higher ratings are usually indicated by larger sizes.

Below are photos and descriptions of the various resistors used in this project.

Carbon Composition 1/2W

Carbon Film 1/2W



Metalized Film 1/2W

Carbon Composition 1W

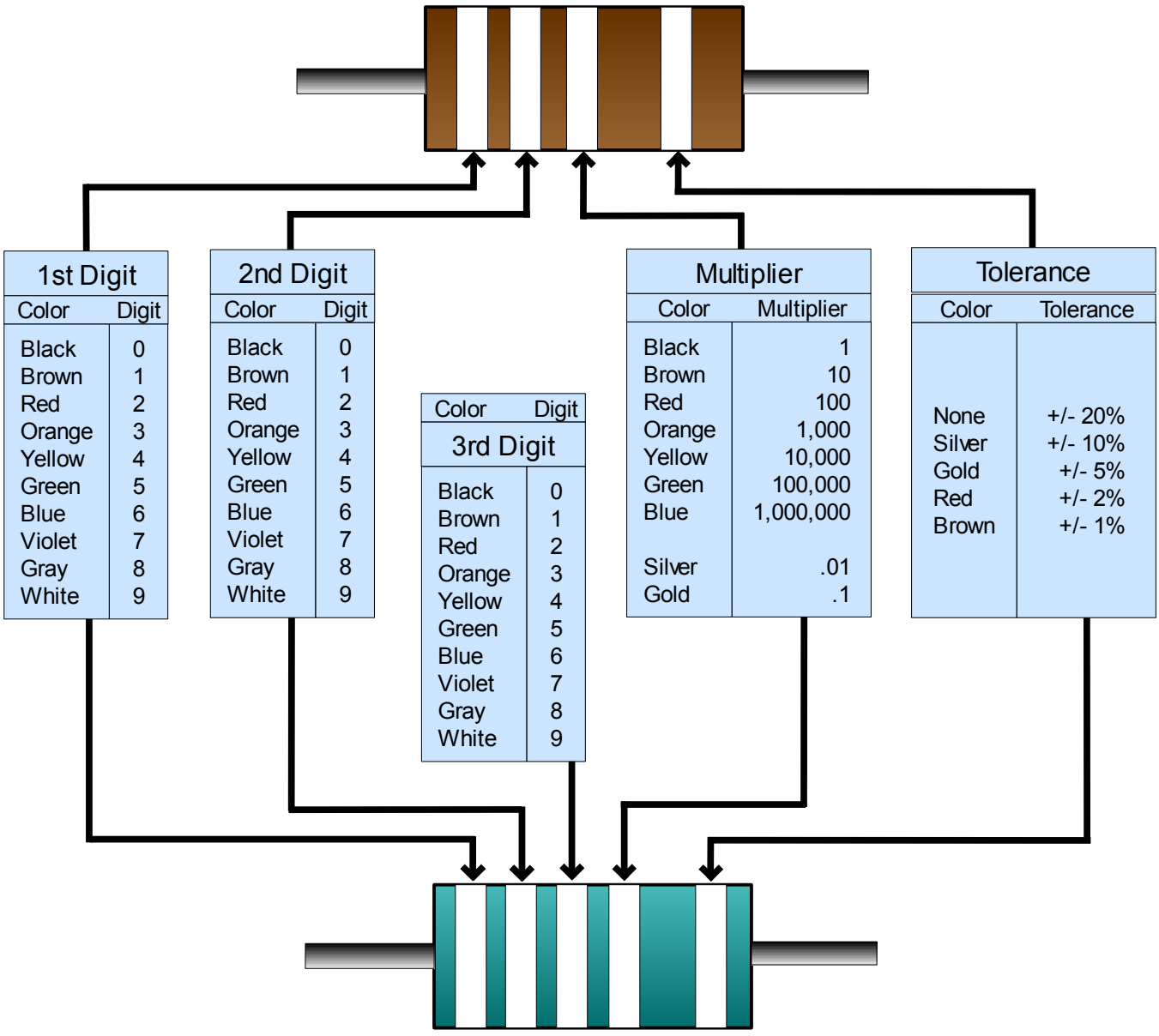
Metal Oxide 1W

Metal Oxide 2W

Metal Oxide 3W

Resistor Types

Carbon Film
Metal Oxide
Carbon Composition



1st Digit	
Color	Digit
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

2nd Digit	
Color	Digit
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

Color	Digit
3rd Digit	
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

Multiplier	
Color	Multiplier
Black	1
Brown	10
Red	100
Orange	1,000
Yellow	10,000
Green	100,000
Blue	1,000,000
Silver	.01
Gold	.1

Tolerance	
Color	Tolerance
None	+/- 20%
Silver	+/- 10%
Gold	+/- 5%
Red	+/- 2%
Brown	+/- 1%

Metal Film (1%)

How to Read Capacitor Value Codes

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This project uses several different kinds of capacitors. Some of these capacitors have their values and voltage ratings printed on them, others use numerical codes. The diagrams below will assist you in locating and identifying capacitor values, tolerances, and voltage ratings for the various circuit requirements for your project.

Cornell-Dubilier Silver Mica – high quality / high accuracy picofarad cap

1st line: 250 +/- %5 = direct value in pfd (250pfd); tolerance 5%
2nd line: 500V SM = voltage rating (500V); batch code

Sprague "Orange Drop" 715 series – Vintage style film & foil polypropylene capacitor.

1st line: 715P600V = 715 series; rated at 600V
2nd line: 104J 0821 = value in pfd (104 = 10 and 4 zeros pfd); tolerance (J = +/- 5%); batch code

104 = .1ufd
103 = .01ufd 223 = .022ufd 473 = .047ufd
102 = .001ufd 222 = .0022ufd 472 = .0047ufd

Xicon Metalized Polypropylene – Warm tone, small size

1st line: F104K d = value in pfd (104 = 10 and 4 zeros pfd); tolerance (K = +/- 10%)
2nd line: 630MPP 1 = voltage rating (630V); construction (MPP = metalized polypropylene)

104 = .1ufd
103 = .01ufd 223 = .022ufd 473 = .047ufd
102 = .001ufd 222 = .0022ufd 472 = .0047ufd

Sozo Film and Foil – Vintage style film & foil polypropylene capacitor, axial leads

1st line: 684K = value in pfd (684 = 68 and 4 zeros pfd); tolerance (K = +/- 10%)
2nd line: 160V = voltage rating (160V)
3rd line: 0834R = batch / date code

104 = .1ufd 684 = .68ufd
103 = .01ufd 223 = .022ufd 473 = .047ufd
102 = .001ufd 222 = .0022ufd 472 = .0047ufd

B Appendix B

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Soldering Hints

Anyone working in electronics should learn how to solder well. Thankfully it isn't hard, it just takes practice and having the proper tools. Once you are able to solder well, your projects will be more professional and more reliable.

Refer to our video “How To Solder” for detailed explanations.
http://www.youtube.com/watch?v=clDydYIVTqU&feature=channel_page

But before you get started, here are a few safety tips that should be followed:

- Fumes from soldering can be harmful therefore it is important to always have adequate ventilation.
- Wear appropriate clothing when working around hot, molten solder. Never wear shorts or open toes shoes.
- protect hands and equipment from burns by using a soldering iron holder. An improperly stored soldering iron is a fire hazard
- Do not eat, drink, or smoke while you are soldering. Limit exposure to lead.
- Wash hands often when soldering.
- Wear safety glasses when soldering.

Purpose of Soldering

Soldering is used to bond two or more metals together. By applying heat to a connection and feeding solder into this connection, the solder will melt and flow around the metals. A small surface amount of each of the metals will additionally melt and inter-mix with the liquid solder forming an alloy. This connection is called an intermetallic bond and the two metals, when properly soldered together, act as if it they were one solid piece.

Importance of Proper Soldering

Proper soldering is the basis for faithful equipment operation. A good solder connection is physically strong and electrically reliable. A poorly soldered connection will have intermittent operation which can cause electrical damage to neighboring components. At the very least, a bad solder connection will create an unpleasant audible experience. Therefore the importance of good soldering skills cannot be over emphasized. Your sound will rely on it.

Basic Soldering Rules

The following are some basic soldering rules that if followed, will result in a reliably soldered connection every time:

1. Make sure the surfaces to be soldered are clean and free of corrosion. A dirty, greasy, or oxidized surface will not accept solder properly, creating an intermittent solder connection.
2. Establish a firm mechanical connection of the components prior to soldering. Solder should only be used to develop an electrical connection and not a mechanical one.

3. Insure that the soldering tip is clean prior to any soldering. A clean solder tip is one wiped lightly across a damp sponge to remove oxides prior to use. It is essential for maximum heat transfer that there are few contaminants on the tip.
4. When applying the soldering iron to a connection to be made, it is important to lay the tip in such a position that the maximum surface area of the tip is presented to the connection. In this way, the maximum heat is transferred to the connection in the minimal amount of time.
5. Apply solder to the work and not the iron. In this way, a properly heated connection will readily accept the solder, further reducing the chances for unreliability.
6. Use only clean, good quality, rosin core solder. Poor quality or dirty solder will not melt smoothly and will deposit contaminants into the connection, making it weak.
7. Use only the amount of solder needed to complete the connection. Use too little solder and the connections is compromised where as too much solder runs the risk of accidentally contacting neighboring connections.
8. Finish the connection by removing the soldering iron quickly. It is important to apply heat only for as long as it needed to properly flow the solder. Any additional heat runs the risk of overheating the parts being soldered.
9. Do not move the parts of the connection while the solder is hardening. It is important that everything stays totally still until the solder has fully set because any movement in the parts while the solder is in a plastic state will result in a weak, unreliable, and cracked connection.
10. Clean any rosin residues from freshly made connections. Rosin residues can trap dirt and dust that could weaken a connection and possibly create arcing conditions. Isopropyl or ethel alcohol and a stiff bristled brush are good for this.

Sequence of Events to Make a Good Connection

1. Establish a good mechanical connection of the components prior to soldering.
2. Place the tip of the iron firmly against the connection to be soldered.
3. Let connection reach soldering temperature (usually within 1 to 2 seconds).
4. Feed solder into the point where the soldering iron tip meets the connection, not on to the tip of the soldering iron.
5. Feed an adequate amount of solder into the connection for the solder to flow around the components to be joined.
6. When adequate amount has been reached, remove solder and iron simultaneously.
7. Do not move connection or components until solder has solidified.
8. Clip off any excess wire lead(s).

C Appendix C

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Amplifier Care, Feeding, and Applications

Now that the amp is together here are a few good hints to keep it up and running and you safe and happy:

- Only plug this amp into properly grounded (three prong) AC receptacles.
- Do not cut off the third prong of the power cord plug thus defeating its safety feature.

WARNING *Keith Relf of "The Yardbirds", Leslie Harvey of "Stone the Crows", and John Rostill of "The Shadows" all died of electrocution while playing their guitars (Leslie Harvey while on stage). Proper grounding is more than just important … it can be life or death!*

- Only plug this amp into the properly wired AC voltages.
- Do not expose this amp to high levels of moisture such as rain or spilled liquids.
- Avoid placing any beverages on the cabinet.
- When ever changing tubes or cleaning this amp, disconnect the amp from the AC power source and allow amp to cool for 10 min. before beginning.
- It is recommended that the amp is only plugged to AC power when the amp is being used. Otherwise, it should be left unplugged from AC voltages.
- Avoid exposing this amp to elevated temperatures such as heaters or hot cars or garages. The expansion and contractions of these temperatures will put undo stress on all the solder connections, possibly damaging them.
- Always provide adequate ventilation for the tubes and amplifier. An air space of 6" or more is recommended between the amp and any other object(s), especially around the rear of the amp. It is a good idea to keep the amp as cool as possible.

Amplifier Feeding

As with any tube amp, the choice of tubes will effect the overall tone of the amp. And of course, some tube choices are more dramatic than others. Therefore, I encourage everyone to shape the tone of this amp to suit their tastes through the use of different tubes. Below is a short list of tubes that can be used for adjusting tone performance without modifying the amp.

Preamp tubes:

- 12AX7A / ECC83 / ECC803 / 7025; (high gain – amplification factor = 100)
- 12AD7; (high gain – amplification factor = 100)
- 12AT7 / ECC81; (high gain – amplification factor = 70)
- 12AY7; (med gain – amplification factor = 40)
- 12AU7 / 5814 / 6189 / 5963 / ECC82; (low gain – amplification factor = 17)
- 12AZ7; (med gain – amplification factor = 60)
- 12DW7; (mixed gain – amplification factor, first triode = 100; second triode = 17)
- 5751; (high gain – amplification factor = 70)

Power tubes:

- 6V6GT - 5871 - 7408 - 7184

Rectifier tubes:

- 5Y3GT - 5AX4 - 5CG4 - 5R4 - 5T4
- 5V4 - 5Z4 - 5AR4 - GZ30 - 6106

Applications

The laboratory environment is nice, but life experiences better determine success levels. Therefore the true test of a good amp is how well it performs “in the field”. The following are some of my favorite field proven gigging and recording hints.

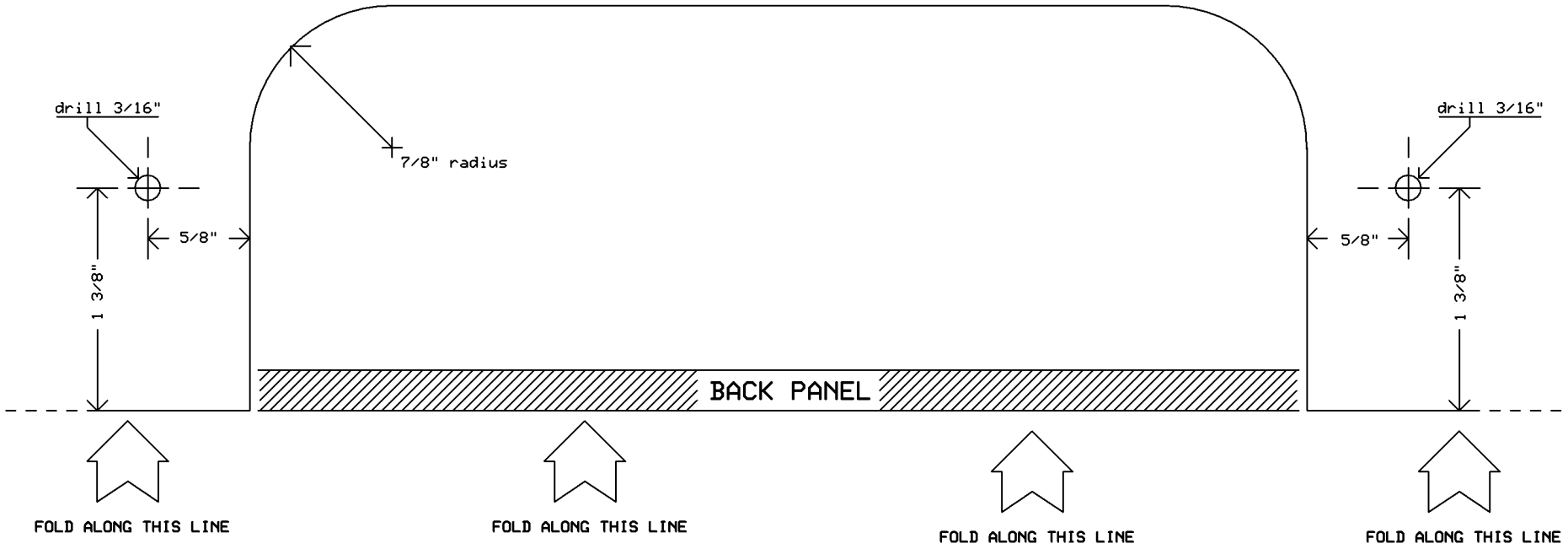
- Run this amp wide open! Let it breath, let it sing. It wants to be heard.
- With the amp wide open, control the level of distortion with the guitar's volume control.
- Try recording this amp by putting a microphone in front, slightly off axis of the speaker to get a crunchy, bluesy tone. Relocate the microphone to directly in front to get an upfront rock tone.
- Instead of one, try recording with two microphones, one in front (straight phase) and another in back (reverse the phase). This will make the amp sound huge when recorded!
- Run the amp into a different cabinet (ie 2x12, 4x12, 4x10). It is surprising how different speaker set ups will respond to 5W. Just set microphones to taste and enjoy.
- Record the amp in the bathroom close to the tub. Tubs ring wonderfully when excited.
- A little slap back echo goes along way so try a delay pedal between the guitar and amp.
- A vibrato or tremolo pedal in front is perfect for soulful coolness.
- Run an overdrive pedal set clean in front of the amp. Now crank up the pedal's output and hit the amp hard with this signal. I love this arrangement!
- Harp players can get control of feedback (as well as tone shaping) by putting an EQ pedal between the harp microphone and the amp.
- Guitar players can benefit from an EQ pedal in front as well. Just a little more shaping can make everyone happy.
- The low end response can be maximized by situating the amp's cabinet as firmly against the floor as possible.
- Run your guitar / harp microphone into the #1 input and then come out of the #2 input of this amp and go into the front end of a different amp. This way you can run two amps at the same time. The sound of this amp mixed with another is very good.
- Connect the output of this amp to a speaker load box with a line out and this amp becomes a great preamp in which to drive another amp or straight to the board.
- Run a vocal microphone (through the appropriate impedance matching devices) and record the most deliciously distorted vocals ever. No modeling can touch this sound.
- Install a solid state rectifier and get an extra watt of power and an animated dynamics in tone.
- Exchange the 6V6 with a 5881 for a more expansive sound scape. It is best to only run the 5881 when using the solid state rectifer.
-

Appendix D

Templates

Appendix D1 is the cabinet drilling template ….....
Appendix D2 is the chassis drilling template – PCB and Turret Boards ….....

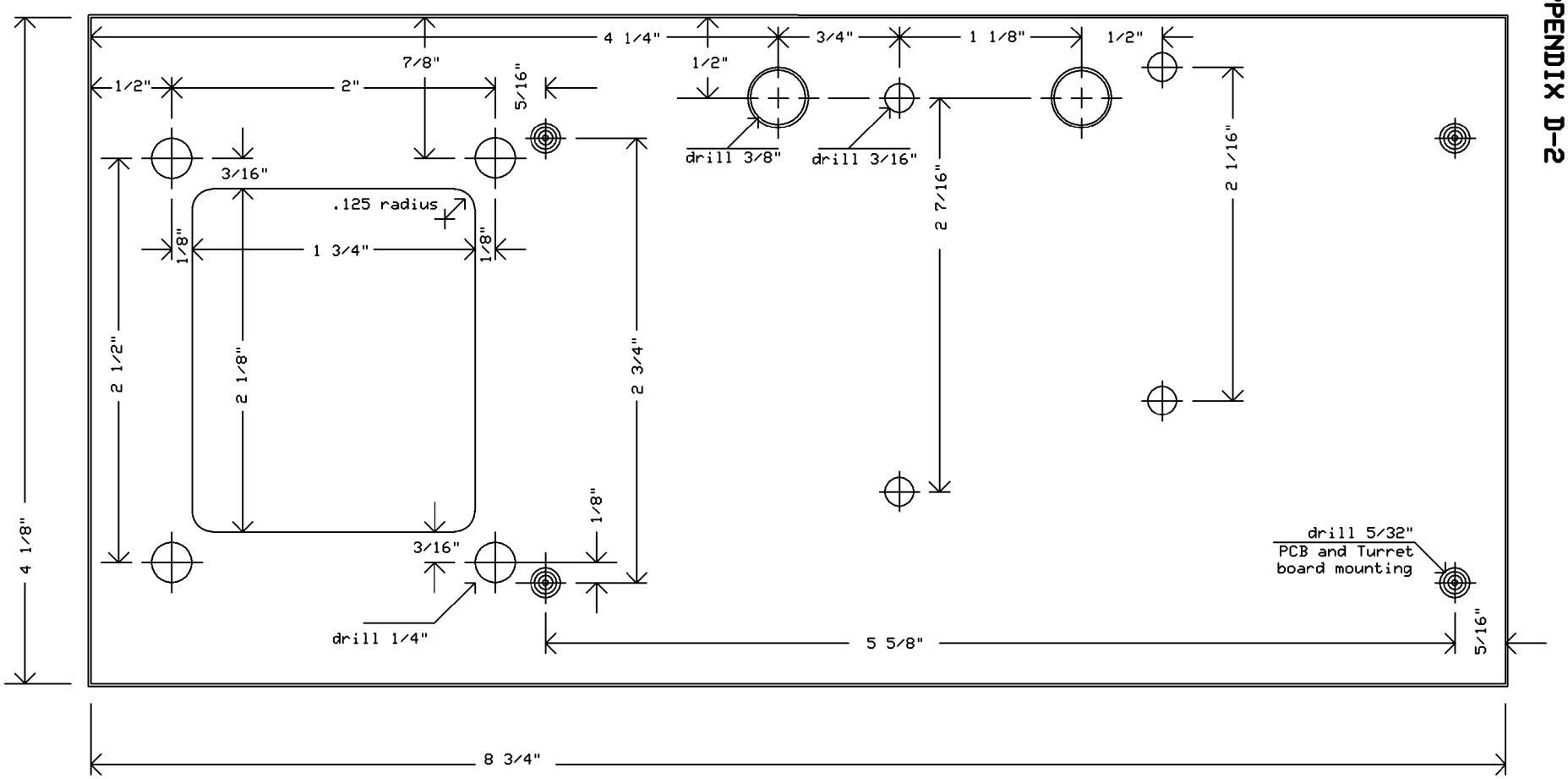
APPENDIX D-1



TubeDepot.com		
Drilling Template Cabinet/Tweed Champ 5F1		
Robert Hull	Rev 1.0 3/19/2009	Page 1 of 1

APPENDIX D-2

tube sockets on this side



printed control panel on this side

TubeDepot.com		
Drilling Template PCB/Turret Brd		
Robert Hull	Rev 1.0 3/19/2009	page 1 of 1