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ASSEMBLY MANUAL

for the Classic " " style

18 WATT TUBE GUITAR AMP KIT

(with some great " " style mods)

Version 20
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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, high wattage amplifiers that to this day, continue to define tone.

With the introduction of a small 18 watt combo in the mid 60's, Marshall took a simple circuit, a great looking cabinet loaded with Celestion speakers, and built an amplifier legendary for great tone. And although this incarnation lasted only four production years, its impact continues to live on.

This British 18W kit is our nod to that original 18 watt, 1x12 combo. With turret board, point-to-point construction, quality components, and just a touch of American upgrading, this kit is ready to become your sound.

This construction manual has been designed with both the beginning and experienced kit builder in mind with an assembly time of 6 - 12 hours. With ample photos detailing every step and numerous modification suggestions, all levels of builders will enjoy not only the process but also the finished product.

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 these written procedures as these will be more 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. 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 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 (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 – 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	TS-OWS

3 Parts Inventory

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qty	description	part number
1 ea	chassis, aluminum Marshall style 18W	CH-MAR18
1 ea	panel, front and back, Marshall style 18W, plastic	CH-MAR18-FP
1 ea	transformer, power; Marshall 18W	TR-PW-12
1 ea	transformer, output; Marshall 18w	TR-OT-11
1 ea	EZ81 JJ/Tesla rectifier tube	JJ-EZ81
1 pr	EL84 JJ/Tesla beam power tetrode (sold in pairs)	JJ-EL84
3 ea	12AX7 JJ/Tesla	JJ-ECC83
6 ea	knob, Marshall style set screw	P-MAR-1-4-BRASS
1 ea	knob, chicken head	P-FTCH-BLACK
1 ea	fuse holder, low profile screwdriver cap, 3AG	FH-LOWPRO
1 ea	fuse, 3AG 500mA fast blow	P-BK-MDL-500MA
1 ea	fuse holder, top mount block, 3AG	P-FH-BLOCK1
1 ea	fuse, 3AG 1A slow-blow	P-BK-MDL-1A
1 ea	Indicator lamp, 6.3V incandescent w/ nut	P-PL-MARSHALL1
6 ea	jack, 1/4", mono closed circuit (501)	P-CL-501
2 ea	washer, chassis grounding (for 501 jack)	GW-CL1442
1 ea	jack, 1/4", stereo closed circuit (505)	P-CL-505
2 ea	switch, toggle SPST; Carling	P-110-63
2 ea	washer, lock 1/2", internal tooth	LW-IT-1-2
1 ea	switch, 3 position rotary	P-ROTARY-SWITCH
1 ea	plug, AC chassis mount, snap in	P-IEC-1
1 ea	power cord, with IEC connector	P-12PWI
2 ea	screw, zinc plated 4-40 x 3/8"	BP-440-3/8
2 ea	nuts, KEPS 4-40	BP-440-KEPS
3 ea	socket, tube, miniature 9pin	SK-B-VT9-ST-C
3 ea	socket, tube, miniature 9pin	SK-B-VT9-ST-2
2 ea	grommet, rubber 1/4" chassis hole / #6 screw	P-GROMMET-1/4
1 ea	washer, flat, #6	BP-632-SAE
2 ea	grommets, rubber 1/2" chassis hole	P-GROMMET-1/2
4 ea	bolt, metric, M6x30mm, stainless steel	MS-M6X30MM
4 ea	washer, metric, M6, stainless steel	BP-M6-WASHER
4 ea	captive nuts, M6	BP-M6-CAPTIVENUT
16 ea	screw, zinc plated 6-32 x 1/4", phillips pan head	BP-632-1/4
7 ea	screw, zinc plated 6-32 x 3/8", phillips pan head	BP-632-3/8
13 ea	nuts, KEPS 6x32	BP-632-KEPS
2 ea	nuts, 6x32	BP-632-NUT
4 ea	standoff, aluminum hex, #6 threaded, 3/4" long	BP-ALSTDOFF-6-FF

1 ea	nuts, 8x32	BP-832-NUT
5 ea	nuts, KEPS 8x32	BP-832-KEPS
2 ea	screw, zinc plated 8-32 x 3/8", phillips pan head	BP-832-3/8
3 ea	solder lug, locking, #8 screw	P-TERMLOCK-8
3 ea	solder lug, locking, #6 screw	P-TERMLOCK-6
1 ea	50ufd / 50ufd @ 500V	CP-JJ-50X2-500V
1 ea	capacitor clamp, small	CP-CLAMP1
1 ea	22ufd / 500V	CP-XAL-22-500V
1 ea	22ufd / 50V (EF86 mod part)	CP-XAL-22-50V
3 ea	47ufd / 50V	CP-XAL-47-50V
1 ea	10ufd / 450V (EF86 mod part)	CP-XAL-10-450V
4 ea	500K audio	RV24A-10D2-15R1-A-500K
1 ea	1K linear w/ on-off switch	RV24A02F-10-15S1-B13
1 ea	1M linear	RV24A-10-15R1-B-1M
2 ft.	wire, 20 awg, stranded, hi-temp PVC - yellow	HTPVC-20-STR-YELLOW
9 ft.	wire, 20 awg, stranded, hi-temp PVC - red	HTPVC-20-STR-RED
13 ft.	wire, 20 awg, stranded, hi-temp PVC - black	HTPVC-20-STR-BLACK
8 ft.	wire, 20 awg, stranded, hi-temp PVC - white	HTPVC-20-STR-WHITE
5 ft.	wire, 20 awg, stranded, hi-temp PVC - blue	HTPVC-20-STR-BLUE
3 ft.	wire, 20 awg, stranded, hi-temp PVC – violet	HTPVC-20-STR-VIOLET
2 ft.	wire, 20 awg, stranded, hi-temp PVC - orange	HTPVC-20-STR-ORANGE
7 ft.	wire, 18 awg, stranded, hi-temp PVC - black	HTPVC-18-STR-BLACK
3 ft.	wire, 18 awg, stranded, hi-temp PVC - red	HTPVC-18-STR-RED
2 ft.	wire, 18 awg, stranded, hi-temp PVC – white	HTPVC-18-STR-WHITE
3 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
3 ft	shielded wire, interconnect	IW-2330
5 ft	aluminum tape, 2" width, self adhesive	P-TAPE-ALUM
1 ea	heat shrink, 1/8" - BLACK, 6" piece	TS-HS-1-8
11 in	G10 red glass epoxy board (sold by the inch)	BP-125BOARD-RED
62 ea	turret, hollow Keystone 1540-4	BP-TURRET
3 ea	825, 1/2W metal film resistor, 1% MIL-SPEC	R-CMF60-825
3 ea	8.25K, 1/2W metal film resistor, 1% MIL-SPEC	R-CMF60-8.25K
2 ea	33.2K, 1/2W metal film resistor, 1% MIL-SPEC	R-CMF60-33.2K
1 ea	47.5K, 1/2W metal film resistor, 1% MIL-SPEC	R-CMF60-47.5K
2 ea	68.1K, 1/2W metal film resistor, 1% MIL-SPEC	R-CMF60-68.1K
5 ea	100K, 1/2W metal film resistor, 1% MIL-SPEC	R-CMF60-100K

2 ea	221K, 1/2W metal film resistor, 1% MIL-SPEC	R-CMF60-221K
7 ea	470K, 1/2W metal film resistor, 1% MIL-SPEC	R-CMF60-470K
3 ea	1M, 1/2W metal film resistor, 1% MIL-SPEC	R-CMF60-1M
1 ea	2.2K, 1/2w metal film, 1%	R-273-2.2K
1 ea	2.2M, 1/2w metal film, 1%	R-273-2.2M
1 ea	22K / 1W, metal oxide power resistor (EF86 mod)	R-262-22K
1 ea	8.2K, 2w metal oxide	R-262-8.2K
2 ea	1.0K ohm / 3W	R-283-1.0K
1 ea	2.2K ohm / 3W	R-283-2.2K
1 ea	150 ohm / 10W wire wound, sand cast	R-CR10-150
1 ea	47pfd / 500V; silver mica	CP-SM-47-500V
1 ea	500pfd / 500V; silver mica	CP-SM-500-500V
4 ea	.0047ufd / 630V; Mallory 150	CP-M150-0047-630V
4 ea	.01ufd / 630V; Mallory 150	CP-M150-01-630V
1 ea	.022ufd / 630V; Mallory 150	CP-M150-022-630V
1 ea	.1ufd/630V; Mallory 150 series	CP-M150-1-630V
3 ea	.022ufd / 630V; MPP radial capacitor	CP-XI-022-630V
1 ea	.047ufd / 630V; MPP radial capacitor	CP-XI-047-630V
1 ea	Turret setter kit	DIY-PFT-KIT

One of the below options could be shipped with the above kit

	micro head cabinet option	
1 ea	cabinet, small box black tolex Marshall style	CAB-MAR18-HEAD
or	**1X12 cabinet option (various speakers available)**	
1 ea	cabinet, 1x12, Marshall style	CAB-MAR18
4 ea	flat washer, #8	BP-832-SAE
1 ea	1/4" plug, Switchcraft 280	P-280
2 ft	tech flex, 1/4", yellow	TS-PTNO-1-4-yellow
1 ea	heat shrink, 3/8" BLACK, 6" length	TS-HS-3-8

The following parts are available for modifications but are NOT included with this kit. These items must be ordered separately.

qty	description	part number
	Filter Choke Mod	
1 ea	choke, filter	TR-CK-02
	Octal Socket Rectifier Tube Mod (does not include tube)	
1 ea	socket, octal	SK-B-VT8-ST
	Master Volume Mod, PPMIV	
1 ea	500K dual audio pot	RV24B-10-15R1-A-500K
1 ea	knob, Marshall style set screw	P-MAR-1-4-BRASS
	Tone Cut Mod	
1 ea	250K linear pot	RV24A-10-15R1-B-250K
1 ea	knob, chicken head	P-FTCH-BLACK
1 ea	.0047ufd / 630V; Mallory 150	CP-M150-0047-630V
	High Performance Cathode Resistor Mod	
1 ea	150, 8w wire wound (brown devil)	R-B8J-150
	Output Tube / Output transformer Protection Mod	
6 ea	1N4007, 1000 PIV, 1A diodes	D-1N4007
2 ea	solder lug, #6	P-TERMLOCK-6
	Solid State / Tube Rectifier Selection Mod	
2 ea	diode 1N4007, 1000 PIV, 1A diodes	D-1N4007
1 ea	Switch, mini-toggle SPDT	P-108-MINI-1
	1X12 cabinet option (does not include speaker)	
1 ea	cabinet, 1x12, Marshall style	CAB-MAR18
4 ea	flat washer, #8	BP-832-SAE
1 ea	1/4" plug, Switchcraft 280	P-280
4 ft.	wire, 20 awg, stranded, hi-temp PVC - black	HTPVC-20-STR-BLACK
4 ft.	wire, 20 awg, stranded, hi-temp PVC - white	HTPVC-20-STR-WHITE
2 ft	tech flex, 1/4", yellow	TS-PTNO-1-4-yellow
1 ea	heat shrink, 3/8" BLACK, 6" length	TS-HS-3-8
	Marshall Style 50W small box	
1 ea	cabinet, small box black vinyl Marshall style	CAB-MAR-SMBOX
	Marshall Style 20W micro box	
1 ea	cabinet, micro box black vinyl, Marshall style	CAB-MAR18-HEAD
	Tremolo hi / lo Speed Selection Mod	
1 ea	Switch, mini-toggle SPDT on-off-on	P-108-MINI-1
1 ea	470K, 1/2w metal film, 1%, 500V rated	R-CMF60-470K
1 ea	1M, 1/2w metal film, 1%, 500V rated	R-CMF60-1M

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 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 four 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 to the underside of the cabinet.
3. **Back panel w/ screws** – The back panel should be secured with four panel screws.

With either cabinet, I encourage inspecting all assembly screws to insure they are tightly holding the cabinet together. In the past I've found that sometimes some screws aren't fully tightened down during assembly.

4.2 Drilling the Four Chassis Mounting Bolts (Head and Combo)

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

Step 1 – Remove the back panel and lay the panel on the work table with the vinyl covering facing down.

Step 2 – With the empty 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 cabinet

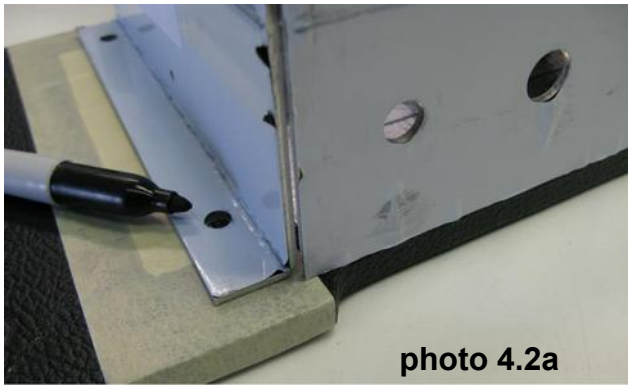

photo 4.2a

back panel (photo 4.2a).
Step 4 – Place the chassis to the side and with a 1/8” drill bit, drill a small pilot hole in the center of each of these marks.
Step 5 – Once the pilot holes have been drilled, drill the final 9/32” hole down the center of each of these pilot 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

NOTE *If you have a square drive bit, the feet are easily removed. And with the feet removed, it is much easier and faster to insure that the mounting holes are correctly spaced prior to drilling.*

Step 1 – Remove the back panel and place to the side.
Step 2 – Place the cabinet upside down with the handle against the work bench and the front of the cabinet facing you.
Step 3 – Lay a strip of masking tape along each cabinet edge on the outside of the feet.
Step 4 – On both strips of masking tape, make two marks 1 1/4” from the outside edge of the cabinet. Place one of these marks near the cabinet front and one mark near the cabinet back on each strip (photo 4.2b). It is important to use a hand square in order to get the correct 1 1/4” measurements.


photo 4.2b


photo 4.2c

Step 5 – On both strips of masking tape, draw a line connecting these front and back marks (photo 4.2b).
Step 6 – On both strips of masking tape, make a mark 1 1/2” from the back edge of the cabinet intersecting the previously drawn line (photo 4.2b).
Step 7 – With the chassis in hand, align the mounting holes of the chassis over the connecting line with one of the chassis holes over the intersecting mark (photo 4.2c).
Step 8 – Make another mark through the remaining mounting hole of the chassis on the connecting line (photo 4.2d) and lay the chassis to the side.


photo 4.2d

Step 9 – Repeat steps 7 and 8 for the opposite edge.
Step 10 – Drill a small 1/8” pilot hole in the center of each of the four marks.
Step 11 – Drill the final 9/32” hole in each of these four pilot holes and remove the masking tape.
Step 12 – Test fit the chassis to the cabinet and make any adjustments as needed.

4.3 Installing the Shielding Tape (Head and Combo)

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.

photo 4.3a

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 – Remove the backing from the second shielding tape strip and apply the tape to the back of the panel along the lower edge of the previous tape, overlapping about 1/8” the entire length (photo 4.3b).

photo 4.3b

Step 6 – Remove the backing from the final shielding tape strip and apply the tape to the back panel along the upper edge of the first tape, overlapping about 1/8” along the entire length (photo 4.3b).
Step 7 – Clear the mounting holes by cutting the shielding tape from around the holes with a hobby knife.

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 – Remove the backing from the second shielding tape strip and apply the tape to the cabinet along the lower edge of the previous tape, overlapping about 1/8” the entire length.

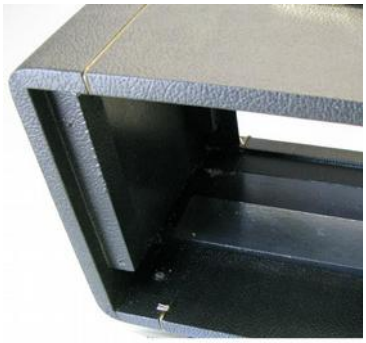

photo 4.3c

photo 4.3d

Step 6 – Remove the backing from the final shielding tape strip and apply the tape to the

cabinet 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 by cutting the shielding tape from around the holes 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 tightly 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.*


photo 4.3a

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).
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 combo kit can be ordered without a speaker leaving the choice of speaker up to you. It is recommended that the power rating of the speaker is at least 35W.*

NOTE *The choice of stock speaker is determined by what we have on hand. This usually alternates between either the Weber or Celestion speakers, both of which are excellent.*

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 and Assembly

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NOTE *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. It is easier to install most modifications during initial assembly than later.*

MOD *If you want to expand the potential range of rectifier tube selections beyond the stock 9 pin EZ81, now is the best time to enlarge the size of the present rectifier chassis hole to accept an octal socket. See "Cool Modifications", Chapter 11 for more information.*

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 – Identify the four mounting holes on the outwardly bent flange edges of the chassis, two on each edge.
Step 2 – With a 5/16" drill bit, enlarge all four of these holes and remove any burrs.
Step 3 – Place the chassis, flange down, on a flat solid surface (concrete floor is good).
Step 4 – Place an inset nut on the flange directly over one of the newly drilled 5/16" holes (photo 5.1a).


photo 5.1b

Step 5 – 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.
Step 6 – Inspect the nut to insure it is well seated (photo 5.1b). Repeat step 5 as needed.
Step 7 – Repeat above for the remaining three nuts.

5.2 Installing the 1/2" Grommets

Step 1 – Press the two 1/2" grommets into the two appropriate chassis holes on either side of the output transformer mounting position making sure the grommets are fully seated.

5.3 Installing the Power Transformer


photo 5.3a

Step 1 – Twist all the wires of the power transformer loosely together and insert them through the square chassis mounting hole.
Step 2 – Position the transformer in the chassis with the red and yellow wires toward the back of the chassis and the black and green wires toward the front.
Step 3 – Seat the transformer against the chassis and install three appropriately bent #8 solder terminals (photo 5.3a) to three of the four transformer mounting bolts (see wiring layout on pg 53 for which three bolts). Arrange these three terminals so they are pointed in the directions as indicated on the wiring layout pg 53.
Step 4 – Install a #8 standard nut on each of these bolts and firmly tighten. Make sure that the #8 solder terminals remain in position while tightening.
Step 5 – Install a #8 KEPS nut on the remaining transformer bolt and firmly tighten.

5.4 Installing the Output Transformer


photo 5.5a

Step 1 – Twist the blue, red, and brown wires tightly together.
Step 2 – Twist the black, yellow, green, and orange wires together.
Step 3 – Place the output transformer on the chassis and feed the red, blue, and brown wire bundle through the chassis mounted grommet nearest the power transformer.
Step 4 – Feed the black, yellow, green, and orange wires through the chassis mounted grommet on the opposite side of the output transformer.
Step 5 – Mount the output transformer to the chassis with the two 8-32 x 3/8" screws and two #8 KEPS nuts.

5.5 Installing the Capacitor and Capacitor Clamp


photo 5.5b

Step 1 – Prior to chassis installation, loosely tighten the clamp to the can capacitor.
Step 2 – Install the cap clamp assembly to the chassis with the clamp adjustment screw placed nearest the power transformer (photo 5.5a).
Step 3 – Secure the clamp to the chassis with two 6-32 x 3/8" screw and two #6 KEPS nuts.
Step 4 – Turn the chassis over and rotate the cap in the clamp until the common terminal is inline with the solder terminal (photo 5.5b).
Step 5 – Turn the chassis back over and firmly tighten the can capacitor in the clamp.

5.6 Installing the Shock Mounted V1 Preamp Tube


photo 5.6a

Step 1 – With a 1/4" drill bit, enlarge the two V1 tube socket mounting holes in the chassis. Deburr any rough edges.
Step 2 – Insert the two 1/4" grommets in these holes, making sure they are properly seated in the chassis.
Step 3 – Prior to mounting the preamp tube sockets, slightly bend the terminals 1 - 3 and 6 – 9 outward of the tube socket (photo 5.6a).

MOD *For the EF86 mod, do not bend terminals 4 and 5 together in Step 4. Refer to Chapter 11, "Cool Modifications" for more information.*

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

Step 4 – Carefully bend terminals 4 and 5 together. The holes of these terminals should meet close to each other (photo 5.6a).
Step 5 – To provide a flat surface for the mounting screws, use a pair of needle nose pliers to carefully bend the edges of the shield near the screw mounting holes inward toward the socket (photo 5.6b, c, and d).
Step 6 - Insert the tube socket from the outside of the chassis and rotate the socket so that pin 6 of the tube is closest to the chassis edge / corner.
Step 7 – Mount the tube socket with two 6-32 x 3/8" screws (photo 5.6e).

Step 8 – On the inside of the chassis, install a #6 flat washer on the screw near the chassis edge.
Step 9 – Install a #6 KEPS nut on this screw (not overly tight, so the socket can slightly rock back and forth in the grommets) nearest the chassis edge and seal in place with a drop of fingernail polish (photo 5.6e and 5.6f).
Step 10 – Install a #6 solder terminal on the opposite screw.
Step 11 – Secure the solder terminal with a #6 standard nut (not overly tight, so the socket can slightly rock back and forth in the grommets) and seal in place with fingernail polish (photo 5.6f).


photo 5.6b


photo 5.6c


photo 5.6d


photo 5.6e

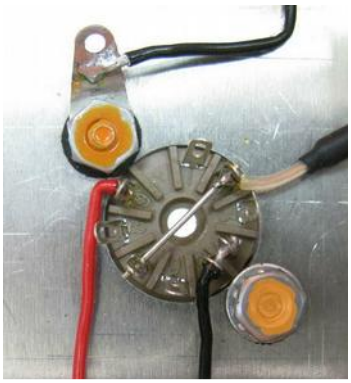


photo 5.6f >

5.7 Installing the V2 – V6 Tube Sockets

MOD *Refer to the "Cool Modifications", Chapter 11 section for modifying the amp from the 9 pin EZ81 rectifier to the more versatile OCTAL rectifier options.*

Step 1 – Prior to mounting the preamp tube sockets (V2 and V3), slightly bend the solder terminals 1 - 3 and 6 – 9 outward as well as bend terminals 4 and 5 together (photo 5.6a). This is for the preamp tubes only. Do not bend the 4 & 5 pins together for the power tubes.

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

Step 2 – Bend the mounting edges of the tube socket inward to allow installation of the screws (photo 5.6b, c, and d).
Step 3 – Insert the tube socket from the outside of the chassis and rotate the socket so that pin 6 of the tube is closest to the chassis edge / corner.
Step 4 – Insert a #6 x 1/4" screw into each mounting hole of each socket from the outside of the chassis and secure the socket on the inside of the chassis with a #6 KEPS nut.
Step 5 – Repeat the above steps for V2 through V6 tube sockets.

5.8 Installing the Faceplate, Input Jacks, Controls & Switches

Step 1 – While holding the faceplate against the front of the amp, install the first vibrato channel LO sensitivity input jack (the one deeper inside the chassis). The jack should be installed with one fiber washer on the inside of the chassis and the solder terminals should be facing toward the normal channel section.
Step 2 – Install one fiber washer and a grounding washer on the second vibrato channel high sensitivity jack and install this jack with these washers into the chassis above the previous

jack. The solder terminals should be facing the normal channel section.
Step 3 – Install the normal channel LO sensitivity jack (the one deeper inside the chassis) into the chassis with one fiber washer and with the terminals facing the chassis side.
Step 4 – Install one fiber washer and a grounding washer on the normal channel HI sensitivity jack and install this jack with these washers into the chassis above the previous jack. The solder terminals should be facing the chassis side.
Step 5 – Bend the alignment tab of all of the 1M audio taper pots against the potentiometer body prior to mounting. Or they can be broken off too.
Step 6 – Install the four 500K audio taper pots in the "volume" and "tone" control positions of the normal and vibrato channels. Position these controls with the solder terminals facing up for easy soldering.

MOD *Get a footswitchable HI / LO speed control by installing a mini SPDT toggle switch between the words "vibrato" and "off". See "Cool Modifications", Chapter 11 for more information.*

Step 7 – Break the alignment tabs off of the remaining 1K w/ switch pot and the 1M pot.
Step 8 – Install the 1K pot with switch in the "intensity" control spot and the 1M pot in the "speed" control spot. Install these controls with the flat washers on the faceplate side and with the solder terminals facing up for easy soldering.
Step 9 – Install the two Carling SPST toggle switches in the AC power and STANDBY positions. Install with the solder terminals facing up for easy soldering.

5.9 Installing the 6.3V Indicator Lamp

Step 1 – Twist the wires of the indicator lamp tightly together, being careful not to pull the body of the lamp out of the back of the red lens.
Step 2 – Feed the twisted wires of the indicator through the front panel mounting hole.
Step 3 – Once the indicator is in place, slide the press nut over the wires and firmly slide the nut into place over the body of the indicator lamp and as flush as possible against the inside chassis front.
Step 4 – Rotate indicator until it is properly aligned and use a little fingernail polish on this inside push nut to hold it in place.


photo 5.9a

5.10 Wiring the V1 – V5 Tube Filaments

MOD *If you are installing an EF86 instead of a 12AX7 tube as the first channel (normal channel) preamp tube, then V1 filament will be wired differently than described below. See "Cool Modifications", Chapter 11 for more information*

NOTE *This is probably the most challenging task in this entire kit build. Making the filament installation look great takes great attention to detail and a very lite use of heat when soldering. I recommend going very slow and be prepared to redo several times. Good luck.*

Wiring the power transformer filament center tap
Step 1 – Locate the green wire with the yellow stripe on it coming from the power transformer.
Step 2 – Cut this wire to a 3" length and strip and tin the end.

Step 3 – Bend a small hook in the end of this wire and solder the wire to the nearby #8 solder terminal at the corner of the power transformer nearest the power (on/off) switch.

V1 wiring

Step 1 – Cut a 26" length of 20AWG red wire and an equal 26" length of 20AWG black wire.
Step 2 – Twist these two wires tightly together the full length.

NOTE *To get an even twist and to speed up the filament wiring process, use a handheld drill to twist the two wires together. Place the loose wire ends into the drill chuck and rotate the drill slowly until the wires are tightly twisted..*

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=clDydYlVTqU*

Step 3 – Untwist these wires about 2" from one end of the twisted pair and strip and tin the black wire at this end.
Step 4 – Install the tinned end of the black wire into terminals 4 and 5 together of V1 and solder.
Step 5 – Route the black wire tightly against the chassis and to the rear chassis edge.
Step 6 – Form a 90 degree angle in the black wire at the chassis edge and lay the remaining wire pair in this corner chassis edge behind the remaining tube sockets.
Step 7 – With the loose red wire end, measure an adequate running distance from the 90 degree angle in the black wire (about 1/2" is good and re-twist this red wire with the black wire to maintain uniformity) and make a sharp 90 degree bend in the red wire.
Step 8 – Run this wire up to terminal 9 of the V1 tube socket and make another 90 degree bend in the red wire so that the red wire points directly toward terminal 9.

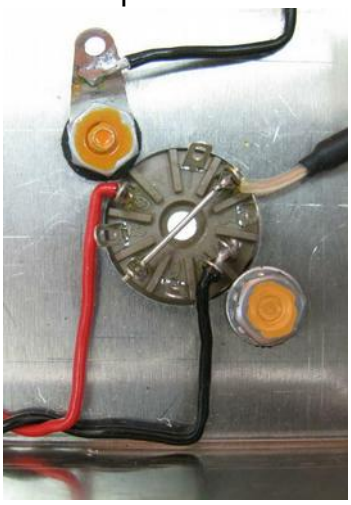


photo 5.10a

Step 9 – Cut the red wire approximately 1/4" to 3/8" from this second bend.
Step 10 – Strip and tin this end and solder it to pin 9 (photo 5.10a). Try to apply as little heat as possible (solder quickly) so that the insulation doesn't contract too much.
Step 11 – Trace the twisted pair over to the opposite side of the V2 tube socket (between V2 and V3). Bend a 90 degree bend in the twisted pair from the chassis edge in line with pin 9 of V2 socket.
Step 12 – Cut the wire pair approximately 1 1/2" inch from the chassis edge where the 90 degree bend is and lay the remaining wire pair to the side.

V2 wiring

Step 13 – Untwist the wires approximately 2" from the cut end and run the red wire tightly along the chassis edge and up to terminal 9 of V2. Reform the 90 degree bend as necessary to maintain uniformity.
Step 14 – Make another 90 degree bend in this red wire so that the red wire points directly into terminal 9 and cut 1/4" to 3/8" after this second bend.
Step 15 – Strip and tin the red wire and insert into pin 9 of V2. Do not solder just yet.
Step 16 – Position the black wire against the chassis and re-twist the black wire around the red wire as needed to maintain uniformity.

Step 17 – Place a 90 degree bend in this black wire directly in line with pin 5 of V2 socket.
Step 18 – Run this black wire up to pin 5 of V2 and cut the wire leaving adequate length for the wire to be installed through both pin 4 and 5 when stripped and tinned.
Step 19 – Strip and tin this black wire and insert into pin 4 & 5 of V2 but do not solder just yet.
Step 20 – Collect the wire pair previously laid to the side and untwist the two wires back approximately 2".
Step 21 – Strip and tin the black wire of this pair. Twist this black wire around the red wire at the chassis and solder (along with previous wire) in pin 4 & 5 of V2.
Step 22 – Neatly run this black wire back over to the chassis edge and form a 90 degree angle in the black wire at the chassis edge. Lay the remaining wire pair in this corner chassis edge behind the remaining tube sockets.
Step 23 – Run the red wire up to terminal 9 of the V2 tube socket and make a sharp 90 degree bend in the red wire so that the red wire points directly to terminal 9 of V2.
Step 24 – Make another 90 degree bend in this red wire so that the red wire points directly into terminal 9.
Step 25 – Cut the red wire approximately 1/4" to 3/8" from this second bend.
Step 26 – Strip and tin this end and twist this red wire around the previous red wire (if possible) to maintain uniform look.
Step 27 – Insert the tinned end of this red wire into pin 9 of V2 and solder along with the previously installed red wire (photo 5.10b). Try to apply as little heat as possible (solder quickly) so that the insulation doesn't contract / melt too much.
Step 28 – Trace the twisted pair over to the opposite side of the V3 tube socket (between V3 and V4) and put a 90 degree bend in the twisted pair from the chassis edge in line with pin 9 of the V3 socket.
Step 29 – Cut the wire pair approximately 1 1/2" inch from the chassis edge where the 90 degree bend is and lay the remaining wire pair to the side.

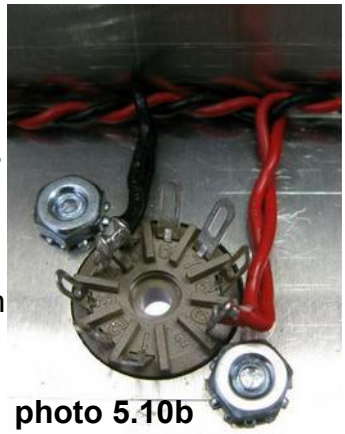


photo 5.10b

V3 wiring
Step 30 – Untwist the wires approximately 2" from the cut end and run the red wire tightly along the chassis edge and up to terminal 9 of V3. Reform the 90 degree bend as necessary to maintain uniformity.
Step 31 – Make another 90 degree bend in this red wire so that the red wire points directly into terminal 9 and cut 1/4" to 3/8" after this second bend.
Step 32 – Strip and tin the red wire and insert into pin 9 of V3. Do not solder just yet.
Step 33 – Position the black wire against the chassis and re-twist the black wire around the red wire as needed to maintain uniformity.
Step 34 – Place a 90 degree bend in this black wire directly in line with pin 5 of V3 socket.
Step 35 – Run this black wire up to pin 5 of V3 and cut the wire leaving adequate length for the wire to be installed through both pin 4 and 5 when stripped and tinned.
Step 36 – Strip and tin this black wire and insert into pin 4 & 5 of V3 but do not solder just yet.
Step 37 – Collect the wire pair previously laid to the side and untwist the two wires back approximately 2".
Step 38 – Strip and tin the black wire of this pair. Twist this black wire around the red wire at the chassis and solder (along with previous wire) in pin 4 & 5 of V3.
Step 39 – Neatly run this black wire back over to the chassis edge and form a 90 degree angle in the black wire at the chassis edge. Lay the remaining wire pair in this corner chassis

edge behind the remaining tube sockets.
Step 40 – Run the red wire up to terminal 9 of the V3 tube socket and make a sharp 90 degree bend in the red wire so that the red wire points directly to terminal 9 of V3.
Step 41 – Make another 90 degree bend in this red wire so that the red wire points directly into terminal 9.
Step 42 – Cut the red wire approximately 1/4" to 3/8" from this second bend.
Step 43 – Strip and tin this end and twist this red wire around the previous red wire (if possible) to maintain uniform look.
Step 44 – Insert the tinned end of this red wire into pin 9 of V3 and solder along with the previously installed red wire (photo 5.10b). Try to apply as little heat as possible (solder quickly) so that the insulation doesn't contract / melt too much.
Step 45 – Trace the twisted pair over to the center line of the V4 tube socket and put a 90 degree bend in the twisted pair from the chassis edge in line with pin 5 of the V4 socket.

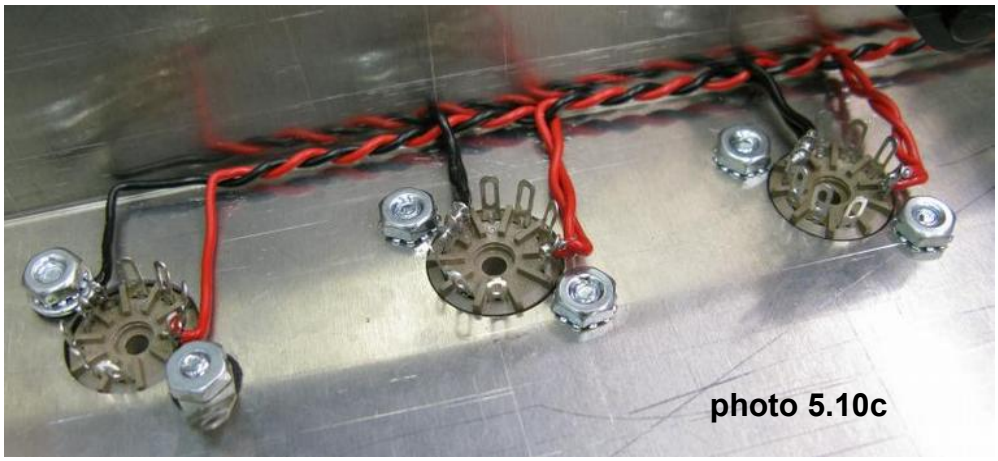


photo 5.10c

Step 46 – Cut the wire pair approximately 1 1/2" inch from the chassis edge where the 90 degree bends are and lay the remaining wire pair to the side.

V4 wiring

Step 47 – Untwist the wires approximately 2" from the cut end and run the red wire tightly along the chassis edge and up to terminal 5 of V4. Reform the 90 degree bend as necessary to maintain uniformity.
Step 48 – Cut the red wire to length and strip and tin the end. Install into terminal 5 but do not solder just yet.
Step 49 – Run the black wire tightly along the chassis edge and up to terminal 4 of V4. Reform the 90 degree bend as necessary to maintain uniformity.
Step 50 – Cut the black wire to length and strip and tin the end. Install into terminal 4 but do not solder just yet.
Step 51 – Collect the wire pair previously laid to the side and untwist the two wires back approximately 1".
Step 52 – Strip and tin both the black and red wires of this pair.
Step 53 – Insert the tinned end of the red wire into pin 5 of V4 and solder along with the previously installed red wire. Try to apply as little heat as possible (solder quickly) so that the insulation doesn't contract / melt too much.
Step 54 – Insert the tinned end of the black wire into pin 4 of V4 and solder along with the previously installed black wire. Try to apply as little heat as possible (solder quickly) so that the insulation doesn't contract / melt too much.
Step 55 – Make two sharp 90 degree bends in these two wires at the chassis edge and lay the remaining red and the black wire pair along the chassis edge over to the V5 tube socket.
Step 56 – Run the twisted pair over to the center line of the V5 tube socket and put a 90

degree bend in the twisted pair from the chassis edge in line with pin 5 of the V5 socket.
Step 57 – Cut the wire pair approximately 1 1/2" inch from the chassis edge where the 90 degree bends are and lay the remaining wire pair to the side.
V5 wiring
Step 58 – Untwist the wires approximately 2" from the cut end and run the red wire tightly from the chassis edge to terminal 5 of V5. Reform the 90 degree bend as necessary to maintain uniformity.
Step 59 – Cut the red wire to length and strip and tin the end. Install into terminal 5 but do not solder just yet.
Step 60 – Run the black wire tightly from the chassis edge and up to terminal 4 of V5. Reform the 90 degree bend as necessary to maintain uniformity.
Step 61 – Cut the black wire to length and strip and tin the end. Install into terminal 4 but do not solder just yet.
Step 62 – Collect the wire pair previously laid to the side. Measure this remaining twisted wire pair to make sure there is at least 9" left. If less than 9" do not use this wire (too short). Instead, twist together 10" of red and black wire.
Step 63 – With the remaining twisted pair, untwist 1" and strip and tin both the black and red wires of this pair.
Step 64 – Insert the tinned end of the red wire into pin 5 of V5 and solder along with the previously installed red wire. Try to apply as little heat as possible (solder quickly) so that the insulation doesn't contract / melt too much.
Step 65 – Insert the tinned end of the black wire into pin 4 of V5 and solder along with the previously installed black wire. Try to apply as little heat as possible (solder quickly) so that the insulation doesn't contract / melt too much.
Step 66 – Make two sharp 90 degree bends in these two wires at the chassis edge and lay along this edge.
Step 67 – Bring the twisted wire pair out from the chassis edge between V5 and the can capacitor pressed tightly against the chassis and all the way to the front panel. Leave like this for now.

5.11 Wiring the V6 Rectifier Tube Filament and HV

MOD *If installing an OCTAL rectifier instead of the 9 pin EZ81, the filament wiring for the OCTAL socket is different than described below. For proper wiring, see "Cool Modifications", chapter 11.*

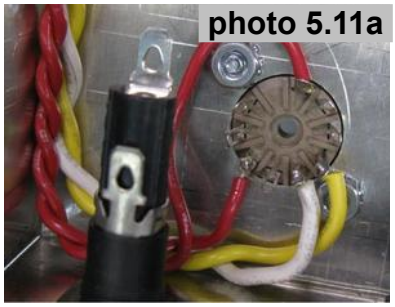


photo 5.11a

Step 1 – Untwist the two solid red wires and the yellow wire and white wires from the transformer wire bundle.
Step 2 – Tightly twist the yellow and white wires together. Pull these wires over to the chassis edge and neatly run them along the edge and corner to the V6 tube socket. Cut to the appropriate length at terminals 4 and 5 of this socket.
Step 3 – Strip and tin these two wires and solder the yellow wire to pin 4 and the white wire to pin 5 (photo 5.11a).
Step 4 – Tightly twist the two red wires together. Place these wires along the same path as the above yellow and white wires.
Step 5 – Untwist the wire ends and so that one end reaches terminal 1 and the other red wire reaches terminal 7 of the V6 socket. Trim wire to the appropriate lengths (photo 5.11a).

Step 6 – Strip and tin these two wires and solder them to terminals 1 and 7 of V6.

5.12 Wiring the Common Chassis Ground

photo 5.12a

Step 1 – Cut a 1 1/2” length of 16AWG buss wire and insert this wire between the solder terminal on the power transformer mounting bolt and the common solder terminal of the can capacitor (photo 5.12a).
Step 2 – Solder both ends of this buss wire to both terminals. At this time, solder the green with yellow striped wire from the power transformer to the terminal.

NOTE *To insure that all connecting wires are well soldered to the common chassis ground, solder each wire individually being sure that the solder flows well before moving to the next wire.*

5.13 Preliminary Wiring of V4 & V5 Tube Sockets

NOTE *“Tack” soldering is a way to make a temporary solder connection with the minimal use of solder. In this way, a wire is held in place and the terminal is left open for further assembly.*

Step 1 – Cut a 3 1/2” length of 20AWG yellow wire.
Step 2 – Strip and tin both ends approximately 1/8”.
Step 3 – Solder one end of this wire to pin 3 of V4.
Step 4 – Tack solder the other end of this wire to pin 3 of V5.

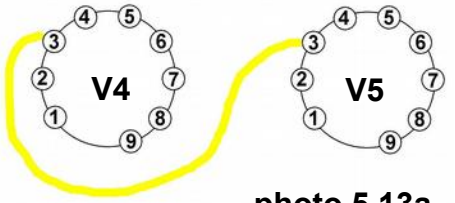


photo 5.13a

5.14 Preliminary Wiring of V3 Tube Socket

NOTE *By removing a small length of insulation from a wire, the insulation can be “salvaged” for use as an insulator with buss wire connections, especially across the back of the tube sockets.*

Step 1 – Cut a short 1” length of 20AWG buss wire.
Step 2 – Install a short 1/2” length of salvaged insulation over this wire.
Step 3 – Tack solder this jumper in place between pin 3 to pin 8 of V3.
Step 4 – Tack solder a 220K / 1/2W resistor between pins 1 and 6 on the back of tube socket (photo 5.14a).

V3

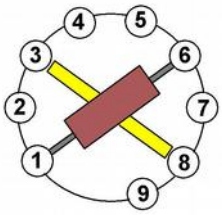


photo 5.14a

5.15 Preliminary Wiring of V2 Tube Socket

Step 1 – Cut a short 1” length of 20AWG buss wire (photo 5.15a).
Step 2 – Install a short 1/2” length of salvaged insulation over this wire.
Step 3 – Tack solder this jumper in place between pins 3 and 8 of V2.

V2

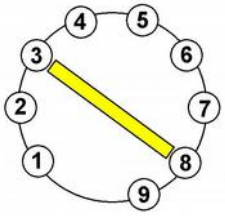


photo 5.15a

5.16 Preliminary Wiring of V1 Tube Socket

Step 1 – Cut three short 1” lengths of 20AWG buss wire.
Step 2 – Slide a 1/2” length of salvaged insulation over each of these wires (photo 5.16a).
Step 3 – Tack solder the first wire jumper in place between pins 2 and 7.
Step 4 – Tack solder the second wire jumper in place between pins 1 and 6.
Step 5 – Tack solder the third wire jumper in place between pins 3 and 8.

V1

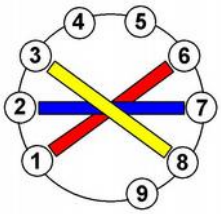


photo 5.16a

5.17 Installing the Rear Plate, Fuse Holder, and 1/4” Jacks

MOD *For a great final tone control, the “Tone Cut” mod can be mounted in one of the speaker jack chassis holes at this time. Refer to “Cool Modifications”, Chapter 11 for more information.*

Step 1 – Remove the thin tape cover to expose the double stick tape on the back of the rear plexiglass panel of the back plate.
Step 2 – Install this rear plexiglass panel on the back of the chassis, being careful to center all the holes correctly before pressing firmly.
Step 3 – Install the two Cliff mono 1/4” jacks (with chrome nuts) into the speaker output jacks with solder terminals facing up for easy soldering.
Step 4 – Install the fuse holder. Insure the middle terminal of the fuse holder is facing up for easy soldering.
Step 5 – Install the stereo footswitch 1/4” jack (all plastic) through the chassis and faceplate with the terminals facing up.

photo 5.18a

5.18 Installing the Impedance Selector

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

Step 1 – Enlarge the speaker selector switch mounting hole in the rear plate by drilling a 7/16” hole in place of the present hole through both the rear plexiglass plate and chassis.
Step 2 – Deburr the plexiglass and metal chassis and insert the impedance selector switch.
Step 3 – Align the selector switch with the common solder terminal facing up (photo 5.18a).

5.19 Installing the AC Entry Receptacle

Step 1 – Hold the AC entry receptacle so that the middle prong solder contact will be clearly visible when installed into the amp.
Step 2 – Press The AC entry receptacle firmly into the square cut out in the rear plate and chassis until it “snaps” into place.

NOTE *The assembly video shows installing a different type of AC entry receptacle. These snap-in types are easier to use and the solder contacts are larger.*

5.20 Wiring the Power Switch, AC Receptacle and Fuse Holder

WARNING *It is important to wire the fuse holder as recommended. This way 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 where fingers could touch.*

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.*

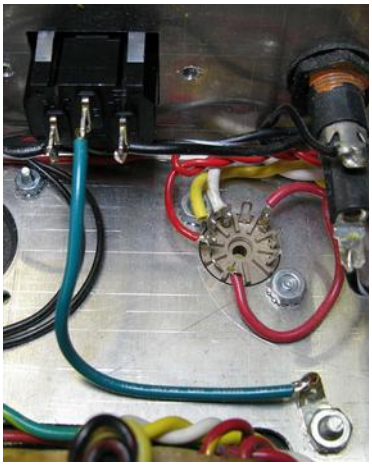
CAUTION

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 AC receptecal)*	*wire #2 (to power switch)*
110/115	*black with white stripe*	*black*
117/120	*black with white stripe*	*black*
220	*black with red stripe*	*black*
230	*black with red stripe*	*black*
240	*black with red stripe*	*black*

MOD *To have the option of selecting between solid state and tube rectifiers, install a switch between the AC fuse holder and the AC recepticle. For proper wiring, see "Cool Modifications", chapter 11.*

photo 5.20a



Step 1 – Choose the appropriate two primary wires from the above list for your area mains voltage.
Step 2 – Run the black wire from the power transformer neatly to the power switch. Trim to an appropriate length and then strip and tin the end. Save the remaining wire for future use.
Step 3 – Solder the above black wire from the transformer to the power switch on the terminal nearest the vibrato speed control.
Step 4 – Cut a 16" length of 18AWG white wire and strip and tin one end.
Step 5 – Solder this 18AWG white wire to the opposite solder terminal of the power switch.
Step 6 – Run this white wire over to the power transformer. Then twist this white wire tightly together with the remaining black with strip wire from the power transformer.
Step 7 – Run these two wires along the edge of the chassis to the fuse holder.
Step 8 – Untwist the two wires so that the white wire can be run to the fuse holder terminal nearest the chassis back plate.
Step 9 – Cut this white wire to appropriate length and strip and tin.
Step 10 – Solder this white wire to the fuse holder terminal nearest the back panel.
Step 11 – Cut the black wire with strip coming from the transformer to appropriate length and Strip and tin the end.
Step 12 – Solder this wire to the AC receptacle terminal nearest the vibrato jack on the back of the AC receptacle.

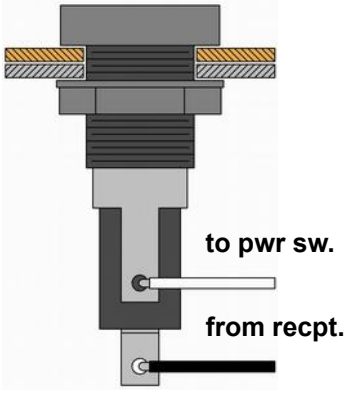


photo 5.20b

Step 13 – Cut a 7” length of the black wire salvaged earlier from the power transformer.
Step 14 – Strip and tin both ends of this wire.
Step 15 – Solder one end of this 7” salvaged black wire to the opposite terminal of the AC receptacle and neatly run the wire along the back edge of the chassis over to the fuse holder.
Step 16 – Solder the opposite end of this black wire to the end terminal of the fuse holder.
Step 17 – Cut a 4” length of recycled wire and solder one end to the middle AC receptacle solder terminal. Solder the opposite end of this wire to the #8 solder terminal under the mounting nut of the transformer nearest the rectifier tube socket (photo 5.20a).

5.21 Capping and Bundling the Unused Power Transformer Taps

NOTE *Cap and bundle only those wires that will not be used. This includes the unused filament and the unused AC inputs leads. Do not bundle the remaining wires.*

Step 1 – Cut two 1” lengths of 1/8” heat shrink.
Step 2 – Install one 1” length per unused yellow filament and AC input wire of the power transformer (the green and red with yellow wires are not capped), just covering the cut end of the wire.
Step 3 – Apply heat with a heat gun to the heatshrink on the wire. The heat shrink should shrink to cover the end (photo 5.21a).
Step 4 – With the heatshrink still hot, squeeze the ends closed with fingers (photo 5.21a).
Step 5 – Tightly bunch the capped wires together and secure with tape or zip ties (photo 5.21b).

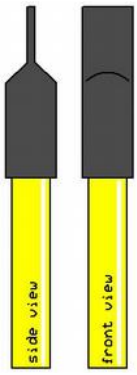


photo 5.21a

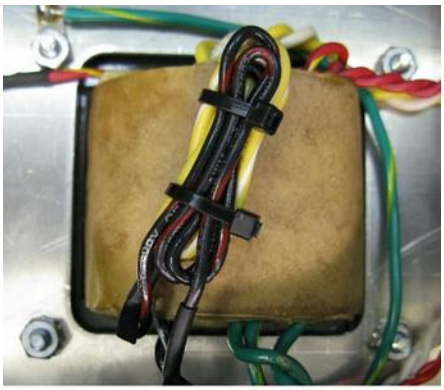


photo 5.21b

5.22 Wiring the Standby Switch


photo 5.22a

Step 1 – Cut a 30” length of 18AWG red wire.
Step 2 – Fold this wire in half and twist these two ends together forming a single twisted pair.
Step 3 – Strip and tin the cut ends and solder these ends to the standby switch (photo 5.22a).
Step 4 – Neatly run the remaining length of twisted wire along the chassis edges to V6 rectifier tube socket pin 3.
Step 5 – Cut one of the red wires at this length and strip and tin this end.
Step 6 – Solder this end to pin 3 of the V6 rectifier tube socket.
Step 7 – Untwist the remaining wire and run it neatly along the chassis edge and over to the nearest can capacitor terminal. Cut to length and strip and tin this end.

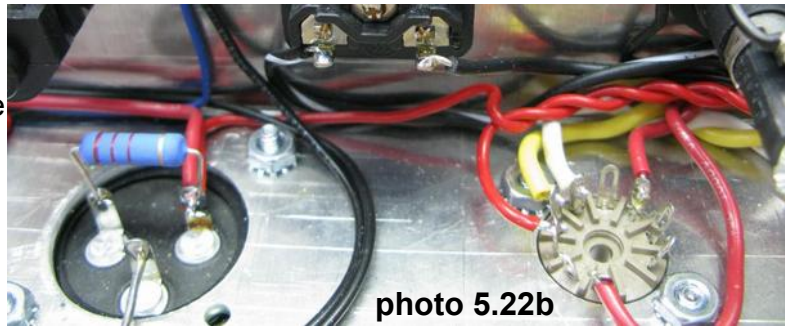


photo 5.22b

Step 8 –Tack solder this wire in place to the can capacitor terminal nearest the AC receptacle.

5.23 Wiring the Can Filter Capacitor

MOD *For quicker dynamics and lower hum from the amp, a small choke can be installed in place of the 2.2K / 3W resistor. Refer to "Cool Modifications", Chapter 11 for more information.*

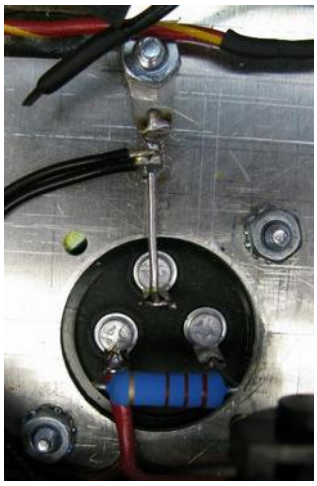


photo 5.23a

Step 1 – Locate the 2.2K / 3W resistor and bend both leads.
Step 2 – Trim the leads and tack solder the resistor between the two positive terminals of the can capacitor (photo 5.22b / 5.23a).
Step 3 – Pull the wires of the primary of the output transformer (brown, red and blue) tight against the chassis and over to the edge at the back of the chassis.
Step 4 – Untwist the red wire just to the point that the stretched wires meet the chassis edge.
Step 5 – Run this wire neatly against the chassis edge and over to the can capacitor terminal nearest the AC receptacle.
Step 6 – Cut this red wire to length and strip and tin the end.
Step 7 – Connect this tinned wire end to the can capacitor terminal nearest the AC receptacle and solder fully (photo 5.22b / 5.23a).

5.24 Wiring the Output Transformer Primary to V4 and V5 Sockets

Step 1 – Locate the brown and blue wires of the output transformer at the chassis edge.
Step 2 – Run the brown wire from the chassis edge over to V5 pin 7 and cut to length.
Step 3 – Strip, tin and solder this brown wire to pin 7, V5.
Step 4 – Run the blue wire along the chassis edge over to V4 pin 7 and cut to length.
Step 5 – Strip, tin and solder this blue wire to pin 7, V4.

5.25 Wiring the Footswitch Jack

MOD *The middle "ring" terminals (B) of this jack can be wired for footswitch selection between high and low speeds of the vibrato. See "Cool Modifications", Chapter 11 for more information.*

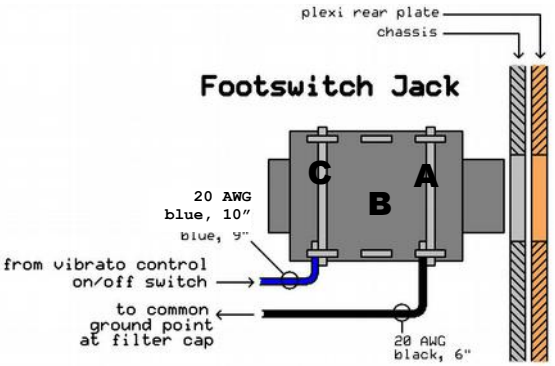


photo 5.25a

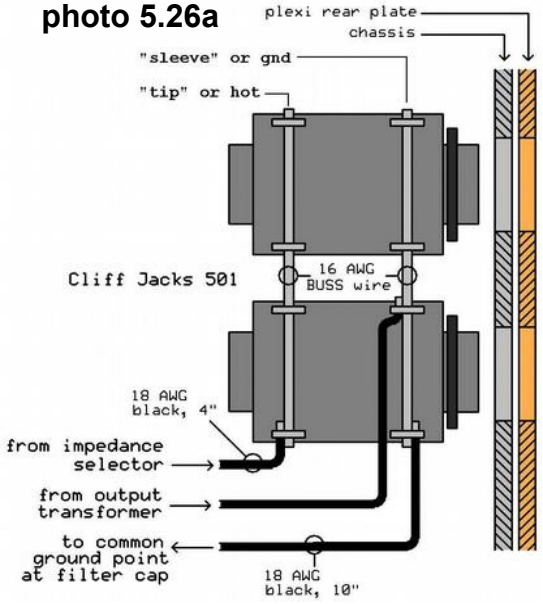
Step 1 – Cut a 6" length of black 20AWG wire and strip 3/4" of insulation from one end and tin.
Step 2 – Insert this 3/4" uninsulated wire end through both "sleeve" terminals of the footswitch jack and solder in place (A) (see drawing 5.25a).
Step 3 – Strip and tin the other end of this 6" wire and solder it to the nearby chassis common ground at the can capacitor.
Step 4 – Cut an 10" length of blue 20AWG wire. Strip 3/4" of insulation from one end and tin.
Step 5 – Tack solder this stripped wire through both "tip" terminals of the footswitch jack (C).
Step 6 – Strip and tin the other end of this 10" wire and tack solder it to pin 7 of V3. Run this wire neatly against the rear chassis edge.

5.26 Wiring the Speaker Output Jacks

MOD

For improved tone control of the output stage, the "Tone Cut" mod can be installed in place of one of the speaker out jacks. Refer to "Cool Modifications", Chapter 11 for more information.

photo 5.26a



Step 1 – Cut two 2-1/2" lengths of 16 AWG buss wire.
Step 2 – Thread the first length through all four "sleeve" terminals of the mounted speaker jacks and solder in place at the farthest end away from the impedance selector.
Step 3 – Thread the second length through all four "tip" terminals of the mounted speaker jacks and solder in place at the farthest end away from the impedance selector.
Step 4 – Tightly press the speaker output wires from the output transformer against the chassis and pull them directly to the area between the impedance selector and speaker output jack. Press and bend these wires against the chassis.
Step 5 – Untwist the black wire from this bundle just enough to reach the "sleeve" terminal between the output jacks (photo 5.26a).
Step 6 – Cut this black wire to the appropriate length and strip and tin the end of this wire and insert it into the open sleeve terminal between the two output jacks (photo 5.26a).
Step 7 – Cut a 10" length of 18AWG black wire and strip and tin one end.
Step 8 – Insert the tinned end of this wire in the open sleeve terminal nearest the impedance selector (photo 5.26a).
Step 9 – Solder the 16 AWG buss wire in the two remaining "sleeve" terminals.
Step 10 – Neatly run the remaining length of the 10" wire along the chassis to the common chassis ground at the can capacitor.
Step 11 – Strip and tin the end of this 18AWG wire and solder it to this common chassis ground nearest the solder terminal end of the buss wire.
Step 12 – Cut a 4" length of 18AWG black wire and strip and tin both ends 1/4".
Step 13 – Insert one tinned end of this wire in the "tip" terminal nearest the impedance selector of the output jacks and solder in place.
Step 14 – Solder the 16 AWG buss wire in the two remaining "tip" terminals. All eight terminals of the speaker output jacks should now be soldered (photo 5.26b).

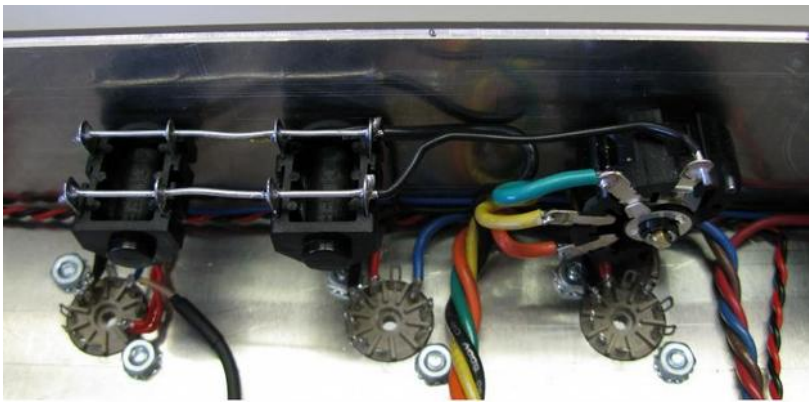


photo 5.26b

5.27 Wiring the Impedance Selector

Step 1 – Aligned with impedance selector with the common terminal pointing up and away from the V5 tube socket directly underneath.
Step 2 – Bend the bundled output transformer wires away from the chassis out to the terminals of the impedance selector.
Step 3 – Cut the orange, yellow, and green wires to the appropriate lengths to reach their appropriate terminals. Strip and tin each end.
Step 4 – Solder the yellow wire (4 ohm tap) to first terminal. The one closest to the common terminal.
Step 5 – Solder the green wire (8 ohm tap) to the second terminal going counter clockwise from the common terminal.
Step 6 – Solder the orange wire (16 ohm tap) to the third and final terminal.
Step 7 – Take the 18AWG wire previously wired to the "tip" terminal of the nearest speaker output jack and solder it to the common terminal of the speaker impedance selector.
Step 8 – Neatly organize all wires against the chassis.

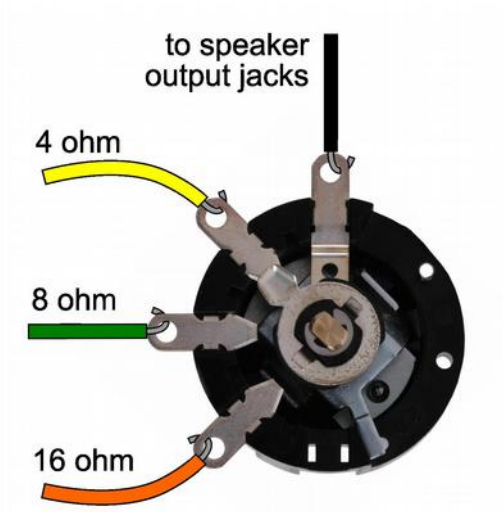


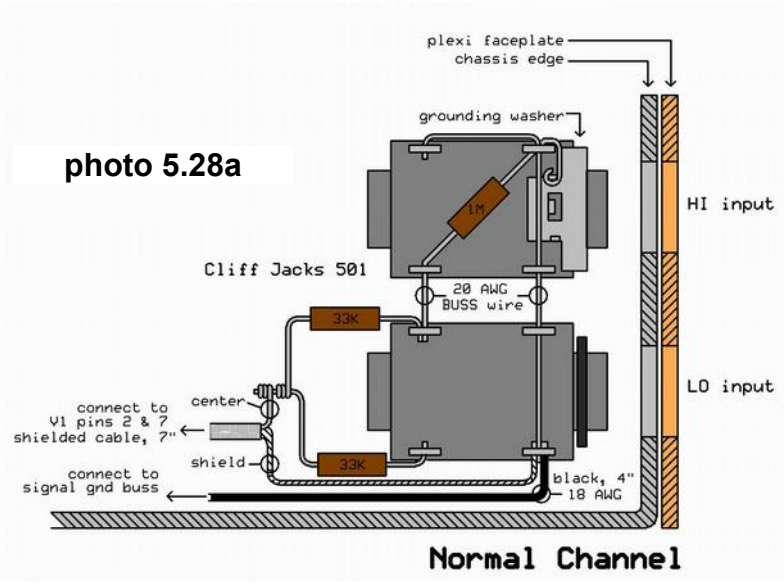
photo 4.3d

5.28 Initial Wiring of the Normal Channel Inputs Jacks

MOD *With the EF86 preamp tube mod, the input wiring is different than below. Refer to the "Cool Modifications", Chapter 11 for proper wiring..*

NOTE *To ease the assembly of the normal channel input jacks, I recommend temporarily installing the jacks in the more spacious vibrato channel position for soldering and assembly.*

photo 5.28a



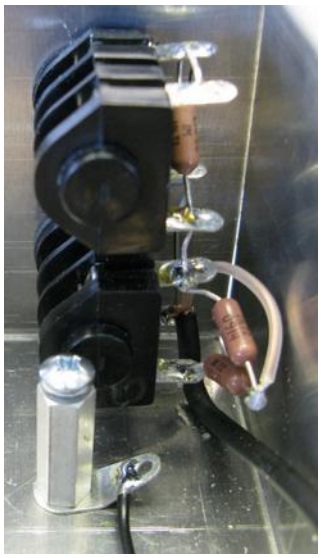


photo 5.28b

Step 1 – With the two normal jacks temporarily installed into the vibrato channel position,

install a 20AWG buss wire through all “sleeve” terminals as well as the top “tip” terminal. Tack solder in place the wire in all terminals (photo 5.28a).

Step 2 – On the upper jack (HI input), install a 1M resistor between the top “sleeve” terminal (extending this lead to the grounding washer) and the bottom “tip” terminal (extend this component lead to the lower jack). Solder all upper (HI input) jack terminals, including grounding washer.

Step 3 – Thread the lead from the upper jack 1M resistor through to the lower (LO input) jack's top “tip” terminal.

Step 4 – Locate the two 33K / 1/2W resistors and twist together one lead from each resistor.

Step 5 – With the other two open resistor leads, connect them close to the two lower jack “tip” terminals and solder both in place.

Step 6 – Remove the normal channel jack assembly from the vibrato position and place on the workbench.

Step 7 – Cut a 6 1/2” length of shielded wire and strip 1” from each end.

Step 8 – For the tube socket end, carefully cut and remove the exposed shield.

Step 9 – Cut a 3/4” length of 1/8” heat shrink and install over the end of the wire.

Step 10 – Shrink the heat shrink to cover where the shield was cut (photo 5.28c).

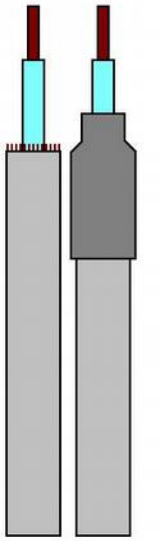


photo 5.28c

Step 11 – Strip and tin the center conductor.

Step 12 – For the jack end of the shielded wire, separate the shield from the center conductor.

Step 13 – Tightly twist the shield together and tin.

Step 14 – Remove the thin black conductive plastic shield from around the center conductor.

Step 15 – Strip 1/4” from the center conductor and tin.

Step 16 – Solder the center conductor to the point where the two 33K resistors twist together and trim any excess twisted component leads.

Step 17 – Tack solder in place the shield of the shielded wire to the lower “sleeve” terminal of the bottom (LO input) jack.

Step 18 – Cut a 4” length of 18AWG black wire and strip and tin each end.

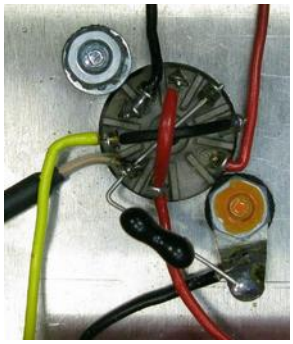


photo 5.28d

Step 19 – Solder one end of this wire (along with the other wires connected to this terminal) to the lower “sleeve” terminal of the bottom (LO input) jack.

Step 20 – Make sure all terminals and connections on these jacks are fully soldered.

Step 21 – Install the completed assembly into the normal input jack position (photo 5.28b).

Step 22 – Run the shielded cable along the chassis edge from the jack assembly to V1 and solder the heat shrink end to pin 2 of V1 (photo 5.28d).

MOD *Photo 5.28d shows a 10pfd silver mica cap between the input terminal 2 and ground. This is a great mod for reducing unwanted radio station reception in the amp.*

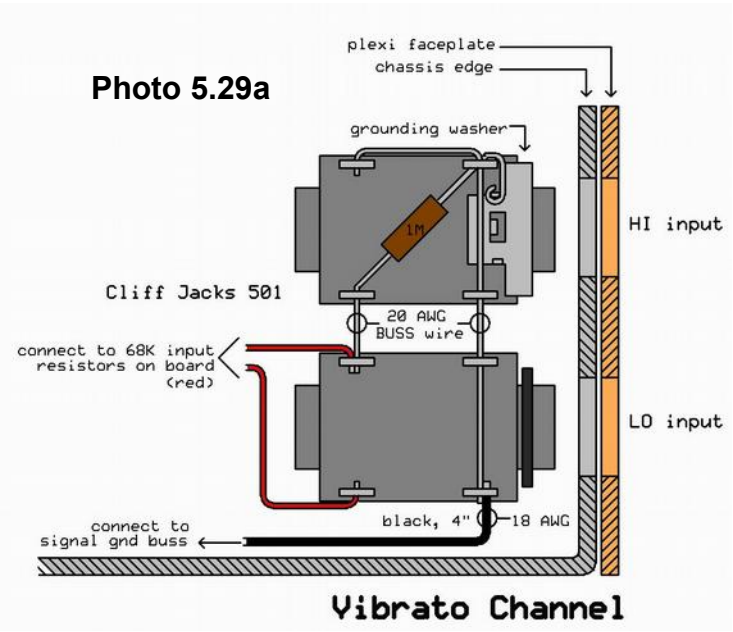
5.29 Initial Wiring of the Vibrato Channel Inputs Jacks

MOD

To further reduce noise and hum in the amp, solder the two 68K input resistors directly to the jacks instead of mounting them to the turret board. Then add a shielded wire straight to V3 pin 2, (in a similar fashion as the normal input jacks above). For more information, see "Cool Modifications", chapter 11.

Step 1 – Install the two vibrato channel jacks into the vibrato positions.
Step 2 – Install a 20AWG buss wire through all "sleeve" terminals as well as the top "tip" terminal. Tack solder in place in all terminals. See drawing at right for reference.
Step 3 – On the upper jack (HI input), install a 1M resistor between the top "sleeve" terminal (extending this lead to the grounding washer) and the bottom "tip" terminal (extend this component lead to the lower jack). Solder all upper (HI input) jack terminals, including grounding washer.
Step 4 – Thread the lead from the upper jack 1M resistor through to the lower (LO input) jack's top "tip" terminal.
Step 5 – Cut a 4" length of 18AWG black wire and strip 1/4" and tin each end.
Step 6 – Solder one end of this wire (along with the buss wire) to the lower "sleeve" terminal of the bottom (LO input) jack.

Photo 5.29a



5.30 Initial Wiring of the Normal Channel Controls

Step 1 – Salvage a length of white insulation 3/4" long, and install on one lead of a 100K resistor.
Step 2 – Center the 100K resistor between the two controls (with the insulated end along the volume control terminals). Bend the leads at 90 degree angles at both ends so that each lead goes into terminal 3 of the two appropriate controls (photo 5.30a).
Step 3 – Solder one end of this component to terminal 3 of the tone control.

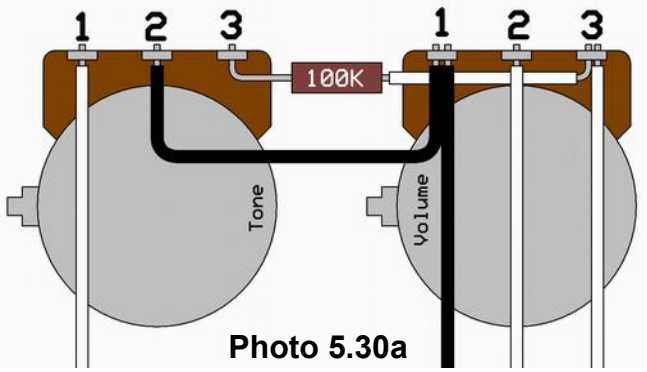


Photo 5.30a

Step 4 – Tack solder the remaining component lead to terminal 3 of the volume control.
Step 5 – Cut a length of 20AWG black wire 2 1/2" long. Strip and tin both ends.
Step 6 – Solder one end of this wire to terminal 2 of the tone control.
Step 7 – Cut a length of 20AWG black wire 4" long. Strip and tin both ends.
Step 8 – Insert the end of the 2 1/3" wire from terminal 2 of the nearby tone control along with the above 4" wire into terminal 1 of this volume control. Solder both wires into place.
Step 9 – The remaining wires (as in the photo 5.30a) will come from the turret board later.

5.31 Wiring the Vibrato Channel Controls

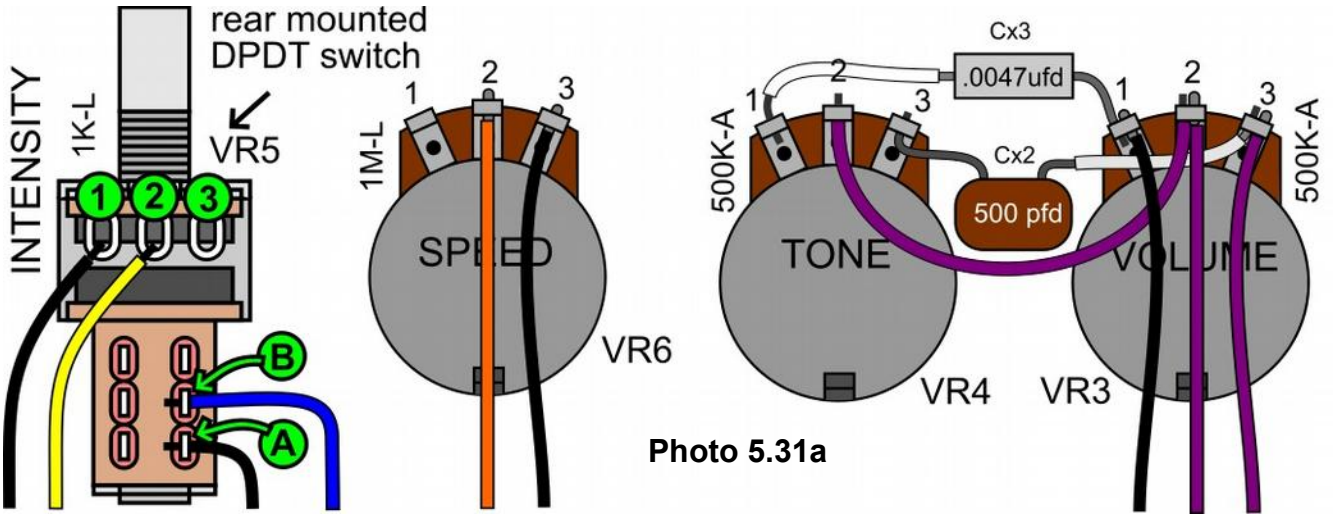


Photo 5.31a

Step 1 – Salvage two 3/4” lengths of insulation (white is shown above).
Step 2 – Install the first piece of insulation on the lead of the 500 pf cap (photo 5.31a).
Step 3 – Bend the leads of the 500 pF cap away from the body in opposite directions.
Step 4 – Center the 500pfd component body between the volume and tone controls and bend the end of the insulated lead into terminal 3 of the volume control and tack solder in place.
Step 5 – Bend the end of the opposite lead of this 500pfd cap into terminal 3 of the tone control and solder in place.
Step 6 – Install the second piece of insulation length on one lead of the .0047ufd cap.
Step 7 – Center the .0047ufd component body between the volume and tone controls and bend the end of the insulated lead into terminal 1 of the tone control and solder in place.
Step 8 – Bend the opposite lead of this .0047ufd cap into terminal 1 of the volume control and tack solder in place.
Step 9 – Cut a length of 20AWG violet wire 2 1/2” long. Strip and tin both ends.
Step 10 – Solder one end of this wire to terminal 2 of the tone control.
Step 11 – Tack solder the opposite end of this wire to terminal 2 of the volume control.
Step 12 – Cut a length of 20AWG black wire 4 1/2” long. Strip and tin one end.
Step 13 – Solder the tinned end of the above wire to terminal 1 of the volume control (along with the lead of the .0047ufd cap). The opposite end of this wire will be soldered to the signal buss ground when the board has been installed.
Step 14 – Cut a length of 20AWG blue wire 12” long and strip and tin one end.
Step 15 – Solder the end of this blue wire to terminal B on the rear of the intensity control.

NOTE *The wiring diagram for the 18W shows this blue wire going to the tube instead of the footswitch. Both methods of wiring are correct. Choose the method that is easiest for you.*

Step 16 – Run this blue wire neatly over to the rear mounted footswich jack and cut to length.
Step 17 – Strip and tin this cut end and solder to the “tip” of the footswitch jack where the other blue wire is connected. Solder all terminals of this jack.
Step 18 – Cut a length of 20AWG black wire 4 1/2” long and strip and tin one end.
Step 19 – Solder the tinned end of this black wire to terminal 3 of the speed control. The

opposite end of this wire will be soldered to the signal buss ground on the turret board later.
Step 20 – Cut a length of 20AWG black wire 5” long and strip and tin one end.
Step 21 – Solder the tinned end of this black wire to terminal 1 of the intensity control. The opposite end of this wire will be soldered to the signal buss ground when the board has been installed.
Step 22 – Cut a length of 20AWG black wire 5” long and strip and tin one end.
Step 23 – Solder the tinned end of this black wire to terminal A on the back of the intensity control. The opposite end of this wire will be soldered to the signal buss ground when the board has been installed.
Step 24 – The remaining wires (as displayed in photo 5.31a) will come from the turret board and will be installed later.

5.32 Wiring the V1 shield ground

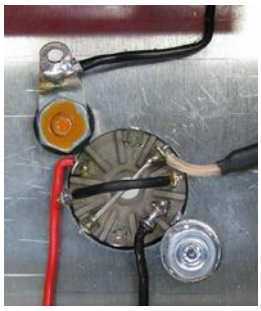


photo 5.32a

Step 1 – Cut a 4.5” length of 20AWG black wire and strip and tin both ends.
Step 2 – Solder one end of this black wire to the #6 solder terminal on the mounting screw at V1 tube (photo 5.32a).
Step 3 – Solder the opposite end of this black wire to the #6 solder terminal at the aluminum standoff nearest the normal channel input jacks (photo 5.32a).

5.33 Installing the Standoffs and Grounding Terminal

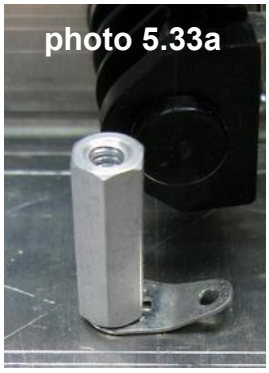


photo 5.33a

Step 1 – Install a #6 solder terminal when mounting the aluminum standoff nearest the normal channel jacks (photo 5.32a) with a #6 screw.
Step 2 – Cut a 3” length of 18AWG black wire and strip and tin both ends.
Step 3 – Tack solder one end of this black wire to the #6 solder terminal on the aluminum standoff nearest the normal channel input jacks.
Step 4 – Install the remaining three aluminum standoffs in the appropriate holes in the chassis, all with #6 screws.

NOTE

- These standoffs are installed into the chassis at this time to insure that the turret board, when built (chapter 6) will properly fit.
- Once the turret board fit has been verified, remove these standoffs from the chassis and mount them to the actual turret board corners (with the #6 screws). This will provide an elevated surface on which to install the components to the turret board.
- When the components have been successfully loaded into the turret board, remove the standoffs from the turret board and remount them in their original chassis locations.

6 Turret Board Assembly

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MOD *This turret board has been designed for either a 12AX7 or an EF86 normal channel preamp tube. The below description covers wiring the turret board for the 12AX7 tube. Refer to "Cool Modifications", Chapter 11 for the requirements for installing the EF86.*

NOTE *The two methods of building a turret board are 1) the press fit method, and 2) the swaging method. For a thorough explanation, see the booklet "How to Make a Top Quality Turret Board" at http://site.tubedepot.com/pdf/turret_boards_v1.pdf.*
As well, view the two videos,"How to Build a Turret Board, pt. 1 – Press Fitting" - http://www.youtube.com/watch?v=eVSjj3S6nsU; and "How to Build a Turret Board, pt. 2 – Swage Fitting" - http://www.youtube.com/watch?v=iYtQC4UBysE.

6.1 Transferring the Template / Layout to the Raw G10 Board

CAUTION *Some printers may automatically reduce the size of the template when printing. Always physically measure the printed template to insure proper scale is maintained.*

CAUTION *With a grease pen or permanent marker, put a mark on the side of the turret board that will receive the turrets. This will insure that the turrets aren't installed on the wrong side.*

Step 1 – Find the template in the back of this manual and cut the template from the page.
Step 2 – Lay this full scale template into the chassis to make sure the mounting holes on the template line up with the stand-offs mounted in the chassis. Adjust and mark the location of the mounting holes on the template as needed.
Step 3 – Lay the full scale template over the G10 board and tape into place.
Step 4 – With a sharp tool (an automatic center punch is perfect for this), make a mark through the template at each drill point, leaving a slight mark into the board.
Step 5 – Once all the marks have been created, remove the template and place to the side for future reference. Before moving on, read the "caution" above regarding marking the turret board. I cannot stress enough the importance of this action (I've ruined lots of boards!).

6.2 Drilling Holes in the Board for Turrets, Wiring, and Mounting

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

CAUTION *There are three hole sizes to be drilled in this board. Refer to the template to insure the correct holes are drilled in the correct spots. To reduce unrepairable errors, I recommend drilling the smallest hole size first and then the following two sizes. It is always easier to make a hole larger than smaller.*

NOTE *Depending on the mounting method you choose to install the turrets, use either the #43 drill bit (for press fitting) or the 3/32" drill bit (for the swage fitting). Refer to the booklet "How to Make a Top Quality Turret Board" (http://site.tubedepot.com/pdf/turret_boards_v1.pdf) to decide which method is best for you.*

Step 1 – Drill the appropriate turret holes throughout the board (either #43 drill bit for press fitting or drill 3/32” for swage fitting).
Step 2 – Deburr these holes with a hobby knife or counter sink tool on both sides of board.
Step 3 – Drill the appropriate wire routing holes (1/8”) throughout the board.
Step 4 – With a countersink bit or tool, countersink these wire routing holes on both the top and bottom of the board (photo 6.2a). This countersinking will protect the wires as they maneuver through these holes.
Step 5 – Drill the appropriate screw mounting holes (5/32”) at the four corners of the board.
Step 6 – Deburr these holes with a hobby knife or counter sink tool on both sides of board.


photo 6.2a

6.3 Insuring Proper Fit of the Board in the Chassis

Step 1 – Lay the newly drilled blank turret board into the chassis over the stand-offs.
Step 2 – Verify that the board can be mounted with screws to these stand-offs.
Step 3 – Adjust the size and / or shape of any mounting hole(s) in the board in an effort to make the board properly fit on the stand-offs.
Step 4 – Once the board has been verified to fit (by mounting with screws to the stand-offs), remove the screws and the board and prepare for mounting the turrets.

6.4 Installing the Turrets

NOTE *Refer to the booklet “How to Make a Top Quality Turret Board” (http://site.tubedepot.com/pdf/turret_boards_v1.pdf) for detailed instructions on installing the turrets into the board.*

Step 1 – Using the method of your choice (press fitting or swage fitting), install the turrets in the appropriate holes of the board making sure that the turrets are mounted on the correct side of the board.

6.5 Installing the Board Mounted Fuse Holder


photo 6.5a

Step 1 – Mount a 3/8”, #6 screw into the mounting hole of the fuse holder.
Step 2 – Mount the fuse holder to the top of the board, inserting the #6 screw through the appropriate hole in the board.
Step 3 – Secure the #6 screw and fuse holder assembly to the board with a #6 KEPS nut on the opposite side of the board and tighten.

6.6 Installing Terminal-to-Terminal Jumpers

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*

NOTE *By removing the standoffs from the chassis and temporarily mounting them to the turret board during the following assembly, soldering will be much easier.*

NOTE *Refer to the following diagram (photo 6.6a) that lists the individually numbered terminals for making the terminal to terminal and under board connections.*

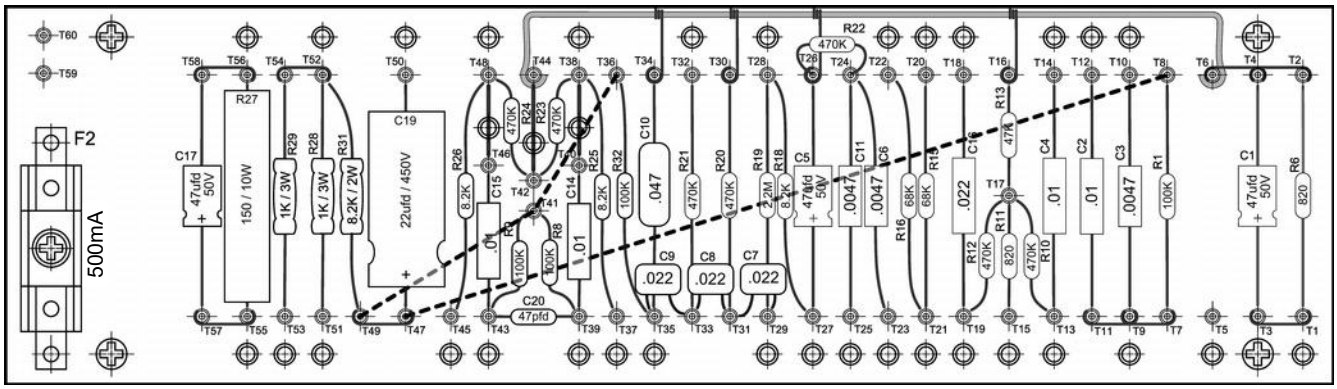


photo 6.6a

photo 6.6c

photo 6.6b

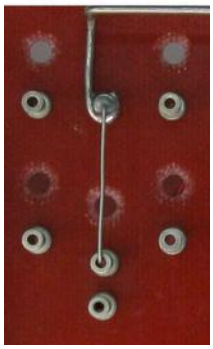


photo 6.6d

Step 1 – With 20AWG buss wire, connect together terminals T2, T4, and T6 and solder (photo 6.6b).
Step 2 – Similarly connect terminals T7, T9, and T11.
Step 3 – Similarly connect terminals T47 and T49 (photo 6.6c).
Step 4 – Similarly connect terminals T52 and T54.
Step 5 – Similarly connect terminals T1 and T3.
Step 6 – Similarly connect terminals T55 and T57.
Step 7 – Similarly connect terminals T56 and T58.
Step 8 – With 20AWG buss wire, connect terminals T42 and T44. Wire these two terminals similar to how a component would be mounted (photo 6.6d). This will make future installation of a master volume easier.
Step 9 – Do not connect terminals T38 and T40 or T46 and T48 just yet.

6.7 Installing the Ground Buss

photo 6.7a

Step 1 – With the 16AWG buss wire, make a small hook at one end, large enough to fit around a turret.
Step 2 – Hook this loop on turret T6 and solder in place (photo 6.7a).
Step 3 – Extend this wire 3/4" from the turret, past the board edge and make a sharp 90° bend in the wire toward the opposite end of the board.

Step 4 – Extend this wire approximately 7” along the board edge from turret T6 (do not cut just yet).
Step 5 – Make a sharp 90° bend in the 16AWG wire toward turret T44.
Step 6 – Make a small hook in the 16AWG wire around turret T44, making sure that the running length of wire remains parallel to the board edge.
Step 7 – Solder this wire to turret T44 and trim.
Step 8 – With the 20AWG buss wire, make a small hook at one end large enough to fit around a turret.

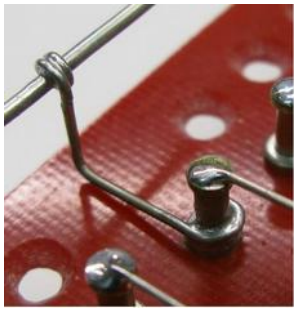


photo 6.7b


photo 6.7d

Step 9 – Hook this loop on turret T16 and solder in place.
Step 10 – Extend this wire 1 1/4” from the turret, past the board edge and trim to length.
Step 11 – Wrap this extended end of the 20AWG wire around the 16AWG buss wire (photo 6.7b). Make sure that the 16AWG wire remains parallel with the board edge.
Step 12 – Once the wire is wrapped once or twice around, trim excess and solder in place.
Step 13 – Repeat the above for turrets T26, T30 and T34 (photo 6.7c).
Step 14 – Once all the wires are soldered in place, bend each wire near the board edge at a 90° angle (photo 6.7d).

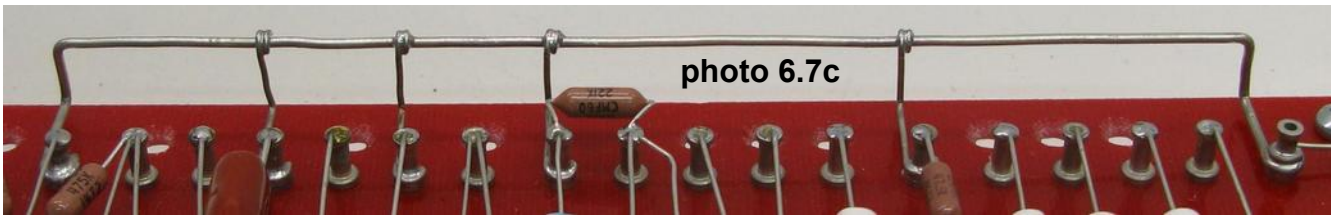


photo 6.7c

6.8 Installing Under Board Power Routing

NOTE *Refer to the below photo as a reference to how the wires are routed under the board. Also refer to photo 6.9a that lists the individually numbered terminals for making the under board connections.*

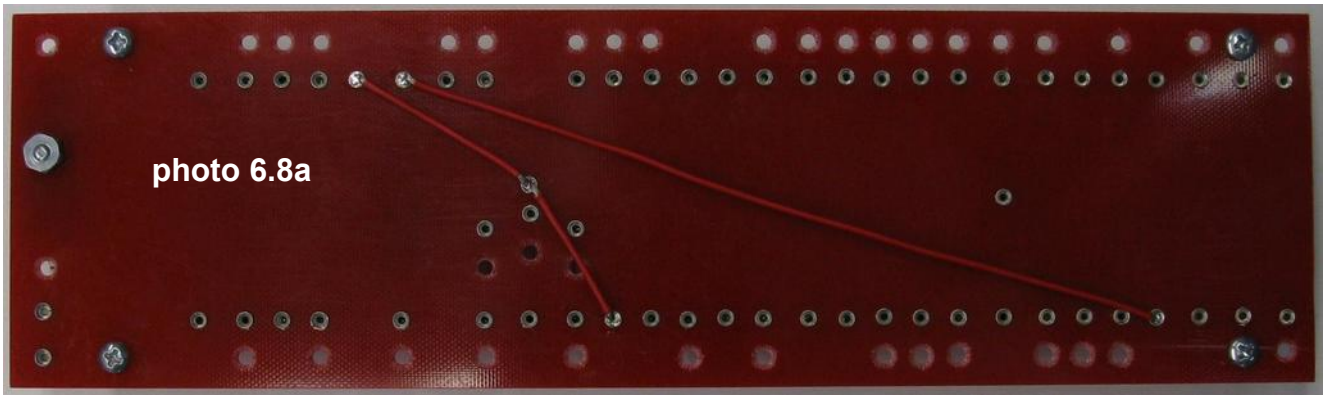


photo 6.8a

Step 1 – Cut a 2 1/4” length of 20AWG red wire, strip and tin one end.
Step 2 – On the back side of the board, solder this wire into the opposite end of turret T49.
Step 3 – Run the above wire directly to turret T41 and carefully trim this wire, leaving enough end to insert into back of T41 turret.

Step 4 – Strip the end of this wire but do not tin. Insert this end into the back of T41 turret (photo 6.8b).
Step 5 – Cut a 2" length of 20AWG red wire, strip and tin one end.
Step 6 – On the back side of the board, solder this wire into the opposite end of T36 turret.
Step 7 – Run the above wire directly to turret T41 and carefully trim this wire, leaving enough end to insert into back of T41 turret.
Step 8 – Strip the end of this wire but do not tin. Insert this end into the back of the T41 turret along with the previous wire (photo 6.8c).
Step 9 – Solder these two wires together into the back of the T41 turret.
Step 10 – Cut a 7 1/2" length of 20AWG red wire, strip and tin one end.
Step 11 – On the back side of the board, solder this wire into the opposite end of turret T47.
Step 12 – Run this wire directly to turret T8 and carefully trim this wire, leaving enough to insert into the back of T8 turret.
Step 13 – Strip and tin the above wire and solder into the back of turret T8.

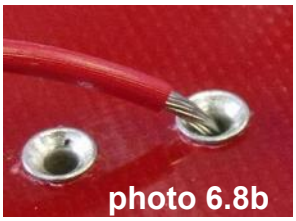


photo 6.8b

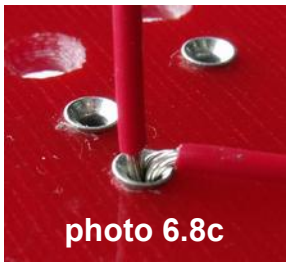


photo 6.8c

6.9 Installing the Components

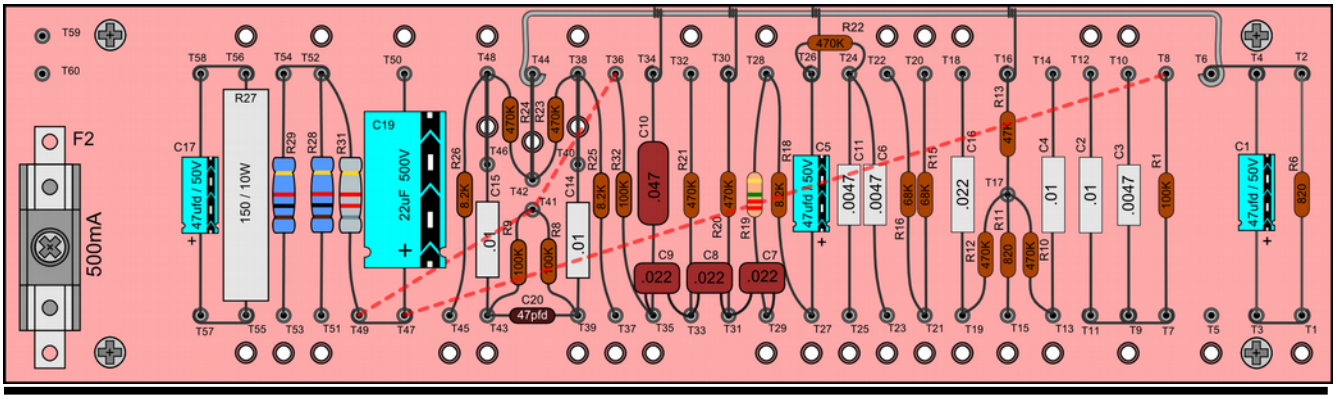
MOD *The below assembly directions covers wiring the turret board for the 12AX7 tube. Refer to "Cool Modifications", Chapter 11 for installing the EF86 tube instead.*

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

NOTE *It is good practice to install all components centered between their mounting turrets with equal length lead on either side of component. Additionally it is important to install all components with their value, voltage rating, and polarity markings facing up. This makes reading and identifying the components easier.*

NOTE *When installing large electrolytic caps, it is good practice to secure the component to the board with a small bead of silicon adhesive. This will hold the component firmrly against the board, removing the chance for the component to vibrate when the amp is played.*

NOTE *The MIL-SPEC resistors used with this kit are rated at 1% and often have very specified values. As example, 475K is used in place of 470K; 825 in place of 820; etc. These specific values are within the ratings of the vintage 10% common resistors.*



NOTE *Capacitor value descriptions uF and uFd are the same. Also, the values for the brown radial leaded capacitors are written on the side in code. Refer to page 62 on reading this code.*

Step 1 – When installing components, insert no more than 1/8" of lead into the terminal holes. Trim all excess beyond this 1/8".
Step 2 – From the right side of the board (photo 6.9a), install a 47ufd / 50V cap across terminals T3 and T4. Make sure the positive terminal of this capacitor is connected to T3. Solder component into place.
Step 3 – Install a 825Ω resistor between turrets T1 and T2. Solder in place at both terminals.
Step 4 – Install a 100KΩ resistor between turrets T7 and T8, soldering at both terminals.
Step 5 – Install a .0047µfd Mallory capacitor between turrets T9 and T10, soldering into place at both terminals.
Step 6 – Install a .01µfd Mallory capacitor between turrets T11 and T12; solder at T12.
Step 7 – Install a .01uF capacitors between turrets T13 and T14; Solder at T14.
Step 8 – Install a .022µfd Mallory capacitor between turrets T19 and T18; solder at T18.
Step 9 – Install a 470KΩ resistor between turrets T13 and T17; solder at T13.
Step 10 – Install an 825Ω resistor between turret T15 and T17. Solder at T15.
Step 11 – Install a 470KΩ resistor between turrets T19 and T17. Solder at T19.
Step 12 – Install a 47.5KΩ resistor between turrets T16 and T17. Create a small loop at the lead end that goes to turret T17 and hook around the inserted lead of the 825Ω resistor (photo 6.9b). Solder at both terminals.
Step 13 – Install a 68.1KΩ resistor between turrets T20 and T21. Solder at T20.
Step 14 – Install a 68.1KΩ resistor between turrets T22 and T21. Solder at both turrets.
Step 15 – Install a .0047µfd Mallory capacitor between turrets T23 and T24. Solder at T23.
Step 16 – Install a .0047µfd Mallory capacitor between turrets T25 and T24, Solder at T25.
Step 17 – Install a 47µfd/50V Electrolytic capacitor between turret T27 and T26. Make sure that the positive of this cap is soldered to T27.
Step 18 – Install a 475KΩ resistor between turret T24 and T26 (photo 6.9c). Solder at both turrets.
Step 19 – Install an 8.25KΩ resistor between turret T27 and T28. Solder at T27.
Step 20 – Install a 2.2MΩ resistor between turret T28 and T29. Solder at T28.
Step 21 – Install a 475KΩ resistor between turret T30 and T31. Solder at T30.

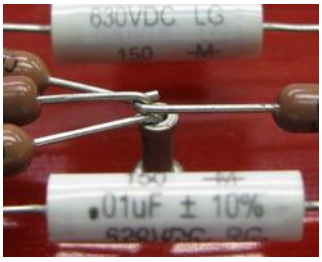


photo 6.9b


photo 6.9c


photo 6.9d


photo 6.9e

Step 22 – Install a 475KΩ resistor between turret T32 and T33. Solder at T32.
Step 23 – Install a .047µfd capacitor (brown cap, code "F473K") between turrets T34 and T35. Solder at T34.
Step 24 – Install a 100KΩ resistor between turrets T35 and T36. Solder at T36.
Step 25 – Trim in half the leads of the three .022µfd capacitors (brown cap, code "F223K").
Step 26 – Insert these three .022µfd capacitors all together. Install the first .022µfd capacitor between turrets T29 and T31. Install the second cap between turrets T31 and T33. Install the final capacitor between turrets T33 and T35 (photo 6.9d).
Step 27 – Slowly press them into the turrets and rotate them slightly until they are nearly flush with the turrets (photo 6.9e).
Step 28 – Remove these three caps from the turrets and trim the leads to where only 1/8" of the lead of each cap fits into the turret. Reinstall the three capacitors and solder into place.
Step 29 – Install an 8.25KΩ resistor between turrets T37 and T38. Solder at T37.
Step 30 – Install a .01µfd Mallory capacitor between turrets T39 and T40. Save the trimmed leads from this component.
Step 31 – With one of the salvaged leads from above, install this salvaged lead between turrets T38 and T40. Solder at T40.
Step 32 – Install a 475KΩ resistor between turrets T38 and T42. Solder at T38.
Step 33 – Install a 475KΩ resistor between turrets T42 and T48. Solder at T42.
Step 34 – Install an 8.25KΩ resistor between turrets T45 and T48. Solder at T45.
Step 35 – Install the remaining salvaged lead between turrets T46 and T48. Solder at T48.
Step 36 – Install a .01µfd Mallory capacitor between turrets T43 and T46. Solder at T46.

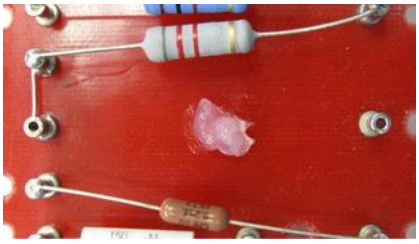


photo 6.9f


photo 6.9g

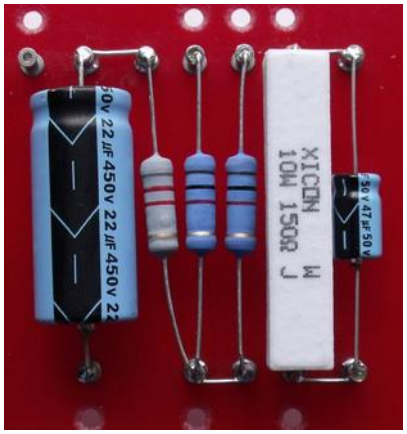


photo 6.9h

Step 37 – Install a 100KΩ resistor between turrets T39 and T41.
Step 38 – Install a 100KΩ resistor between turrets T41 and T43. Solder at T41.
Step 39 – Install a 47pfd silver mica capacitor between T39 and T43. Solder at both turrets.
Step 40 – Install a small bead of silicon sealant (just a dab with do) to the board directly between turrets T47 and T50 (photo 6.9f). This will help to hold the component firmly to the board and reduce potential buzzing.
Step 41 – Install a 22µfd/500V electrolytic cap between turrets T47 and T50 directly on top of the silicon sealant. Make sure the positive lead of this component is connected to turret T47. Solder in place (photo 6.9g / h).
Step 42 – Install a 8.2KΩ/2W metal oxide resistor between turrets T49 and T52. Solder at T49 (photo 6.9h).
Step 43 – Install a 1KΩ/2W metal oxide resistor between turrets T51 and T52.
Step 44 – Install a 1KΩ/2W metal oxide resistor between turrets T53 and T54. Solder these two metal oxide resistors in place at all four turrets (T51 – T54) (photo 6.9h).
Step 45 – Install a 150Ω/10W wire wound resistor between turrets T55 and T56. Solder at

both turrets (photo 6.9h).

MOD *Install an 8W "Brown Devil" 150Ω resistor (R-B8J-150) in place of the sand cast 150Ω/10W resistor for a way cooler vintage look.*

Step 46 – Install a 47µfd/50V electrolytic capacitor between turrets T57 and T58. Solder at both turrets. Make sure to connect the positive lead of this capacitor to terminal T57.

6.10 Installing the Interconnect Wiring

MOD *Refer to "Cool Modifications", Chapter 11 for directions on installing a post phase inverter master volume or for substituting an EF86 for a 12AX7 in the normal channel.*

NOTE *To speed up the process of measuring and cutting the wires, I recommend laying a strip of masking tape on your work bench and marking, in 1/2" steps, from 0 to 10" (photo 6.10a).*

NOTE *By temporarily installing the standoffs to the turret board, the board will stand clear of the work bench making soldering the wires to the board much easier.*

Back Edge, 20AWG

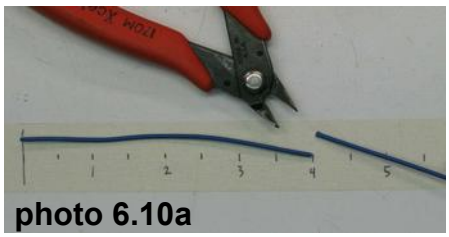


photo 6.10a


photo 6.10b


photo 6.10c

Step 1 – Cut a 5" length of white 20AWG wire and strip and tin 1/4" at one end.
Step 2 – Make a small hook in the end just large enough to fit around a terminal (photo 6.10b).
Step 3 – Insert wire through the routing hole nearest terminal T10 from the top of the board.
Step 4 – Place the hook in the wire around terminal T10 (photo 6.10c) and solder in place (photo 6.10d). Pull all excess wire tightly through hole (photo 6.10e).

NOTE *MIL-SPEC soldering specifies wrapping the wire between 180° to 270° around the terminal. More than this makes future maintenance and modifications much more difficult.*

NOTE *For a uniform look when installing these wires, have all the wire hooks soldered to their respective terminals facing the same way. It looks great (photo 6.10f).*

Step 5 – Cut a 5 1/2" length of white 20AWG wire and solder to terminal T12 as above.
Step 6 – Cut a 5" length of white 20AWG wire and solder to terminal T14 as above.
Step 7 – Cut a 7" length of violet 20AWG wire and solder to terminal T18 as above.
Step 8 – Cut a 3 1/2" length of red 20AWG wire and solder to terminal T20 as above.
Step 9 – Cut a 3 1/2" length of red 20AWG wire and solder to terminal T22 as above.


photo 6.10d


photo 6.10e

Step 10 – Cut a 9” length of yellow 20AWG wire and solder to terminal T28 as above.
Step 11 – Cut a 9” length of orange 20AWG wire and solder to terminal T32 as above.

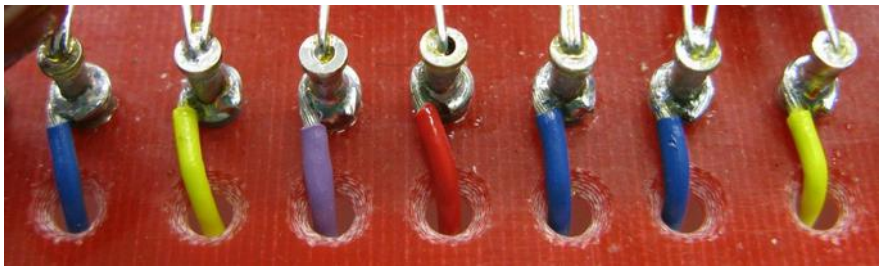


photo 6.10f

Front Edge, 20AWG
Step 12 – Cut a 3” length of yellow 20AWG wire and solder to terminal T1 as above.
Step 13 – Cut a 3 1/2” length of red 20AWG wire and solder to terminal T9 as above.
Step 14 – Cut a 3” length of blue 20AWG wire and solder to terminal T13 as above.
Step 15 – Cut a 3 1/2” length of yellow 20AWG wire and solder to terminal T15 as above.
Step 16 – Cut a 3 1/2” length of blue 20AWG wire and solder to terminal T19 as above.
Step 17 – Cut a 4 1/2” length of blue 20AWG wire and solder to terminal T21 as above.
Step 18 – Cut a 4 “ length of red 20AWG wire and solder to terminal T23 as above.
Step 19 – Cut a 7 1/2” length of violet 20AWG wire and solder to terminal T25 as above.

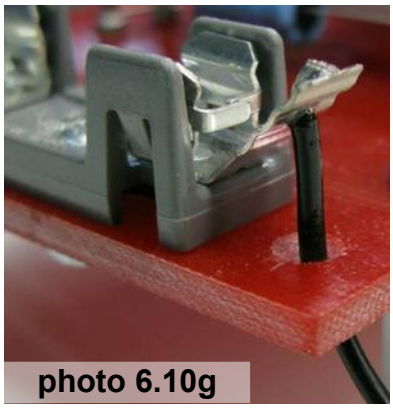


photo 6.10g

Step 20 – Cut a 3 1/2” length of yellow 20AWG wire and solder to terminal T27 as above.
Step 21 – Cut a 3 1/2” length of blue 20AWG wire and solder to terminal T29 as above.
Step 22 – Cut a 3 1/2” length of red 20AWG wire and solder to terminal T35 as above.
Step 23 – Cut a 3” length of blue 20AWG wire and solder to terminal T37 as above.
Step 24 – Cut a 6” length of red 20AWG wire and solder to terminal T39 as above.
Step 25 – Cut a 7” length of red 20AWG wire and solder to terminal T43 as above.
Step 26 – Cut a 4” length of blue 20AWG wire and solder to terminal T45 as above.
Step 27 – Cut a 3” length of white 20AWG wire and solder to terminal T51 as above.
Step 28 – Cut a 3” length of white 20AWG wire and solder to terminal T53 as above.
Step 29 – Cut a 3” length of yellow 20AWG wire and solder to terminal T55 as above.

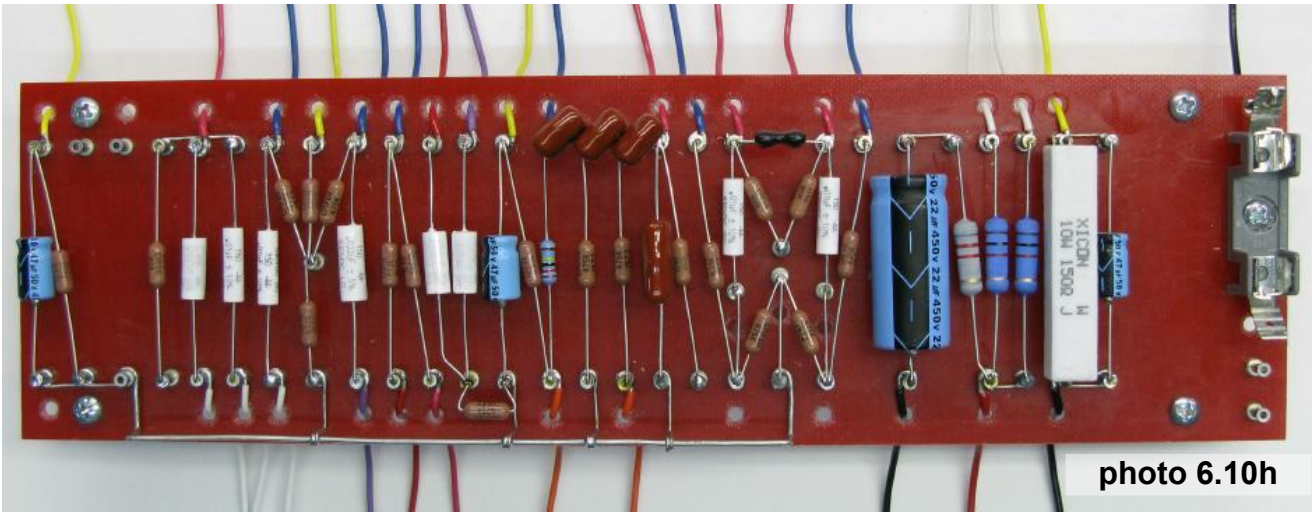


photo 6.10h

Back Edge, 18AWG
Step 30 – Cut a 8” length of black 18AWG wire and solder to terminal T50 as above.
Step 31 – Cut a 9” length of red 18AWG wire and solder to terminal T52 as above.
Step 32 – Cut a 7” length of black 18AWG wire and solder to terminal T56 as above.

Front Edge, 18AWG
Step 33 – Cut a 5” length of black 18AWG wire.
Step 34 – Strip and tin the end of the above wire and from the back of the board, insert this wire up through the routing hole to the fuse holder tab nearest the mounting screw (photo 6.10g).
Step 35 – Solder the above black 18AWG wire to the mounting tab of the fuse holder.

(See completed board photo 6.10h)

7 Chassis and Turret Board Assembly

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NOTE *Remove the standoffs from the board and remount the standoffs to the chassis if they were previously used to support the turret board while soldering components and / or wiring.*

NOTE *All wires are slightly longer than needed. Therefore, prior to soldering the wires to the terminals, test the length of the wires to the terminals and cut to length as needed.*

7.1 Wiring Chassis Ground to Signal Buss Ground

photo 7.1a

photo 7.1b

Step 1 – Bend the violet wire attached to terminal T25 under the board and past turret T24 on the buss ground side of the board. Temporarily feed it around the buss ground wire just to hold it in place (photo 7.1a).
Step 2 – Locate the 18AWG black ground wire attached to the solder terminal nearest the normal channel input jacks mounted under the standoff (photo 7.1b).
Step 3 – This is the last wire to be connected to this solder terminal. Therefore any wires previously tacked in place can be fully soldered to this terminal.
Step 4 – Solder the wire from the solder terminal to the ground buss on the board nearest turret T6 (photo 7.2a).
Step 5 – Secure the board to the standoffs with the four #6 -32 – 1/4" screws.

7.2 Wiring Input Jack Grounds to the Signal Buss Ground

photo 7.2a

Step 1 – With the turret board installed on the stand offs, locate the 18AWG black wire coming from the two input jack assemblies.
Step 2 – Strip and tin this wire and solder to the signal buss ground nearest the point where the chassis ground wire is also soldered.

7.3 Wiring Volume Control Grounds to the Signal Buss Ground

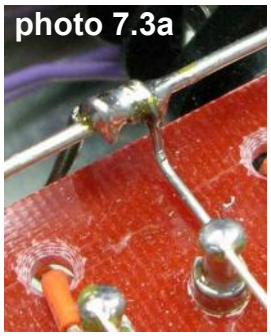


photo 7.3a

Step 1 – Locate the 20AWG black wire attached to the normal channel volume control (photo 7.5a).
Step 2 – Strip and tin this wire and solder it to the signal buss ground nearest turret T6 (photo 7.2a).
Step 3 – Locate the 20AWG black wire attached to the tremolo channel volume control (photo 7.6a).
Step 4 – Strip and tin this wire and solder it to the signal buss ground nearest turret T30 (photo 7.3a)

7.4 Wiring Tremolo Control Grounds to the Signal Buss Ground

Step 1 – Locate the two 20AWG black wires attached to the tremolo INTENSITY control.
Step 2 – Strip and tin both of these wires and solder them to the signal buss ground nearest turret T44 (photo 7.4a).
Step 3 – Strip and tin the end of the 20AWG black wire attached to the tremolo SPEED control and solder it to the signal buss ground nearest turret T44 (photo 7.4a).

photo 7.4a

7.5 Wiring Normal Channel Controls

Step 1 – Locate the 20AWG white wire attached to terminal T10 of the turret board. Strip and tin the end of this wire and connect it to terminal 3 of the normal channel volume control (along with the lead of the 100K resistor) (photo 7.5a).
Step 2 – Locate the 20AWG white wire attached to terminal T12 of the turret board. Strip and tin the end of this wire and connect it to terminal 1 of the normal channel tone control.
Step 3 - Locate the 20AWG white wire attached to terminal T14 of the turret board. Strip and tin the end of this wire and connect it to terminal 2 of the normal channel volume control.

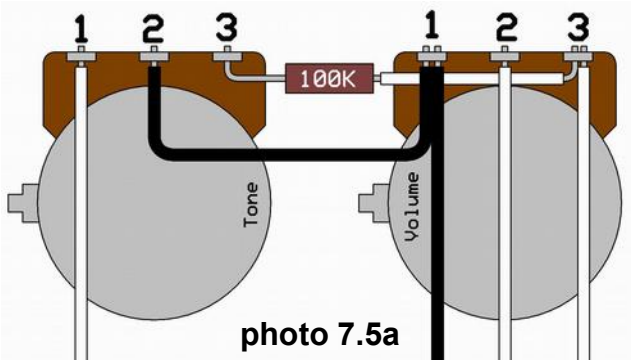


photo 7.5a

7.6 Wiring Tremolo Channel Controls

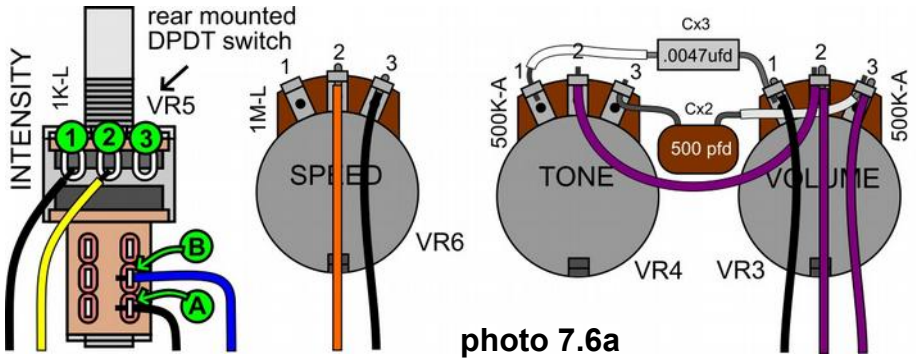


photo 7.6a

Step 1 – Locate the 20AWG violet wire attached to terminal T18 of the turret board. Strip and tin the end of this wire and connect it to terminal 2 of the tremolo channel volume control (along with the previous wire) (photo 7.6a).
Step 2 – Locate the 20AWG violet wire attached to terminal T25 of the turret board (this wire should be pulled under the board). Strip and tin the end of this wire and connect it to terminal 3 of the tremolo channel volume control.
Step 3 – Locate the 20AWG yellow wire attached to terminal T28 of the turret board.
Step 4 – Locate the 20AWG orange wire attached to terminal T32 of the turret board.
Step 5 – Twist these two wires together
Step 6 – Strip and tin the end of the yellow wire coming from terminal T28 and solder it to terminal 2 of the tremolo intensity control (photo 7.6a).
Step 7 – Strip and tin the end of the orange wire from terminal T32 and solder it to terminal 2 of the tremolo speed control (photo 7.6a).

7.7 Wiring Tremolo Channel Input jacks

NOTE *Soldering these two wires is quite a challenge if you are using a large soldering iron. You may want to remove the board to wire these and then install both together into the chassis.*

Step 1 – Locate the 20AWG red wire attached to terminal T20. Strip and tin the end and solder it to the bottom terminal of the input jack nearest the chassis surface (terminal B - photo 7.7a).
Step 2 – Locate the 20AWG red wire attached to terminal T22. Strip and tin the end and solder it to the top terminal of the input jack nearest the chassis surface (terminal A – photo 7.7a).

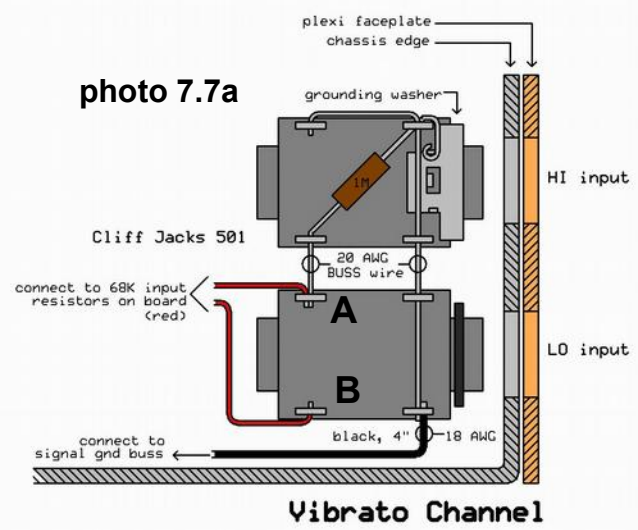


photo 7.7a

7.8 Wiring Filter Cap & Cathode Resistor to Chassis Ground

Step 1 – Locate the 18AWG black wire attached to terminal T50. Strip and tin the wire end and solder it to the chassis power ground.
Step 2 – Locate the 18AWG black wire attached to terminal T56. Strip and tin the wire end and solder it to the chassis power ground.

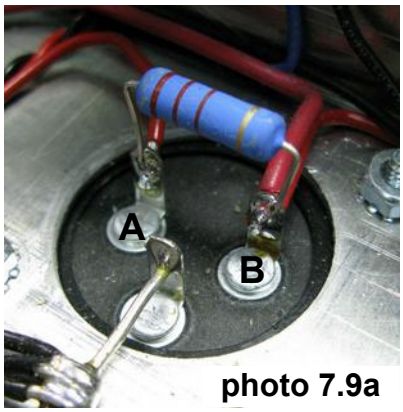


photo 7.9a

7.9 Wiring Voltage Divider Resistor to B+

Step 1 – Locate the 18AWG red wire attached to terminal T52.
Step 2 - Strip and tin the wire end and solder it to the “A” terminal on the 50x50 can capacitor (photo 7.9a).

7.10 Wiring the Indicator Lamp and Filaments


photo 7.10a

Step 1 – With the turret board mounted in the chassis, locate the red and black twisted 20AWG filament wires.
Step 2 – Neatly run these wire to terminals T59 and T60 on the turret board.
Step 3 – Cut to length and strip and tin these two wires.
Step 4 – Bend a small hook in each wire and tack solder the red wire to T59 and the black wire to T60 (photo 7.10a).
Step 5 – Neatly run the two wires from the indicator lamp to T59 and T60 on the turret board.
Step 6 – Cut these two wires to length and strip and tin both ends.
Step 7 – Bend a small hook in each wire end and tack solder these two wires in place, one wire on turret T59, the other wire on the turret T60.
Step 8 – Locate the two twisted green filament wires from the power transformer.
Step 9 – Neatly run these two wires from the power transformer to T59 and T60 on the turret board.

Step 10 – Cut these two wires to length and strip and tin both.
Step 11 – Bend a small hook in each wire end and solder these two wires in place (along with the other previously tack soldered wires), one wire on T59, the other on T60 (photo 7.10a).

7.11 Wiring the V1 preamp tube

MOD

The below wiring covers the standard 12AX7 installation for V1. Refer to "Cool Modifications", Chapter 11 for substituting an EF86.

photo 7.11a

Step 1 – Strip and tin the end of the yellow 20AWG wire from turret T1.
Step 2 – Solder this wire to terminal 3 of tube V1 tube socket.
Step 3 – Strip and tin the end of the red 20AWG wire from turret T9.
Step 4 – Solder this wire to terminal 1 of tube V1 tube socket (photo 7.11a).

7.12 Wiring the V2 preamp tube

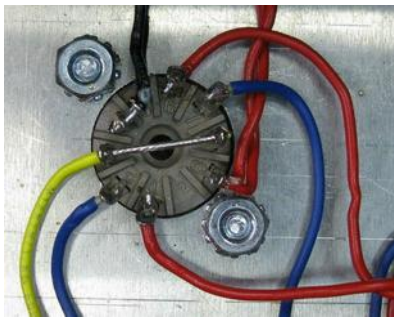


photo 7.12a

Step 1 – Strip and tin the end of the blue 20AWG wire from turret T13.
Step 2 – Solder this wire to terminal 2 of tube V2 tube socket.
Step 3 – Strip and tin the end of the yellow 20AWG wire from turret T15.
Step 4 – Solder this wire to terminal 3 of tube V2 tube socket.
Step 5 – Strip and tin the end of the blue 20AWG wire from turret T19.
Step 6 – Solder this wire to terminal 7 of tube V2 tube socket (photo 7.12a).
Step 7 – Strip and tin the end of the red 20AWG wire from turret T39. Place a small mark at the stripped and tinned end with a permanent marker.
Step 8 – Strip and tin the end of the red 20AWG wire from turret T43.
Step 9 – Twist these two red wires together the full length, being careful not to rub off the mark on the one wire from turret T39.
Step 10 – Solder the wire from turret T39 with the mark to terminal 1 of tube V2 tube socket (photo 7.12a).
Step 11 – Solder the remaining wire from turret T43 to terminal 6 of tube V2 tube socket (photo 7.12a)

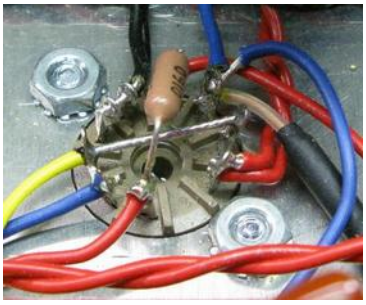


photo 7.13a

7.13 Wiring the V3 preamp tube

Step 1 – Strip and tin the end of the red 20AWG wire from turret T23.
Step 2 – Solder this wire to terminal 1 of tube V3 tube socket.
Step 3 – Strip and tin the end of the blue 20AWG wire from turret T21.
Step 4 – Solder this wire to terminal 2 of tube V3 tube socket.
Step 5 – Strip and tin the end of yellow 20AWG wire from turret T27.
Step 6 – Solder this wire to terminal 3 of tube V3 tube socket.
Step 7 – Strip and tin the end of the red 20AWG wire from turret T35.
Step 8 – Solder this wire to terminal 6 of tube V3 tube socket.

Step 9 – Strip and tin the end of the blue 20AWG wire from turret T29.
Step 10 – Solder this wire to terminal 7 of V3 tube socket (photo 7.13a). Even though photo 7.13a shows it, there is not a shielded cable that will be soldered to pin 7 of the V3 socket.

7.14 Wiring the V4 and V5 power tubes


photo 7.14a

Step 1 – Strip and tin the end of the blue 20AWG wire from turret T37.
Step 2 – Solder this wire to terminal 2 of tube V4 tube socket.
Step 3 – Strip and tin the end of the white 20AWG wire from turret T51.
Step 4 – Solder this wire to terminal 9 of tube V4 tube socket (photo 7.14a).
Step 5 – Strip and tin the end of the blue 20AWG wire from turret T45.
Step 6 – Solder this wire to terminal 2 of tube V5 tube socket.
Step 7 – Strip and tin the end of the yellow 20AWG wire from turret T55.
Step 8 – Solder this wire to terminal 3 of tube V5 tube socket.
Step 9 – Strip and tin the end of the white 20AWG wire from turret T53.
Step 10 – Solder this wire to terminal 9 of tube V5 tube socket (photo 7.14b).


photo 7.14b


photo 7.15a


photo 7.15b

7.15 Wiring the HT Fuse Holder

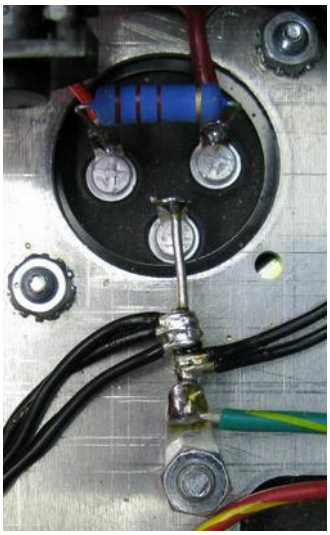


photo 7.15c

Step 1 – Locate the red wire with yellow stripe coming from the power transformer.
Step 2 – Neatly run this wire over to the fuse holder solder terminal nearest turret T59.
Step 3 – Cut to length and strip and tin the end.
Step 4 – Run the end of this wire up through the board to the fuse holder terminal and solder in place (photo 7.15a).
Step 5 – Strip and tin the end of the black 18AWG wire connected to the other end of the fuse holder (photo 7.15b).
Step 6 – Solder this black 18AWG wire to the chassis ground nearest the can cap (photo 7.15c).

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 – Install a 1A, slow blow fuse into the rear panel mounted fuse holder and a 500mA (.5A) slow blow fuse in the internal board mounted 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 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”. The power and standby 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 at the wall.
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 T59 and T60 (polarity is not important).

photo 8.1a

Step 6 – There should be about 6.6 VAC as measured at these two turrets (photo 8.1a)
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.*


photo 8.2a

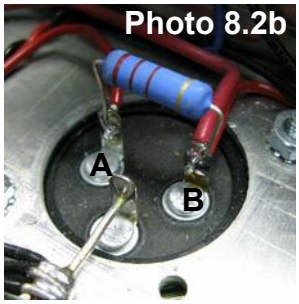


Photo 8.2b

Step 1 – With the amp still disconnected from AC power, install the tube rectifier.
Step 2 – Plug the amplifier's AC power cord into the AC power source at the wall.
Step 3 – 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 4 – With your multimeter on the 500 volt DC range, connect the meter's black lead to chassis ground (photo 8.2a) and carefully touch the meter's red lead to the “B” terminal of the can capacitor (photo 8.2b). The voltage here should be around +413 Vdc.
Step 5 – Remove AC power by disconnecting the AC power cord from the AC source.

8.3 Preamp Tubes, Installation and Testing

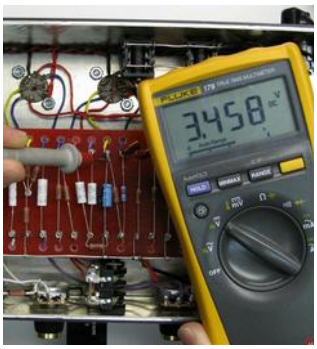
NOTE *The previous voltages were measured without power and preamp tubes installed. Those voltage values will decrease with the added load of the tubes.*

NOTE *The presence of voltages at steps 4, 5 & 6 indicates that the preamp tubes are correctly sourcing current (they are working). The tolerances for these voltages are +/- 10%.*

Photo 8.3a

photo 8.3b

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 panel indicator 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 point (photo 8.2a) and touch the red lead to turret T1. The voltage here should be close to +1.4 (photo 8.3a).
Step 5 – Adjust the meter range to the 200 volt range and move the red lead to turret T17. The voltage here should be close to 83 volts (photo 8.1d).
Step 6 – Adjust the meter range back to the 20 volt range and move the red meter lead to turret T27. The voltage here should read 3.4 volts (photo 8.3c).
Step 7 – Remove the AC power by disconnecting the AC power cord from the AC source.

8.4 Power Tubes, Installation and Testing

photo 8.4a

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 vibrato intensity and speed controls should be turned fully counterclockwise. 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 500 volt range, connect the meter's black lead to chassis ground (photo 8.2a) and carefully touch the meter's red lead to the "B" terminal of the can capacitor (photo 8.2b). The voltage here should be around +345 Vdc.
Step 7 – Move the red lead to the "A" terminal of the cap capacitor (photo 8.2b). The voltage here should be around +320 Vdc.
Step 8 – Move the red lead to turret T55. The voltage here should be around 11 volts Vdc (photo 8.4a).

NOTE *The voltages above as measured at the can cap and the cathode resistor (turret T55) will vary depending on the idle current of the individual tubes. +/- 15% is acceptable.*

Step 9 – Remove both multimeter leads from the amp and set meter to the side.

8.5 Signal Injection, Final Testing

Step 1 – With no signal source connected to either input, turn the normal channel tone control fully clockwise.
Step 2 – Turn the normal channel volume control 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 – If the above hiss is heard, turn the volume control back to minimum (leave tone

control turned up).
Step 4 – Turn the vibrato channel tone control fully clockwise.
Step 5 – Turn the vibrato channel volume control 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 6 – If the above hiss is heard correctly, turn the vibrato channel volume control back to minimum (leave tone control turned up).
Step 7 – With a 1/4" guitar cord, connect a suitable signal source (a guitar is good) into one of the normal channel jacks.

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 8 – Turn up the normal channel volume control on the amp and verify that the signal from the signal source is coming from the speaker.
Step 9 – Repeat the above for the vibrato channel.
Step 10 – Turn the vibrato intensity control to "on" and verify that the vibrato is working.
Step 11 – Turn the vibrato speed control clockwise to verify that the speed is adjustable.
Step 12 – If everything checks good, we are almost done!

Final notes (important stuff I forgot to mention):

- 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 wires around. These would be the wires between the turret board, the tube sockets, and the controls. Because the amp has a great deal of gain, proper wire routing becomes important. Often a wire with a strong signal will "bleed" into an adjacent wire causing 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.

- If the amp "clicks" in rhythm with the tremolo speed, then I recommend moving the wires around similar to the above technique. The tremolo oscillator signal is very strong and will bleed into neighboring audio wires if the wires are too close.

9 Amp Final Assembly

9.1 Installing Chassis in Cabinet


photo 9.1a

photo 9.1b

Head Cabinet

Step 1 – Place the predrilled 18W cabinet head, face down on the work bench with the rubber feet facing toward you.
Step 2 – With the tubes installed into the chassis, insert the chassis into the cabinet with the knobs facing down toward the bench.
Step 3 – Loosely install all the screws with washers through the cabinet into the corresponding press nuts mounted into the chassis. Do not tighten until all screws are properly threading.
Step 4 – Once all the screws and their washers are loosely threaded, center the chassis in the front opening.
Step 5 – Once the chassis is properly centered, tighten the four mounting screws to the cabinet.
Step 6 – Finish the installation by attaching the rear panel.
Step 7 – Your amp is done and ready for you to connect it to a speaker cabinet and play.


photo 9.1c

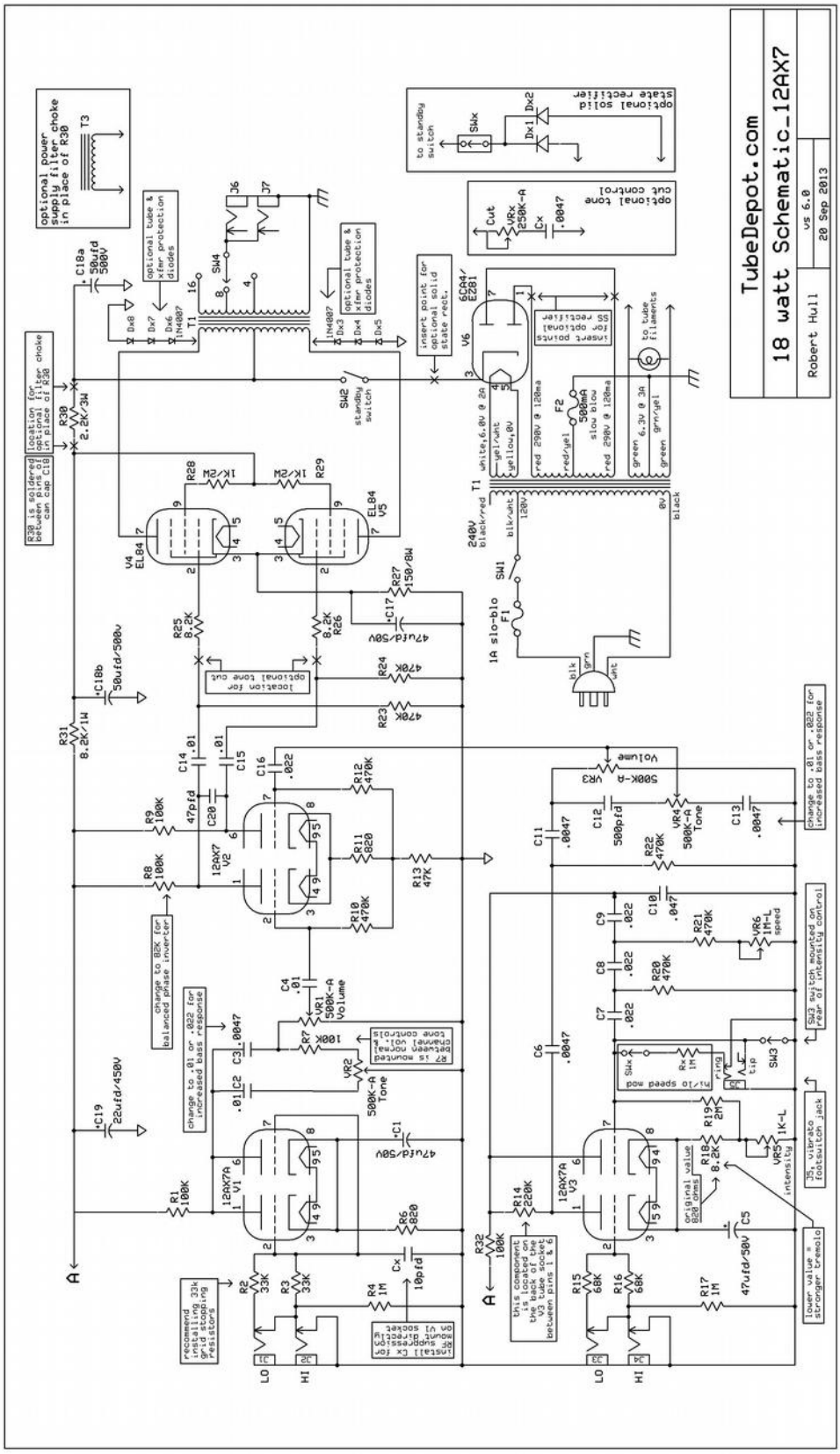
Combo Cabinet

Step 1 – Remove the power tubes and the rectifier tube from the chassis.
Step 2 – Rest the chassis on its transformers with the knobs facing toward you.
Step 3 – Lay the back panel on top of the chassis with the cutout of the panel facing toward you.
Step 4 – Loosely install all the screws with washers through the back panel into the corresponding press nuts mounted into the chassis. Do not tighten until all screws are properly threading.
Step 5 – Once all the screws and their washers are loosely threaded, center the back panel opening to the front panel controls.
Step 6 – Once the chassis is properly centered under the back panel, tighten the four mounting screws.
Step 7 – Turn the back panel and chassis over and reinstall the power tubes and rectifier tube (It is really difficult to install the tubes with the chassis already in the combo cabinet).

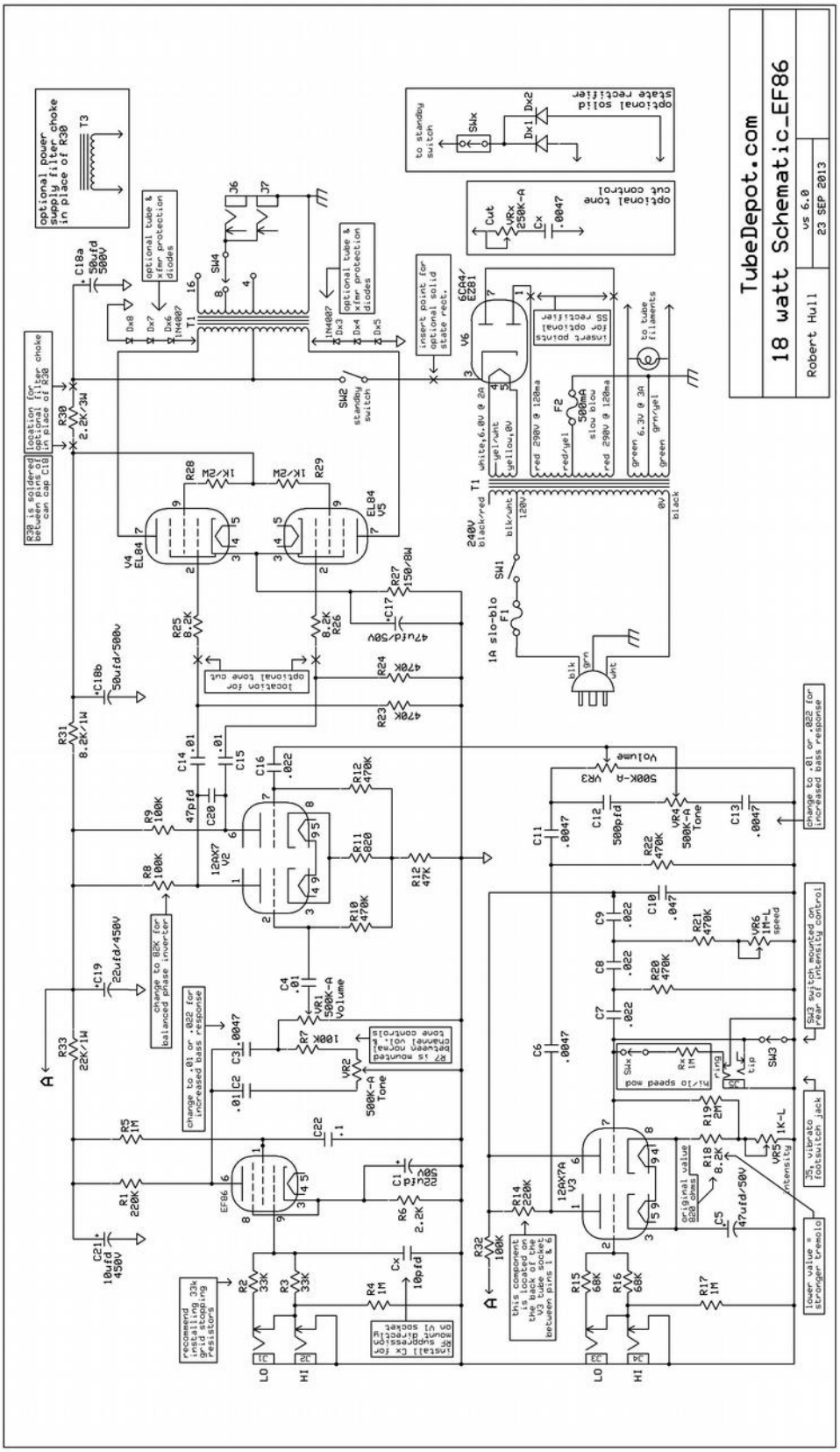

photo 9.1d

Step 8 – Install the chassis and back panel assembly into cabinet with the knobs facing up.
Step 9 – Connect the 1/4” plug from the speaker in the cabinet to the speaker jack of the chassis. Make sure that the proper impedance on the amp is selected for the impedance of the speaker.
Step 10 – Your amp is done and ready for you to play.

THE END

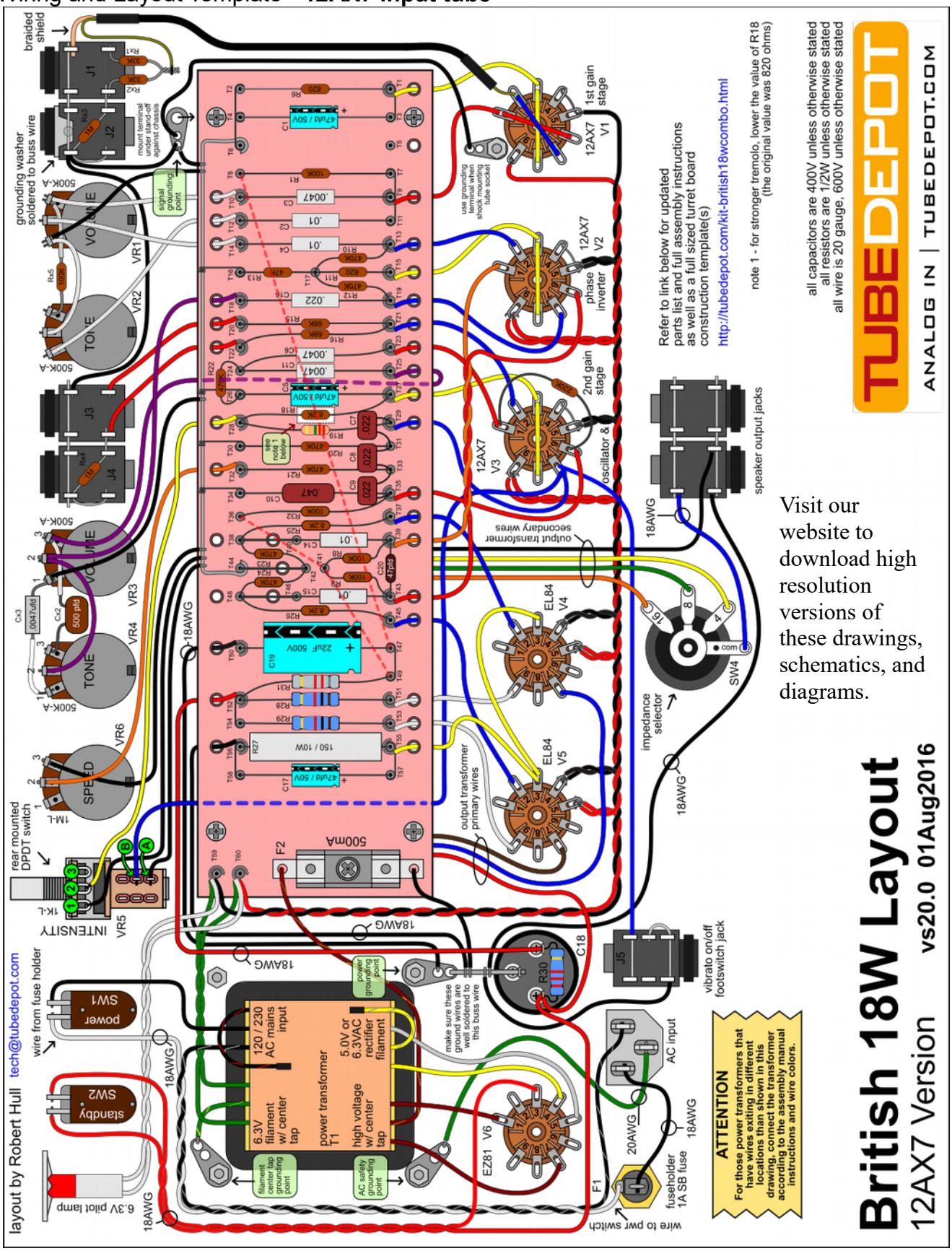


Visit our website to download high resolution versions of these drawings, schematics, and diagrams.

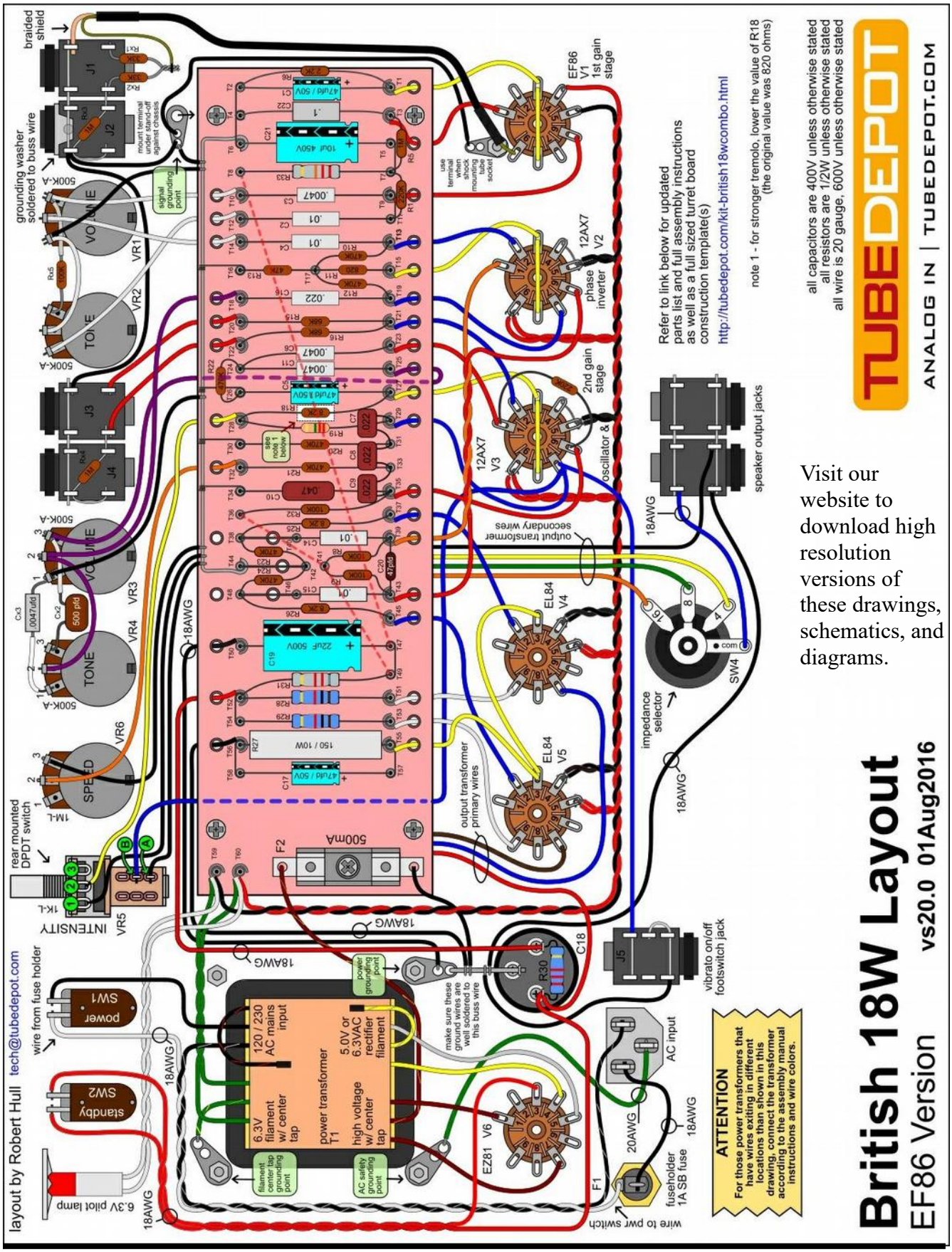


Visit our website to download high resolution versions of these drawings, schematics, and diagrams.

Wiring and Layout Template - **12AX7 input tube**



Wiring Template - **EF86 input tube**



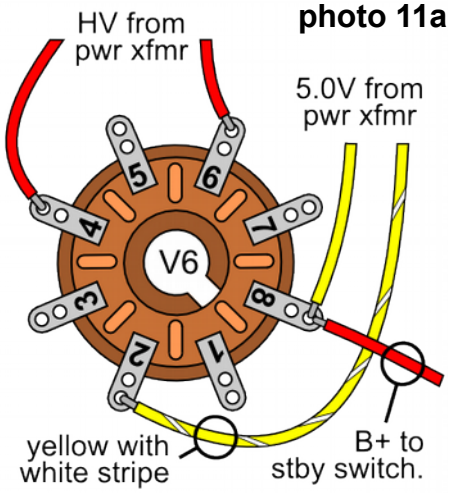
11 Cool Modifications

Install a GZ34 in place of the EZ81

The GZ34 provides more solid dynamics creating less "sag". With an octal socket you can also experimentation with many types of rectifier tubes such as 5Y3, 5V4, 5R4, etc.

Step 1 – Cut a hole in the chassis (in place of the original 9 pin hole) large enough to accommodate an octal socket. Drill the two mounting holes and install the octal socket.
Step 2 – Connect the yellow with white stripe and the yellow wires (filament wires) from the power transformer to pins 8 and 2 of the octal socket (photo 11a). Tape off the unused white wire.
Step 3 – Connect the two red wires (HV) from the power transformer to pins 4 and 6 of the octal socket.
Step 4 – Connect the B+ wire from the standby switch to pin 8 of the octal socket.
Step 5 – Install your octal rectifier of choice.

photo 11a



Upgrade the normal channel input tube from a 12AX7 to an EF86 -

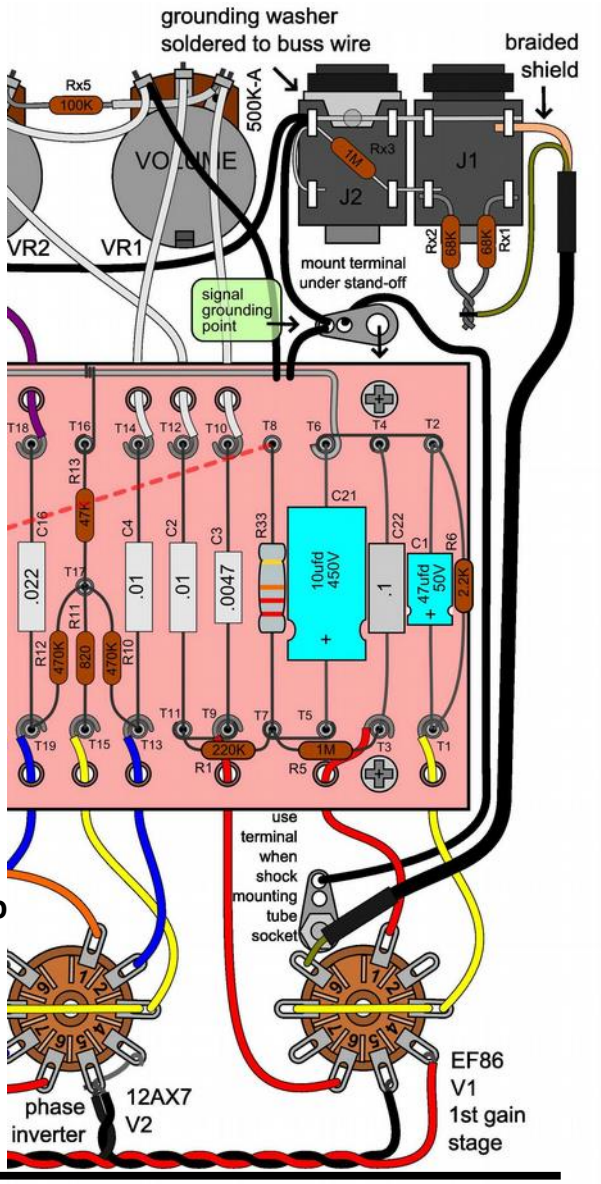
An EF86 gives a more transparent high end and tighter low end … very "VOX AC15" sounding.

The wiring layout at right (drawing 11b) shows the proper components and wiring diagram for the conversion from 12AX7 to EF86.

Rx1 and Rx2 (attached to the input jack) work well as 33K each. Two 68K resistors will function too but with a slight reduction in sensitivity gain.

The EF86 adds a very "shimmering" high end quality to the tone where as the 12AX7 has a very "vocal" midrange quality.

drawing 11b

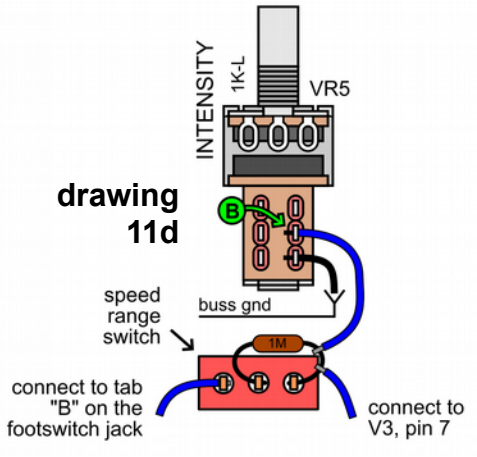


Install a HI / LO vibrato speed range select switch

A switch can be installed so that two separate vibrato ranges can be selected. These ranges can be wired to be footswitchable between the two speeds.

photo 11c

Step 1 – Drill a hole in the faceplate and mount the toggle switch (photo 11c).
Step 2 – Solder a 1M resistor between the inside pin and one outside pin of the toggle switch (drawing 11d).
Step 3 – Solder a wire between point "B" on the back of the intensity control pot and the outside lug of the speed range switch (a wire should also connect to V3, pin 7 as before).
Step 4 – Solder a wire between the outside lug of the range switch and the middle "B" terminal of the footswitch jack (drawing 11e).
Step 5 – Solder a 20AWG jumper wire between terminals "D" and "E" of the footswitch jack as shown.



drawing 11d

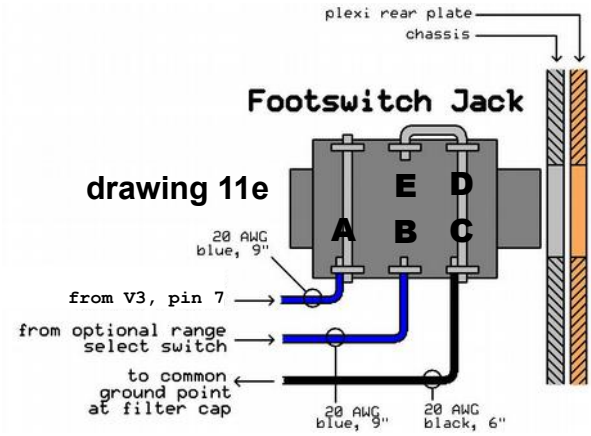
Install a Tube / Solid State Rectifier Selector Switch

Solid state rectifiers will improve the punch of the bass frequencies as well as the overall output wattage of the amp. By installing a selector switch, like below, you can select between either rectifier type depending on your playing style.

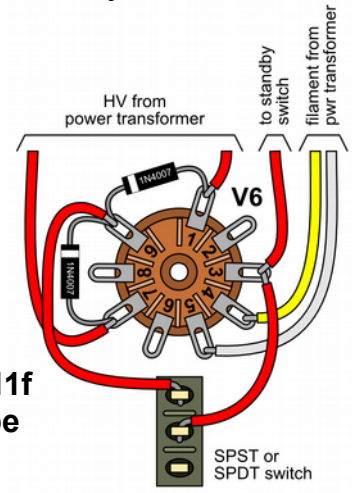
If you have an EZ81 rectifier, refer to drawing 11f for the proper wiring diagram.

If you have a GZ34 (or other octal rectifier), refer to drawing 11g for the proper wiring diagram.

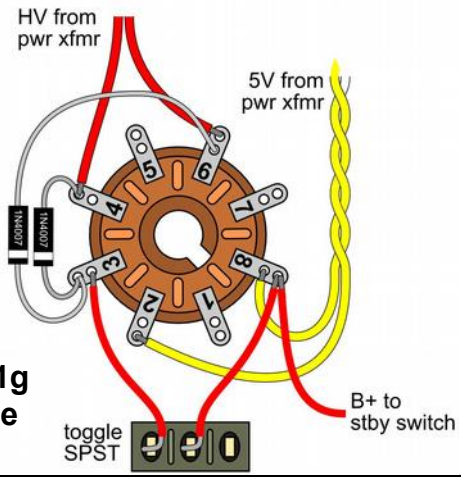
In both illustrations, install the two 1N4007 diodes across the tube socket, joining together at an unused pin on the socket. Then wire the SPST toggle switch between the conjunction of the diodes and the output of the rectifier tube.



drawing 11e



drawing 11f
9 pin tube



drawing 11g
Octal Tube

Install a Post Phase Inverter "Tone Cut" Control

If you regularly run the amp at heavier distortion level, a post phase inverter tone control is very useful for taming the high end response of the amp. This tone control is identical to what can be found in the vintage Vox AC30 as well as many boutique amps. I recommend removing the second speaker output jack to use as the chassis hole for this control.

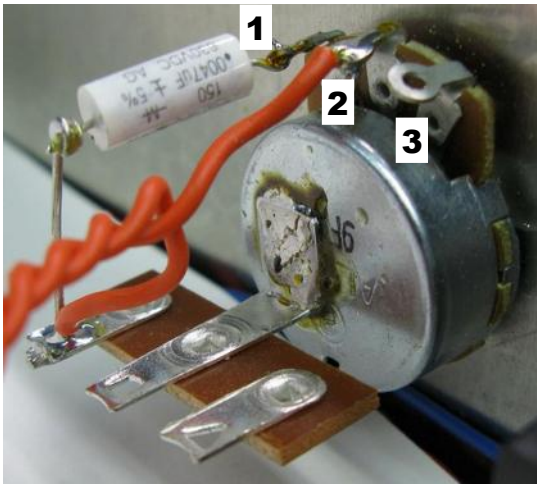


Photo 11e

Step 1 – Install a 250K linear taper potentiometer into the chassis

Step 2 – Solder a 2 or 3 position terminal strip to the back of the pot (photo 11e).

Step 3 – Solder a .0047ufd / 630V cap between terminal 1 of the pot and one of the outside lugs of the terminal strip (not the middle grounding terminal).

Step 4 - Install two 20AWG wires 7" long between terminal 2 (the wiper) of the pot and the solder terminal end of the .0047 / 630V capacitor.

Step 5 – Twist these two wires together and run them neatly to turrets T48 and T38. Cut to length, strip and tin the end of these wires and then solder them around these two turrets. There should be wire routing holes located near these turrets to facilitate neatly routing these wires under the board if so desired.

Install a Choke in the Power Supply

By installing a choke in the power supply, the dynamics of the amp will be quicker and the low end will hold together better. The amp will have slightly more power output and any hum residual will decrease even further. The inexpensive choke as used in the Fender Deluxe Reverb is a perfect choice for this application.

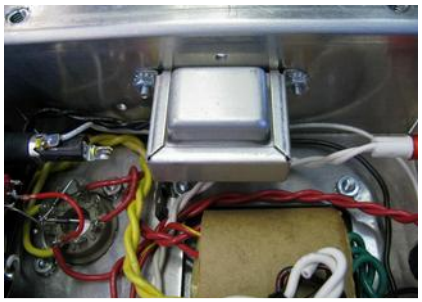


Photo 11f


Photo 11g

Step 1 – Attach the choke to the inside of the chassis near the power transformer with #6 screws and nuts (photo 11f). You will have to drill holes in the chassis for this.

Step 2 – Twist the two black wires of the choke loosely together and run them neatly over to the can filter cap.

Step 3 – Remove the 2.2K / 3W resistor from across the terminals of the can cap. In place of the 2.2K / 3W resistor, install the two black wires of the choke (photo 11g).

Install a Post Phase Inverter Master Volume (PPIMV)

MOD *These directions refer to mounting the MV control in place of one of the vibrato input jacks. Other options are in place of one of the speaker jacks or drilling a dedicated hole.*

There are many master volume control options, however this version is my personal favorite. It is a bit complicated to wire but the sound is very good.

NOTE *Refer to the drawing on page 58 for a very clear layout of how to wire this type of master volume. The various wire colors are for clarity of explanation.*

Step 1 – With a dual ganged 500K audio taper potentiometer, bend the two outside lugs together to form a single terminal (photo 11h). This will be identified as "1".
Step 2 – Install a 20AWG wire 5" long on this folded terminal 1.
Step 3 – Install two 20AWG wires 5" long, one wire on terminal 2 and the other wire on terminal 4 (photo 11i).
Step 4 – With a permanent marker, make a mark near the opposite end of the wire attached to terminal 4. Twist these two wires together.
Step 5 – Install two 20AWG wires 5" long, one wire on terminal 3 and the other wire on terminal 5 (photo 11i).
Step 6 – With a permanent marker, make a mark near the opposite end of the wire attached to terminal 5. These marks will assist in identifying the wires. Twist these two wires together (photo 11j).
Step 7 – Remove one of the vibrato channel input jacks and install this dual ganged pot in the chassis at this point (photo 11k). Refer to following page for removal of input jack.
Step 8 – Remove the jumper that connects T40 and T38. As well, remove the jumper that connects T46 and T48
Step 9 – Neatly run the wire from the pot terminal 1 (folded terminals) over to turret T44 of the turret board. Cut to length, strip and tin the end and solder to the ground buss at this point.
Step 10 – Neatly run the two wires from the pot terminals 2 and 4 over to turrets T38 and T48 of the turret board.
Step 11 – Cut these two wires to length, strip and tin the ends.
Step 12 – Solder the wire from terminal 2 (the wire with the mark on it) from the pot to turret T38.
Step 13 – Solder the wire from pot terminal 4 to turret T48. There are wire routing holes in the turret board for these wires.
Step 14 – Neatly run the two wires from terminals 3 and 5 of the pot over to turrets T40 and T46 of the turret board.
Step 15 – Cut these two wires to length, strip and tin the ends.
Step 16 – Solder the wire from pot terminal 3 (the wire with the mark on it) to turret board turret T40.
Step 17 – Solder the wire from pot terminal 5 to turret board turret T46. There are wire routing holes in the turret board for these wires (photo 11L – next page).

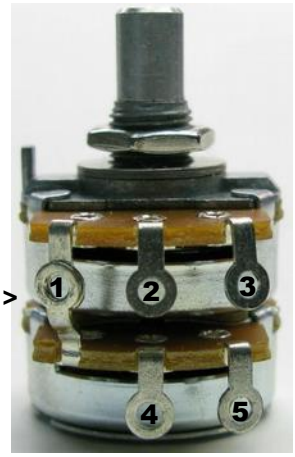


photo 11h

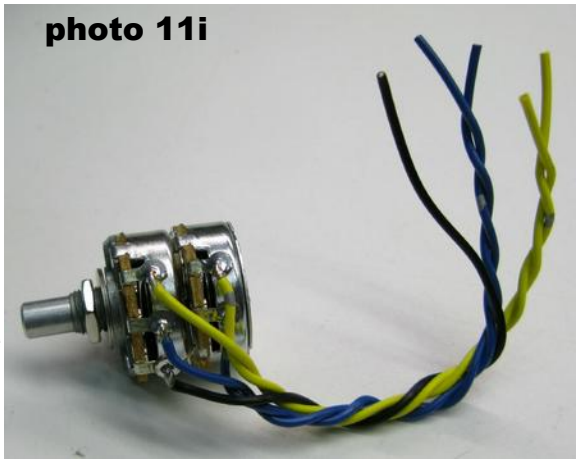
photo 11i


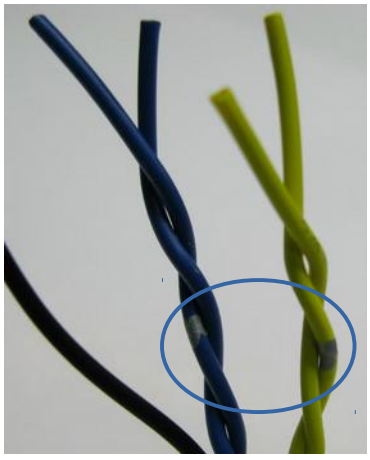
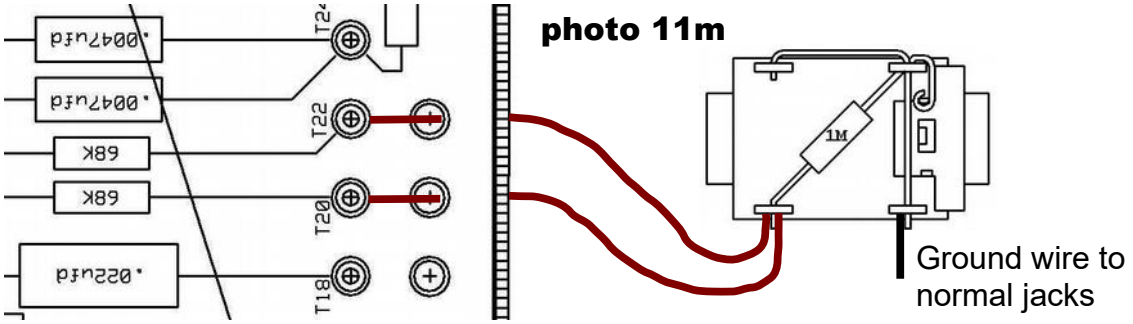
photo 11j


photo 11k


Wiring for One Input Jack, Vibrato Channel

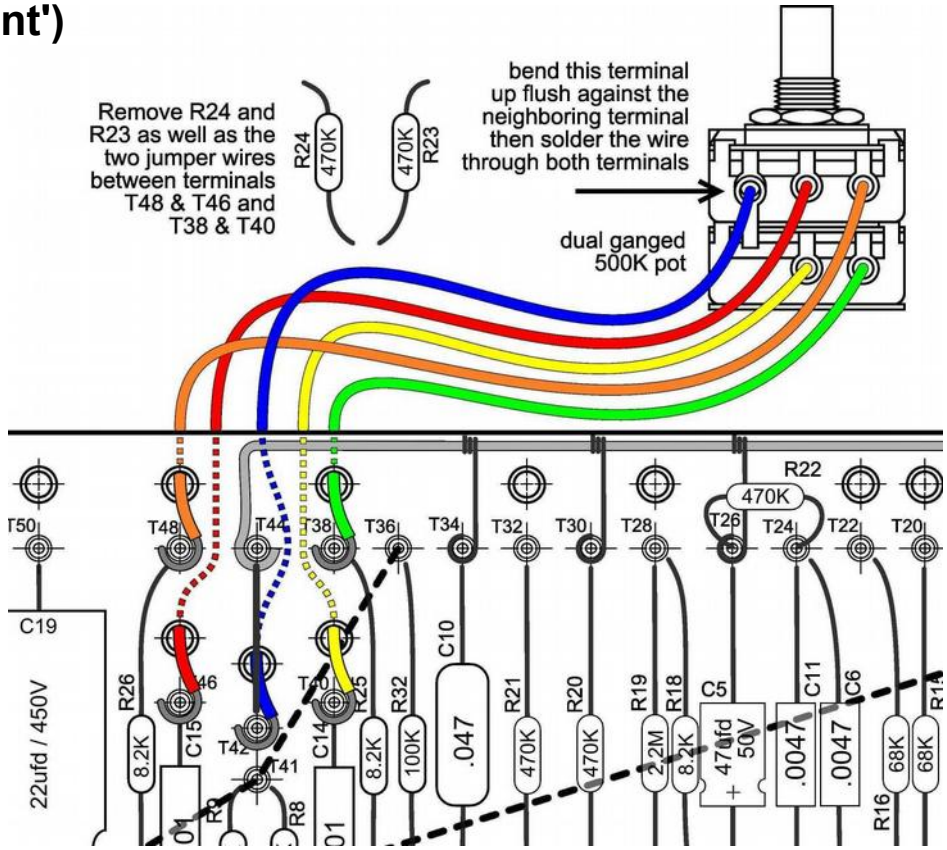
The following (photo 11m) is the correct wiring for using a single HI sensitivity input jack in the vibrato channel. This allows the other hole to be used for installing the master volume.



Preamp Tube RF Shunt

If you are receiving unwanted radio stations into your amp, here is an easy modification to clean up your signal. Connect a 10pfd capacitor between pin 2 of the tube socket and the nearest chassis ground connection. This is for the 12AX7 input tube.

Master Volume (cont')



A Resistor and Capacitor Codes

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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

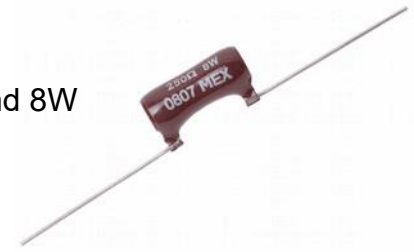
Metal Oxide 1W

Metal Oxide 2W

Metal Oxide 3W

Wire Wound 5W

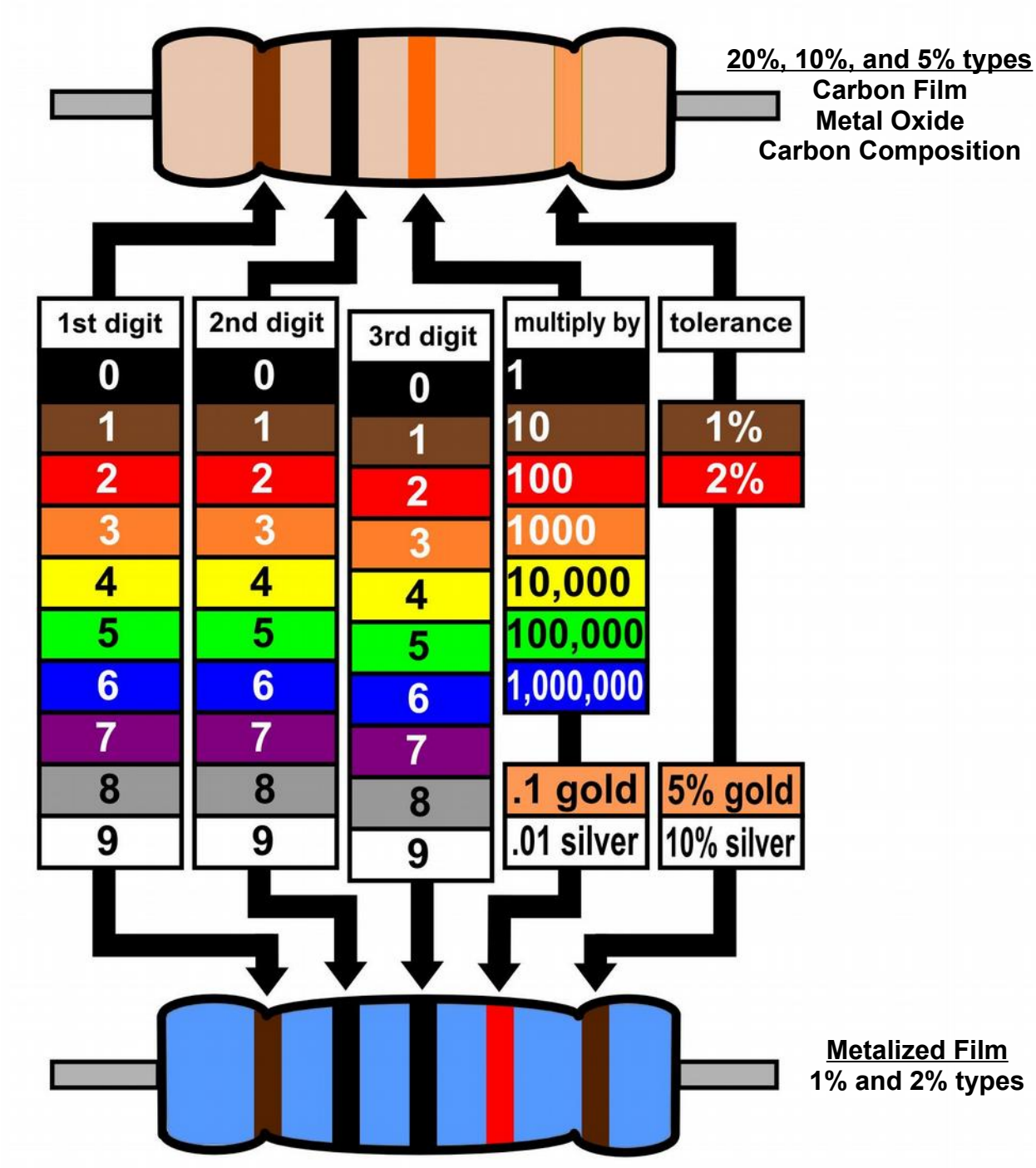
Wire Wound 8W



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 to represent these characteristics and it is these codes that are printed on the components.

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



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.

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

Sozo Polyester Film and foil / Mallory 150 Metalized Polypropylene Film – Vintage style film capacitors, 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

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=clDydYIVTqU

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 accept solder properly, 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 is great for signal transfer but terrible for soldering. It isn't that gold can't be soldered, because solder sticks easily to gold. Rather gold doesn't stick well to the base metals it is plated on. This is the problem.

Connections soldered directly to gold 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 terminal.

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 faithful 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 only 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:

- EL84 - 7189 - 6BQ5 - 6V6 (with amp modification)

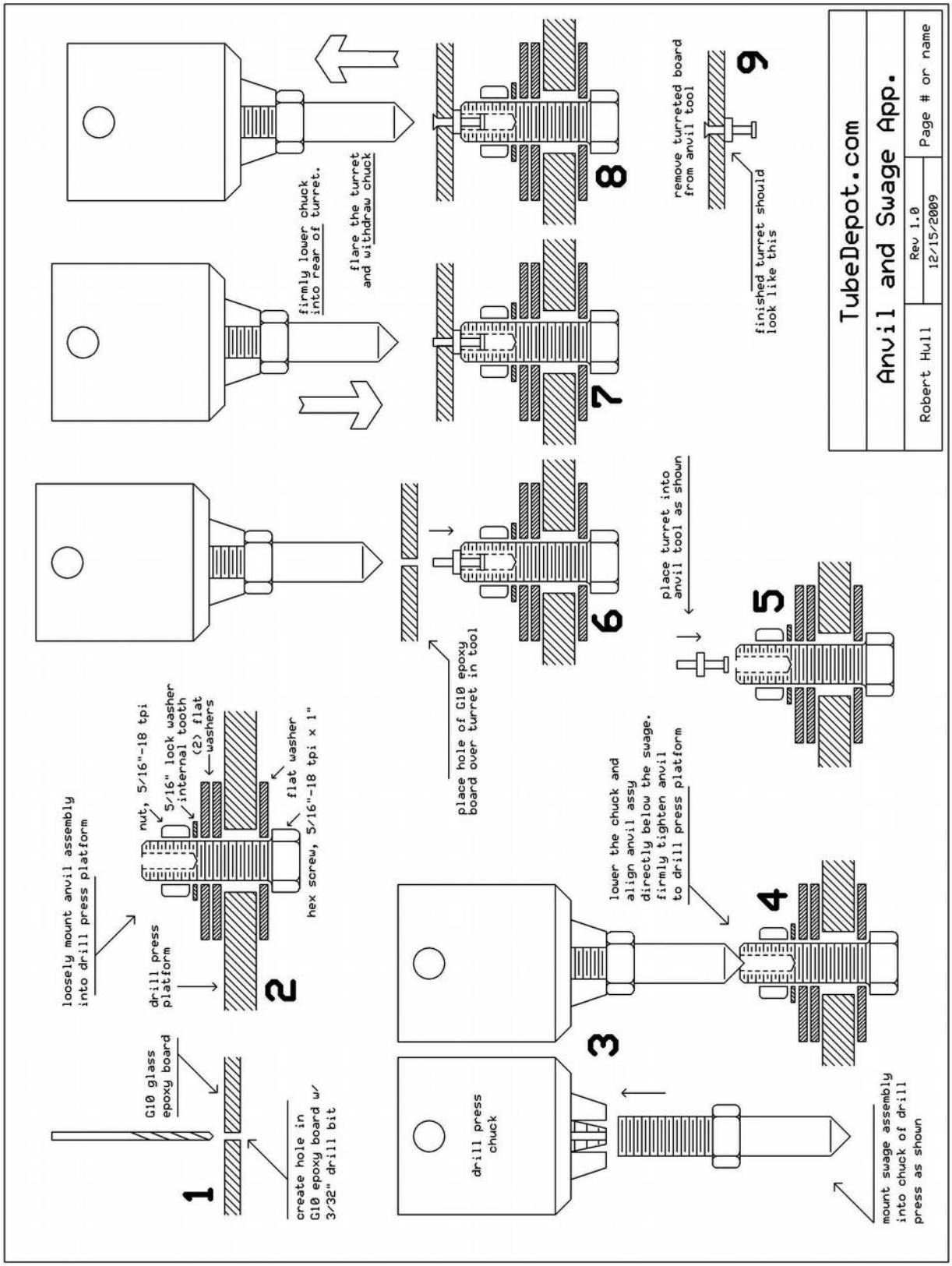
Rectifier tubes (with amp modification):

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

Applications

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

How to Swage Fit Turrets



How to Press Fit Turrets