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ASSEMBLY MANUAL

easy 1 2 3 4 5 hard

recommended level of difficulty

JTM45+ “ ” Styled 50W Tube Guitar Amp Kit

(with some great “ ” styled mods)

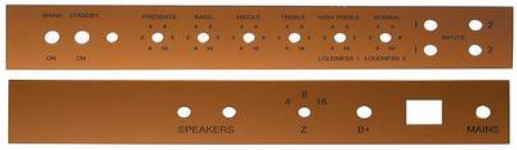

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Table of Contents

Preface

Marshall amplifiers have always been the forefront in the sound of rock n' roll. Since the early 1960's, Marshall has taken simple circuits and turned them into extraordinary, amplifiers that to this day, continue to define great tone.

In the early 60's, the JTM45 established Marshall as the new leader in guitar amplifiers. While all the other amplifier manufacturers were designing their amps to be cleaner, Marshall took a different path. With a simple circuit (from the Fender 1959 4x10 Bassman), Marshall “crunched” it full of harmonically rich tone and built an amplifier that set the standard for everyone to follow.

This British JTM45+ kit is our nod to the original JTM45 and MkII 50W amplifiers. With turret board, point-to-point construction, quality components, and just a touch of American upgrading, this kit is ready to become your sound.

Unlike previous assembly manuals, we have designed this manual for the more advanced builder in mind. This manual is lite on step-by-step instructions, but filled with detailed drawings and photos. We are leaving these drawings and photos to speak for themselves. If you have previous amp building experience, you will enjoy the challenge that this kit provides.

But before we get started, a safety review …

Robert Hull

Director of Technical Services
TubeDepot.com

Before continuing, PLEASE READ the following:

NOTE

We are continually making improvements to this assembly manual in an effort to provide the best instructions possible. Therefore, when the manual's instructions differ from the video, I recommend following this written manual as this will be more up-to-date and accurate.

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 if accidentally touched. 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 can 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 any safety 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.*
MOD	*Used when identifying potential modification point(s)*

2 Tools and Supplies

As with any construction project, there are certain recommended tools and supplies. The following are the tools and supplies NOT provided with the kit but are needed for completion. These are expected to be 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 (cordless recommended)	
Drill bit, 1/8” - AC receptacle installation; turret board wire routing	TL-DB-40125
Drill bit, 5/32” - turret board mounting	TL-DB-40156
Drill bit, 9/32” - Chassis mounting in cabinet	
Drill bit, 5/16” - inset nut installation into chassis	
Drill bit, 7/16” - impedance selector installation	
Drill bit, 1/4” - shock mounted tube socket mounting holes	
Countersink bit	
Masking tape, 2” or 3”	
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 / solder extractor	TS-384-1000
Solder wick or desoldering braid	TS-1817-10F
Sponge or soldering iron tip cleaner	TL-TIP-CLEANER

The following are tools that really nice to have on hand:

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 (dim bulb tester) – self built	
Needle nose pliers – small size, for electronics work	TL-NN7776
Wire cutters, diagonal – small size, for electronics work	TL-170M
Center punch – an automatic center punch is great	
Nutdrivers - 5/16”, 11/32”, 7/16”, 1/2”	
Square, 9”	
Scratch Awl	
De-burring tool	TL-DB-1
Fingernail polish (for holding nuts and screws in place)	
Step drill bit (1/8” - 1/2”)	
Orange wood stick – for moving components and wires into place	TS-OWS

3 Parts Inventory

Make sure the following items are included with your kit. Let us know if there are any missing items or if you have any questions regarding a particular part(s).

qty	*description*	*TD part number*
1	chassis, aluminum Marshall style JTM45	CH-MARJTM45
1	panel, front and back, Marshall style JTM45, plastic	CH-MARJTM45-FP
1	xfmr, power, 45W Marshall style w/ rectifier tap	TR-PW-05
1	xfmr, output, 50W Marshall style by Classictone	18025
1	choke, Marshall style 3 HY, 250mA by Classictone	18058
1	GZ34 JJ dual-diode rectifier	JJ-GZ34
1	EL34 beam power tetrode (sold in pairs) 12AX7 /	JJ-EL34
3	ECC83 dual triode preamp tube	JJ-ECC83
7	knob, Marshall style w/ set screw	P-MAR-1-4-BRASS
1	knob, chicken head, vintage w/ set screw	P-VSCH
2	fuse holder, low profile screwdriver cap, 3AG	P-FH-LOWPRO
2	fuse, 3AG 500mA slow blow (HT fuse)	P-BK-MDL-.5A (one spare)
2	fuse, 3AG 3A fast blow (Mains fuse)	P-BK-AGC-3A (one spare)
1	Indicator lamp, 6.3V incandescent	P-PL-MARSHALL-1
1	push nut-flat round 5/16" stud (included w/ above lamp)	
6	jack, 1/4", Amphenol mono	P-ACJM-IHS
2	washer, chassis grounding for above jack	GW-CL1442
1	switch, toggle SPST; Carling	P-110-63
1	switch, toggle DPST, Carling	P-2BK62-73
2	washer, lock 1/2", internal tooth	LW-IT-1-2
2	switch, mini toggle, DPDT, (on-on)	P-108-MINI-2
1	switch, mini toggle, SPDT (on-off-on)	P-108-MINI-3
1	switch, 3 position rotary	P-ROTARY-SWITCH
1	plug, AC chassis mount, press fit	P-IEC-1
1	power cord, with IEC connector	P-12PWI
3	diode, 1N4007	D-1N4007
2	diode, GP02-30-E3/73	D-R3000
3	socket, tube, miniature 9 pin	SK-B-VT9-ST-C
3	shield, tube socket, miniature 9 pin	SK-PCP
3	socket, tube, octal chassis mount	SK-B-VT8-ST
3	grommets, rubber 1/2" chassis hole	P-GROMMET-1/2
4	bolt, metric, M6x30mm, stainless steel	MS-M6X30MM
4	flat washer, metric, M6, stainless steel	BP-M6-WASHER
4	captive nuts, M6	BP-M6-CAPTIVENUT

qty	*description*	*TD part number*
4	screw, zinc plated 6-32 x 1/4", phillips pan head	BP-632-1/4
18	screw, zinc plated 6-32 x 3/8", phillips pan head	BP-632-3/8
2	nuts, standard 6x32	BP-632
12	nuts, KEPS 6x32	BP-632-KEPS
4	standoff, aluminum hex, #6 threaded, 1/2" long	BP-ALSTDOFF-6-FF-1/2"
7	nuts, KEPS 8x32	BP-832-KEPS
3	nuts, 8-32 standard	BP-832-NUT
6	screw, zinc plated 8-32 x 3/8", phillips pan head	BP-832-3/8
4	solder lug, locking, #8 screw	P-TERMLOCK-8
4	solder lug, locking, #6 screw	P-TERMLOCK-6
10 ft.	wire, 20 AWG, stranded, hi-temp PVC - yellow	HTPVC-20-STR-YELLOW
10 ft.	wire, 20 AWG, stranded, hi-temp PVC - red	HTPVC-20-STR-RED
10 ft.	wire, 20 AWG, stranded, hi-temp PVC - black	HTPVC-20-STR-BLACK
10 ft.	wire, 20 AWG, stranded, hi-temp PVC - white	HTPVC-20-STR-WHITE
10 ft.	wire, 20 AWG, stranded, hi-temp PVC - blue	HTPVC-20-STR-BLUE
10 ft	wire, 20 AWG, stranded, hi-temp PVC - violet	HTPVC-20-STR-VIOLET
10 ft.	wire, 20 AWG, stranded, hi-temp PVC - orange	HTPVC-20-STR-ORANGE
10 ft.	wire, 18 AWG, stranded, hi-temp PVC - black	HTPVC-18-STR-BLACK
2 ft	wire, 20 AWG, solid bare buss wire, tinned copper	BW-20
2 ft	wire, 16 AWG, solid bare buss wire, tinned copper	BW-16
2 ft	shielded wire, interconnect	IW-2330
5 ft	aluminum tape, 2" width, self adhesive	P-TAPE-ALUM
1 ft	double stick tape, 1" wide (not listed in stock – applied to back of plastic back plate)	
1	heat shrink, 1/8" - BLACK, 6" piece	TS-HS-1-8
11 in.	G10 glass epoxy board (11”x 3-1/8”)	BP-125BOARD-RED
68	turret, hollow Keystone 1540-4	BP-TURRET
1	470 / 1/2W, 1% metal film	R-273-470
2	820 / 1/2W, 1% metal film	R-273-820
2	1.5K / 1/2W, 1% metal film	R-273-1.5K ← mod.
1	2.7K / 1/2W, 1% metal film	R-273-2.7K
2	5.6K / 1/2W, 1% metal film	R-273-5.6K
1	22K / 1/2W, 1% metal film	R-273-22K
1	27K / 1/2W, 1% metal film	R-273-27K
2	33K / 1/2W, 1% metal film	R-273-33K
1	47K / 1/2W, 1% metal film	R-273-47K
1	51K / 1/2W, 1% metal film	R-273-51K
1	56K / 1/2W, 1% metal film	R-273-56K ← mod.
4	68K / 1/2W, 1% metal film	R-273-68K
1	82K / 1/2W, 1% metal film	R-273-82K
5	100K / 1/2W, 1% metal film	R-273-100K

qty	*description*	*TD part number*
2	220K / 1/2W, 1% metal film	R-273-220K
2	470K / 1/2W, 1% metal film	R-273-470K
4	1M / 1/2W, 1% metal film	R-273-1M
2	1.0 / 1W metal oxide	R-273-1
3	10K / 1W, metal oxide power resistor	R-273-10K
1	15K / 1W, metal oxide power resistor	R-273-15K
1	220K / 1W, metal oxide power resistor	R-273-220K
2	470 / 3W metal oxide	R-282-470
1	1K / 3W metal oxide	R-282-1K
2	10K / 3W metal oxide	R-282-10K
1	22K / 3W metal oxide	R-282-22K
1	47pfd / 500V; silver mica	CP-SM-47-500V
1	100 pF / 500V; silver mica	CP-SM-100-500V
1	250pfd / 500V; polystyrene	CP-PFC-250-500V
1	500pfd / 500V; polystyrene	CP-PFC-500-500V
1	.0022ufd / 630V; Mallory 150	CP-M150-0022-630V ← mod.
7	.022ufd / 630V; Mallory 150	CP-M150-022-630V
2	.1ufd / 630V; Mallory 150	CP-M150-1-630V
2	.68 / 100V, Mallory 150	CP-M150-68-100V
2	50ufd / 50ufd @ 500V	CP-JJ-50X2-500V
2	capacitor clamp, small	CP-CLAMP1
1	16ufd / 475V	CP-FT-16-475V
1	47ufd / 500V	CP-FT-47-500V
1	330uF / 16V	CP-ST-330-16V
2	10uF / 160V	CP-ST-10-160V
1	5K linear	RV24A-10D2-15R1-B-5K
1	25K linear	RV24A-10D2-15R1-B-25K
1	250K linear	RV24A-10D2-15R1-B-250K
4	1M audio	RV24A-10D2-15R1-A-1M
1	50K trimmer pot	BP-BIASPOT-50K
1	Turret setter kit	DIY-PFT-KIT

The following additional parts are particular to your choice of head or combo kits:

head kit -

1	cabinet, small box black tolex Marshall style	CAB-MAR-SMBOX

combo kit -

1	cabinet, 1x12 combo Marshall style	CAB-MAR18
1	speaker, 12",(various 75W speakers)	our secret hidden stock
1	1/4" phone plug, Switchcraft P-280	P-280
1 ft.	techflex, yellow	TS-PTNO-1-4
2 ft.	wire, 18 AWG, stranded, hi-temp PVC - white	HTPVC-18-STR-WHITE

4 Cabinet Preparation

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 with the cabinet.

4.1 Cabinet Inventory

Combo Cabinet

1. **Handle w/ mounting hardware** – There should be a single flat black handle with two gold end covers mounted to the top of the cabinet.
2. **Feet, rubber** – There should be four rubber feet attached with screws.
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 five panel screws. All panel screws should have a finishing washer.
4. **Baffle screws** – There should be eight black oxide coated screws with matching black finishing washers holding the baffle in the cabinet.
5. **Speaker bolts** – There should be four black oxide coated bolts for securing the speaker to the baffle board.

Head Cabinet

1. **Handle w/ mounting hardware** – There should be a single flat black handle with two gold end covers mounted to the top of the cabinet.
2. **Feet, rubber** – There should be four rubber feet attached with screws.
3. **Back panel w/ screws** – The back panel should be secured with four panel screws.

With either cabinet, inspect all screws. I've found screws that weren't fully tightened during assembly. These loose screws will buzz when vibrated by the speaker or speaker cab.

4.2 Drilling the Four Chassis Mounting Bolts

CAUTION *The following steps call for drilling the mounting holes in the cabinet for the chassis. Make sure to review, reread and remeasure at each step to reduce potential drilling errors. Because (as the wise old amp builder's saying goes) what is drilled, cannot be undrilled.*

4.2.1 Combo Cabinet

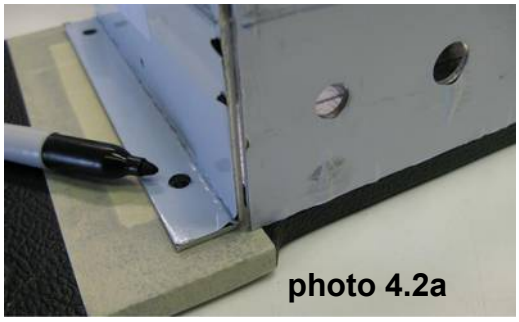
photo 4.2a

Step 1 – Remove the back panel and lay the panel on the work table with the vinyl covering facing down.
Step 2 – With the aluminum chassis, center the chassis on the back panel with the control panel side of the chassis flush against the back panel cutout (photo 4.2a).
Step 3 – Make a mark through each of the four mounting holes of the chassis onto the back panel (photo 4.2a).
Step 4 – Drill a small 1/8” pilot hole in the center of each of these marks.
Step 5 – Once the pilot holes have been drilled, drill the final 5/16” hole down the center of each of these holes.
Step 6 – With a hobby knife, clean the edges of the holes by cutting off any excess vinyl covering left from the drilling operation.

4.2.2 Head Cabinet

Step 1 – Place the cabinet upside down with handle against the bench and front of cabinet facing you.
Step 2 – Lay two strips of masking tape on each end just on the inside of the feet.
Step 3 – On both strips of masking tape, make marks 1-3/8", following the curve, from the outside edge of the cabinet (photo 4.2b).
Step 4 – Locate the front of the chassis (the front has the four input holes). Now, align the front of the chassis mounting lips on the 1-3/8" mark (photo 4.2b). Visually center the chassis over the front opening of the cabinet. (photo 4.2c).
Step 5 – Make a mark through the four chassis mounting holes onto the tape. Move the chassis to the side. (photo 4.2d)
Step 6 – Drill a 5/16" hole in each of the four marks. Remove the masking tape. (Increase this hole size to 3/8" if needed).
Step 7 – With a hobby knife, clear the holes of any remaining vinyl covering.

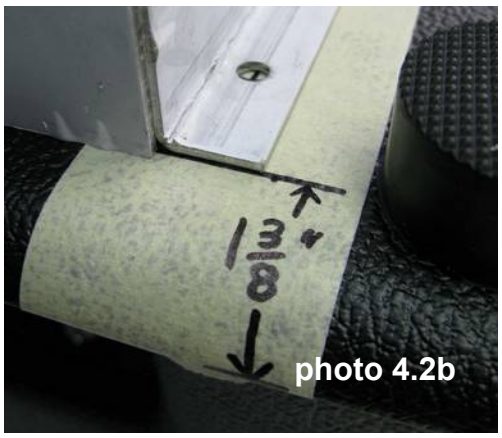

photo 4.2b

photo 4.2d

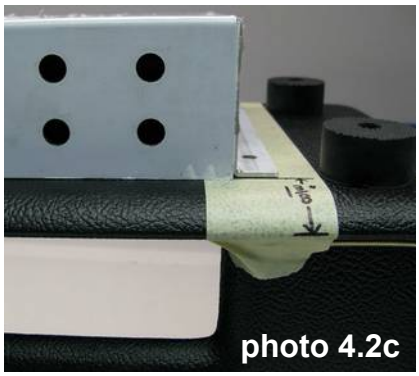
photo 4.2c

4.3 Installing the Shielding Tape

4.3.1 Combo Cabinet

Step 1 – Place the cabinet back panel with the vinyl side down toward the desk.
Step 2 – Cut three lengths of shielding tape, each 20" long.
Step 3 – Remove the backing from the first of these 20" 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 centered between the chassis mounting holes.
Step 5 – Apply the second strip of tape along the lower edge of the previous tape, overlapping about 1/8" the entire length (photo 4.3b).
Step 6 – Apply the final shielding tape strip along the upper edge of the first tape, overlapping about 1/8" (photo 4.3b).
Step 7 – With a hobby knife, Clear the mounting holes of shielding tape.

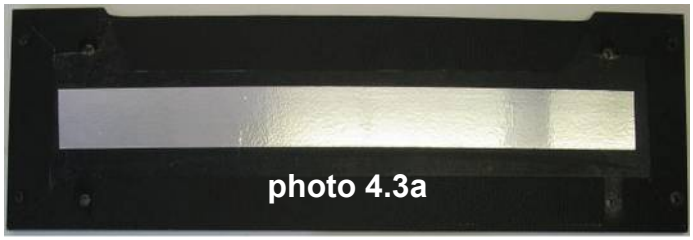
photo 4.3a

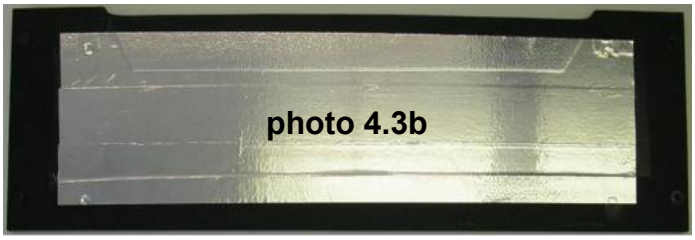
photo 4.3b

4.3.2 Head Cabinet

Step 1 – Place the cabinet with the back open toward you.
Step 2 – Cut three lengths of shielding tape, each 18” long.
Step 3 – Remove the backing from the first of the 18” 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 first aluminum tape strip to the inside of the cabinet, centered down the middle between the chassis mounting holes (photo 4.3c).
Step 5 – Apply the second shielding strip to the cabinet along the lower edge of the previous tape, overlapping about 1/8” the entire length.

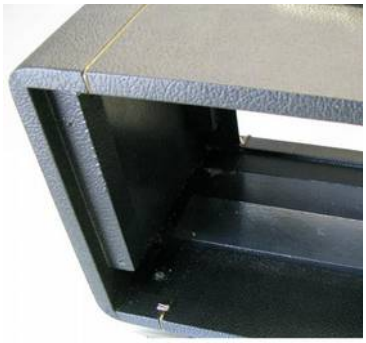
photo 4.3c

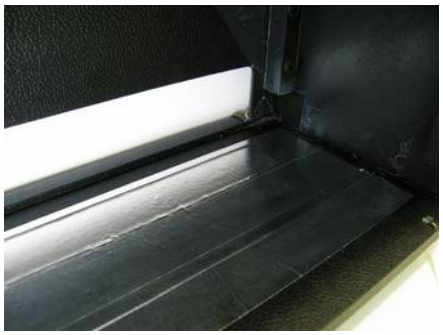
photo 4.3d

Step 6 – Apply the third strip along the upper edge of the first tape, overlapping about 1/8” along the entire length (photo 4.3d).
Step 7 – Clear the mounting holes of shielding tape with a hobby knife.

4.4 Wiring the Speaker Cable to the Speaker (Combo Cabinet)

NOTE *For hints on improved soldering skills, review Appendix B at the end of this manual. Additionally, see “How to Solder”, http://www.youtube.com/watch?v=cIDydYIVTqU*

Step 1 – Measure a 14” length of white 18AWG wire, and a 14” length of black 18AWG wire.
Step 2 – Twist these black and white wires tightly together the full length.

NOTE *To get an even, tight twist, use a handheld drill to twist the two wires together. Place the loose wire ends into the drill chuck and slowly turn the drill until the wires are well twisted.*

Step 3 – At one end of this twisted pair, strip the insulation back ½ ” from both wires and tin these two wires

NOTE *The ¼” phone plug was invented for use in telephone switchboards in 1878. And 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 – Unscrew the barrel of the ¼ ” phone plug and solder the two tinned wires to the plug; white to center and black to shield (photo 4.3a).
Step 5 – Slide the length of yellow Techflex over this twisted pair right up to the center conductor of the plug (photo 4.3b).
Step 6 – Slide the 3” length of 3/8” heat shrink up over the Techflex up to the center conductor of the plug (photo 4.3b).


photo 4.3a

Step 7 – Shrink the heat shrink in place with a heat gun (photo 4.3b)

CAUTION *Be careful when applying heat to the heatshrink, especially at the point where the techflex and heatshrink meet. The techflex will quickly melt if excess heat is applied.*

photo 4.3b

photo 4.3c

Step 8 – Install the remaining 3" heat shrink length over the tech flex at the opposite end of the twisted pair near the cut end.
Step 9 – Shrink the heat shrink in place with a heat gun.
Step 10 – At the opposite end of the twisted wire pair, strip back the insulation ¼" and tin these two wires.
Step 11 – Solder these wires to the terminals of the speaker; the white wire to the "+" terminal and the black wire to the "-" terminal (photo 4.3c).

4.4 Mounting the Speaker in the Cabinet (Combo Cabinet)

NOTE *The speaker that comes with the combo kit could be one of several different speakers (not just Celestion as shown).*

Step 1 – Remove the four speaker mounting screws from the speaker baffle board.
Step 2 – With speaker in hand, carefully align the speaker mounting holes to the baffle board mounting holes (I recommend installing the speaker with connecting terminals on top).
Step 3 – Install a single #8 flat washer on each of the four mounting screws prior to installation.
Step 4 – Install the four mounting screws through the speaker mounting holes into the baffle board. Firmly tighten down.

photo 4.4a

5 Chassis Preparation, Assembly, and Wiring

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MOD *There are several great modifications that are possible on this amp. I recommend reviewing these mods prior to beginning the following assembly steps to see if there is something that interests you.*

5.1 Installing the Captive Nuts into the Chassis

WARNING *During all drilling and cutting operations, it is important to wear proper eye protection and follow appropriate safety precautions.*

photo 5.1a

Step 1 – Locate the four mounting holes on the outwardly bent flange edges of the chassis, two on each edge.
Step 2 – Remove the protective white plastic on just these edges.
Step 3 – With a 5/16” drill bit, enlarge all four of these holes and remove any burrs.
Step 4 – Place the chassis, flange down, on a flat solid surface (concrete floor is good).
Step 5 – Place an inset nut on the flange directly over one of the newly drilled 5/16” holes (photo 5.1a).
Step 6 – With a few blows from a hammer to the top of the insert nut, seat the nut firmly into the hole and flush against the chassis flange. To assist in making sure the nut is firmly seated, you can also insert the chassis edge and nut into a vise and press together (photo 5.1b).

photo 5.1b

Step 7 – Inspect the nut to insure it is well seated (photo 5.1c). Repeat step 6 as needed.
Step 8 – Repeat above for the remaining three nuts.
Step 9 – Once all the nuts have been mounted, test fit in the cabinet and modify the hole size as needed.

photo 5.1c

5.2 Drilling New Holes for Mounting Can Capacitors

Step 1 – Measure and mark appropriate side of chassis with pen according to (drawing 5.2a).
Step 2 – Use a center punch to mark the point to be drilled.
Step 3 – Drill the 5/32” holes at each of these marks and debur the holes.
Step 4 – Remove all remaining protective plastic covering from chassis.

drawing 5.2a

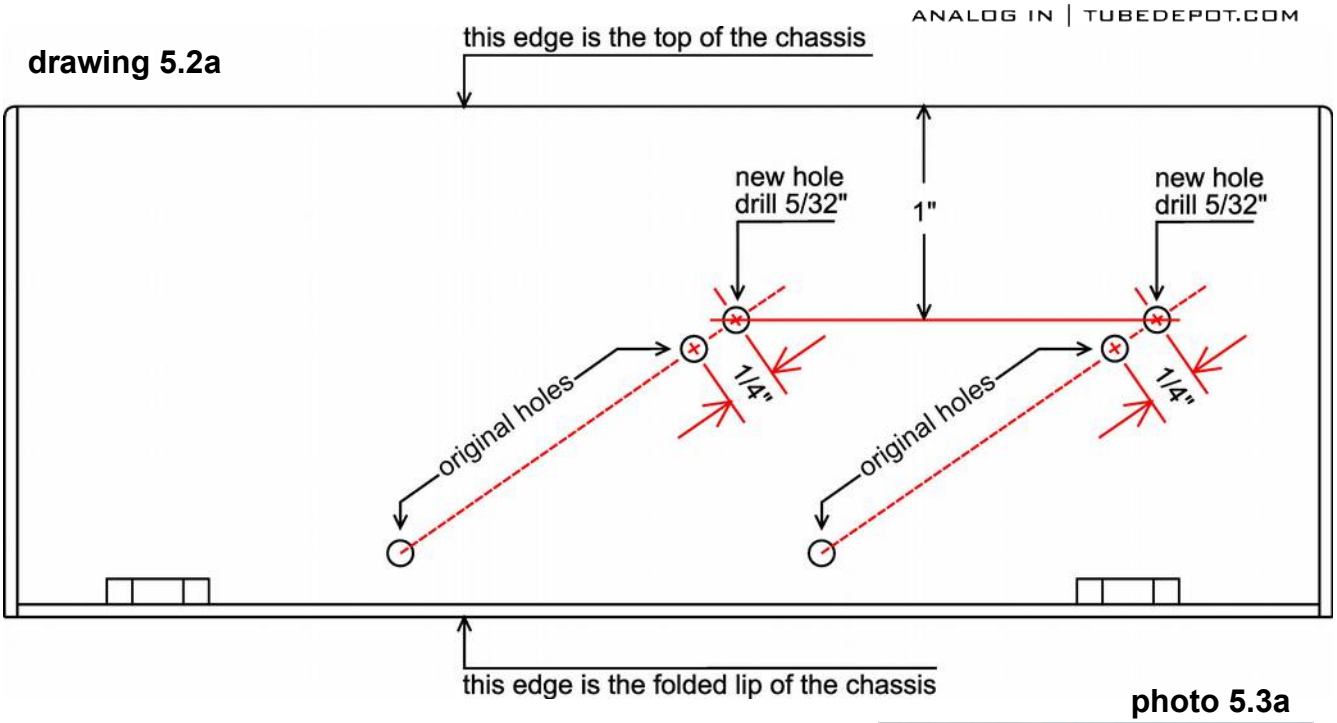


photo 5.3a

5.3 Installing the Grommets

Step 1 – install 1/2” grommets in the appropriate holes on the top of chassis (photo 5.3a).

5.4 Installing the Tube Sockets

Step 1 – Modify the tube shield covers by flattening both ends of the base so that the mounting screws will properly lay flush against the chassis (photos 5.4a and 5.4b).
Step 2 - Install the three 9 pin tube sockets in the appropriate holes in the chassis. Note alignment of sockets and which #6 screws are used (drawing 5.4a).
Step 3 – Install the three octal tube sockets in the appropriate holes in the chassis. Make sure to include the #6 solder terminals on the power tube sockets. Note alignment of sockets and which #6 screws and nuts are used with each socket (drawing 5.4b).

photo 5.4a

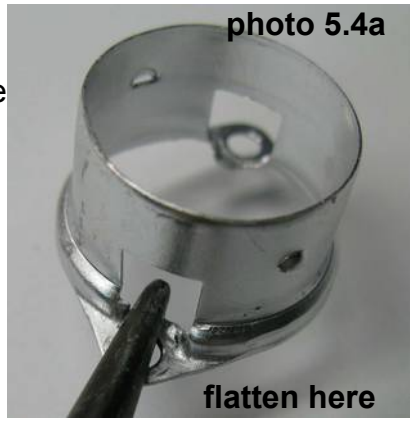
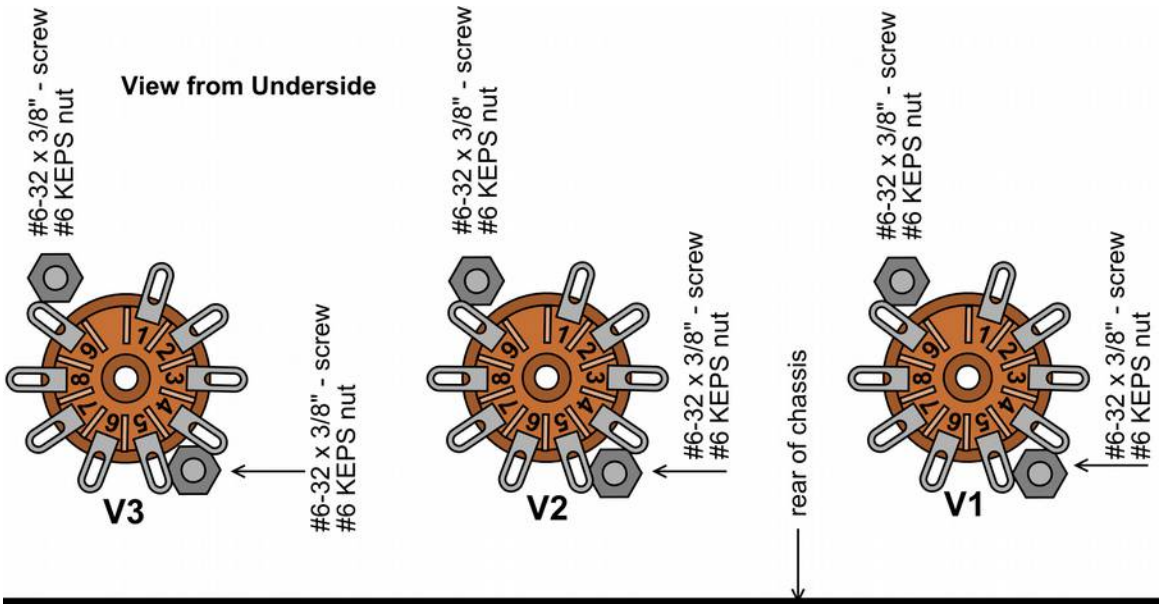
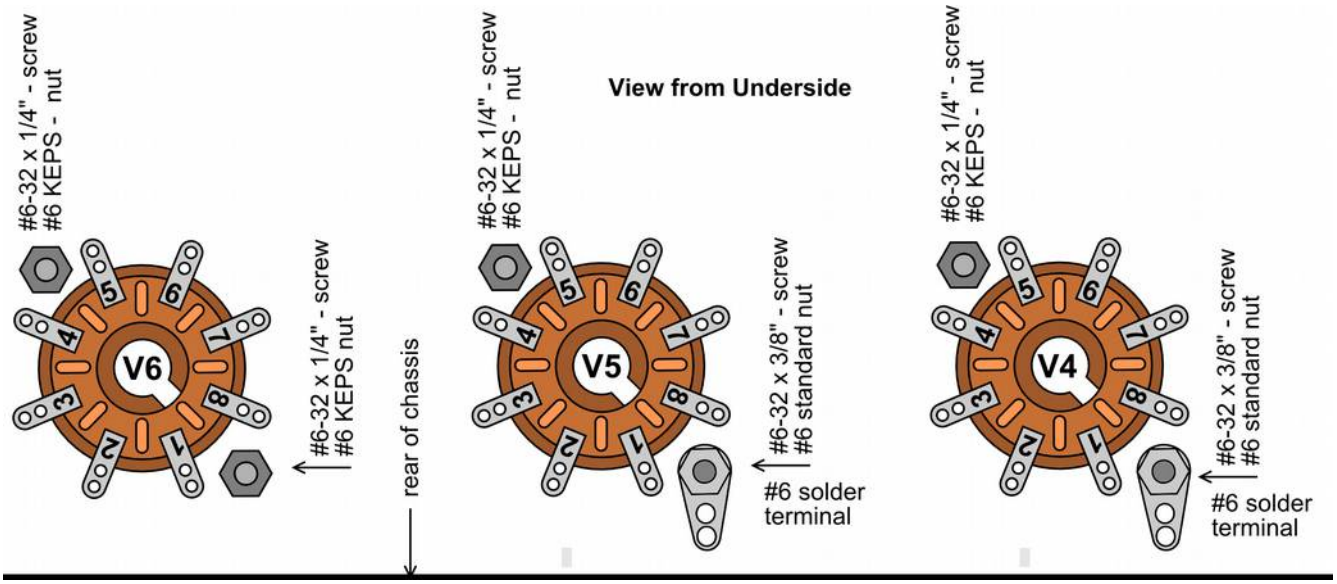


photo 5.4b



9 pin socket installation **Drawing 5.4a**

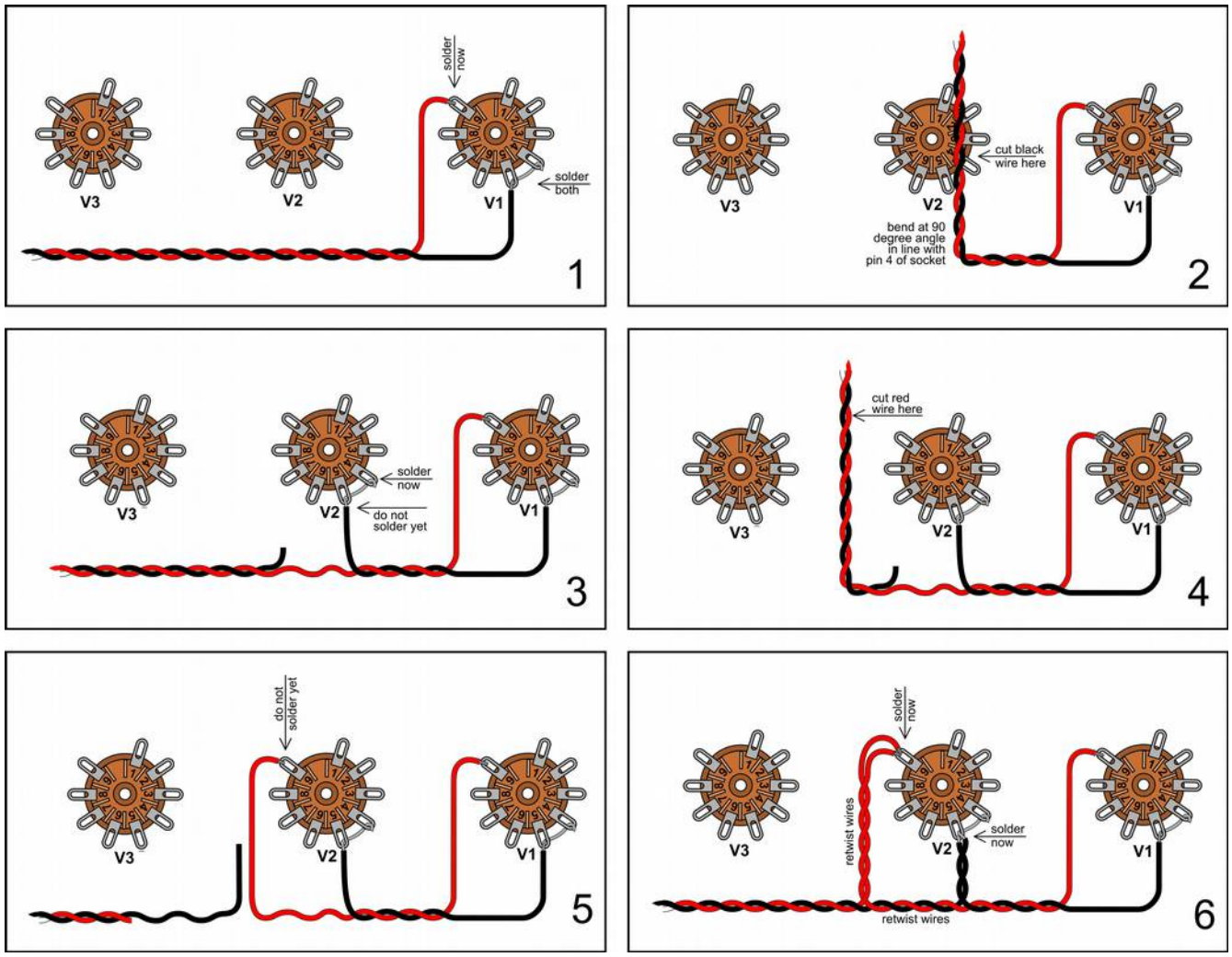


Octal socket installation **Drawing 5.4b**

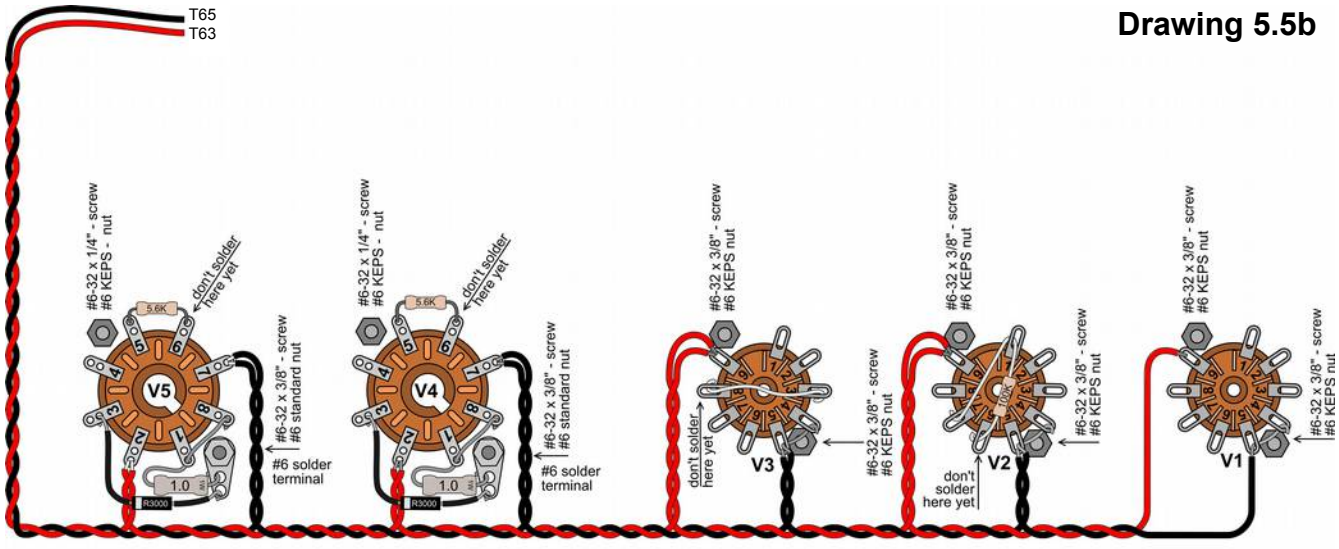
5.5 Wiring the Filaments

Step 1 – Use an electric drill to twist together 3-1/2 feet of 20AWG black and 20AWG red wires. The resultant dual twisted wire should be about 3 feet long.
Step 2 – Wire the filaments for the preamp and power tubes. Review the following drawings for method description (drawing 5.5a & 5.5b).

Drawing 5.5a

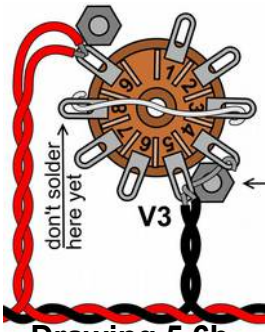


Drawing 5.5b

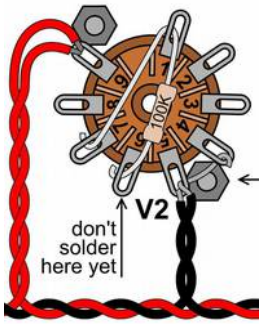


5.6 Preliminary Wiring of Tube Sockets

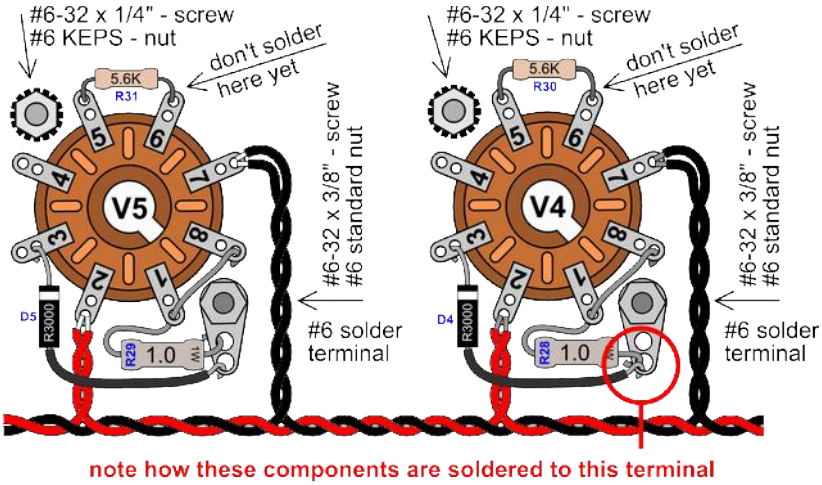
Step 1 – Wire a 100K / 1/2W resistor to the back of the V2 socket as shown (drawing 5.6a). Do not apply solder to pin 6 just yet.
Step 2 – Wire a jumper wire across the back of the V3 (pins 3 & 8) socket as shown (drawing 5.6b). Do not apply solder to pin 8 just yet.
Step 3 – Wire a 5.6K / 1/2W resistor to the back of V4 and V5 sockets as shown. Do not solder where indicated (drawing 5.6c).
Step 4 – Wire a 1.0 / 1W resistor to pins 1 & 8 of V4 and V5 sockets as shown (drawing 5.6C)
Step 5 – Cut four 3/4" pieces of recycled 20AWG plastic wire insulation and place over the leads of the R3000 diodes.
Step 6 – Wire the two R3000 diodes to the V4 and V5 sockets as shown (drawing 5.6C). Pay careful attention to polarity of diodes.



Drawing 5.6b



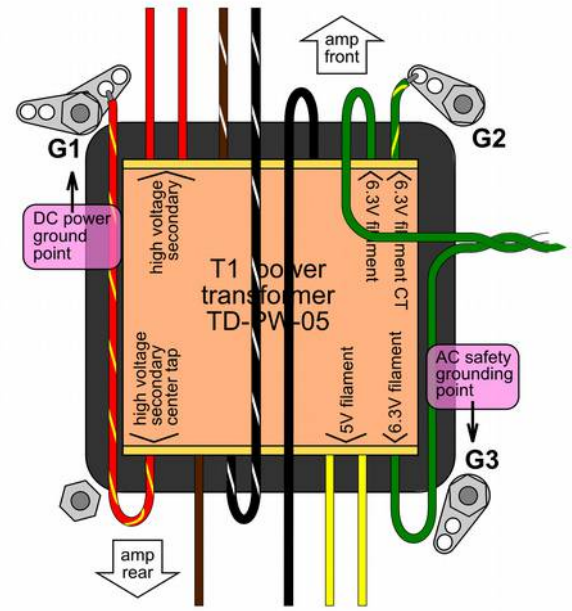
Drawing 5.6a



Drawing 5.6c

5.7 Installation of Hardware, Transformers and Faceplate

Step 1 – Install the power transformer with the yellow wires coming through the chassis cutout toward the rear of the chassis. Refer to drawing to determine the proper location of the four #8 solder terminals (drawing 5.7a). Use three standard #8 nuts on the solder terminals and one KEPS #8 nut on the remaining mounting bolt.
Step 2 – Install the four aluminum standoffs to the chassis with four #6-32 x 1/4" screws.
Step 3 – Install the output transformer with the red, blue and white wires coming through the grommet nearest the front of the chassis and with the remaining yellow, orange, violet, and black wires coming through the grommet nearest the back of the chassis. Secure with four #8x32-3/8" screws and four #8 KEPS nuts.
Step 4 – Install the choke with the two black wires coming through the remaining grommet. Secure with two #8x32-3/8" screws and two #8 KEPS nuts.



Drawing 5.7a

Step 5 – Remove protective plastic from faceplate and rear plate.
Step 6 – Install faceplate along with input jacks, master volume, volume & tone controls, power and standby switches and indicator lamp (with rear lock washer). Refer to drawing for proper component alignments (drawing 5.15c).
Step 7 – Install IEC AC power entry connector into the square cut out on the back of chassis

(before installing rear plate). Snap firmly into place.
Step 8 – Remove backing of double stick tape on back of rear plate and Install the rear plate along with the two fuse holders and the two speaker jacks. The impedance selector will be installed later. Refer to drawing for proper component alignments (drawing 5.15c).

5.8 Tube / Solid State Rectifier Select Switch Installation

photo 5.8a

Step 1 – Drill a 1/4" hole through the back panel and chassis. This hole should be centered between the mains fuse and the IEC AC power entry connector (photo 5.8a).
Step 2 – Debur this 1/4" hole & install the mini DPDT switch.

5.9 Feedback select Switch Installation

photo 5.9a

Step 1 – Drill a 1/4" hole through the back panel and the chassis. This hole should be centered between the impedance selector and the nearest speaker jack (photo 5.9a).
Step 2 – Debur this 1/4" hole and install the mini SPDT (center off) switch.

5.10 Impedance Selector Installation

photo 5.10a

Step 1 – Enlarge the impedance selector hole to 13/32" with either a 13/32" drill bit or hand reamer.
Step 2 – Debur this 13/32" hole and install the impedance selector switch. Align this switch with the switch limit pin closest to the chassis surface (photo 5.10a).

5.11 Power Transformer Wiring,

Step 1 – Wire the power transformer primary (black and brown wires) according to your local AC mains supply to the power switch and the AC IEC connector. (drawings 5.11a and 5.11b).
Step 2 – Wire the appropriate 18AWG wire between the power switch and input fuse holder (drawing 5.11a or 5.11b).
Step 3 – Wire the appropriate wire (18 AWG black) between the AC fuse holder and the AC IEC connector (drawing 5.11a or 5.11b).
Step 4 – Wire the rectifier filament (yellow wires) to the rectifier tube (drawing 5.11a or 5.11b).
Step 5 – With the standby switch, insure the word "MEXICO" on the side of the switch is facing the lamp. Wire the HV (red wires) to the standby switch (drawing 5.11a or 5.11b).
Step 6 – Wire the filament center tap (green with yellow stripe) to the grounded solder terminal G2 (drawing 5.11a or 5.11b). Save the remaining wire for future use.
Step 7 – Wire the HV center tap (red with yellow stripe) to the grounded solder terminal G1 (drawing 5.11a or 5.11b).
Step 8 – install a wire (recycled wire from filament center tap) between the AC IEC connector and the appropriate grounded solder terminal G3 (drawing 5.11a or 5.11b).

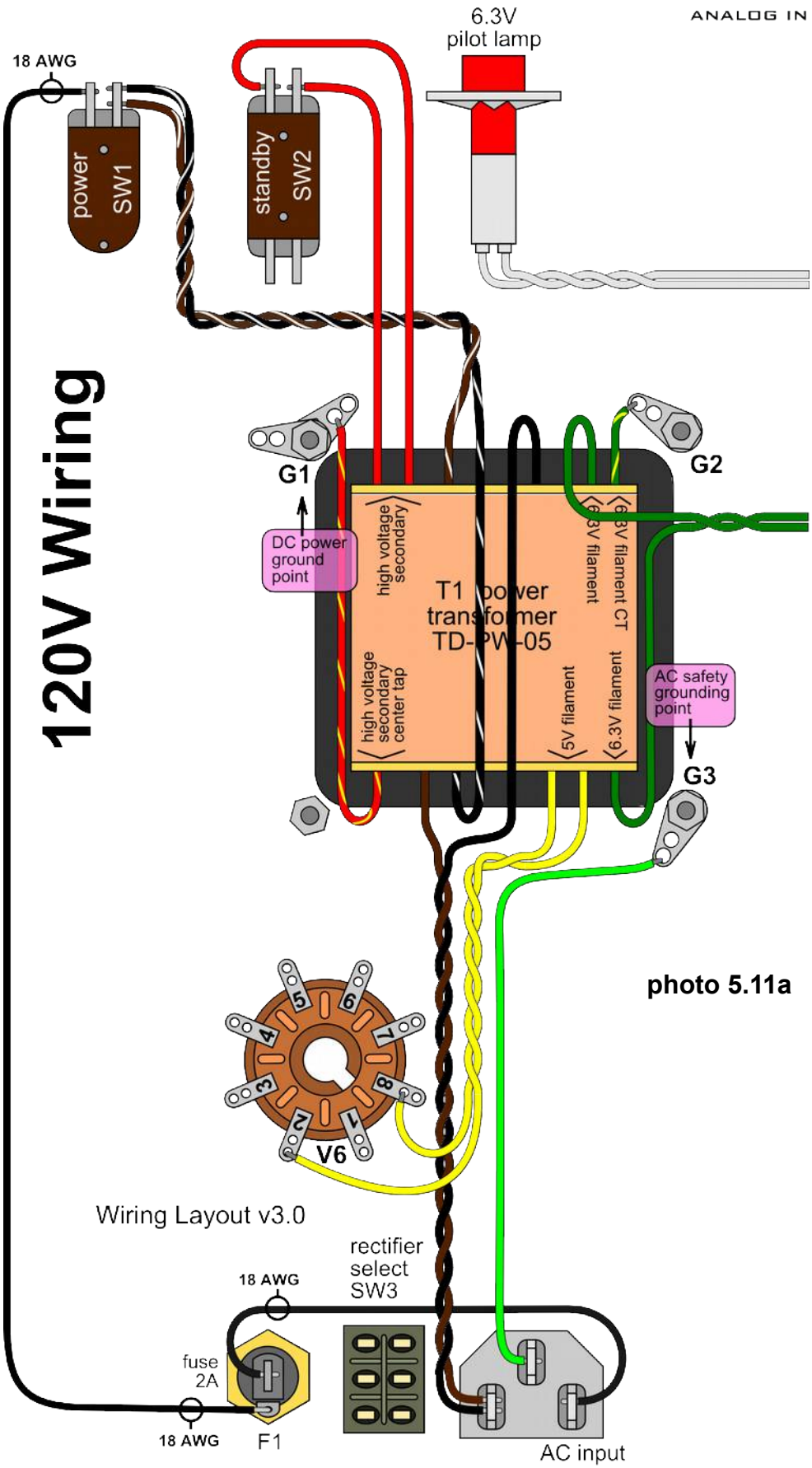

120V Wiring
18 AWG
power SW1
standby SW2
6.3V pilot lamp
G1
G2
G3
DC power ground point
high voltage secondary
6.3V filament
6.3V filament CT
T1 power transformer TD-PW-05
high voltage secondary center tap
5V filament
6.3V filament
AC safety grounding point
V6
Wiring Layout v3.0
rectifier select SW3
18 AWG
fuse 2A
18 AWG
F1
AC input

photo 5.11a

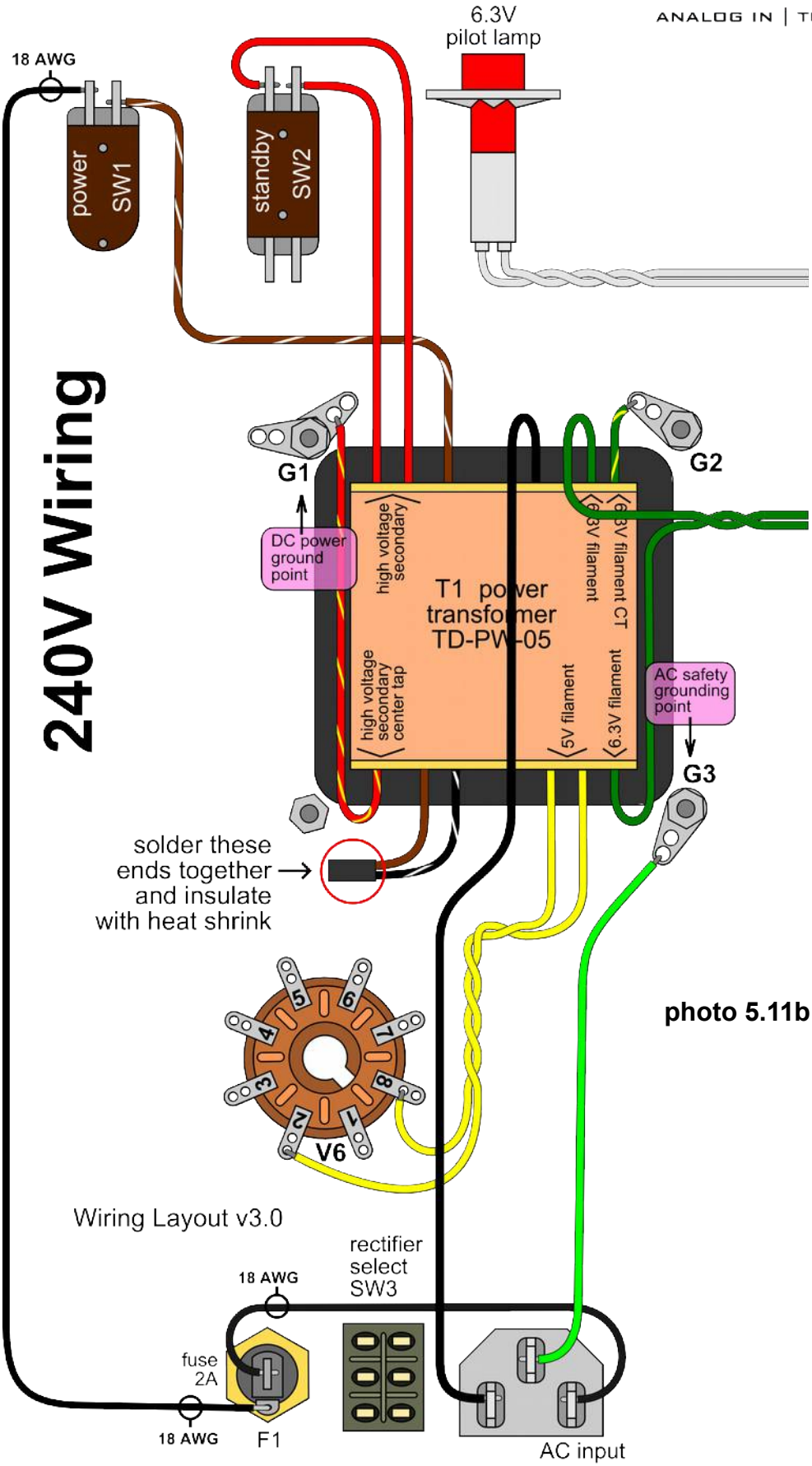

240V Wiring
18 AWG
power SW1
standby SW2
6.3V pilot lamp
G1
G2
G3
DC power ground point
high voltage secondary
T1 power transformer TD-PW-05
6.3V filament
6.3V filament CT
high voltage secondary center tap
5V filament
6.3V filament
AC safety grounding point
solder these ends together and insulate with heat shrink
V6
Wiring Layout v3.0
rectifier select SW3
18 AWG
fuse 2A
18 AWG
F1
AC input

photo 5.11b

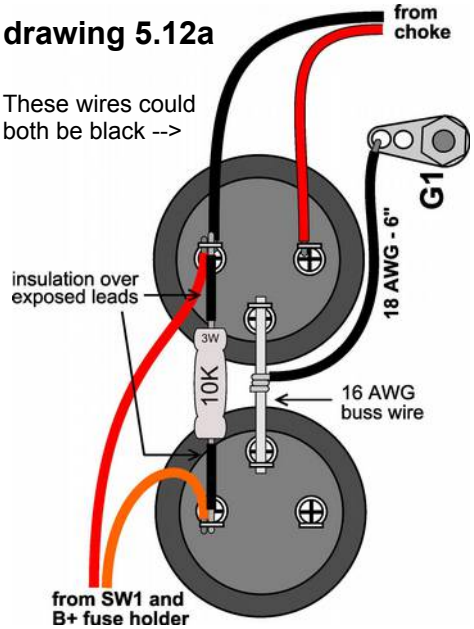
5.12 Wiring the High Voltage (B+) Power Supply

photo 5.12a

Step 1 – Wire the two diodes to the back of the rectifier tube socket (drawing 5.12b). Be sure the polarity of the diodes are installed as shown. Save space by mounting the diodes directly over the socket.
Step 2 – Twist together the saved wires from installing the standby switch and solder one end of these wires to the remaining standby switch terminals and the other end to the rectifier tube socket (drawing 5.12b).
Step 3 – Wire the rectifier select switch to the B+ fuse holder and tube rectifier socket as shown (drawing 5.12b).
Step 4 – Connect a red 20AWG wire between the tube rectifier and the B+ fuse holder (drawing 5.12b)
Step 5 – Wire a black 20AWG wire, 12” long on the G1 grounded solder lug (drawing 5.12b).
Step 6 – Wire a black 20AWG wire, 16” long on the G1 grounded solder lug (drawing 5.12b).
Step 7 – Wire a black 18AWG wire, 6” long on the G1 grounded solder lug (drawing 5.12a).
Step 8 – Loosely mount the two can caps in their respective holders as shown (photo 5.12a).

NOTE Before soldering the can cap, thoroughly scrape the three contacts with a hobby knife or equivalent to insure good solder connections.

drawing 5.12a

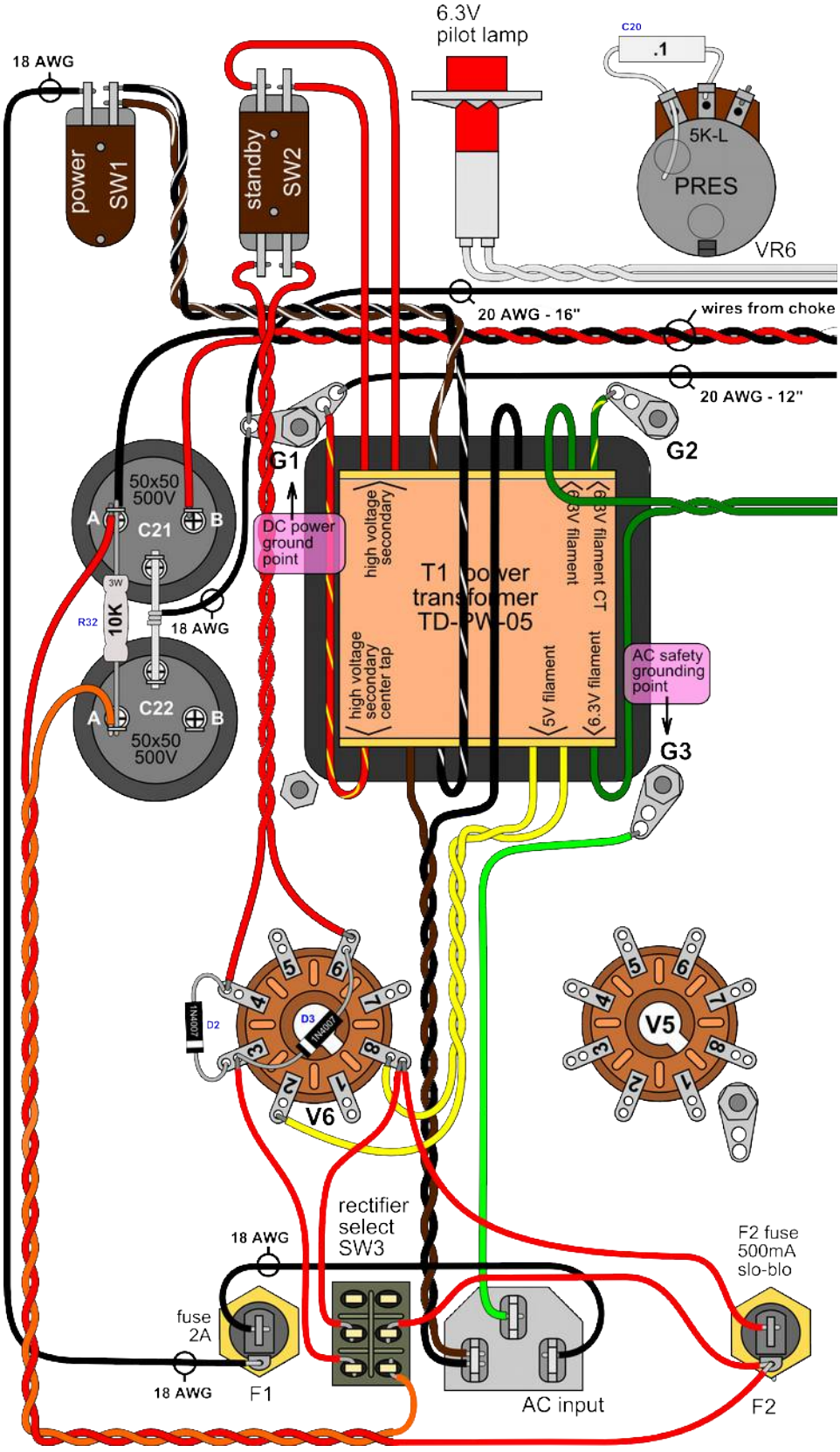


Step 9 – Temporarily mount the two can caps to the chassis with #6-32 x 1/4” screws and #6 KEPS nuts. Rotate the caps to where the ground tabs face each other (drawing 5.12a).
Step 10 – Remove the caps and holders from the chassis and tighten down the caps into their holders.
Step 10 – Reinstall the caps and holders into the chassis.
Step 12 – Install a short piece of 16AWG bare buss wire between the two ground lugs (drawing 5.12a).
Step 13 – Solder the end of the 6” length of 18AWG black wire from the grounded solder terminal, G1 to the middle of the buss wire between the can caps (drawing 5.12a).
Step 14 – cut two 3/4” lengths of recycled insulation and install on the leads of the 10K / 3W resistor.
Step 15 – Install the 10K / 3W resistor across the terminals of the two can caps (drawing 5.12a and 5.12a). Do not solder this resistor in place just yet.
Step 16 – Connect the leads from the choke to the terminals of the can cap (drawing 5.12a). Solder only the terminal with the single choke lead.

NOTE With some models of choke, both wires are black. The wires are not polarized therefore soldering to either terminal is correct.

Step 17 – Twist a red and an orange 20AWG wires together to form a 10” twisted pair cable.
Step 18 – Wire the orange wire of this cable to the rectifier switch and the red wire to the B+ fuse holder (drawing 5.12b).

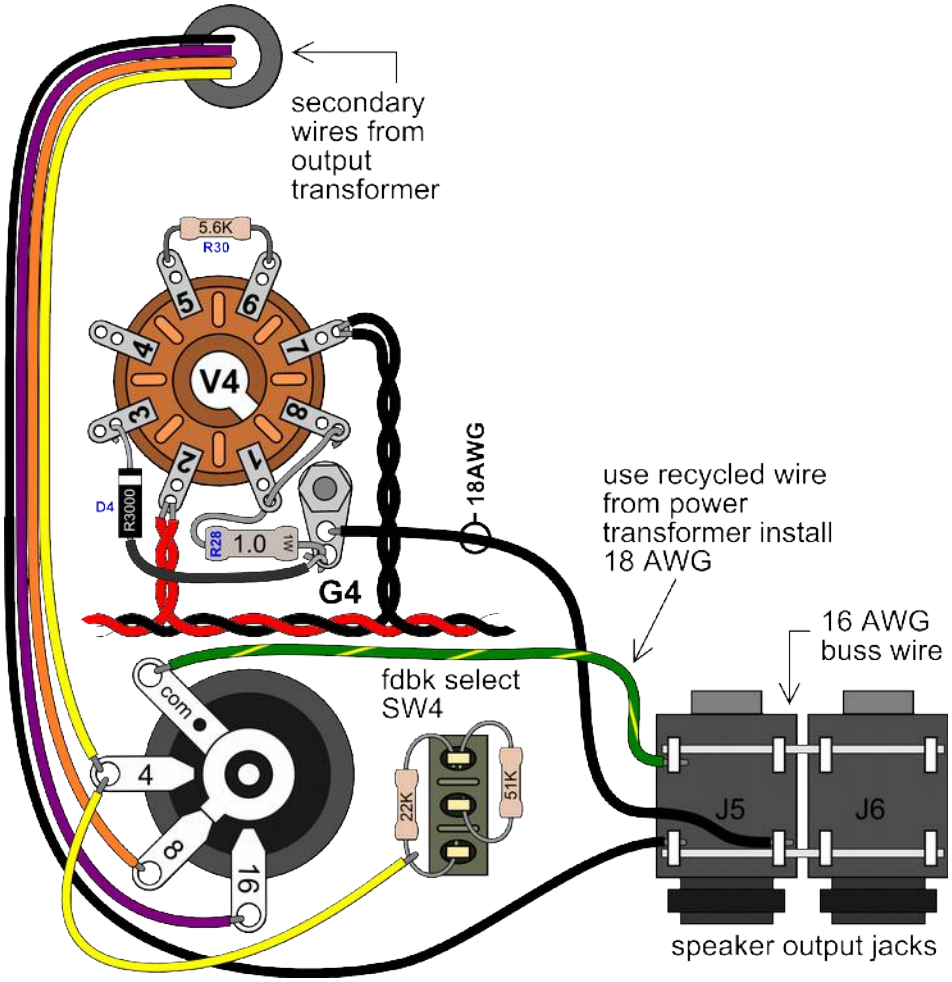
Step 19 – Run these wires along the chassis to the can caps and solder the red wire to the juncture of the wire from the choke and the 10K resistor on the can cap (drawing 5.12a).
Step 20 – Solder the orange wire to the terminal at the opposite end of the 10K resistor.



drawing 5.12b

5.13 Wiring the Output Transformer, Feedback Switch, & Speaker jacks

Step 1 – Insure that you have the TR-OT-07 output transformer (if you have a different transformer, let us know). From the bundle of primary wires, solder the white wire to the side terminal of the B+ fuse holder (drawing 5.15c).
Step 2 – From this same wire bundle, solder the blue wire to pin 3 of V5.
Step 3 – From this same wire bundle, solder the red wire to pin 3 of V4. Keep this red wire long enough to reach V5, pin 3 just in case these two wires have to be exchanged.
Step 4 – Solder two lengths of 16AWG buss wire through the contacts of the output jacks as shown (drawing 5.13a).
Step 5 – Connect the bundle of secondary wires of the output transformer to the impedance selector as shown (drawing 5.13a).
Step 6 – Solder the black lead from the output transformer to the output jacks.
Step 7 – Solder a 3" piece of 18 AWG black wire from the grounded solder terminal G4 (at the V4 power tube) to the output jacks (drawing 5.13a).
Step 8 – Solder a 6" length of 18 AWG wire (recycled power transformer wire is fine) between the COM terminal of the impedance selector and output jacks (drawing 5.13a).
Step 9 – Install the two resistors on the rear of the feedback switch (drawing 5.13a).
Step 10 – Install a 20AWG wire between the 4 ohm tap of the impedance selector switch and the feedback selector switch as shown (drawing 5.13a).



drawing 5.13a

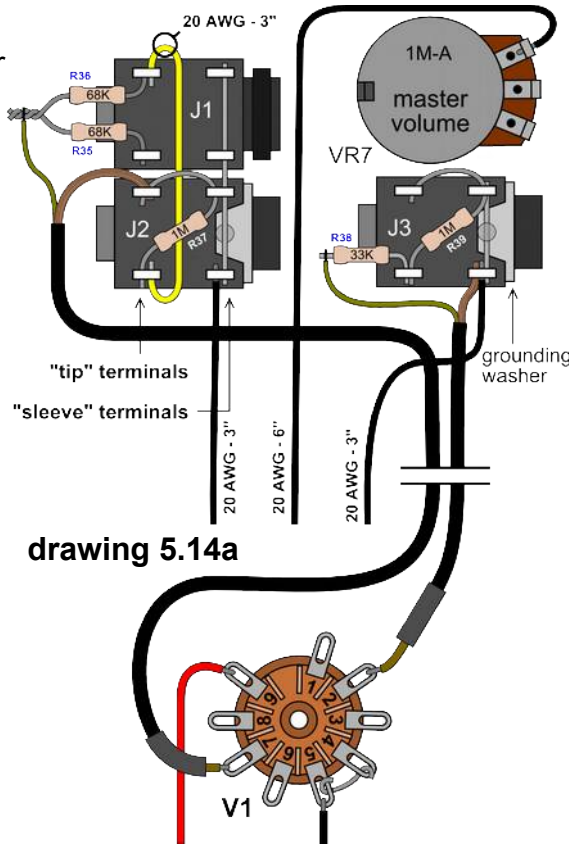
5.14 Wiring the Input Jacks

Step 1 – Remove the jacks J1, J2, J3, and the master volume from the chassis.
Step 2 – Remove the fiber washers from J2 and J3 and install the grounding washers in their place.

NOTE Do not reinstall the fiber washers on jacks J2 or J3.

Step 3 – install the two 68K resistors on J1.
Step 4 – Install the 1M resistor on J2 and "tack" solder in place (drawing 5.14a).

NOTE "tack" soldering refers to applying only enough solder to hold a component in place for assembly.



drawing 5.14a

Step 5 – Install 3" of 20AWG wire between the "tip" terminals of J1 and J2 as shown (drawing 5.14a).
Step 6 – Install the 1M resistor on J3 but do not solder at sleeve terminal just yet.
Step 7 – Solder the buss wire (16 AWG) across the sleeve terminals on J3 and solder only at juncture of 1M resistor.
Step 8 – Bend the terminals of the grounding washer of J3 to its sleeve buss and solder (photo 5.14a).
Step 9 – Install the 33K resistor on J3 and solder.
Step 10 – Strip 3/4" of the outside insulated jacket off the ends of two shielded cables and separate the shields and center conductors.
Step 11 – Strip 1/8" insulation from the center conductors of both cables and tin these ends.
Step 12 – Insert the shield from one of this cables into the lower sleeve terminal (drawing 5.14a) of J3.
Step 13 – Insert a 3" black 20AWG wire in this sleeve terminal along with the shield and solder in place. Be careful not to melt the insulation of the center conductor of the shielded cable.
Step 14 – On J3, solder the center conductor to the end of the 33K resistor (drawing 5.14a).

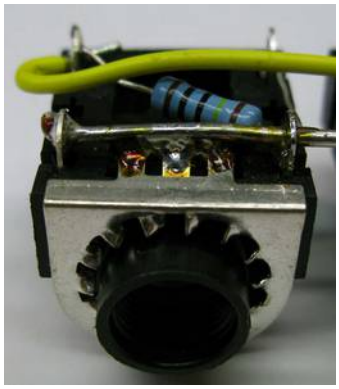


photo 5.14a

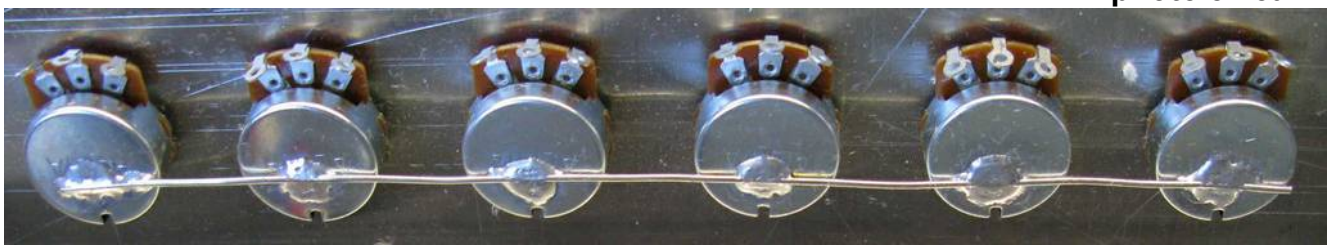
Step 15 – Reinstall all jacks into the chassis.
Step 16 – Solder 16AWG buss wire through the sleeve terminals of J1 & J2.
Step 17 – Solder the grounding washer of J2 to the jack buss (photo 5.14a)
Step 18 – Solder a 3" black 20AWG wire to the lower sleeve terminal of J2.
Step 19 – Make sure all jack terminals have been properly soldered.
Step 20 – Reinstall VR7 master volume control and solder a 6" black wire to the left outside terminal of VR7 (drawing 5.14a)
Step 21 – Run the shielded cables from the jack assembly to the appropriate terminals of V1 tube socket and trim to length.
Step 22 – Strip 1/2" of the insulated jacket off the ends of these two shielded cables and separate the shield and center conductor.

Step 23 – Cut the shield wire flush with outside insulation.
Step 24 – Install 1/2" of heat shrink to the cable, covering the point where the shield exited the outside insulation. This will insulate the ends of the shield where trimmed at the jacket.
Step 25 – Strip 1/8" of insulation from both center conductors and tin these ends.
Step 26 – Solder these ends to their appropriate terminals on tube socket, V1.

5.15 Wiring Volume, and Tone Controls

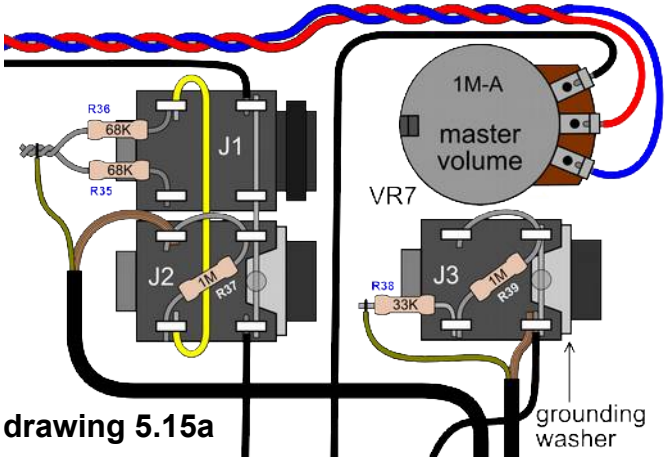
Step 1 – Lightly scrape a clean area on the back of each pot with a hobby knife. Apply a small dab of solder to this clean spot.
Step 2 – Cut an 8-1/2" length of 16 AWG buss wire and solder this wire to each of the solder spots on the back of the pots (photo 5.15a). It is easiest to attach the wire first to one of the end pots and work toward the opposite direction.

photo 5.15a



NOTE The buss wire along the back of the pots is to insure that if the pots come loose, they will not spin and break their connecting wires.

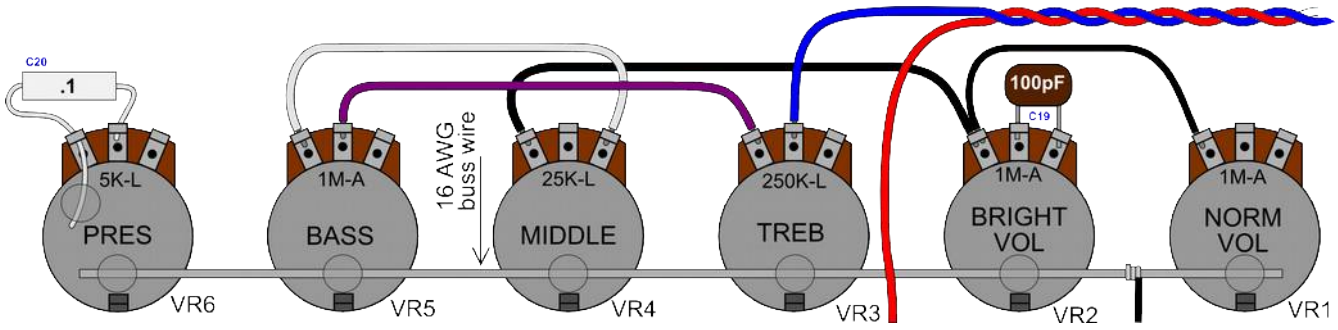
Step 3 – Twist 14" of red and blue 20 AWG wires together.
Step 4 – Solder one end of these wires to the master volume (drawing 5.15a).
Step 5 – Measure the blue wire to the middle terminal of the treble control, untwist and solder in place (drawing 5.15b).
Step 6 – Direct the remaining red wire behind the buss wire and to the bottom of the chassis.
Step 7 – Solder the 0.1 uF capacitor on the presence control between the center and outside terminals. Solder the cap lead to the back of the pot (drawing 5.15b).

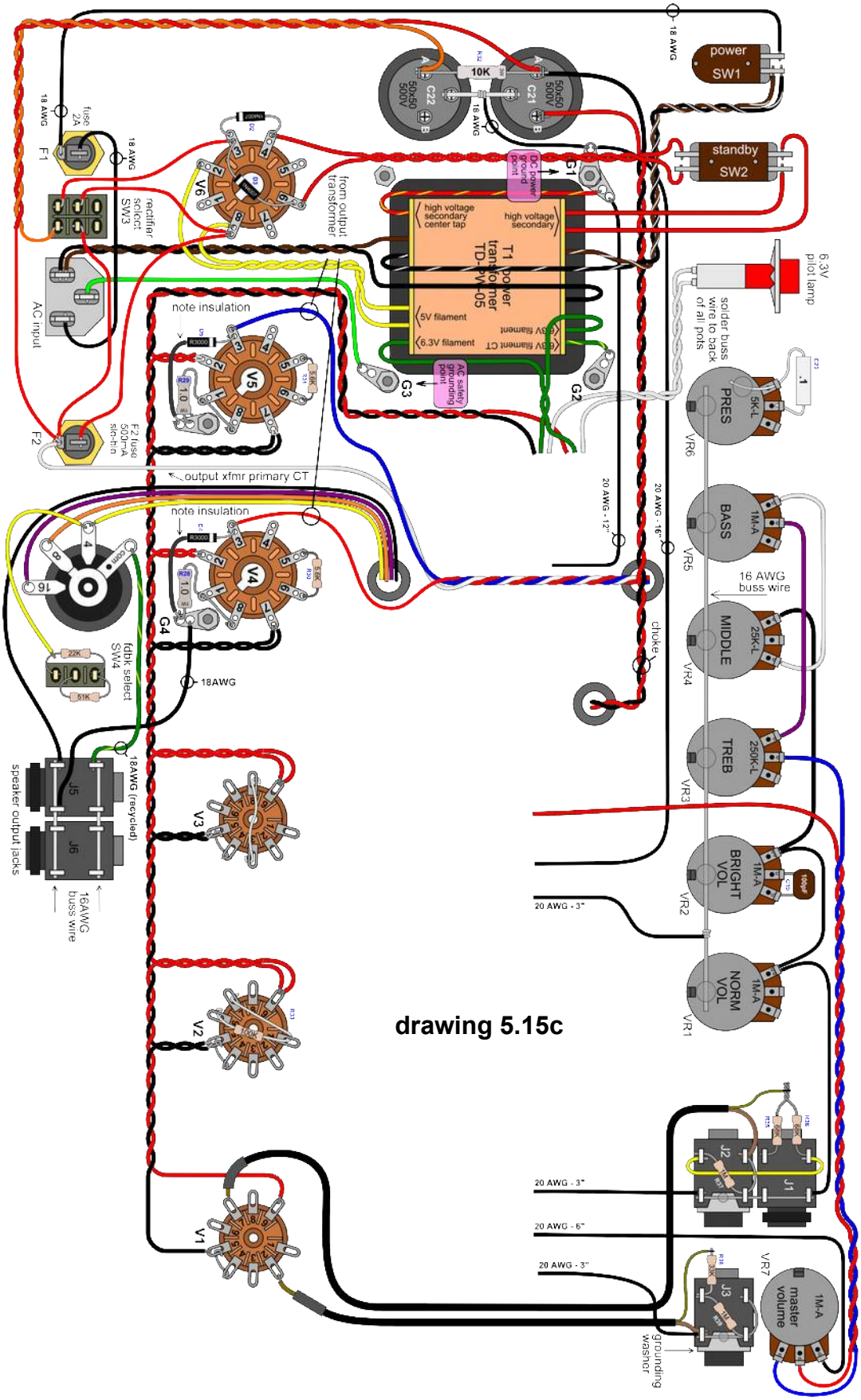


drawing 5.15a

Step 8 – Solder the 100pF capacitor on the bright volume control (drawing 5.15b).
Step 9 – Wire the remaining controls as shown (drawing 5.15b).

drawing 5.15b





drawing 5.15c

6 Turret Board Construction

6.1 G10 Board Drilling / Turret Installation

Step 1 – Print appropriate paper template and trim to the size of the G10 board. Template can be found at end of manual.
Step 2 – Transfer template information to appropriate sized blank G10 board.
Step 3 – Drill indicated holes (turrets, wire routing, standoff mounting) into G10 board.
Step 4 – Check fit the turret board to the standoffs already mounted to the chassis and adjust the four mounting holes as needed.
Step 5 – Verify that board correctly fits on standoffs, adjust mounting hole size(s) as needed.
Step 6 – Install the turrets into the drilled G10 board.

NOTE

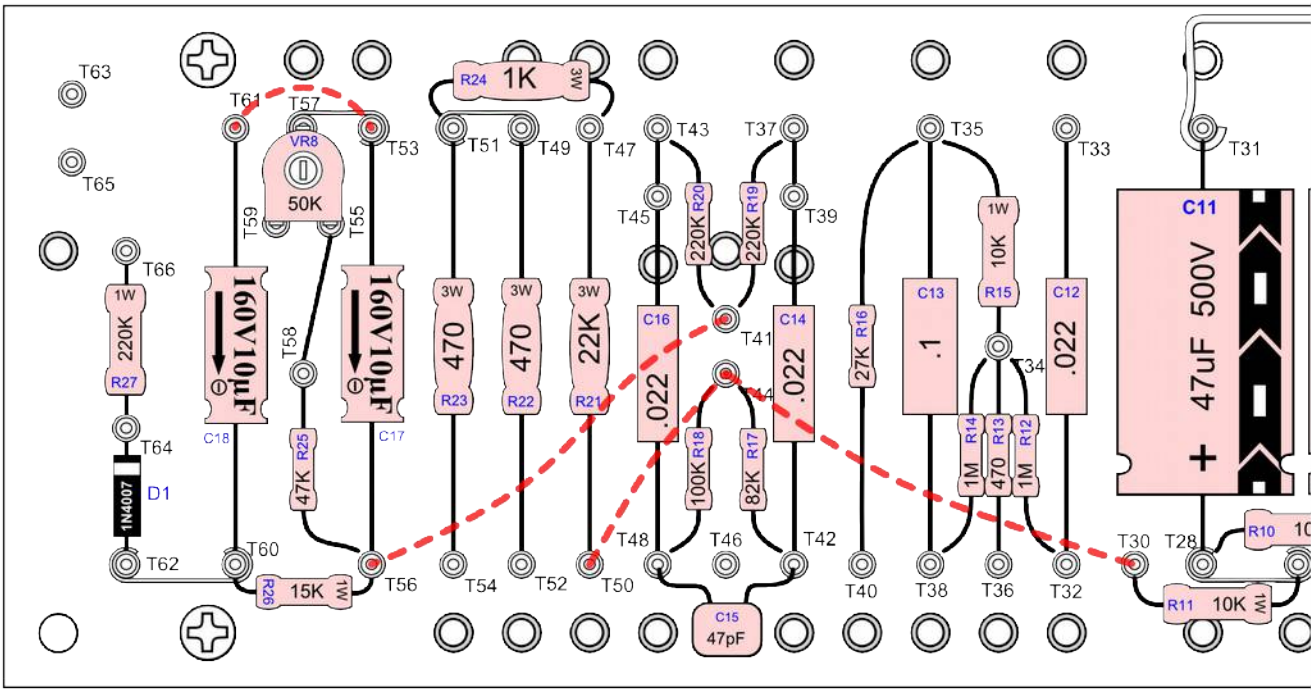
Refer to the videos "How to build a Turret Board"
Part 1 - http://www.youtube.com/watch?v=eVSjj3S6nsU
Part 2 - http://www.youtube.com/watch?v=iYtQC4UBysE

NOTE

Refer to the pamphlet:
"How to Make Top Quality Turret Boards (with simple tools)"
http://site.tubedepot.com/pdf/turret_boards_v1.pdf

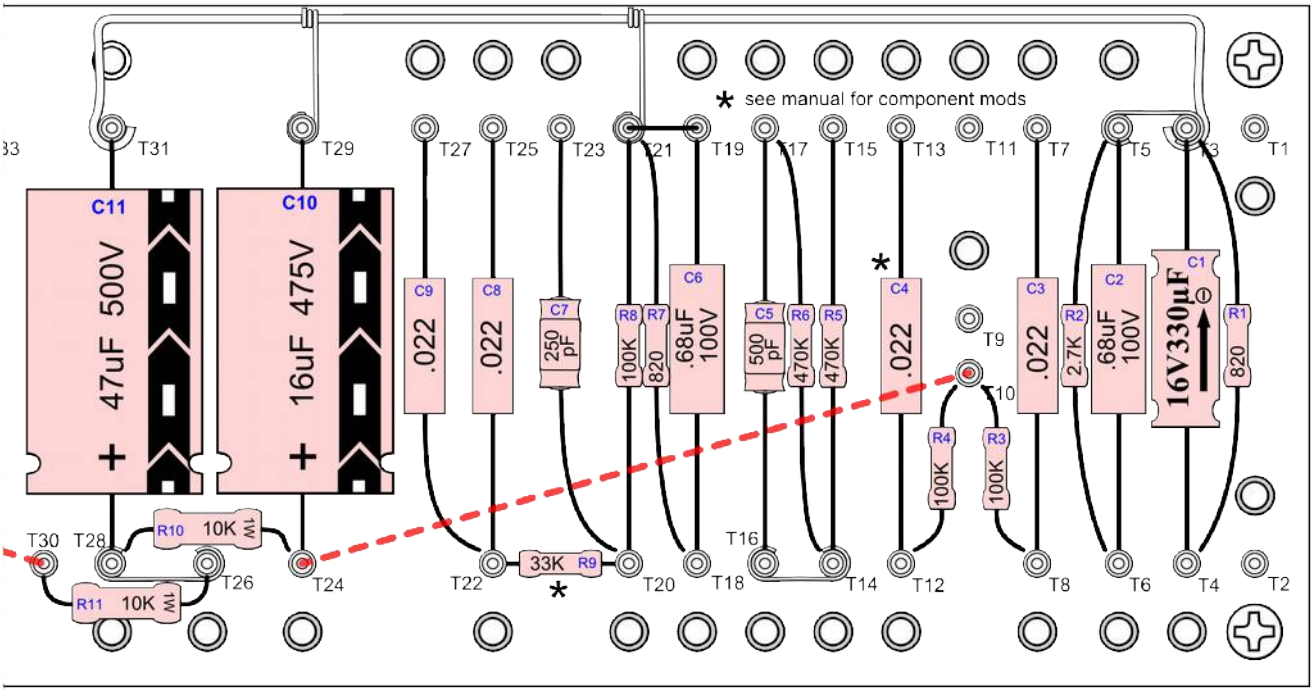
6.2 Turret Board Component Installation

Step 1 – Solder the four separate under-board 20 AWG jumper wires between T61 and T53; T56 and T41; T50 and T44; T44 and T30 (drawing 6.2a).
Step 2 – Solder the under-board 20 AWG jumper wire between T24 and T10 (drawing 6.2b).



drawing 6.2a

drawing 6.2b



Step 3 – Solder the 16 AWG ground buss to the board between T3 and T31 (photo 6.2a).


Photo 6.2a

Step 4 – Using 20 AWG buss wire, solder shorting links between the buss ground and terminals T21 and T29 (photo 6.2b).

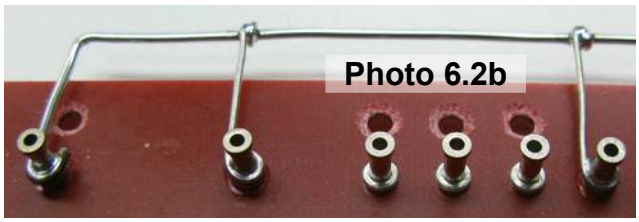


Photo 6.2b

Step 5 – Bend entire ground buss assembly into place (photos 6.2c and 6.2d).

Step 6 – Solder shorting links around terminals T3 and T5; T14 and T16; T49 and T51; T53 and T57; T60 and T62 (drawings 6.2a and 6.2b).

Step 7 – Begin installing the components to the turret board as per the turret board layout diagrams (drawings 6.2a and 6.2b). For the resistor mounted across turrets T28 and T24, mount the resistor across the leads of the capacitors (photo 6.2f).

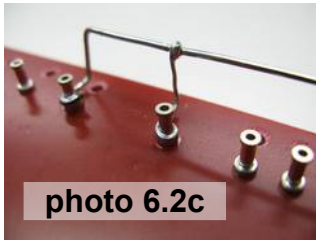


photo 6.2c

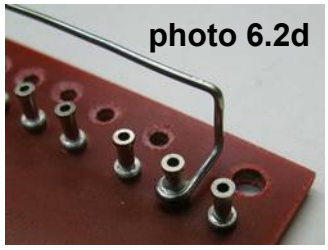


photo 6.2d

CAUTION Electrolytic caps and diodes are polarity sensitive and must be installed on the turret board as shown in the drawing(s).

NOTE Be creative at points where more than three leads are soldered into the same turret (turret T34 – see photo 6.2e).

MOD Send end of manual for component changes and modifications.

Step 8 – There will be several jumper wires to install between select turrets. These jumpers should be installed at the same time as the components. These jumpers will go between turrets T19 and T21; T26 and T28; T37 and T39; T43 and T45; and T55 and T58. Use bare 20 AWG wire or recycled component lead(s).

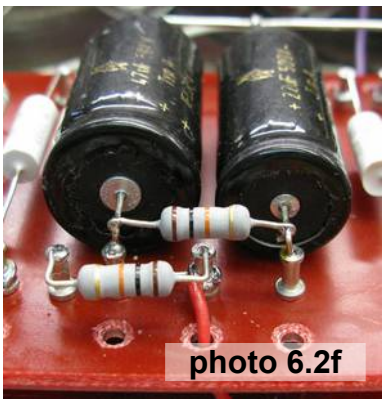


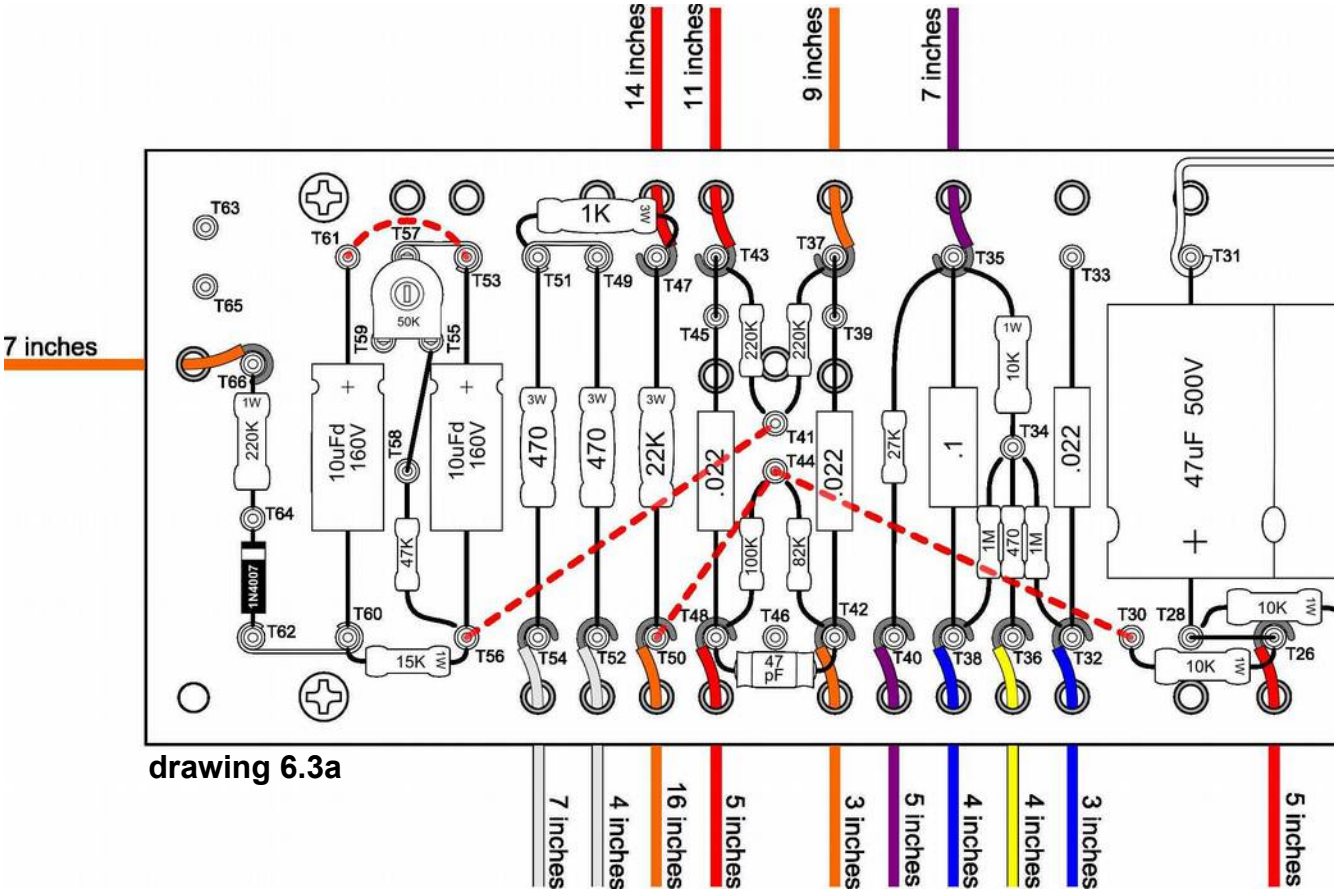
photo 6.2f

photo 6.2e

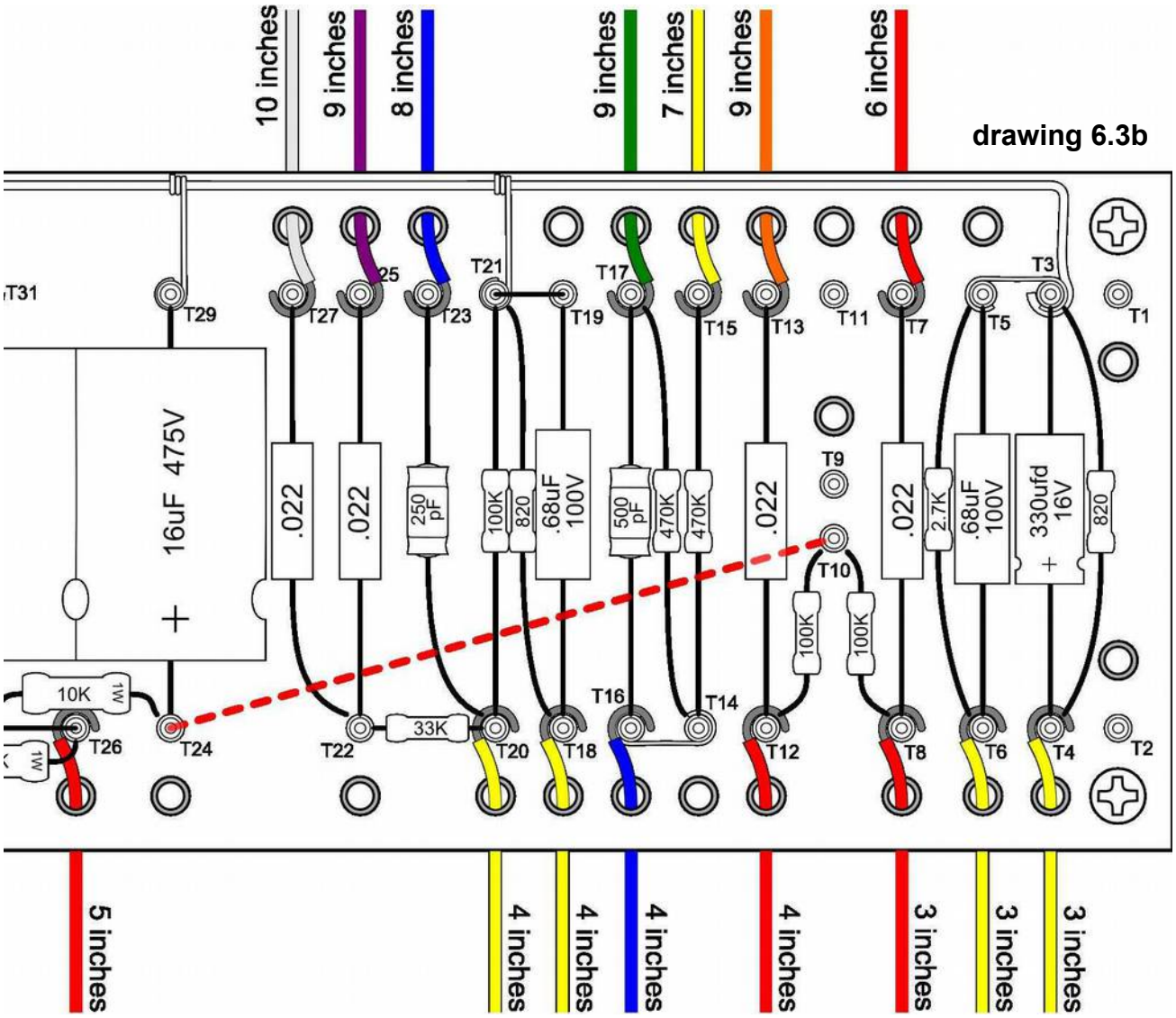
NOTE It is normal for there to be resistors and capacitors left over after completing this kit. These extra components are additional values for further "tone shaping" of the kit if desired. See end of this manual.

6.3 Turret Board Wire Installation

Step 1 – Install each colored 20AWG wire to the appropriate turret at the length specified according to drawings 6.3a and 6.3b.



drawing 6.3a

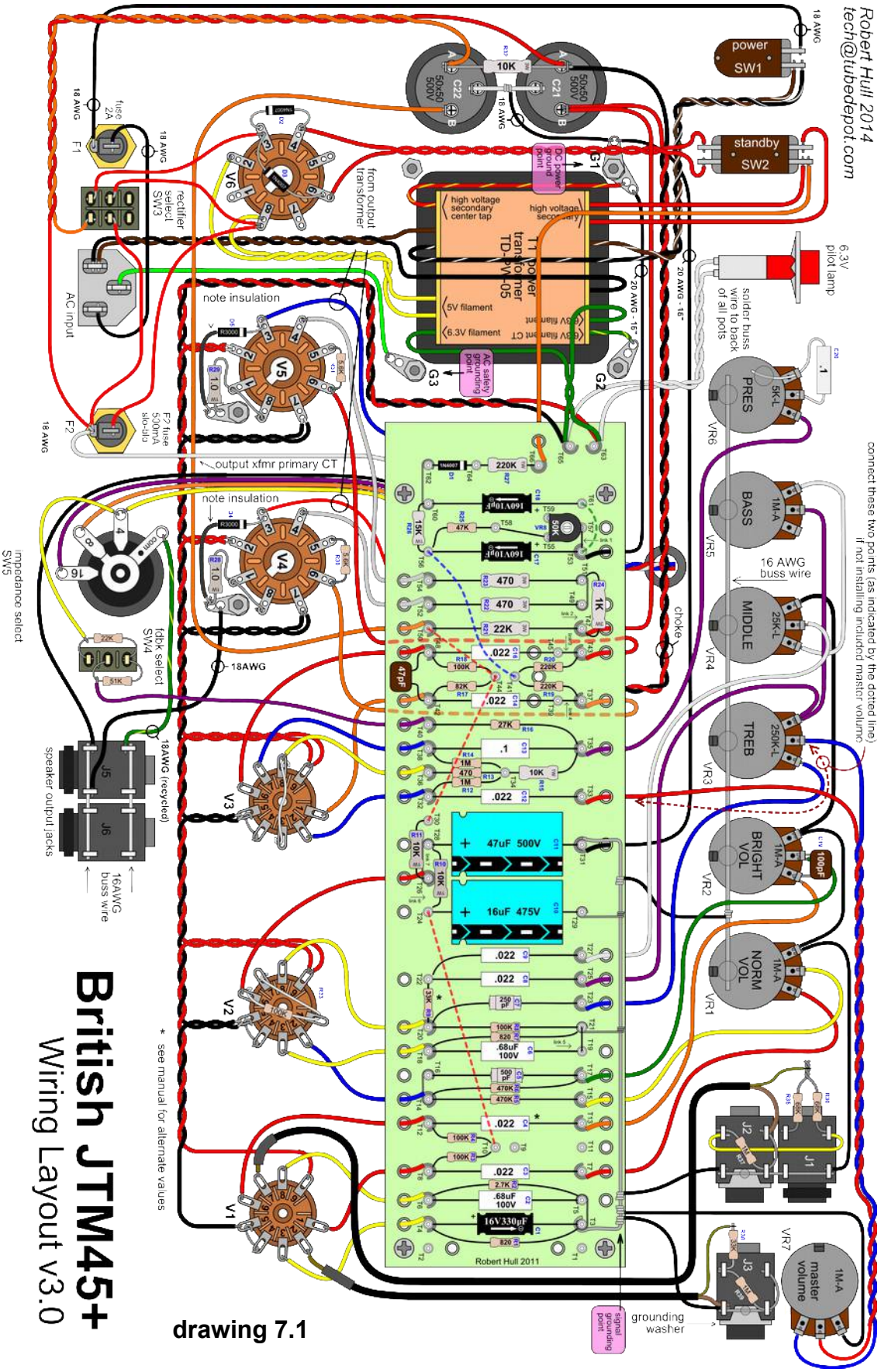


Step 2 – Twist the wires from T43 and T37 together for about 4 inches. When the board is installed into the chassis, these wires will be routed underneath the board along the chassis toward the power tubes.

7 Turret Board / Chassis Assembly and Wiring

7.1 Turret Board Installation

Step 1 – Route the two wires coming from turrets T43 and T37 around the back side of the turret board, coming out from the board around turrets T48 and T42.
Step 2 – Hold the above two wires in place and physically mount the completed turret board into the chassis onto the standoffs and secure in place with four #6-32 x 3/8” screws.
Step 3 – Solder the wires from the turret board to the appropriate chassis locations. Trim the wires as needed (drawing 7.1). It is a good idea to make these connecting wires as short as reasonably possible.
Step 4 – Route the wires going to the front panel controls underneath the buss wire, toward the chassis.
Step 5 – Route the wires going to the power supply along the edges of the chassis to reduce potential noise.
Step 6 – Install a short (2”) 20 AWG, black wire between the buss ground of the turret board and the buss ground across the back of the pots.
Step 7 – Connect the ground wires from the input jacks and master volume to the buss ground of the turret board.
Step 8 – Connect the longer ground wire from the G1 grounding terminal to turret T31.
Step 9 – Connect the shorter ground wire from the G1 grounding terminal to turret T53.



British JTM45+

Wiring Layout v3.0

drawing 7.1

8 Testing

You are almost finished. And although the first temptation is to plug up the amp and turn it on, I recommend taking the time to review all your connections. This will be time well spent as it will tie together all the construction steps. Errors are more likely to stand out during this time and it is not uncommon to find two or three errors (I always do).

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

8.1 Initial AC testing

Step 1 – If not already installed, insert a 2A, fast acting fuse into the rear panel mounted fuse holder labeled “mains” and a 500mA (.5A) fuse into the rear panel mounted fuse holder labeled “B+” .

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 panel mounted 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 recommended could cause severe and costly equipment damage in case of an internal component failure or wiring error.*

NOTE *The following voltage levels as measured, will vary depending on the AC wall voltage. The measurements that I've listed were made with a wall voltage of 116 Vac.*

Step 2 – **With the amp unplugged and no tubes installed**, turn the amplifier's power and standby switches to “on”. These switches will remain on until all tests are finished.

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.*

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.*

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.*

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

Step 3 – Plug the amp's AC power cord into AC 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 – With your multimeter on the 20 VAC scale (this is the only **AC** measurement we will be making), put the two meter leads on turrets T63 and T65 (polarity is not important).
Step 6 – There should be about 7 VAC as measured at these two turrets.
Step 7 – After 5 min. of trouble-free operation, remove the AC power by disconnecting the AC

power cord from the AC source. Leave the amp's power and standby switches in the “on” position.

8.2 High Voltage (B+) Testing

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 the high voltages.*

CAUTION *Elevate the amp off of the work bench with a thick book(s) under the transformers so that the rectifier and power tubes are not damaged during the following tests.*

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

Step 1 – With the amp still disconnected from AC power, install the tube rectifier.
Step 2 – Select the “tube rectifier” position with the rectifier switch (if installed).
Step 3 – Plug the amplifier's AC power cord into the AC power source at the wall.
Step 4 – The panel indicator should illuminate. Visually verify that the filament inside the rectifier tube is glowing. Monitor the amplifier for any unusual smoke or smells or blown fuse. If anything unusual occurs, disconnect power immediately and review connections.
Step 5 – With your multimeter on the **500 volt DC** range, connect the meter's black lead to chassis ground. Placing the meter lead in one of the captured nuts is fine. Touch the meter's red lead to one of the positive terminals of the can cap mounted to the side of the amp, closest to the power switch. The voltage here should be around +492 V dc (+/- 10V).
Step 6 – Remove AC power by disconnecting the AC power cord from the AC source.

8.3 Preamp Tubes, Installation and Testing

NOTE *The previous voltages were measured without power and preamp tubes installed. Those previous voltage values will all decrease with the added load of the tubes.*

NOTE *The presence of voltages at the following steps 4 - 8 indicates that the preamp tubes are correctly sourcing current (it's working). The tolerances for these voltages are +/- 10%.*

Step 1 – With the amp still disconnected from AC power, install all three 12AX7 preamplifier tubes (no power tubes just yet).
Step 2 – Plug the amplifier's AC power cord into the AC power source at the wall.
Step 3 - The power light should illuminate. Monitor for any unusual smoke or smells or blown fuses. If anything unusual occurs, disconnect power immediately and review connections.
Step 4 – Let the amplifier warm up for 2 minutes. With the multimeter on the **20 volt range**, connect the meter's black lead to a chassis ground as before and touch the red lead to turret T6. The voltage here should be close to +1.7 Vdc (+/- .5V).
Step 5 – Touch the red meter lead to turret T4. The voltage here should be +.9 V (+/- .5V).
Step 6 – Touch the red meter lead to turret T18. The voltage here should be +1.0V (+/- .5V).
Step 7 – Adjust the meter range to the **200V range**. Touch the red meter lead to T20. The voltage here should read 157V (+/- 25V).
Step 8 – Touch the red meter lead to turret T36. The voltage here should be +35 V (+/- 10V).

Step 9 – Touch the red meter lead to turret T41. Adjust the bias control until you reach the most negative voltage. This should be around - 56V (+/- 5V).
Step 10 – Remove the AC power by disconnecting the AC power cord from the AC source.

8.4 Power Tubes, Installation and Testing

Step 1 – Install the two power tubes.
Step 2 – Connect a speaker(s) to one of the output jacks and set the impedance selector to the correct speaker impedance.
Step 3 – Turn all volume and tone controls to minimum positions. The power and standby switches should remain in the "on" position.
Step 4 – Plug the amplifier's AC power cord into the AC power source at the wall.
Step 5 – The panel indicator should illuminate. Monitor for any unusual smoke or smells or blown fuse. If anything unusual occurs or if loud hum is heard from the speaker, disconnect power immediately and review all connections. Let the amplifier warm for 2 minutes.
Step 6 – With your multimeter on the **2 volt range** (we will be reading mV), connect the meter's black lead to chassis ground as before and carefully touch the meter's red lead to the wire connecting pins 1 and 8 together on one of the power tubes. The voltage here should be around 4 – 5 mV … or less.
Step 7 – While still measuring this pin 8 /1 combination of one of the power tubes, adjust the bias pot until you read about 30mV on the meter. The voltage will take some time to settle so you will have to readjust several times before it is steady.
Step 8 – Move the red lead to the other pin 8/1 connection on the other power tube. This should be about the same voltage, +/- 5 milliVolts.
Step 9 – Remove both multimeter leads from the amp and set meter to the side. Leave the amp running. Monitor the amp for a few minutes to make sure nothing is out of the ordinary.

8.5 Signal Injection, Final Testing

Step 1 – With no signal source connected, turn all the tone controls fully clockwise.
Step 2 – Turn the master volume control fully clockwise and listen for a low level hiss from the speaker. There may be a slight hum too, but any dramatic hum indicates wiring troubles.
Step 3 – Turn the high treble control up and down, the level of hiss should increase and decrease with the control. Return the control to the minimum setting.
Step 4 – Turn the normal channel volume control up and down. The level of hiss should increase and decrease with the control. There may be a slight hum as well, but any dramatic hum indicates wiring troubles. Return the control to the minimum setting.
Step 5 – With a 1/4" guitar cord, connect a suitable signal source (a guitar if preferred) into the number 1 jacks nearest the word "normal" (these are the "high treble" inputs).

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

Step 6 – Slowly turn up the "high treble" channel and listen to the sound source. Adjust the volume to verify that the level goes up and down accordingly.
Step 7 – Repeat the same for the #2 input (s) and the "normal" channel control.
Step 8 – If everything checks good, turn off the amp.

8.1 Final Assembly

Step 1 – Install the knobs on all controls and the impedance selector.
Step 2 – Install the completed chassis into the cabinet (head or combo).
Step 3 – Connect the speakers and now … really test the amp.
Step 4 – Your amp is done and ready for play.

THE END

Final notes (important stuff to mention):

- To determine which direction of the solid state / tube rectifier switch is which, remove the tube rectifier and turn the amp on as if you were going to play. Which ever position of this rectifier select switch provides sound is the solid state rectifier position.

- The feedback selector has three settings: 1) bassman position; 2) 1987 model (middle) position; 3) JTM45 position. The setting of this switch that gives the least overall midrange gain is the bassman position (most negative feedback). The middle position is the high gain "plexi" position (least negative feedback), and the final position is the JTM45 position.

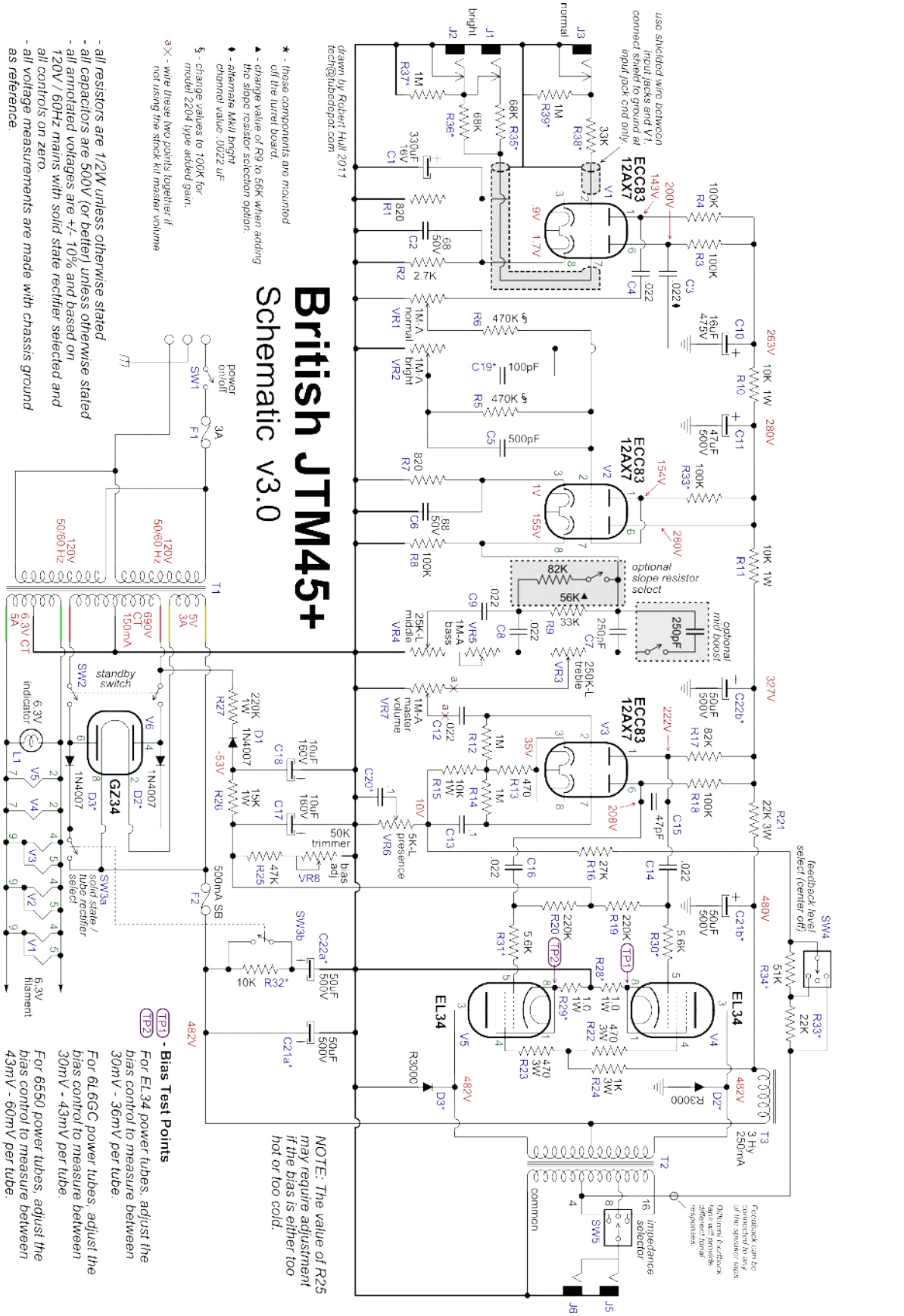
- You can run the amp perfectly well with the rectifier tube removed and the rectifier select switch in the "solid state" position. The power transformer runs cooler without the rectifier tube since it is not having to provide the 5V filament supply for the rectifier tube.

- If the amp squeals (becomes unstable) when played at high volumes, I recommend using a wooden stick (old chop stick works great) and move the hookup wires around. These are the wires between the turret board, the tube sockets, and the controls. Because the amp has so much gain, proper wire routing becomes important. Often a signal will "bleed" into an adjacent wire and cause troubles. This is easily corrected by moving the physical location of the wires around. Turn the amp on as if you are going to play (the amp must be connected to a cabinet), turn the controls fully up, and with your wooden probe, move the wires in the amp around. Find the locations for these wires that are the quietest (for hum and for potential feedback). You can use a dab of silicone sealant to hold the wires in place if you like.

- When turned, the presence control will give a little audible "swish" in the sound. This is a result of the very small level of DC voltage present on this control.

- I recommend "jumpering" the inputs and using the two volume controls independently to provide more bass gain or more treble gain as needed. This is the classic set-up and operation with these 4 input / no master volume style amps.

- The effectiveness of the tone controls will change at different volume levels. Because of this interaction between the tone controls and the volume, it will take some experimentation to really dial in the sound of the amp.


British JTM45+
Schematic v3.0
drawn by Robert Hull 2011
tech@tubedepot.com
use shielded wire between input jacks and V1. connect shield to ground at input jack end only.
- all resistors are 1/2W unless otherwise stated
- all capacitors are 500V (or better) unless otherwise stated
- all annotated voltages are +/- 10% and based on 120V / 60Hz mains with solid state rectifier selected and all controls on zero.
- all voltage measurements are made with chassis ground as reference.
NOTE: The value of R25 may require adjustment if the bias is either too hot or too cold.
(TP1) (TP2) - Bias Test Points
For EL34 power tubes, adjust the bias control to measure between 30mV - 36mV per tube.
For 6L6GC power tubes, adjust the bias control to measure between 30mV - 43mV per tube.
For 6550 power tubes, adjust the bias control to measure between 43mV - 60mV per tube.
ECC83 12AX7
EL34
GZ34
standby switch
power on/off
optional slope resistor select
optional mid boost
feedback level select (center off)
impedance selector
bias adj
solid state / tube rectifier select
common
filament
indicator

How to Read Resistor Types and Values

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

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 various resistors that could be used in your project.

Carbon Composition 1/2W

Carbon Film 1/2W

Metalized Film 1/2W

Carbon Composition 1W

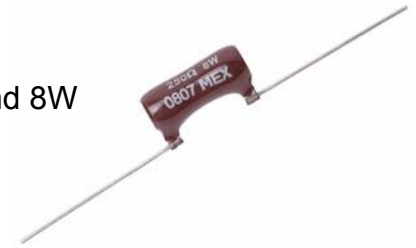
Metal Oxide 1W

Metal Oxide 2W

Metal Oxide 3W

Wire Wound 5W

Wire Wound 8W

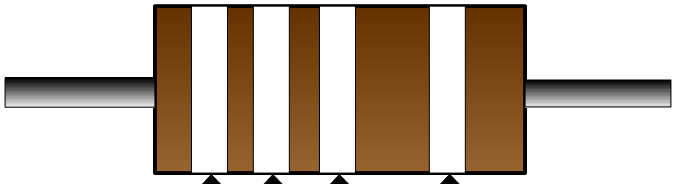


How to Read Resistor Types and Values

Most electronic components are so small that printing the actual values, ratings and tolerances on the individual component is often impossible. Therefore, codes were invented and these codes are printed on the components to describe what values they are.

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

20%, 10%, and 5% types
Carbon Film
Metal Oxide
Carbon Composition



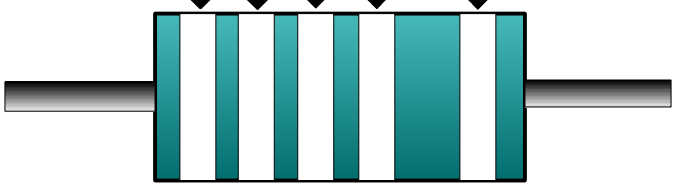
1st Digit	
Color	Digit
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

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%



Metalized Film
1% and 2% types

How to Read Capacitor Types and Values

Some 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 various components.

Cornell-Dubilier Silver Mica – high quality / high accuracy; small values

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

Sprague "Orange Drop" 715 and 716 series – Vintage style film & foil polypropylene capacitor. Very accurate; good for HiFi use.

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

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

Mallory 150 Film and Foil – metalized polyester capacitor, axial leads. Accurate tone, clear.

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 Soldering Hints

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Anyone working in electronics should make time to 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=clDydYlVTqU

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 inter-metallic bond and the two metals, when properly soldered together, act as if it they were one solid, very strong connection.

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 reliably soldered connections every time:

1. Make sure the surfaces to be soldered are clean and free of corrosion. A dirty, greasy, or oxidized surface will not properly accept solder, creating an intermittent solder connection. Clean all surfaces prior to soldering.
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 the tip is shiny and clean.
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 against 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. A properly heated (and clean) connection will readily accept 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 necessary to flow into and around the connection. Too much solder can create a “solder bridge” with a neighboring connection. If too little solder is used, the connection will be physically and electrically weak.
8. Finish the connection by removing both the solder and the soldering iron quickly and at the same time. It is important to apply heat only for as long as is needed to properly flow the solder. Too much 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. Any movement 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 solder connections. Solder flux residues can trap moisture, dirt and dust that can weaken a connection and possibly create arcing conditions. Cleaners such as Isopropyl or ethyl alcohol and even acetone are very good at removing flux residues. Use a stiff bristled (acid) brush to mechanically scrub the surfaces as well as a paper towel to absorb the contaminants.

By following the below sequence of events every time you make a solder connection, your connections will perform better than ever before. And they will look great too …

Sequence of Events in Making a Good Connection

1. Make sure all surfaces to be soldered are clean and free of oxides.
2. Establish a good mechanical connection of the components prior to soldering.
3. Place the tip of the iron firmly against the connection to be soldered.
4. Let connection reach soldering temperature (usually within 1 to 5 seconds).
5. Feed solder into the point where the soldering iron tip meets the connection.
6. Feed just enough solder into the connection for the solder to flow around the components to be joined.
7. When adequate solder amounts have been applied, remove the unused solder and soldering iron simultaneously.
8. Keep the connection totally still until the solder has solidified.
9. Clean any solder flux residue from the connection.

A note regarding soldering to anything gold plated

Gold plating is great for a corrosion free signal transfer but problematic for soldering reliability. Where as solder adheres wonderfully well to gold plating, gold plating often doesn't stick well to the base metals to which it is plated. This is the underlying problem.

Connections soldered directly to gold plating will adhere for awhile. But eventually the gold plating will peel off the base metal (while still adhering to the solder) leaving no connection with the intended base metal. This has become a broken connection.

The solution is to always scrape the gold plating off of a potential connection, down to the base metal, prior to soldering. This will guarantee a faithfully soldered connection.

C Amplifier Care and Feeding

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Now that your amp is together and working, here are a few good hints to keep it up and running and everyone 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!*

- Plug this amp into 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.
- Whenever changing tubes or cleaning this amp, disconnect the amp from the AC power source and allow the 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 affect 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:

- EL34 - 6550 - KT77 - 6L6 / KT66 / 5881 / EL37 (w/ slight amplifier modification. Contact me for more information – tech@tubedepot.com)

Rectifier tubes:

- GZ34 - 5AR4 - 5R4 - GZ37

Applications

The laboratory environment is nice, but life experiences are better. Time to play.

D Mods

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With the amp finished and sounding great, many amp builder starts to think, “how can I make it better”? Well, the below mods can help you define “better” …

Here are a few cool mods for experimentation …

1. Change the value of the tone control “slope” resistor (R9, between T20 and T22) – This kit uses a value of 33K where as the original JTM45 and Fender 4x10 bassman used a 56K in this position. We've included both values for fun.
2. Change the value of the bright channel coupling cap (C4, between T12 and T13) – This kit uses .022, the original “plexi” used .0022. The smaller cap allows less bass into the signal chain, thereby improving the tonal variety when mixing the two channels together.
3. Change the value of the tone control treble cap (C7, between T20 and T23) - This kit uses a 250pF. By increasing to 500pF, more midrange will be available. Put these two on a switch and it becomes a midrange boost.
4. Change the value of the phase inverter cathode resistor (R15, between T34 and T35) and replace V3 with a 12AT7 – by changing the phase inverter to a 12AT7, the low end from the amp becomes much more solid. This is a great mod for players that use pedals in front of the amp. Replace R15 with a 22K / 1W resistor and install the 12AT7.
5. Change the phase inverter to a low gain 12AU7 – For those wanting to play the amp with more preamp drive but without so much output volume. replace R15 with 22K / 1W resistor and then install a 12AU7. The output stage volume will decrease giving more room to turn up the preamp.
6. Install a different master volume – By upgrading from the stock master volume to a post phase inverter master volume (PPIMV) type, the amp will sound more natural at lower volume settings.
7. Install a “cut control” in place of the presence control – A cut control functions as a very high frequency adjustment after the power tubes. This will allow better control of the “brittleness” often associated with an amp at full volume.
8. Replace the 5AR4 / GZ34 rectifier tube with a 5R4 rectifier tube – changing to a much lower efficiency 5R4 tube will give a massive amount of sag. Very cool sounding.
9. Link together the first gain stage cathodes – The JTM45 had the cathodes of the first gain stage tube tied together. This made the two front panel “channels” very interactive with each other when mixed together. Move the wire attached to T4 to T6.
10. Operate the amp with 6L6 / KT66 / 6550 power tubes – for the most part, these tubes can be directly installed into the amp and all is well (after rebiasing). There are a few other changes that can be made to “fine tune” the installation of these tubes.
11. The more obscure mods – effects loop; reverb; variable B+ control; balanced line out; they are all possible … some more difficult than others.

For any questions regarding mods, contact: tech@tubedepot.com