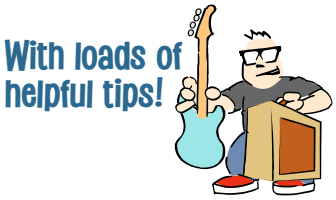
’59 TWEED 15W
COMBO AMP KIT
ORIGINAL 5E3 CIRCUIT

ASSEMBLY INSTRUCTIONS



StewMac® ICON KITS

Contents

’59 TWEED 15W

COMBO AMP KIT ORIGINAL 5E3 CIRCUIT

Iconic Tweed tone is now in your hands

Be excited!

Your new StewMac ’59 Tweed will be a blast to play through and even more fun to build.

This amp is mellow and clean at low volumes, but its claim to fame is its cranked, angry, sagging distortion at searing volume. No other amp is more fun to tame.

This amp is an ICON

This amp is one of the great enigmas of rock-n-roll. The master tone knob governs the timbre of both channels, and affects volume too. But the kicker is this: the volume knob on the channel you’re NOT plugged into affects your tone! Why is this? Who cares?! Everybody’s too busy making music with this thing!

StewMac® ICON KITS

StewMac ICON KITS bring classics that are no longer made, or are simply unaffordable, within reach. And the best part is you get to build them with your own hands.

We give painstaking attention to parts selection, authentic materials, and instantly recognizable details—everything that makes the originals so sought after.

Build it with StewMac

These immersive instructions walk you through every step of creating this tone machine. And you’ll learn a lot, gaining a deep knowledge of your amp’s inner workings.

Follow our steps closely for safety, too: we’ve carefully laid out a path that even newcomers can follow in handling electrical components.

Building an amp can seem daunting, but nobody makes it easier than StewMac. Watch for helpful tips along the way, too—we’re here to help!

Let's get building!

Here's how to build this amp!

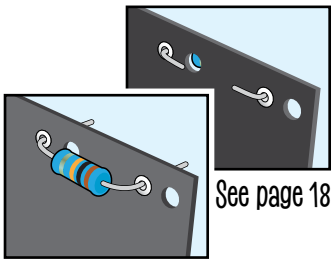
Quick look:

Sort your components by type, using the **parts list**.

Get the **cabinet** ready, starting at **Step 1** on page 9.

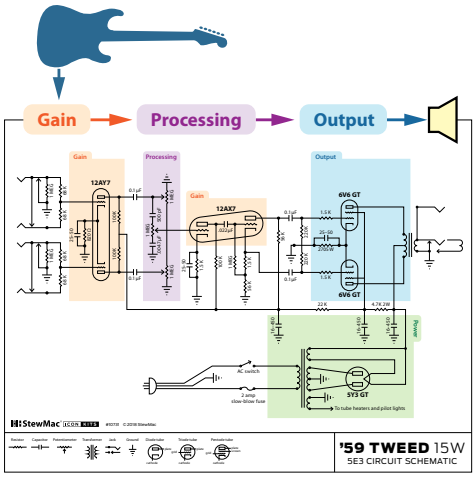
You'll prep the metal **chassis** and the **eyelet board** too.

Wiring comes later:



See page 18

1. First, you'll **wrap** the leads, connecting them without solder.
2. Then **double-check** all the connections. Don't rush!
3. When everything checks out, it's time to **solder**. The numbered steps tell you when.



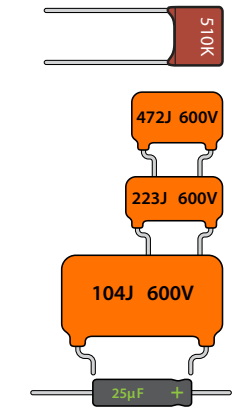
Learn more:
You don't need to read the **schematic**, but it's fun.
See how your guitar's signal gets processed into sound.
This is on page 35.

Parts list

Resistors

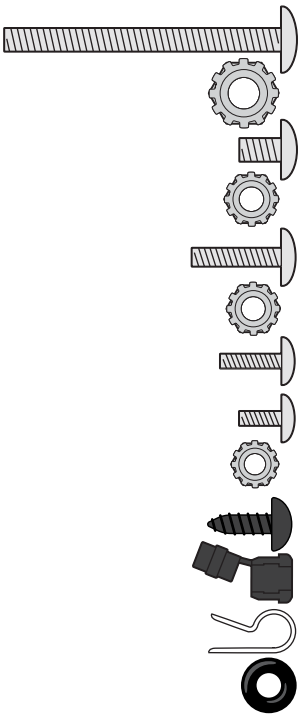
- ☐ (2) 100Ω .5W carbon composite
- ☐ (1) 820Ω .5W carbon composite
- ☐ (4) 1.5K .5W carbon composite
- ☐ (1) 22K .5W carbon composite
- ☐ (2) 56K .5W carbon composite
- ☐ (4) 68K .5W carbon composite
- ☐ (3) 100K .5W carbon composite
- ☐ (2) 220K .5W carbon composite
- ☐ (3) 1M .5W carbon composite
- ☐ (1) 4.7K 2W metal oxide
- ☐ (1) 270Ω 5W ceramic

Capacitors

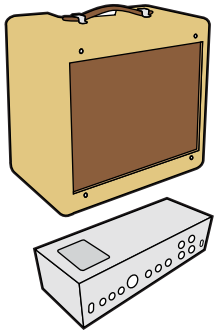


- ☐ (1) 500pF 500V silver mica
- ☐ (1) .0047µF 600V Orange Drop
- ☐ (1) .022µF 600V Orange Drop
- ☐ (4) 0.1µF 600V Orange Drop
- ☐ (3) 25µF 50V Sprague Atom
- ☐ (3) 22µF 500V electrolytic filter caps

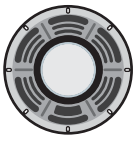
Hardware



- ☐ (2) 10-32 machine screw, 1-1/2"
- ☐ (2) 10-32 locknut
- ☐ (2) 8-32 machine screw, 1/4"
- ☐ (6) 8-32 locknut
- ☐ (2) 6-32 machine screw, 1/2"
- ☐ (2) 6-32 locknut
- ☐ (6) 4-40 machine screw, 3/8"
- ☐ (4) 4-40 machine screw, 1/4"
- ☐ (10) 4-40 locknut
- ☐ (1) Black wood screw
- ☐ (1) Strain relief for power cord
- ☐ (1) Cable clamp for power cord
- ☐ (2) Rubber strain relief grommet



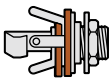
- ☐ (1) Cabinet
- ☐ (1) Chassis
- ☐ (1) Eyelet board
- ☐ (1) Insulation board



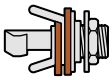
- ☐ (1) 8Ω Jensen 12" speaker

Parts list

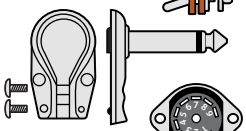
Tubes, lamps, fuses, and sockets



☐ (5) Input jack (3-lug shorting jack)



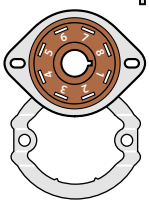
☐ (1) Extension speaker jack (2-lug mono jack)



☐ (1) Speaker plug

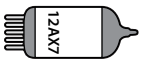
☐ (2) 9-pin tube socket for preamp tube

☐ (2) Shield for 9-pin tube socket



☐ (3) 8-pin tube socket for power and rectifier tube

☐ (3) Tension clip for 8-pin tube socket

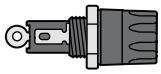


☐ (1) Preamp tube (12AX7, also called ECC83S)

☐ (1) Preamp tube (12AY7, also called 6071)

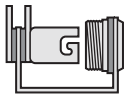
☐ (2) Power tube (6V6 or 6V6S)

☐ (1) Rectifier tube (5Y3 or 5Y3S)



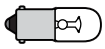
☐ (1) Fuse socket

☐ (1) Fuse (2-amp, slow-blow)



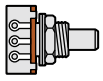
☐ (1) Pilot lamp socket

☐ (1) Pilot lamp lens



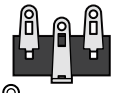
☐ (1) Pilot lamp bulb (#47)

Additional components

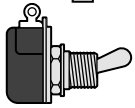


☐ (3) Control pot (1M)

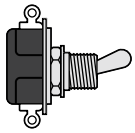
☐ (3) Chicken head knob



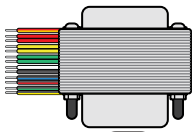
☐ (2) Three-lug ground terminal



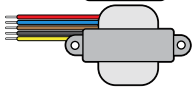
☐ (1) Power switch (2 lugs)



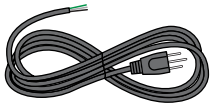
☐ (1) Ground switch (3 lugs)



☐ (1) Power transformer



☐ (1) Output transformer



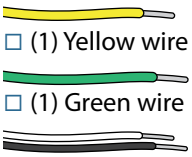
☐ (1) Power cord

Heat-shrink tubing

☐ (1) 1/8" diameter (5" length)

Vintage-style **push-back wire** lets you push the insulation back instead of cutting it away. **BUT:** We find that trimming the insulation still works better.

Wire



☐ (1) Yellow wire

☐ (1) Green wire

☐ (1) Speaker wire (two leads)

Tools and supplies

Required

Phillips screwdrivers, #1 and #2
Item #3000 Guitar Tech Screwdriver Set

Needle nose pliers
Item #1610 Long-nose Pliers

Wire cutter
Item #1607 Fine-gauge Wire Cutter

Wire stripper
Item #1606 Wire Stripper

Soldering iron (preferably 40W)
Item #0501 Solomon SL-30 Soldering Station

Solder (at least one Pocket-Pak)
Item #0505 Kester Pocket-Pak Solder

Solder sucker
Item #0503 Solomon Solder Sucker

Drill with a 5/32" bit
For mounting eyelet board to chassis

Ruler
Item #4905 StewMac Shop Rule

Digital multimeter
Item #3618 PEAKMETER Pocket Multimeter

Glue
Wood glue, white glue or contact cement for gluing a paper label inside the cabinet

Snuffer stick (bleed resistor)
Item #1552 SnufferStick

Pencil

Wooden chopsticks

Helpful

Round-nose bending pliers
Item #1609 Round-nose Bending Pliers

Solder wick
Item #0504 Solder Wick, 5-foot roll

Soldering aids
Item #0521 StewMac Soldering Aids

Soldering stand
Item #0506 Solomon Soldering Stand

Printed circuit board vise

Solder Monster, or helping hand tool
Item #0531 StewMac Solder Monster

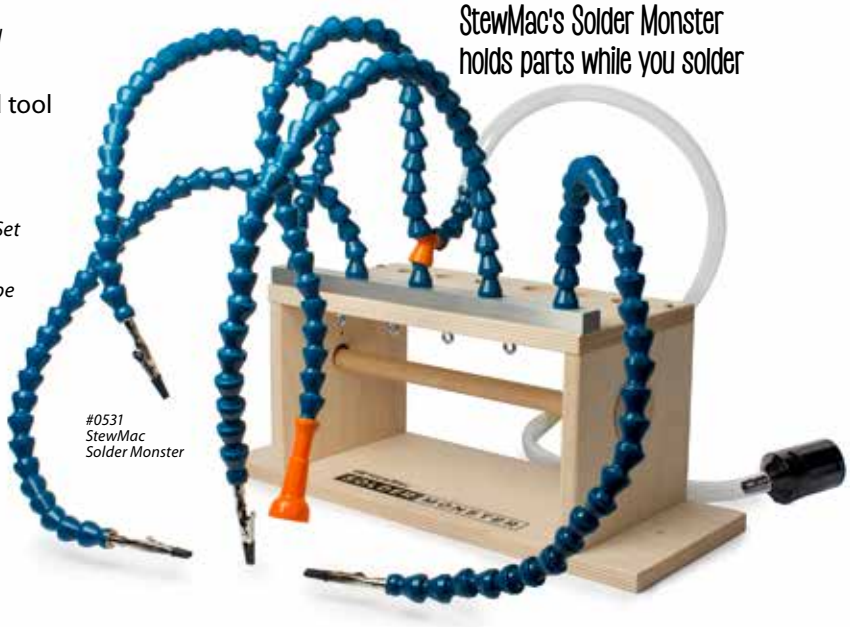
Fine tip permanent marker

Scratch awl or center punch
Item #3000 Guitar Tech Screwdriver Set

Copper shielding tape
Item #0028 2" Conductive Copper Tape

Tray for loose parts

Heat gun for heat-shrink tubing



Amp voltages are seriously dangerous!

High voltage, even when unplugged

When you turn on an amp, the capacitors are designed to take on a charge and hold it. That stored voltage is enough to injure you seriously, or even kill you.

These components aren't a threat until the first time you plug the amp in. The stored electricity can be safely discharged to ground with a snuffer stick. See how to use it below.

Once your amp has been turned on, don't touch the wiring with your bare hands—even after turning the amp off. If you need to press on a contact, use a chopstick or Sharpie marker, which are both non-conductive. Don't use a pencil, because graphite is conductive.

It's important that you understand the dangers so you're working safely. Here's how to do it right.

Wear rubber-soled shoes

Rubber soles increase the insulation between yourself and the ground.

Take off your ring

A metal ring on your finger can bridge a hot connection to ground.

Professionals who work on amps take these safety habits very seriously

Wear safety glasses

Rosin-core solder sometimes bubbles up, and it can spew molten specks into the air. You don't want molten solder in your eyes.

It's better not to work alone

Electrical shocks can incapacitate you, and having someone available to call 911 can be a lifesaver.

Take breaks and stop when you're tired

Fatigue leads to mistakes, and no one can afford mistakes when working with electricity.

Stay suspicious

Whether it's the first time you've been inside a live amplifier or the 100th time, don't become complacent. If you discharge the caps and walk away for a few minutes, check again for residual voltage when you return. Capacitors can self-charge through a phenomenon known as dielectric memory.

Check before powering up

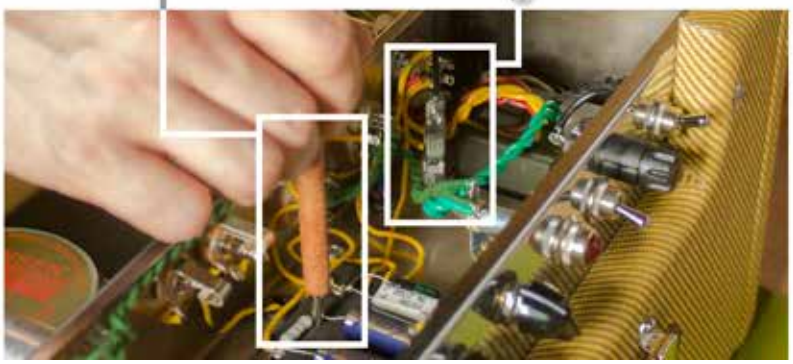
It's easy to forget that you a left a stray tool or wire in the chassis. It's also easy to forget to re-attach the speaker wire, and that can fry an output transformer in seconds. Constant vigilance is your friend when working on amps.

Always unplug it

Unplug the amp whenever you don't specifically need it plugged in. Some points are always hot when the amp's plugged in, even if the power switch is off. These points include the lugs on the fuse socket, power switch, and standby switch.

How to use a snuffer stick

To discharge a capacitor, clip the snuffer stick lead to ground—preferably a mounting bolt on the power transformer. Hold the tip of the stick to the cap's positive lead and use your multimeter to watch the voltage drain to less than 18V.



How to read resistor values

A resistor's value—the amount of resistance it creates—is rated in ohms (Ω). Larger ohm values mean more resistance. For example, a 100Ω resistor creates ten times as much resistance as a 10Ω resistor.

The resistors used in amplifiers are too small to have value numbers printed on them. Instead, a system of colored bands tells their values. The key to reading these bands is provided below. However, an easier way to decode these bands is to download one of the many smartphone apps for this purpose.

One band will be the nearest to an end of the resistor. That band tells the first value. Combine it with the value of band 2 to get a two-digit number (68 in our example below). Multiply that number by band 3 (68 x 1,000 = 68,000). Thousands are represented by the letter K, so this resistor is 68K (kilo-ohms, or KΩ).

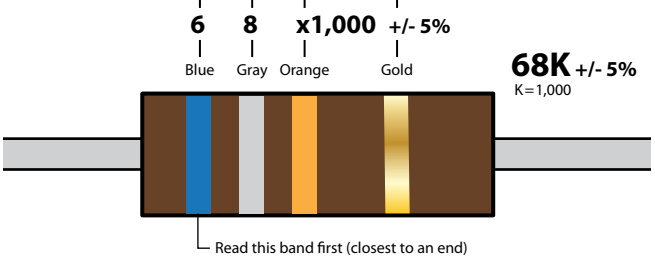
If there is a fourth band, it will be either silver or gold. This indicates the tolerance allowed during manufacturing. The resistors used in this kit have a +/- 5% tolerance, represented by a gold band 4.

A magnifying glass helps a lot. The bands on a 470Ω resistor are yellow/violet/brown, and the bands on a 47K resistor are yellow/violet/orange. They're easily confused!

Can't read the colors?

You can always use a multimeter to test a resistor's value. Set your meter to ohms and connect the test leads on each side of the resistor.

	Band 1 1st Digit	Band 2 2nd Digit	Band 3 Multiplier	Band 4 Tolerance
BLACK	0	0	1	None +/- 20%
BROWN	1	1	10	
RED	2	2	100	
ORANGE	3	3	1,000	
YELLOW	4	4	10,000	
GREEN	5	5	100,000	
BLUE	6	6	1,000,000	
VIOLET	7	7		
GRAY	8	8	0.01	+/- 10% SILVER
WHITE	9	9	0.1	+/- 5% GOLD



Capacitor values

Capacitor values are typically printed on the component. The key values with caps are their capacitance and voltage.

Think of a capacitor as a container that can hold electricity. Capacitance, measured in farads, refers to how much electricity this container can hold—its capacity. One farad (1F) would be much too large for use in an amplifier. Caps for amps are rated in millionths of a farad, called microfarads (µF), or trillionths of a farad: picofarads (pF). The voltage spec for a cap refers to how much DC voltage it can handle at any given time.

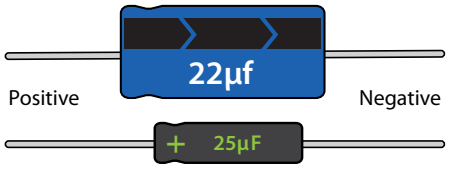
A unique property of capacitors is that they don't allow DC current to flow past them, only AC current. This is important in parts of an amplifier circuit, such as the path between a preamp stage and a power amp stage. Here, a "coupling capacitor" will block DC voltage, allowing only the AC guitar signal to pass.

Filter caps

Capacitors also filter out 60Hz hum, or "ripple," after the AC current from the wall is converted to DC. These capacitors are called filter caps, because they filter out the ripple from a power supply. The filter caps in this amp are the 8µF and 22µF electrolytic capacitors.

Electrolytic caps

Electrolytic capacitors contain electrolyte: a liquid or gel that gives them a large storage capacity. Electrolytic caps are typically polarized.

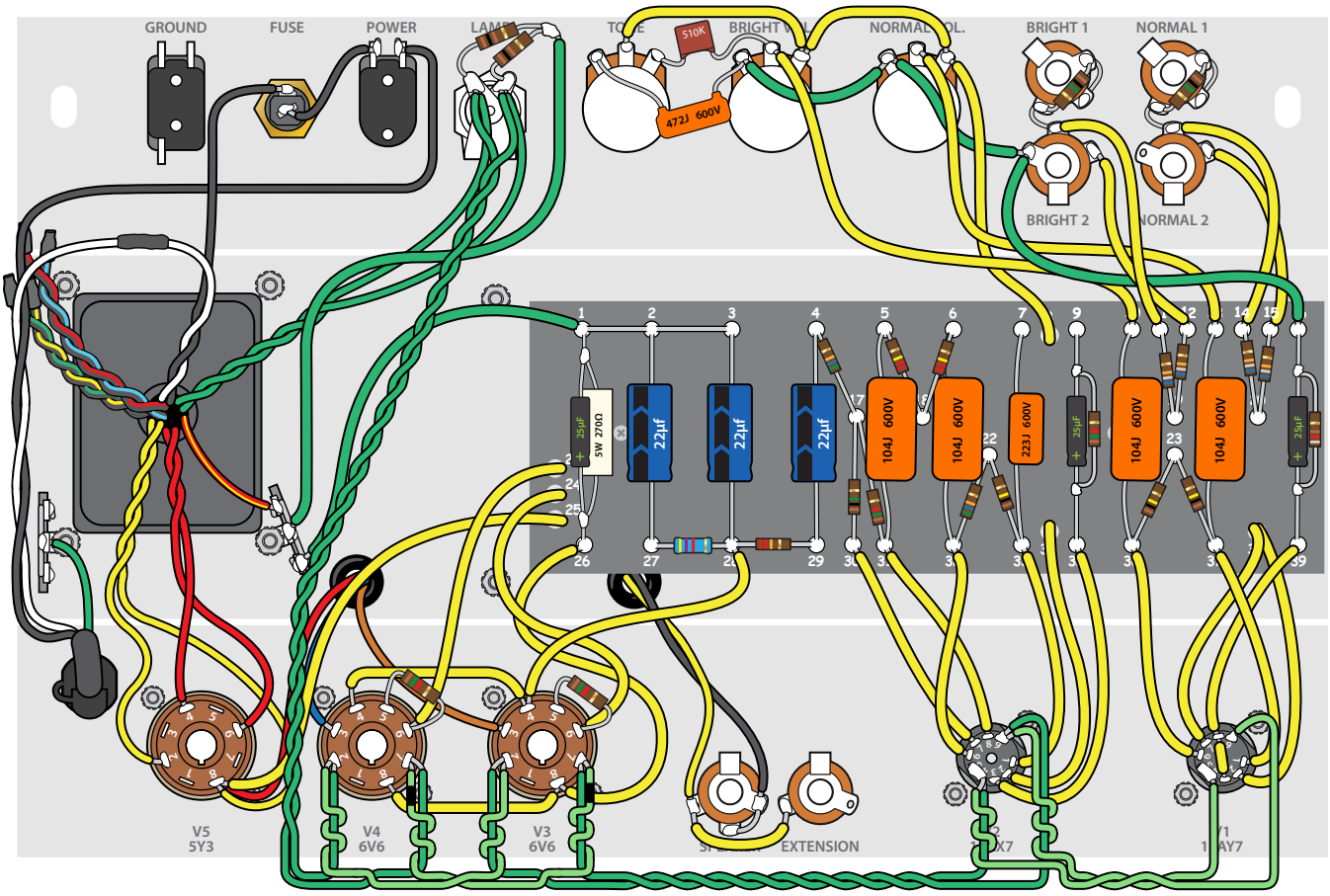


Polarized caps

Some capacitors have polarity and some don't. It's extremely important to install polarized caps correctly in a circuit. The positive lead of an electrolytic cap will be indicated by an indented ring around one edge of the capacitor. The negative lead will often be indicated by a band of arrows pointing to the negative lead.

Installing capacitors with the polarity backwards will make the circuit malfunction and quickly destroy the capacitor—even causing it to explode.

Complete wiring diagram



Our diagrams show a flat view of the metal chassis

Here's the complete 5E3 wiring

When you've finished the kit, you'll have connected all the parts shown in this wiring diagram. If it looks complex now, don't worry; we'll start at the very beginning and do this one step at a time.

Your amp-building skills will get stronger with each step!

Start by prepping the cabinet

Prepare the cabinet for mounting the amp chassis by first removing the two back panels.

☐ STEP 1

Mount the power cord clamp

Drill a 5/64" pilot hole to mount the nylon cable clamp. Locate the clamp on the left wall of the cabinet, 5-1/2" from the bottom.

Back

Don't drill through the cabinet! Use a piece of masking tape on your drill bit to mark the depth, or use a StewMac Depth-stop Drill Bit (item #1712).

Use the black cable clamp screw to mount the cable clamp. You'll secure the power cord with this clamp later, during final assembly.

☐ STEP 2

Solder the speaker plug

Use a small screwdriver to remove the back of the speaker plug.

On the black and white speaker leads, push the insulation back 3/8". Solder the white positive lead to the tip lug (center of the plug). See "Tips for great soldering" on page 18.

Trim the black lead to fit and solder it to the sleeve lug. The solder joints need to be neat in this metal case. Reassemble the plug.

Do a continuity test with your multimeter (page 32) to make sure there's no connection between the plug's tip and its metal case. If the meter shows continuity, open the plug and rework your solder joints.

Prepping the cabinet

☐ STEP 3

Solder the speaker leads

Twist the speaker leads together to keep them neat.

Push the insulation back 3/8" and insert the white lead into the speaker's positive terminal and the black lead through the negative terminal.

Before soldering these leads, place a business card or other protection under the terminals to prevent solder dripping onto the speaker cone. Solder the two leads to the speaker terminals.

☐ STEP 4

Install the speaker

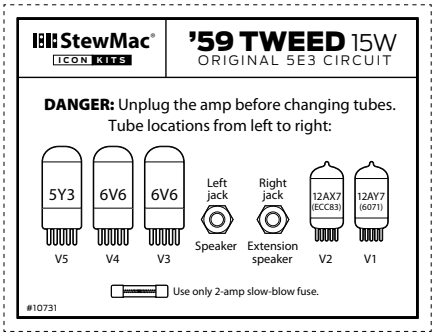
Remove the nuts from the four speaker mounting screws. Carefully slide the speaker onto the mounting screws until it's flush with the front panel.

Install the four speaker mounting nuts so they're lightly touching the speaker frame.

Do not tighten the nuts in a circular pattern around the speaker, because this can warp the speaker frame.

Instead tighten one nut with a quarter turn so it's just snug, then do the same to the opposite side. Then snug the third nut and fourth. Repeat this criss-cross pattern of quarter-turns until all four nuts have had one full turn. This will give proper tension to compress the speaker gasket. Overtightening can warp the frame, damage the cone and cause unwanted distortion.

This criss-cross pattern keeps the speaker frame flat against the cabinet. Tightening in a circular pattern makes it warp.



☐ STEP 5

Glue the tube placement chart

Cut out the tube replacement chart on page 39. Put a thin coat of glue or contact cement on the back and glue it to the inside wall of the cabinet.

☐ STEP 6

Optional copper shielding

If you prefer extra shielding on your amp, apply copper shielding tape (item #0028) on the top back panel, covering the exposed wood. This helps shield the circuit from unwanted interference caused by other electrical devices.

Because this tape's adhesive will be subjected to heat from the tubes, it's a good idea to staple the corners to the wood panel.

Prepping the boards

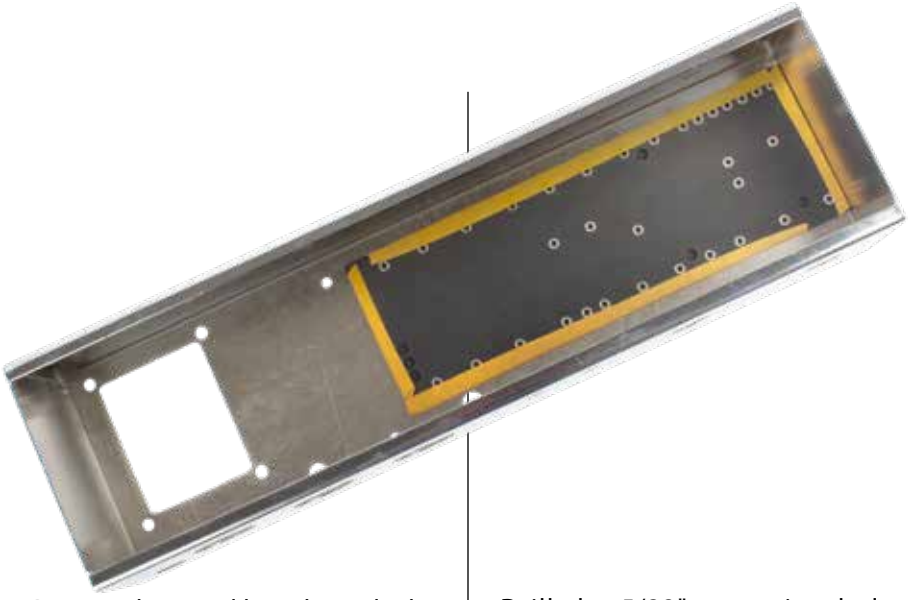
The components will be soldered to the eyelet board. The blank piece of fiberboard is an insulator to keep the eyelet board from touching the metal chassis.

Two bolts hold the eyelet and insulator boards to the chassis. The first step in preparing these boards is to drill mounting holes for these bolts.

☐ STEP 7

Drill two holes in the boards

Place the insulator board behind the eyelet board, aligning the two boards so the edges are flush. Tape them together with masking tape to keep them aligned for drilling.



Position the taped boards inside the chassis as shown above, with a gap of roughly 1/4" between the long edges of the boards and chassis. The short ends of the boards are flush against the end of the chassis.

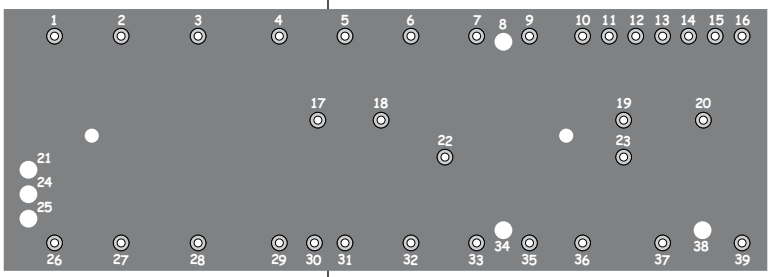
Holding the boards in place, turn the chassis so you can see the two mounting holes. Using a sharp pencil through the holes, mark the hole locations onto the insulator board.

Drill the 5/32" mounting holes through the pair of boards. Separate the boards and set the insulator aside for later.

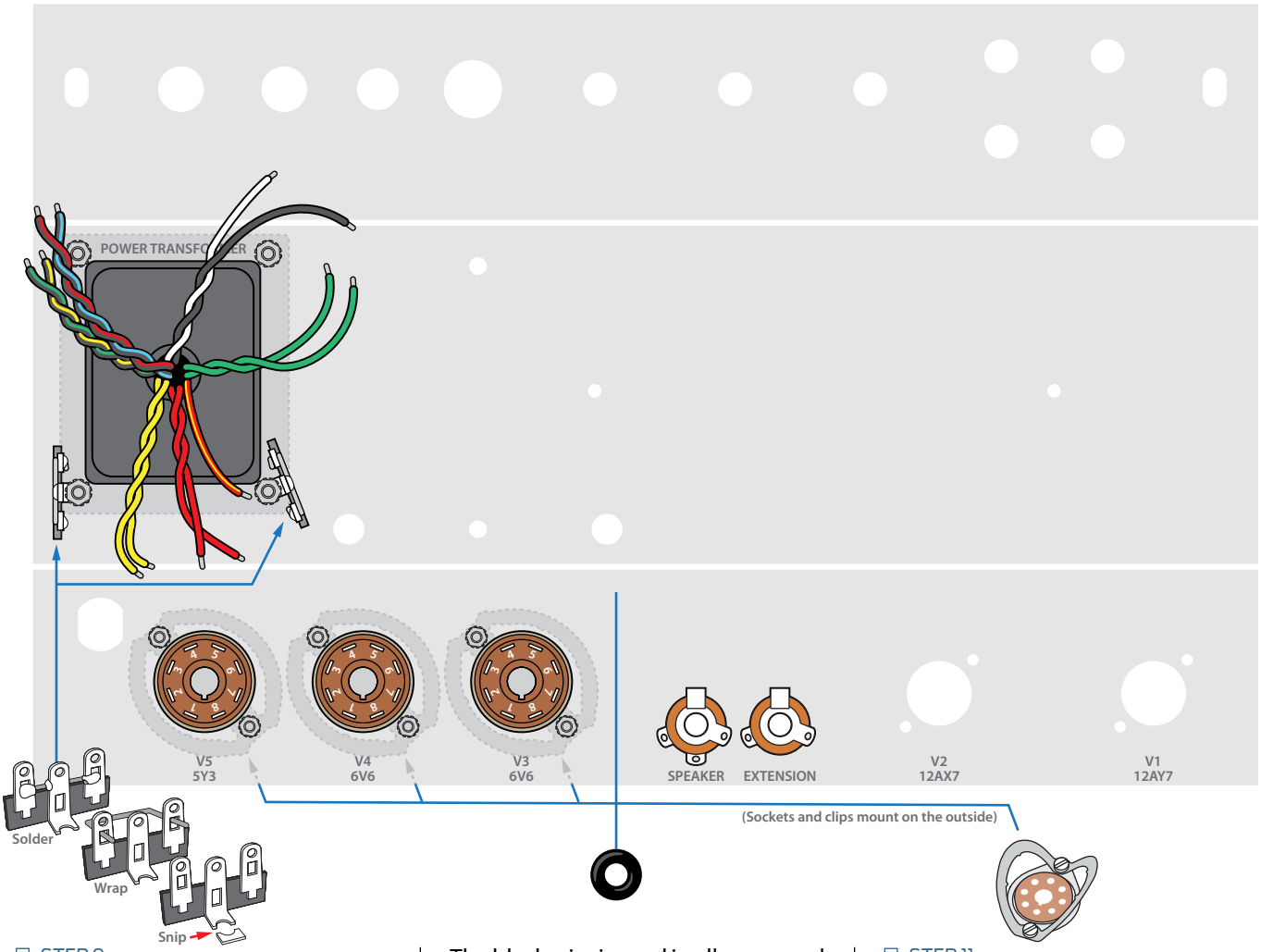
☐ STEP 8

Number the eyelets and holes

These instructions will refer to the eyelets and holes by number. Use a pencil to mark these numbers onto your eyelet board:



Installing the chassis-mounted components



☐ STEP 9

Prep the two grounding strips

With a wire cutter, snip the mounting holes on the three-lug terminals as pictured. Cut two 1" pieces of green wire and remove the insulation. Wrap and solder the wires to the terminals, electrically connecting all three lugs. These are used as grounding strips.

☐ STEP 10

Mount the power transformer

The power transformer has thirteen leads, including three pairs with matching colors, plus seven wires with different colors. Twist the same-color pairs together and pull the red lead with a yellow stripe off to the side.

Five of the other wires allow you to wire the unit for different voltages, depending on the electrical system where you live.

The black wire is used in all cases, and it's twisted together with another wire depending on your country's voltage:

100V: black/blue striped
120V: white
220V: black/yellow striped
230V: black/green striped
240V: black/red striped

In North America for example, you would twist the white wire together with the black wire for 120V.

Twist the four unused transformer wires into two pairs. You'll terminate them independently in a few steps.

Uncover the mounting bolts and install the transformer on the outside of the chassis, with four 8-32 locknuts inside. Mount the two grounding strips at the corners as shown.

☐ STEP 11

Install the two speaker jacks

Mount the speaker output jack (3-lug shorting jack) and the extension speaker jack (2-lug) with the large washer on the outside. Tighten them well for good electrical grounding.

☐ STEP 12

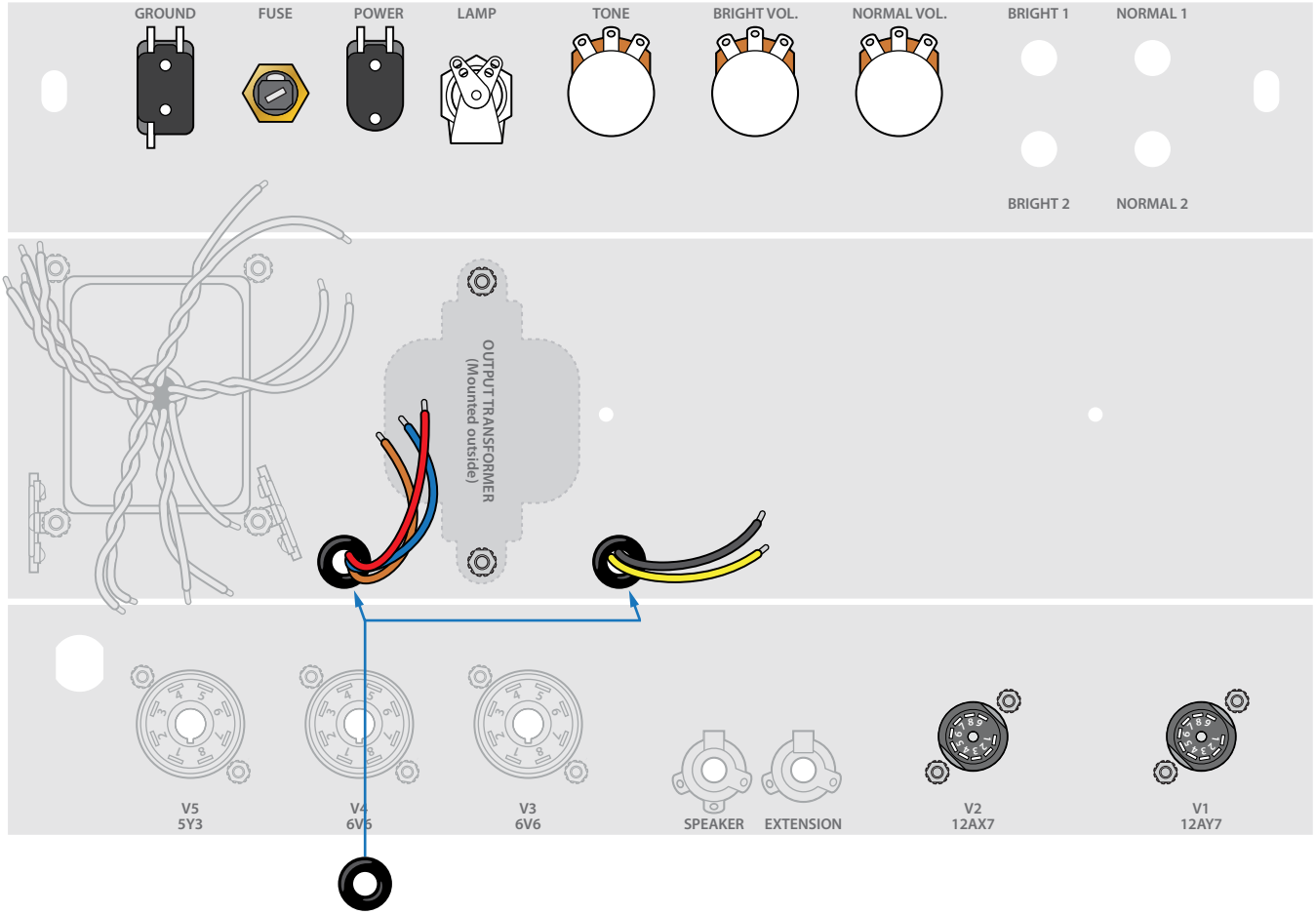
Install the 5Y3 tube socket + clip

The sockets for the 5Y3 and 6V6 tubes are identical, so you can use any one of them for this step. Orient the socket so pin 1 is nearest the open side of the chassis. Use two 4-40 x 3/8" machine screws to mount the socket outside of the chassis. Include a tension clip on the outside to support the tube.

☐ STEP 13

Add the 6V6 tube sockets + clips

Mount the two 6V6 tube sockets and tension clips in the same way.



☐ STEP 14

Install two rubber grommets

Squeeze these into the two holes for strain relief for the transformer wires.

☐ STEP 15

Mount the output transformer

The output transformer has five leads. Thread the red, blue, and brown wires through one rubber grommet as shown, and the yellow and black leads through the other grommet.

Using two 8-32 x 1/4" machine screws, mount the transformer to the outside of the chassis.

☐ STEP 16

Add 12AY7+12AX7 tube sockets

Use two 4-40 x 1/4" machine screws for mounting each of these sockets. Position the socket so pin 3 is toward the open side of the chassis.

☐ STEP 17

Install the ground switch

Mount the 3-lug ground switch. This switch is purely cosmetic, because ground switches are no longer needed in modern amps with 3-wire grounding power cords. But having it there keeps the vintage 1950s look.

☐ STEP 18

Install the fuse socket

Mount the fuse socket so its side lug is facing up, toward the open side of the chassis. This makes it easier to solder later.

☐ STEP 19

Install the power switch

Mount the power switch with its two lugs facing up for soldering later.

☐ STEP 20

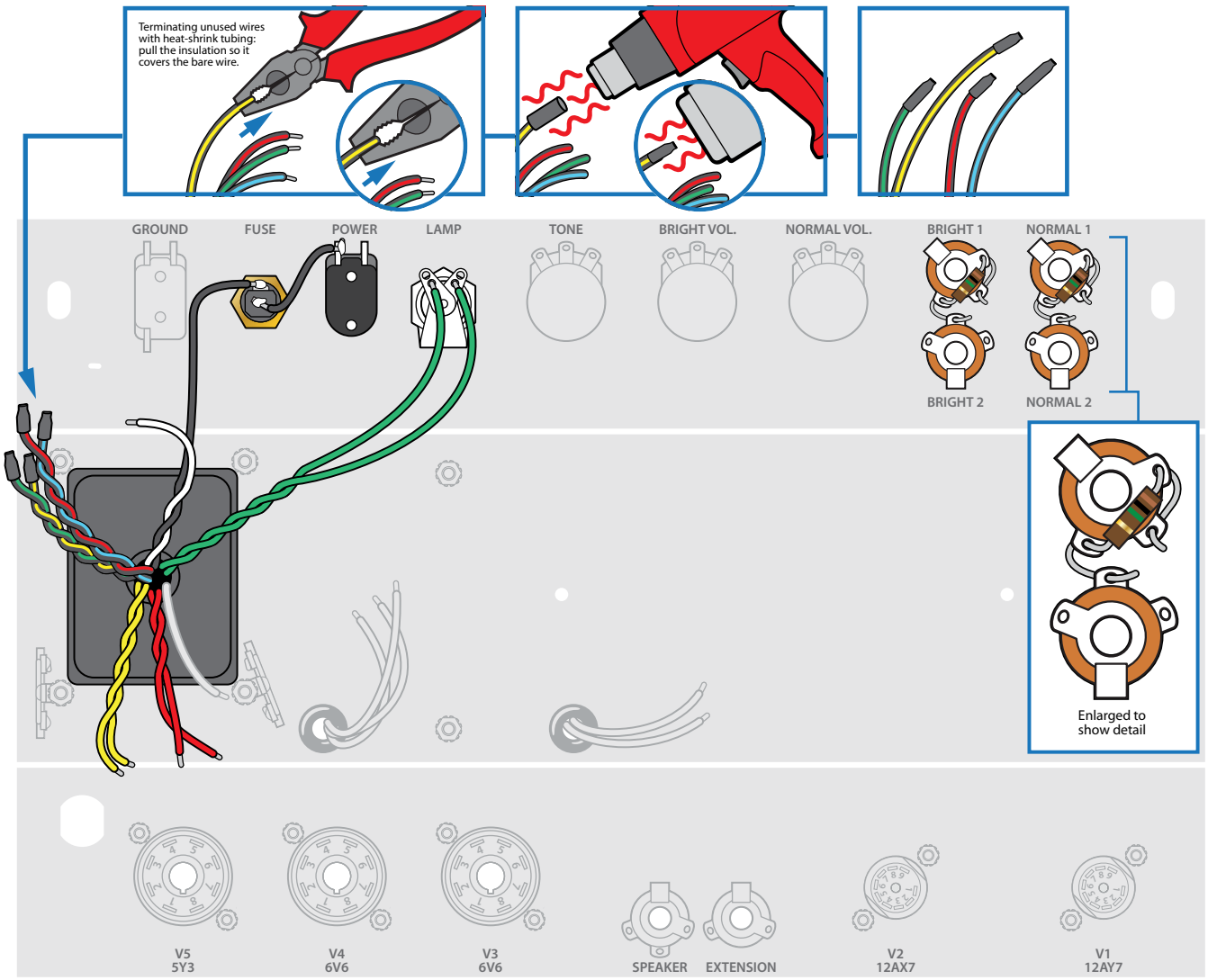
Install the pilot lamp socket

Mount the socket by screwing the lens from the outside into the socket assembly. Position the socket so the tabs are facing up for soldering.

☐ STEP 21

Install the control pots

Mount the pots so their lugs are facing up. When we refer to these lugs as left or right, it's assuming you're looking at the pot from the same point of view as the wiring diagram.



☐ STEP 22

Install input jacks + 1M resistors

Mount jacks 1 and 2 in the Normal channel. Turn the jacks as pictured, so a side lug of jack Normal 1 is close to the center lug of jack Normal 2.

Run the leads of a 1M resistor through the right and left lugs of jack Normal 1, positioning it out of the way of a guitar cable plug. It doesn't matter which direction the resistor is attached, because resistors aren't polarized.

Wrap one end of this resistor onto the center lug of jack 1, and the other end onto the center lug of jack 2. This resistor connects all three lugs of jack 1, plus the center lug of jack 2.

Don't solder these connections yet.

Using another 1M resistor, repeat these steps for jacks 1 and 2 in the Bright channel.

☐ STEP 23

Install power transformer leads

Run the black wire from the power transformer to the side lug of the fuse socket. Trim it to length and solder it. Use the trimmed scrap to create a short jumper from the end lug of the fuse socket to the closest lug of the power switch. Leave the white wire for now, we will connect it in a later step.

☐ STEP 24

Power transformer green leads

Run the two green wires from the power transformer to the lugs on the pilot lamp socket (either wire can go to either lug). Trim these wires to length and wrap them onto the lugs. Don't solder these connections yet.

☐ STEP 25

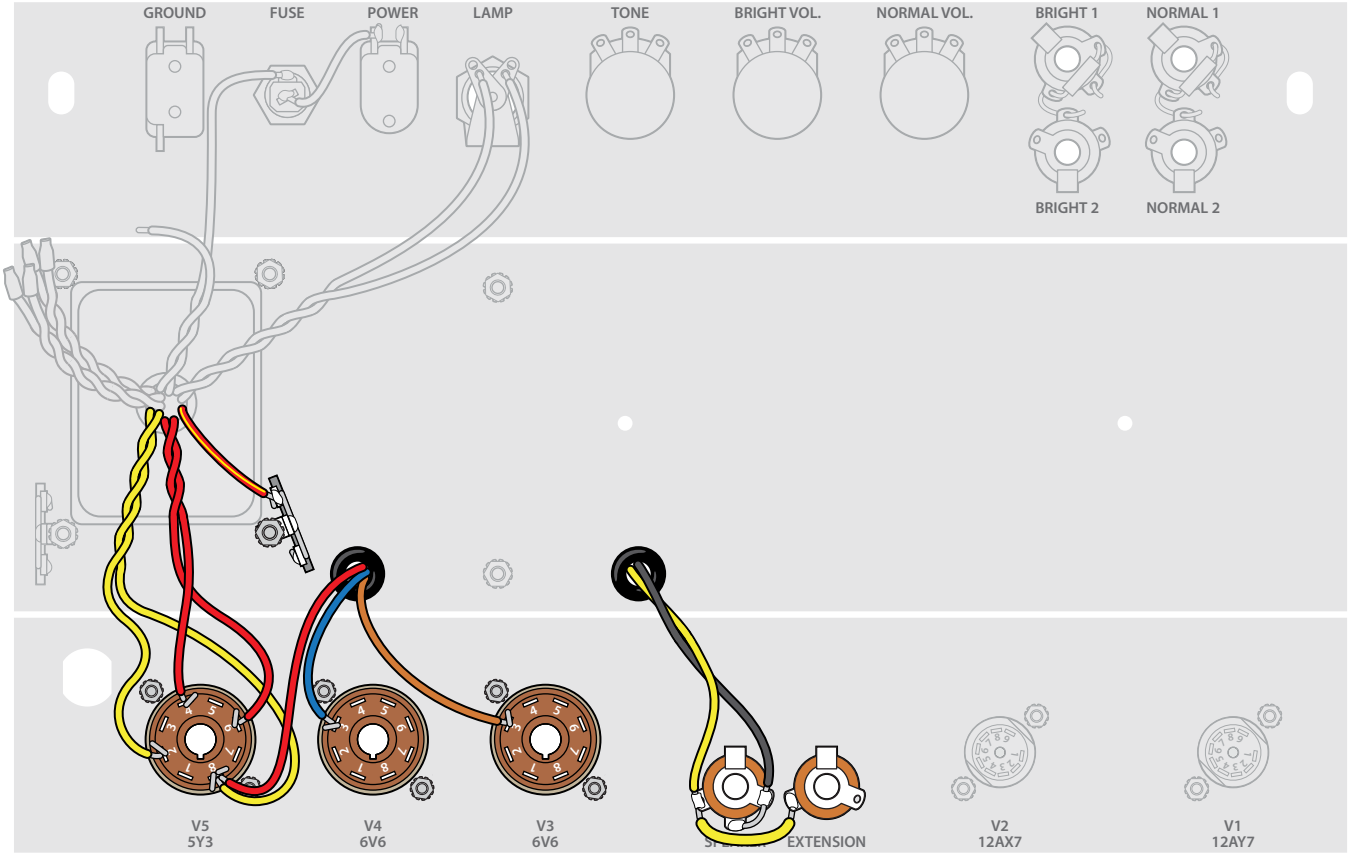
Terminate unused power transformer leads

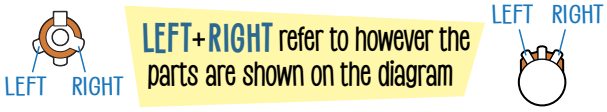
The four unused leads from the power transformer need to be safely terminated and tucked away in the chassis.

Trim these leads to 4". With one hand hold the leads where they come out of the transformer and with the other hand pull the insulation of each lead until it stretches about a 1/4" past the wire inside. This creates further insulation over the internal conductor of each lead.

Once the insulation is stretched out, apply 1" of heat-shrink tubing to the end of each lead.

Once the heat-shrink cools, twist these leads back up and tuck them in between the left side of the power transformer and the chassis wall.





☐ STEP 26

Power transformer red leads

Trim the power transformer's red leads to an appropriate length and wrap one lead onto the lower eyelets of pin 4 of the V5 socket (5Y3). Socket pins have upper and lower eyelets for multiple connections.

Wrap the other red lead onto pin 6 of the same socket. Don't solder these red leads yet.

☐ STEP 27

Power transformer yellow leads

Trim the power transformer's yellow leads to an appropriate length. Wrap one yellow lead onto pin 2 of the V5 socket.

Wrap the other yellow lead onto pin 8 of the same socket. Don't solder these yellow leads yet.

☐ STEP 28

Output transformer blue, brown, and red leads

Trim the red wire from the output transformer and wrap it onto pin 8 of the V5 socket. Don't solder it yet.

Trim and wrap the blue wire onto pin 3 of the V4 socket. Don't solder it yet.

Trim and wrap the brown wire onto pin 3 of the V3 socket. Don't solder it yet.

☐ STEP 29

Connect the speaker jacks

Wrap a 3/4" wire, with the insulation removed, between the center lug and right lug of the speaker output jack. Don't solder it yet.

Wrap 2" of yellow wire between the left lug of the speaker output jack and the left lug of the extension speaker jack. Don't solder it yet.

☐ STEP 30

Output transformer yellow+ black leads

Trim the yellow and black leads from the output transformer to reach the speaker output jack.

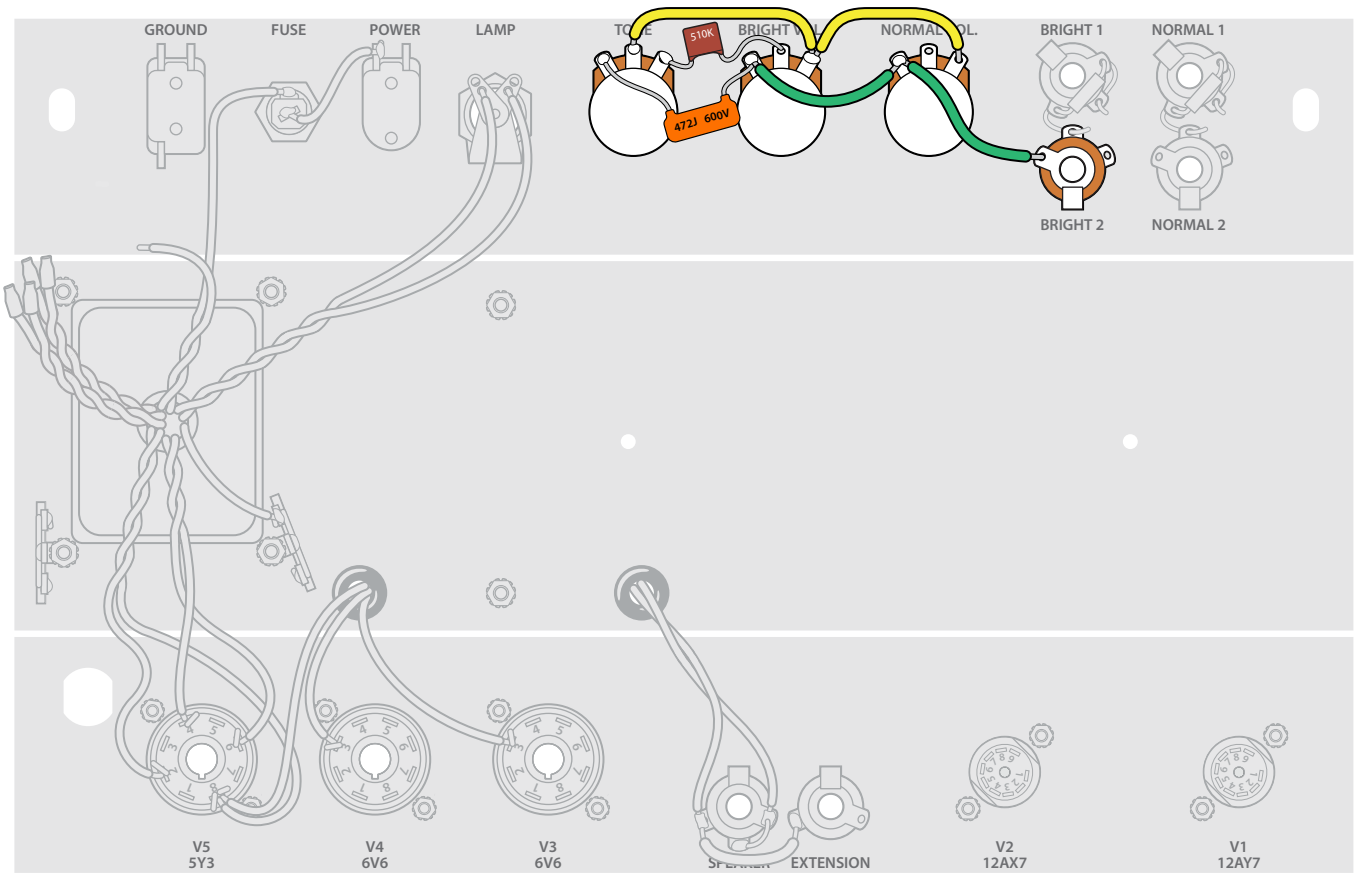
Solder the black lead to the right lug of the jack, along with the short wire from the previous step. Solder the other end of this short wire to the center lug of the speaker jack.

Solder the yellow lead to the left lug of the speaker jack along with the wire going to the extension speaker jack.

☐ STEP 31

Power transformer red/yellow lead

Trim the power transformer's red/yellow lead to length and solder it to the 3-lug grounding strip as shown.



☐ STEP 32

Attach the 500pF silver mica capacitor

Solder one lead of the 500pF cap to the right lug of the Tone pot. Wrap the other lead through the center lug of the Bright volume pot, but don't solder this connection yet.

☐ STEP 33

Add the 0.0047µF Orange Drop capacitor

Solder one lead of the 0.0047µF cap to the left lug of the Tone pot. Wrap the other lead onto the left lug of the Bright volume pot, but don't solder this connection yet.

☐ STEP 34

Add two yellow jumpers

Wrap a 2-1/2" yellow wire between the center lug of the Tone pot and the right lug of the Bright volume pot. Solder the connection at the center lug of the Tone pot.

A connecting wire like this is called a jumper.

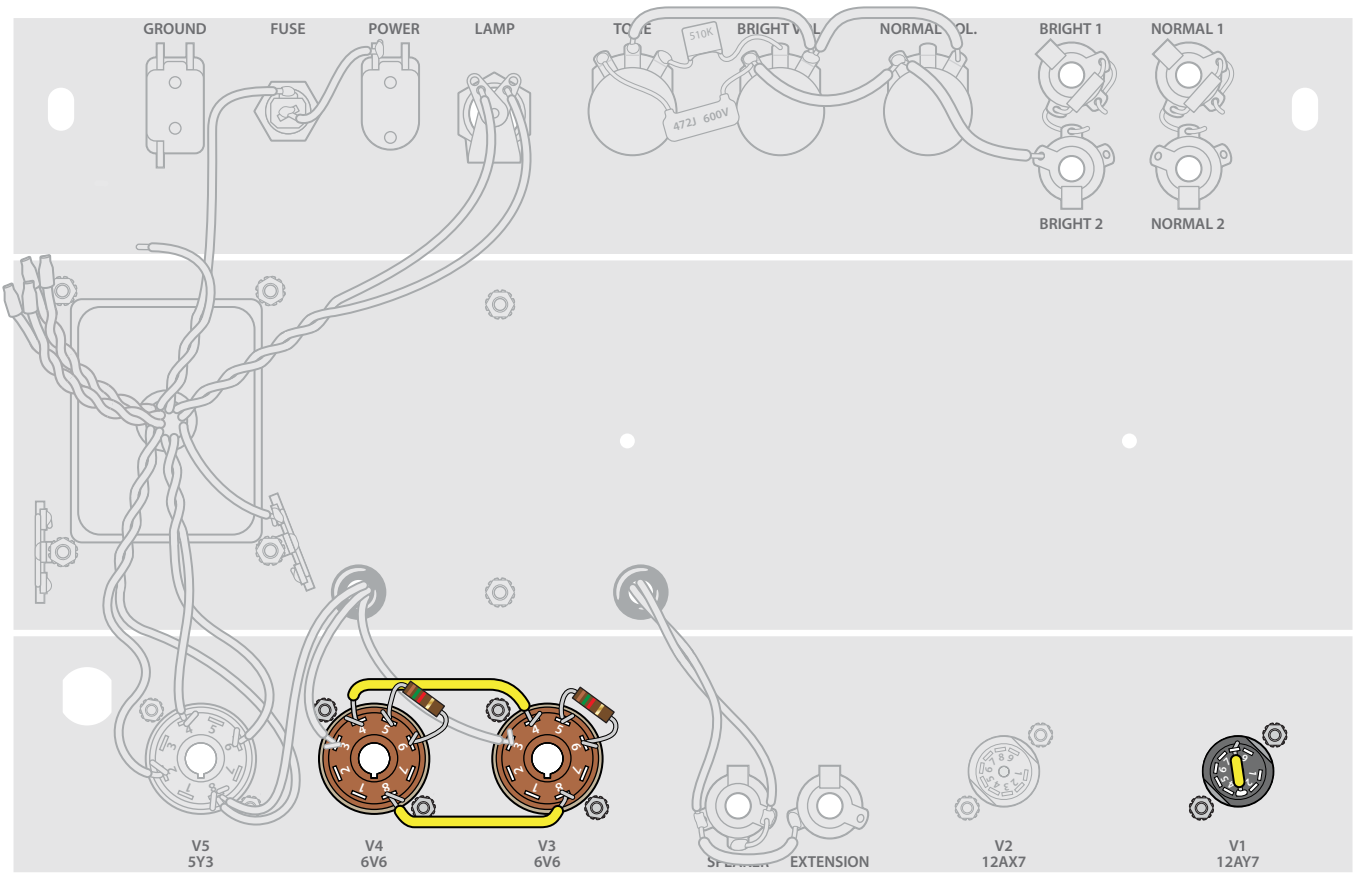
Wrap a 2" yellow jumper between the right lug of the Bright volume pot and the other end through the right lug of the Normal volume pot. Solder two leads at the right lug of the Bright volume pot. Leave the connection to the right lug of the Normal volume pot unsoldered for now.

☐ STEP 35

Add two green jumpers

Add a 2-1/2" green jumper between the left lug of the Bright volume pot and the left lug of the Normal volume pot. Solder the connection at the left lug of the Bright volume pot along with the lead from the 0.0047uF Orange Drop cap added in Step 35.

Add a 3" green jumper between the left lug of the Normal volume pot and the left lug of the Bright 2 input jack. Solder the connection at the left lug of the Normal volume pot, along with the green jumper already on that lug. Don't solder the connection to the left lug of the Bright 2 input jack yet.



☐ STEP 36

Add two 1.5K resistors

Wrap a 1.5K resistor through the top eyelets of pin 5 and pin 6 on the V3 tube socket.

Wrap the other 1.5K resistor through the top eyelets of pin 5 and pin 6 on the V4 tube socket. Solder these leads in place on all four pins.

☐ STEP 37

Add two yellow jumpers

Add one 3" yellow jumper between the bottom eyelet of pin 8 on the V3 tube socket and the bottom eyelet of pin 8 on the V4 tube socket. Solder these connections.

Add another 3" yellow jumper between the bottom eyelet of pin 4 on the V3 tube socket and the bottom eyelet of pin 4 on the V4 tube socket. Don't solder these connections yet.

☐ STEP 38

Add a tiny yellow jumper

Add a 3/4" yellow jumper between pins 3 and 8 of the V1 tube socket. Solder the pin 3 connection, but just wrap onto pin 8 for now.

☐ STEP 39

Inspect and double-check

This is a good time to step away from the project for a few minutes and take a break.

When you're ready to go at it again, carefully review every connection you've made so far.

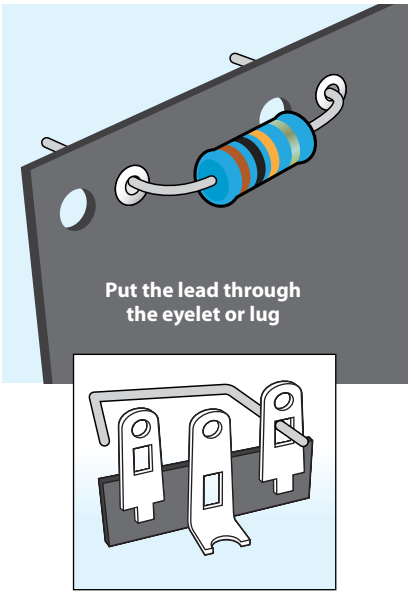
Be suspicious
Assume there's a mistake and you're the one who'll find it!

When everything checks out, you're ready to move onto the eyelet board.

How to wrap and solder the eyelet board

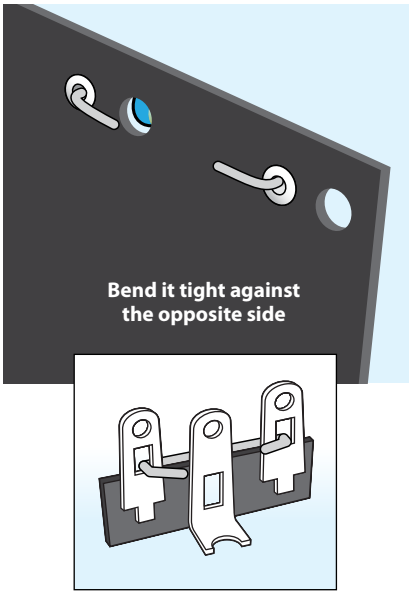
Wrap

Don't solder the components as they go onto the eyelet board. Instead wrap all the parts onto the board, bending their leads tightly so the parts stay in place without solder.



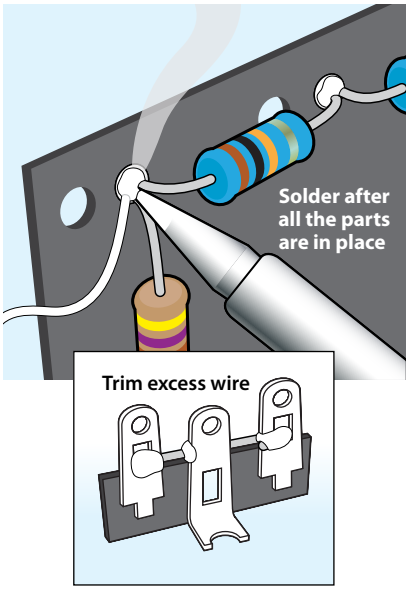
Inspect

When all the parts are in place, stop and inspect. Go back over every step. Careful inspection is the best way to make sure your amp works the first time you turn it on.



Solder

Solder each connection point only once. Reheating to add another part makes a messy, faulty solder joint. Use the soldering tips below to get professional results.



Don't think of solder as glue

Good mechanical connections make good electrical connections. Solder's job is to finalize an already good joint, not to hold the parts on the board.

Make the specs visible

Attach components with the specs facing out so you can read them. Many builders also align resistor bands to read in the same direction.

How much insulation to strip?

With plastic insulation, strip 3/8" from the wire ends. Push-back wire works best when you strip away about 1/4" of the cloth wrap.

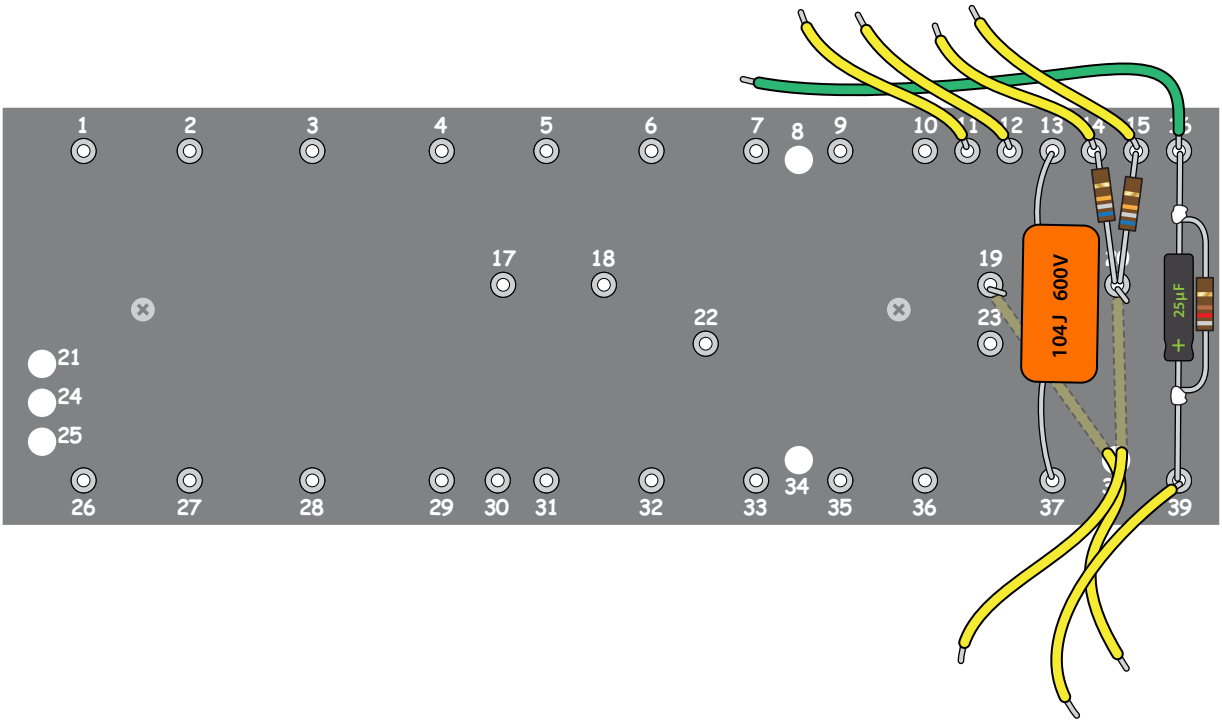
Tips for great soldering

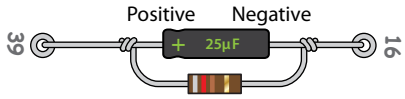
- **Wrap the leads tightly** for good electrical contact before soldering.
- Melt a small amount of solder onto the tip of the iron ("**tinning**" the iron). Hold the tip against the connection until the connection reaches soldering temperature. This should take just a few seconds.

You should also tin component leads, like coating multi-strand wires to help the solder flow for a more solid joint.

- Keep your soldering tip clean by wiping it often on a damp sponge. Also keep it tinned by occasionally melting a little solder onto it.
- Feed solder to the connection, not to the iron. Stop feeding solder once the eyelet is filled. Keep the iron on the connection for a second longer; this pause gives time for all of the flux to cook out of the joint.
- Don't blow on the hot solder or touch anything until the joint has cooled completely. A good solder joint is shiny—a sign that it was left to cool undisturbed.
- After the joint has cooled, trim away the excess wires.
- Plan so each joint is only soldered once. Resoldered joints are messy and more likely to fail.

Wrapping parts onto the eyelet board





☐ STEP 40

Install a 25µF capacitor + 820Ω resistor + two jumpers

Wrap and solder the leads of the 820Ω resistor onto the leads of a 25µF cap, joining the two parts so they can be installed as a unit.

Wrap this capacitor/resistor assembly between eyelets 16 and 39. **Note the polarity of the capacitor.** Connect the cap's negative lead to eyelet 16. Resistors have no polarity, so they can be installed in either direction.

Cut a 5" length of green wire and wrap one end onto eyelet 16. Wrap a 2-1/2" yellow wire onto eyelet 39.

☐ STEP 41

Add two 68K resistors + three yellow jumpers

Wrap one 68K resistor between eyelets 14 and 20, and the other 68K resistor between eyelets 15 and 20.

Cut two yellow jumpers, 2" long. Add one at eyelet 14 and one at 15.

Turn the board over and add a 5" yellow jumper from the back at eyelet 20. Run this jumper to the front of the board through hole 38 and pull it tight to keep it in place.

For neat-looking wiring, use wire strippers to trim 1/4" of the insulation from the ends of the push-back wire.

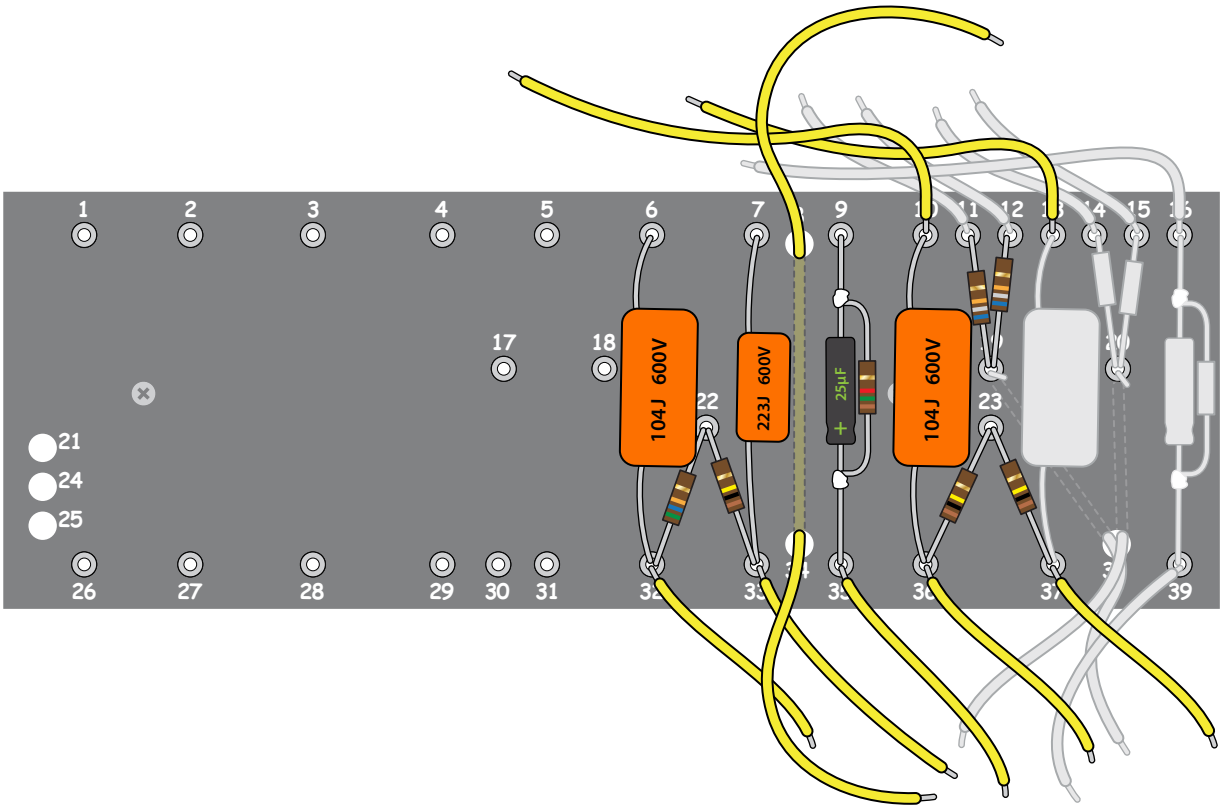
☐ STEP 42

Install a 0.1µF Orange Drop capacitor + two jumpers

Wrap one 0.1µF Orange Drop cap between eyelets 13 and 37. This cap is not polarized, so it can be installed in either direction.

Cut two yellow jumpers, each 2" long. Add one at eyelet 11 and one at 12.

Turn the board over and add a 4" yellow jumper from the back at eyelet 19. Run this jumper to the front of the board through hole 38 and pull it tight to keep it in place.



☐ STEP 43

Add two 68K resistors

Place one 68K resistor through eyelets 11 and 19, and the other 68K resistor through eyelets 12 and 19.

☐ STEP 44

Add two 100K resistors + two jumpers

Place one 100K resistor through eyelets 23 and 36, and the other 100K resistor through eyelets 23 and 37.

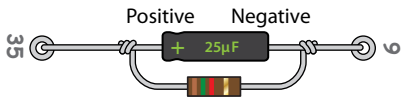
Cut two yellow jumpers, 3" long. Add one at eyelet 36 and one at 37.

☐ STEP 45

Install a 0.1µF cap + one jumper

Wrap one 0.1µF Orange Drop cap between eyelets 10 and 36. This cap can be installed in either direction.

Attach one 5-1/2" yellow jumper to eyelet 13 and attach one 6" yellow jumper to eyelet 10.



☐ STEP 46

Install a 25µF capacitor + 1.5K resistor + one jumper

Wrap and solder the leads of the 1.5K resistor onto the leads of a 25µF cap, joining them as you did in Step 42.

Wrap this capacitor/resistor assembly between eyelets 9 and 35. **Note the polarity of the capacitor.** Connect the negative lead to eyelet 9.

Add a 3-1/2" yellow jumper wire at eyelet 35.

☐ STEP 47

Thread a long jumper through two holes in the board

Add a 10" yellow jumper down through hole 8 and back up through hole 34, leaving about 2-1/2" coming through hole 8 and about 3-1/2" through hole 34.

☐ STEP 48

Add a 0.022µF capacitor + 100K resistor + one jumper

Wrap a 0.022µF Orange Drop cap between eyelets 7 and 33.

Add a 100K resistor between eyelets 22 and 33.

Add a 3" yellow jumper to eyelet 33.

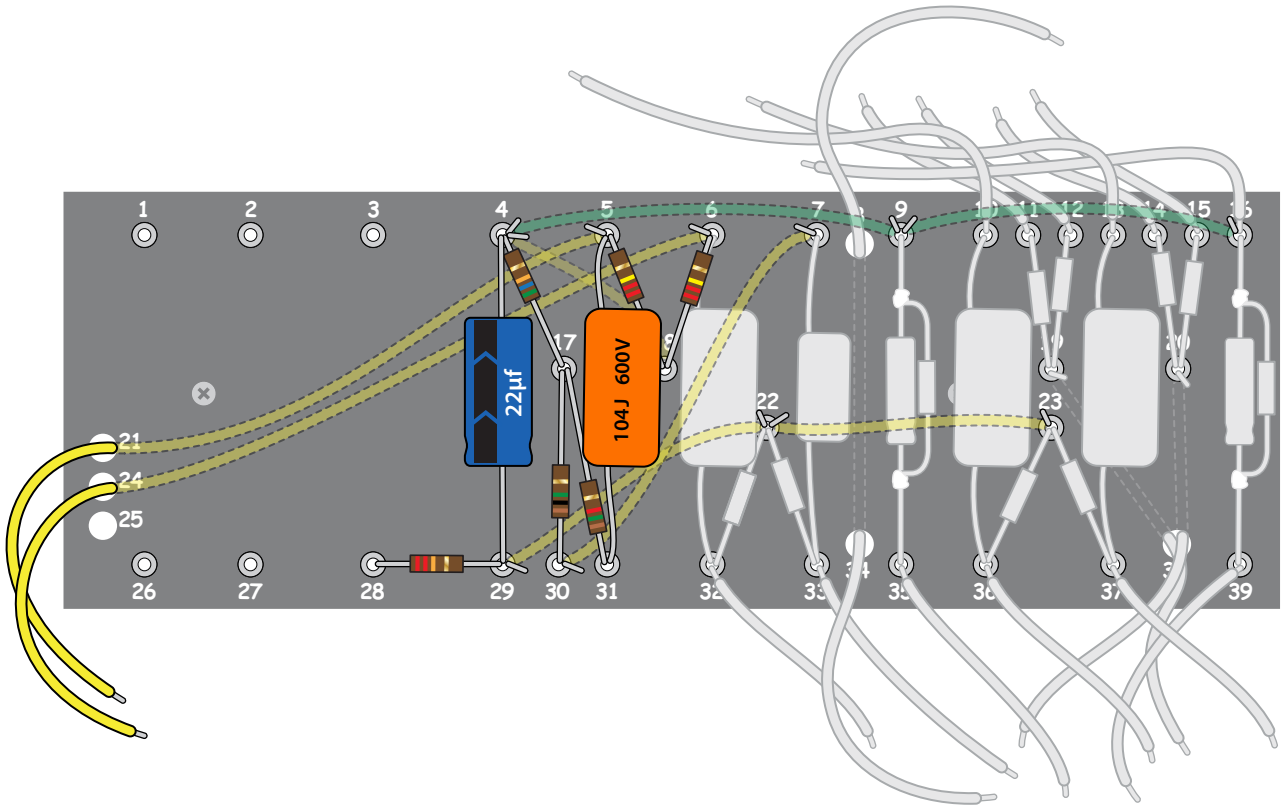
☐ STEP 49

Add a 0.1µF capacitor + 56K resistor + one jumper

Add a 56K resistor between eyelets 22 and 32.

Add a 0.1µF Orange Drop capacitor between eyelets 6 and 32.

Add a 2-3/4" yellow jumper wire to eyelet 32.



☐ STEP 50

Install two 220K resistors + one 0.1µF capacitor

Wrap the leads of a 220K resistor onto eyelets 5 and 18. Wrap the other 220K resistor onto eyelets 6 and 18.

Add a 0.1µF Orange Drop capacitor between eyelets 5 and 31.

☐ STEP 51

Add three jumpers on the back of the board

Flip the board over and add one 9" yellow jumper at the back of eyelet 6. Thread this jumper up through hole 24 and pull it tight to keep it in place.

Add another 8" yellow jumper to the back of eyelet 5. Thread this through hole 21 and pull it tight.

Wrap a 1-1/2" yellow jumper between eyelet 18 and eyelet 4 on the back of the board.

☐ STEP 52

Add three resistors

Wrap a 1.5K resistor between eyelets 31 and 17.

Add a 1M resistor between eyelets 30 and 17.

Add a 56K resistor between eyelets 4 and 17.

☐ STEP 53

Add one 22µF electrolytic cap + 22K resistor

Wrap a 22µF electrolytic cap through eyelets 4 and 29. **Note the polarity.** The negative lead goes to eyelet 4. When electrolytic capacitors don't show a positive or negative symbol, look for the arrow design; the arrows point to the negative lead.

Add a 22K resistor between eyelets 28 and 29.

☐ STEP 54

Add five jumpers on the back of the board

Turn the board over for the next five jumpers.

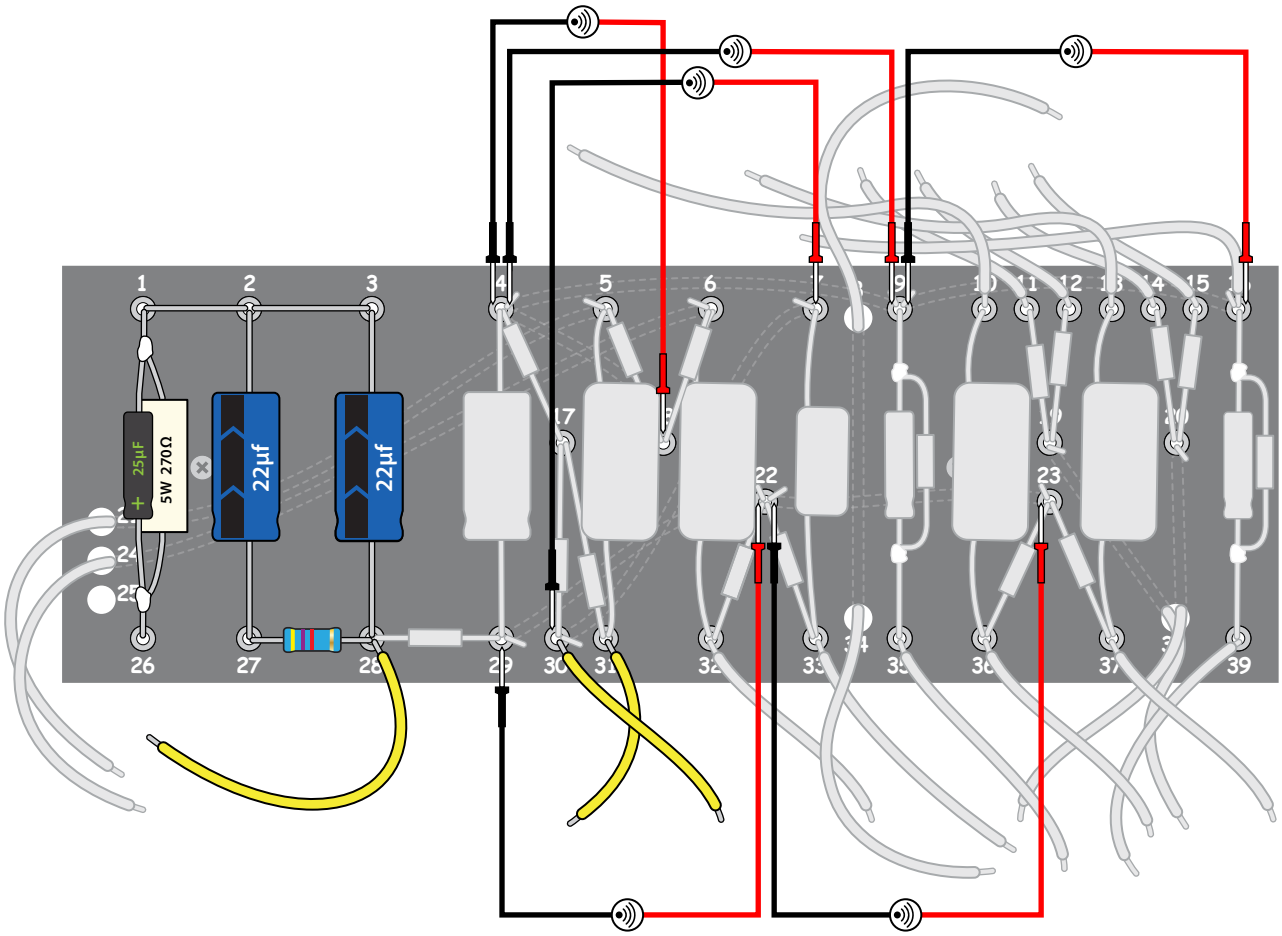
Add a 2-3/4" yellow jumper between eyelet 29 and eyelet 22.

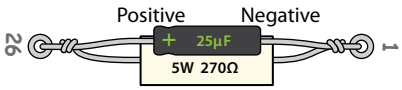
Add a 2-1/2" yellow jumper between eyelet 22 and eyelet 23.

Add a 3-1/2" yellow jumper between eyelet 7 and eyelet 30.

Add a 3-1/2" green jumper between eyelet 4 and eyelet 9.

Add a 3" green jumper between eyelet 9 and eyelet 16.





☐ STEP 55

Test the back-of-board jumpers

Flip the board over and double-check the jumpers on the back. The easiest way to do this is to set your multimeter to test for continuity and do this test between eyelets 22+23, 22+29, 7+30, 4+18, 4+9, and 9+16.

Read about testing on page 32.

If any of these checks don't show continuity, now's the time to correct these jumpers.

The most common errors in building this circuit come from these back-of-board jumpers, and it's a lot easier to fix this now than after the board is wired up to the chassis components.

☐ STEP 56

Add two 22µF electrolytic caps

Wrap a 22µF electrolytic cap through eyelets 3 and 28. **Note the polarity.** The negative lead goes to eyelet 3.

Wrap the other 22µF electrolytic cap between eyelets 2 and 27. Connect the negative lead to eyelet 2.

☐ STEP 57

Add two green jumpers

Cut two 1-1/2" green jumpers and remove their fabric insulation. Wrap one jumper between eyelets 1 and 2 and the other jumper between eyelets 2 and 3.

☐ STEP 58

Add a 4.7K resistor

Add a 4.7K resistor between eyelets 27 and 28.

☐ STEP 59

Add a 25µF cap + 270Ω resistor

Wrap and solder the leads of the 270Ω resistor onto the leads of a 25µF cap, joining them to install as a unit.

Wrap this capacitor/resistor assembly between eyelets 1 and 26. **Note the polarity of the capacitor.** Connect the negative lead to eyelet 1.

☐ STEP 60

Add two yellow jumpers

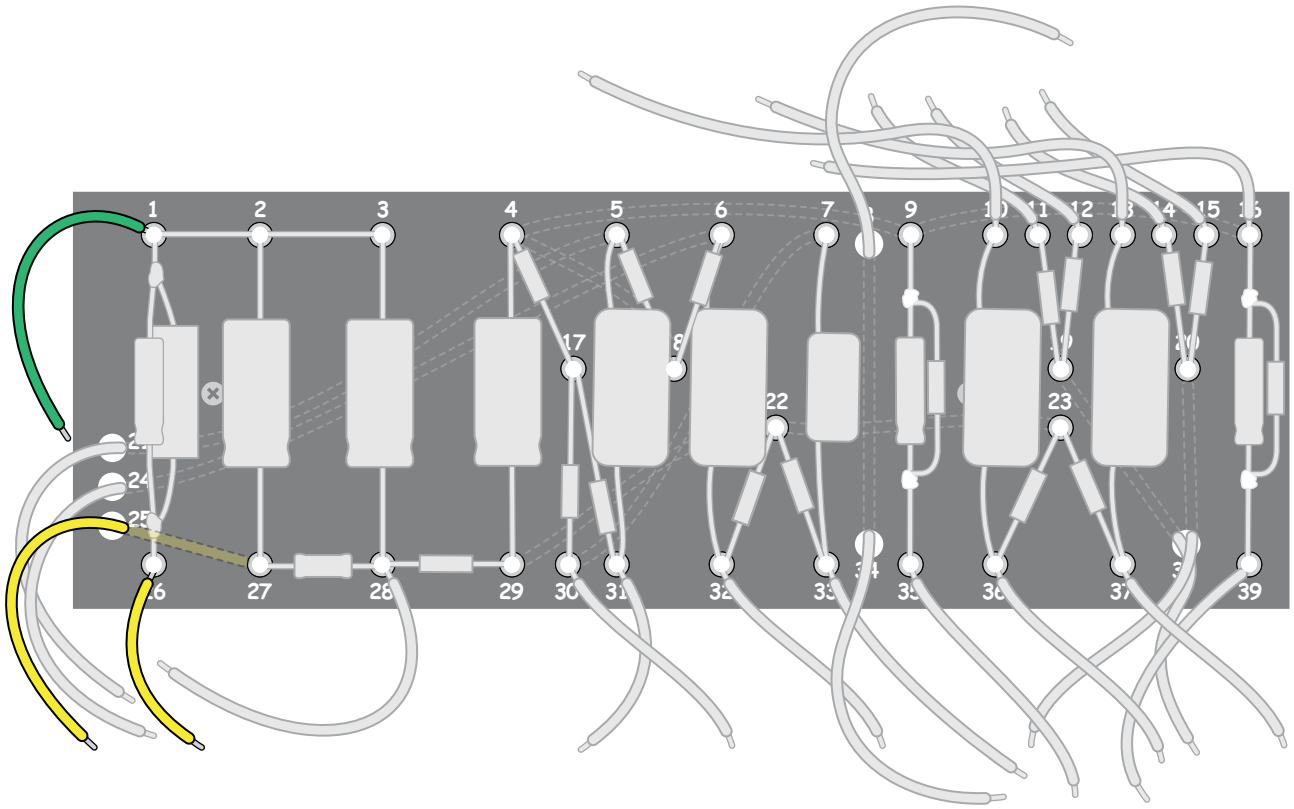
Cut two 3" yellow jumpers. Add one to eyelet 31, and the other to eyelet 30.

☐ STEP 61

Add a longer yellow jumper

Wrap a 5-1/2" yellow jumper onto eyelet 28.

Soldering the eyelet board



☐ STEP 62

Add a yellow jumper in back

Wrap a 7" yellow jumper from the back of eyelet 27. Run the other end of this jumper up through hole 25.

☐ STEP 63

Add a short yellow jumper

Add a 2-1/2" yellow jumper wire to eyelet 26.

☐ STEP 64

Add a green jumper

Add a 4-1/2" green jumper to eyelet 1.

☐ STEP 65

Stop and review

All the components and wires are now on the eyelet board. **Take a break to rest your eyes.** It's time to inspect your work so far, and it's a mistake to do that in a rush.

Review everything to make sure you've correctly followed each step so far. To find no mistakes at this stage is pretty unusual, and it's much easier to correct them now than after you're done soldering!

As you check your work, make sure every connection is tight.

☐ STEP 66

Solder the connections on the eyelet board

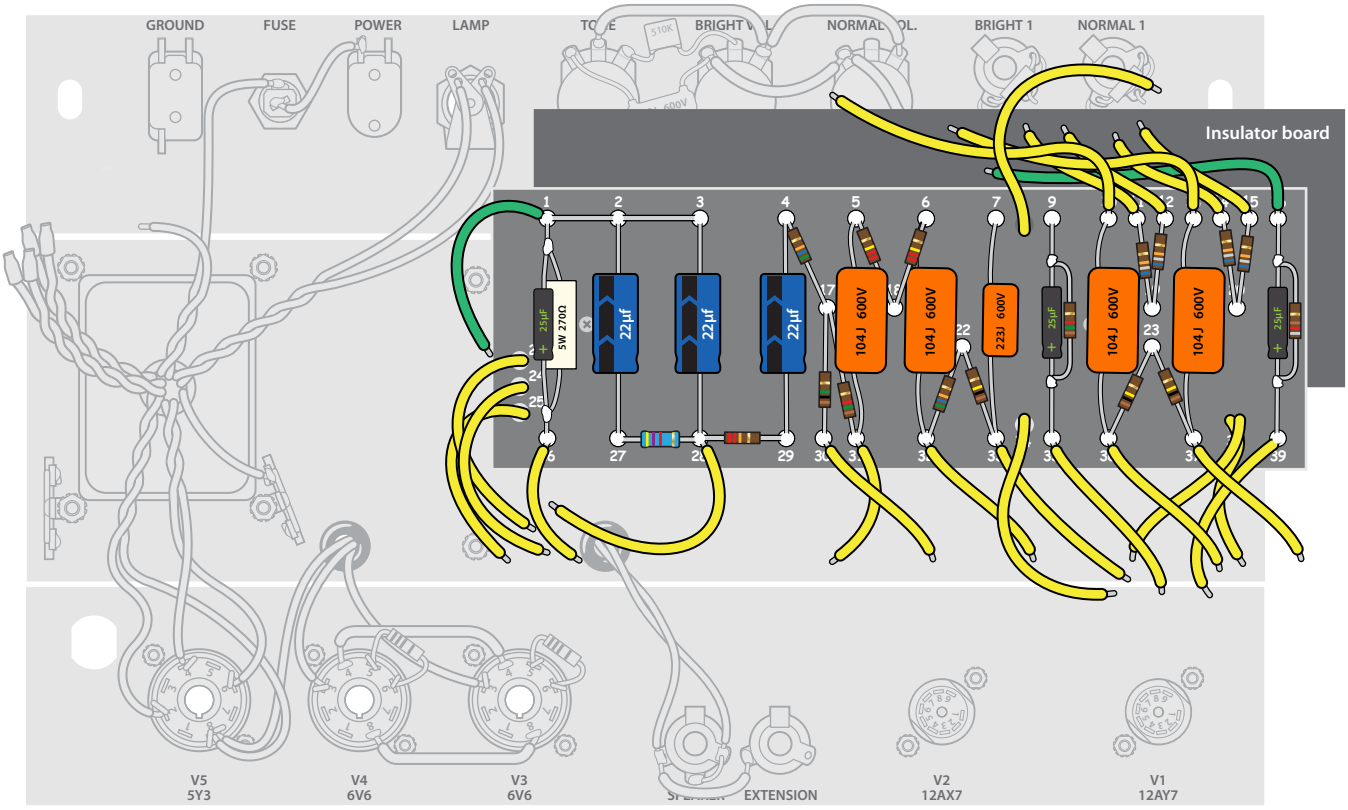
When all the parts and wires are in the right place and tightly wrapped, it's time to set the connections with solder.

Review the tips for great soldering on page 18, then solder each connection on the eyelet board.

After soldering all the joints, clip the excess leads on the back and the front of the board. This is important to avoid a short in your circuit.

Check all your solder joints to make sure they're shiny.

Installing the eyelet board



☐ STEP 67

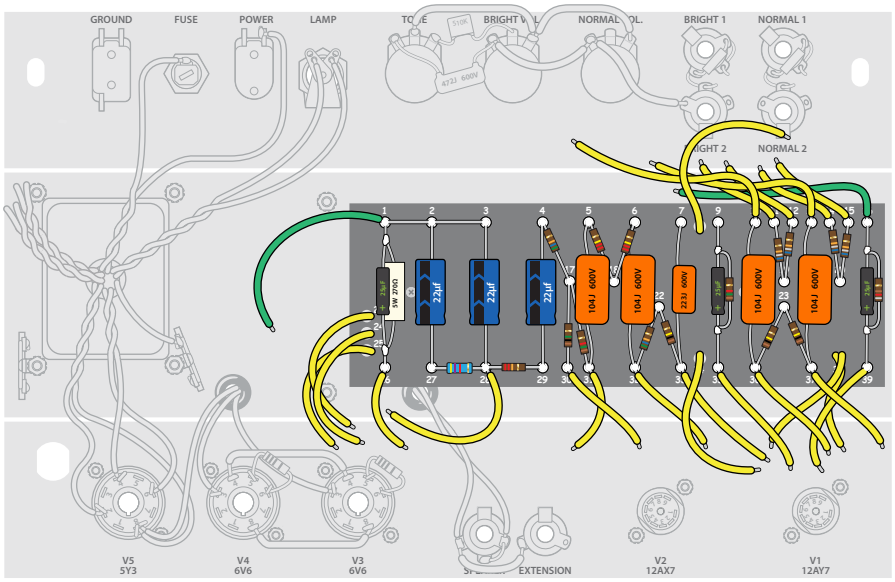
Install the eyelet board, backed by the insulator board

Before installing the eyelet board and insulator board in the chassis, make sure you have enough length on the unsoldered jumpers coming through holes 8 and 34 to reach their components.

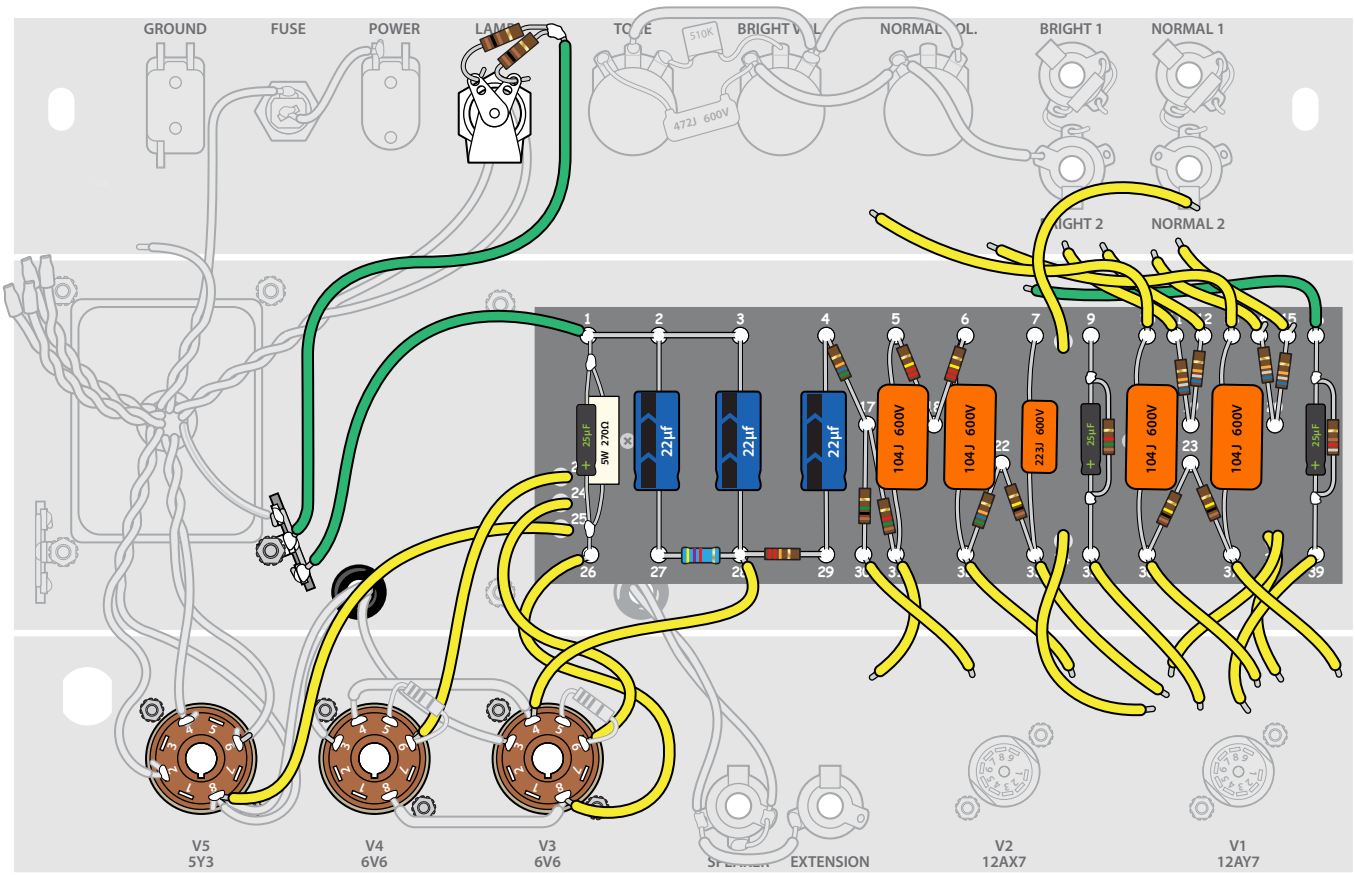
The jumper from hole 8 needs 2-1/2" to reach the Normal volume pot.

The jumper from hole 34 needs 3-1/2" to reach the V2 tube socket.

Lay the insulation board on the bottom of the chassis, aligning the mounting holes. Put the eyelet board on top, and run a 6-32 x 1/2" machine screw through the boards and chassis. Secure this with a locknut on the outside of the chassis. Do the same with the second machine screw.



Connecting the eyelet board to the chassis components



☐ STEP 68

Connect two 100Ω resistors to the lamp socket

Twist one lead from each of two 100Ω resistors together to join them. Wrap the other leads of these resistors to the lugs of the pilot lamp socket. Don't solder these connections yet.

☐ STEP 69

Add a ground wire

Solder a 4" green jumper to the joined leads of the 100Ω resistors.

Solder the other end of this jumper to the center lug of the ground strip near the 6V6 sockets.

☐ STEP 70

Solder a green jumper

Solder the green jumper from eyelet 1 to the last open lug of the grounding strip located near the 6V6 sockets.

☐ STEP 71

Solder tube socket V5

Wrap the yellow jumper from hole 25 through pin 8 on the V5 tube socket, along with the yellow power transformer lead and the red output transformer lead. Solder these connections to this socket (six wires). Trim away any excess wire ends.

☐ STEP 72

Solder tube socket V4

Wrap the yellow jumper from hole 21 to pin 6 of the V4 socket and solder in place.

Make sure all connections on the V4 socket so far are soldered in place.

☐ STEP 73

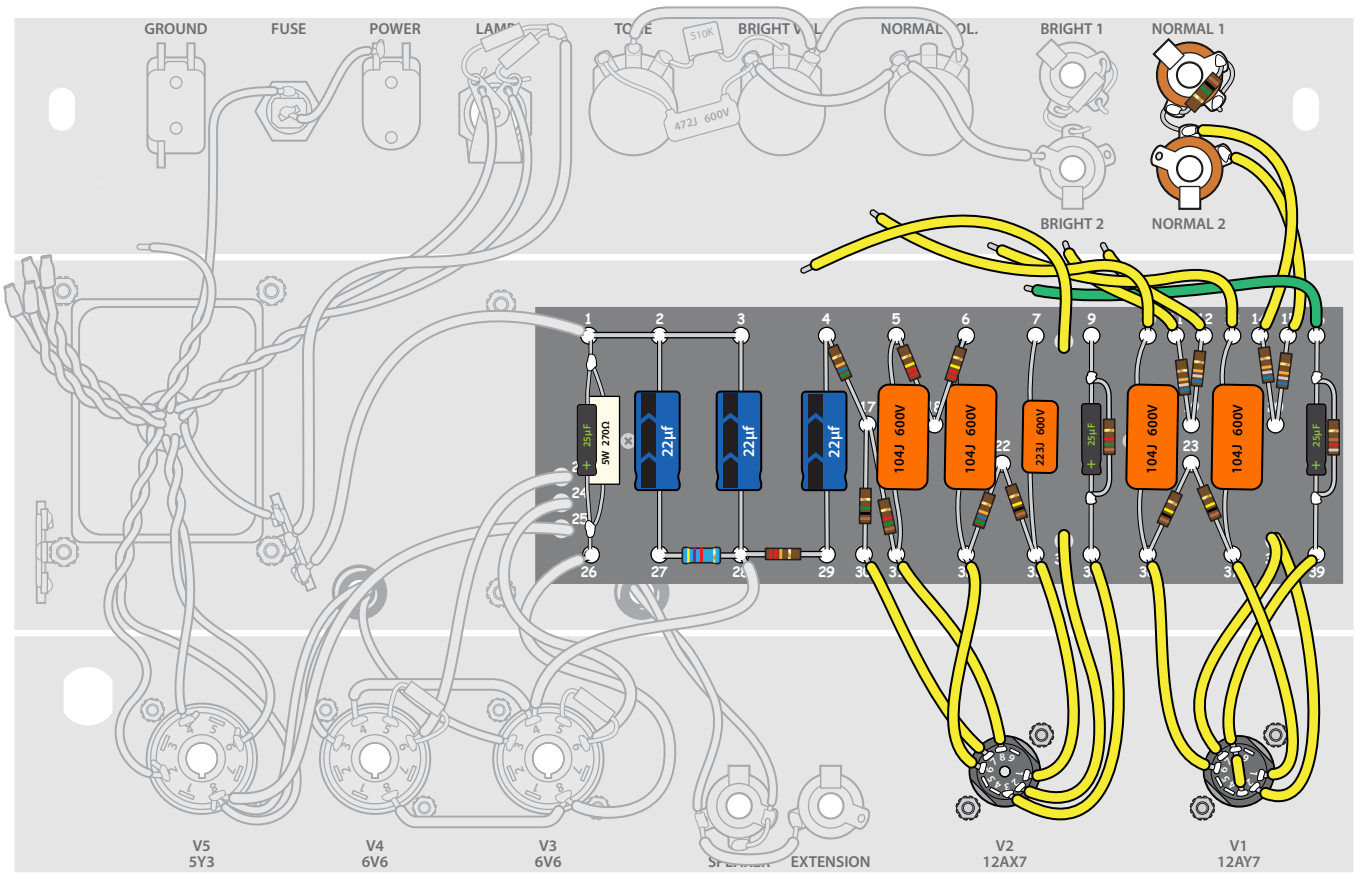
Solder tube socket V3

Wrap the yellow jumper from hole 24 to pin 6 of the V3 socket and solder in place.

Wrap the yellow jumper from eyelet 26 through pin 8 of the V3 socket and solder in place with the existing jumper.

Wrap the yellow jumper from eyelet 28 through pin 4 of the V3 socket and solder in place with the existing jumper.

Make sure all connections on the V3 socket so far are soldered in place.



☐ STEP 74

Solder tube socket V2

Wrap the jumper from eyelet 32 onto pin 6 of the V2 socket.

Wrap the jumper from eyelet 33 onto pin 1 of the V2 socket.

Wrap the jumper from eyelet 30 onto pin 7 of the V2 socket.

Wrap the jumper from eyelet 31 onto pin 8 of the V2 socket.

Wrap the jumper coming through hole 34 to pin 2 of the V2 socket.

Wrap the jumper from eyelet 35 onto pin 3 of the V2 socket.

Solder the connections to this socket (six wires). Trim the wire ends.

☐ STEP 75

Solder tube socket V1

Wrap the jumper from eyelet 36 onto pin 6 of the V1 socket.

Wrap the jumper from eyelet 37 onto pin 1 of the V1 socket.

Find the jumper coming through hole 38 that has continuity to eyelet 19. Wrap this jumper onto pin 7 of the V1 socket.

Wrap the jumper from eyelet 39 to pin 8 of the V1 socket, along with the jumper from pin 3.

Find the jumper coming through hole 38 that has continuity to eyelet 20. Wrap this jumper to pin 2 of the V1 socket.

Solder the connections to this socket (five wires). Trim the wire ends.

☐ STEP 76

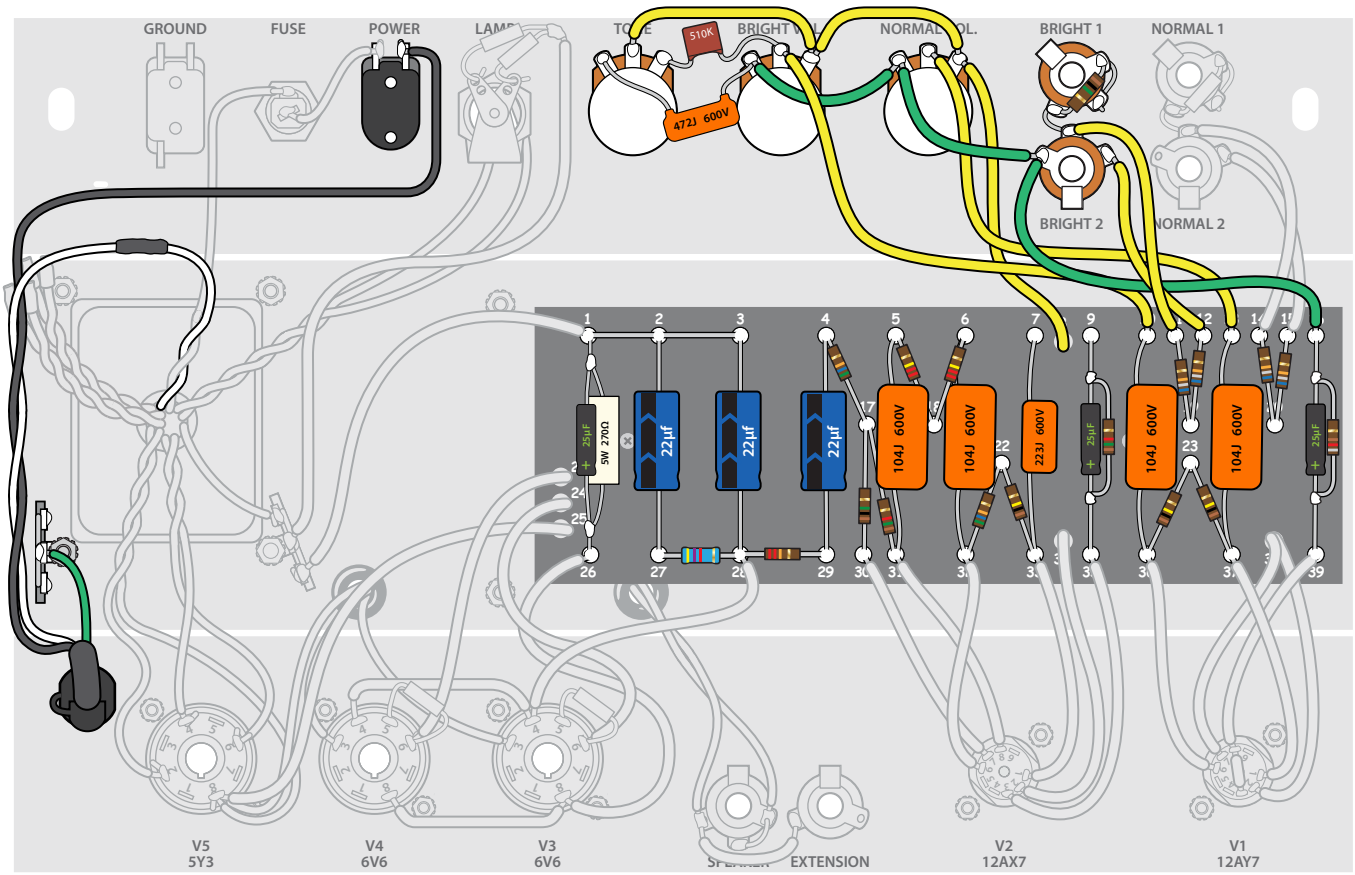
Solder the Normal channel jacks

Solder the jumper from eyelet 15 to the right lug (tip connection) of the Normal channel jack 2.

Solder the jumper from eyelet 14 to the middle lug of the Normal channel jack 2, along with the resistor lead from jack 1.

Solder the connections to Normal channel jacks 1 and 2.

Trim the excess wires.



☐ STEP 77

Solder the Bright channel jacks

Solder the jumper from eyelet 12 to the right lug (tip connection) of the Bright channel jack 2.

Solder the jumper from eyelet 11 to the middle lug of Bright jack 2.

Solder the jumper from eyelet 16 to the left lug (shield connection) of the Bright channel jack 2 along with the green jumper already in place. Solder any unsoldered resistor leads into place on the Bright channel input jacks now. Trim the excess wires.

☐ STEP 78

Solder the volume pots

Solder the jumper from eyelet 13 to the middle lug of the Normal volume pot.

Solder the jumper from eyelet 10 to the middle lug of the Bright volume pot, with the capacitor lead already in place.

Solder the jumper coming through hole 8 to the right lug of the Normal volume pot along with the jumper.

☐ STEP 79

Add the power cord + strain relief

Strip away 9" of the power cord's outer insulation. Twist the black and white leads together.

Cut the green lead from the power cord to reach the 3-lug grounding strip nearest the access hole. Tin this lead and wrap it through the middle lug of the 3-lug grounding strip.

Pull the power cord leads through the hole in the chassis and secure with the black strain relief. If it's tight, use pliers to squeeze it onto the power cord outside the chassis, and keep squeezing to fit into the mount hole.

☐ STEP 80

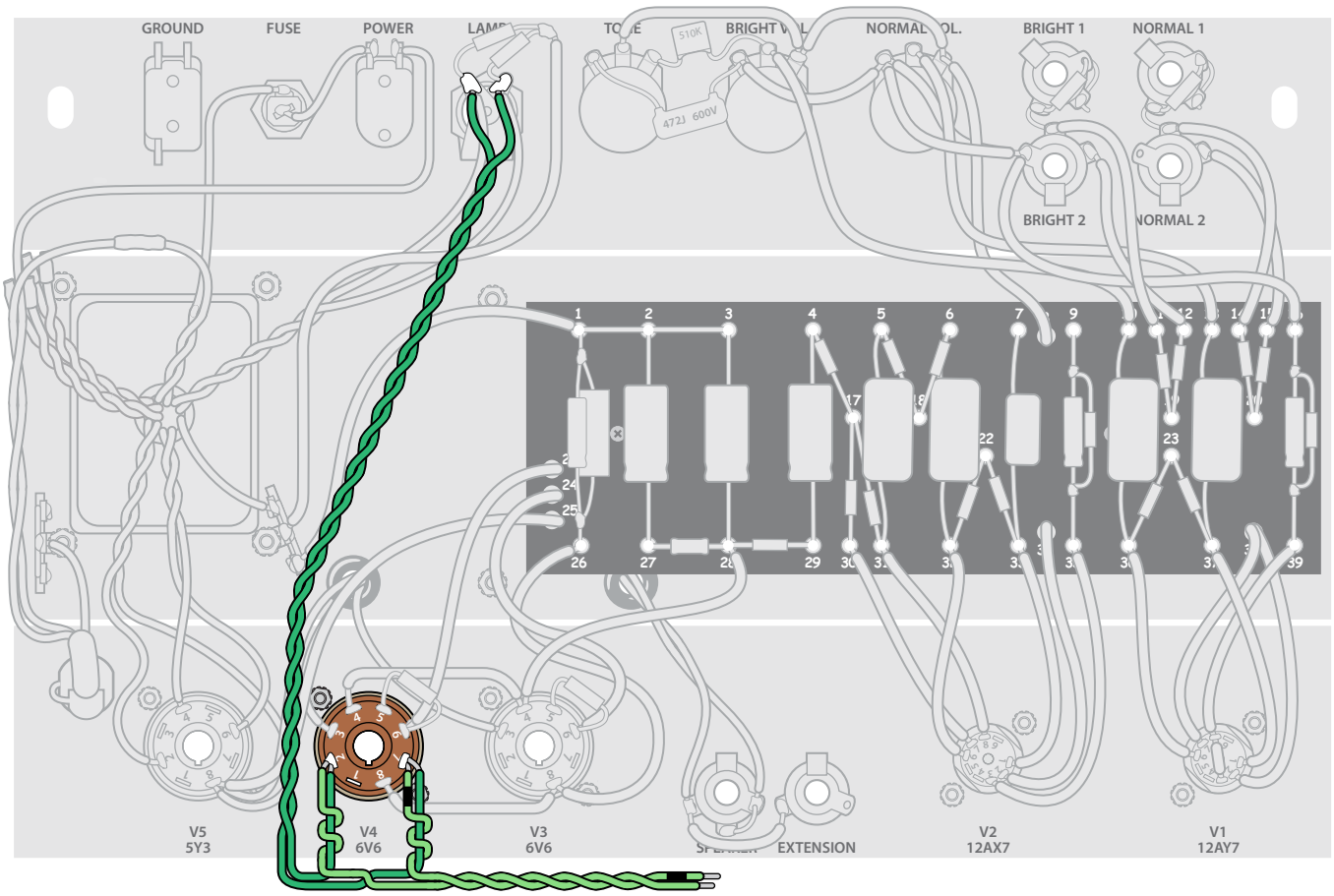
Connect the power cord leads

Run the twisted black and white leads along the side edge of the chassis. Cut a 3/4" length of heat-shrink and add it to the white lead.

Run the white power cord lead to reach the white lead from the power transformer. Trim to length, then twist this lead together with the white lead from the power transformer and solder this connection, known as a splice. Once cool, add the heat-shrink and heat it.

Run the black power cord lead to the open lug of the power switch. Trim it to length, then solder in place.

Solder the power cord's green ground wire to the nearby grounding strip.



☐ STEP 81

Install the heater wires

In this step, green power supply leads are being jumped from the pilot lamp socket to the tube sockets. They carry the AC voltage to power the heating elements in the tubes.

Take the time to read and understand this two-page section before starting.

☐ STEP 82

Add two 3-1/2" green jumpers

Twist these two wires together tightly, leaving 1" of straight wire at each end. Wrap these jumpers onto the lugs of the pilot lamp socket. Solder this connection, along with the two resistors and the green power transformer leads already wrapped onto the pilot lamp.

☐ STEP 83

Add two 4-1/2" green jumpers

Use a black marker to ink both ends of one of these jumpers, so you'll recognize it after it's twisted with the other. Twist these jumpers together tightly, leaving 1" of straight wire at each end.

Join these to the wires from the pilot light by twisting the ends together.

Wrap the pair of these ends that include the ink-blackened wire onto pin 7 of the V4 socket.

Wrap the other pair onto pin 2 of the V4 socket.

Solder these connections. Bend these wires so they stick straight out from the socket by 1" as described in the hum-reducing tips explained at left.

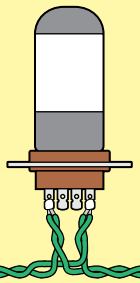
Bend them into a 90-degree angle toward their next connection.

How to REDUCE THE HUM caused by AC voltage

These green heater wires carry AC voltage that will cause hum if they get too close to wires that carry the signal. These tips minimize that hum.

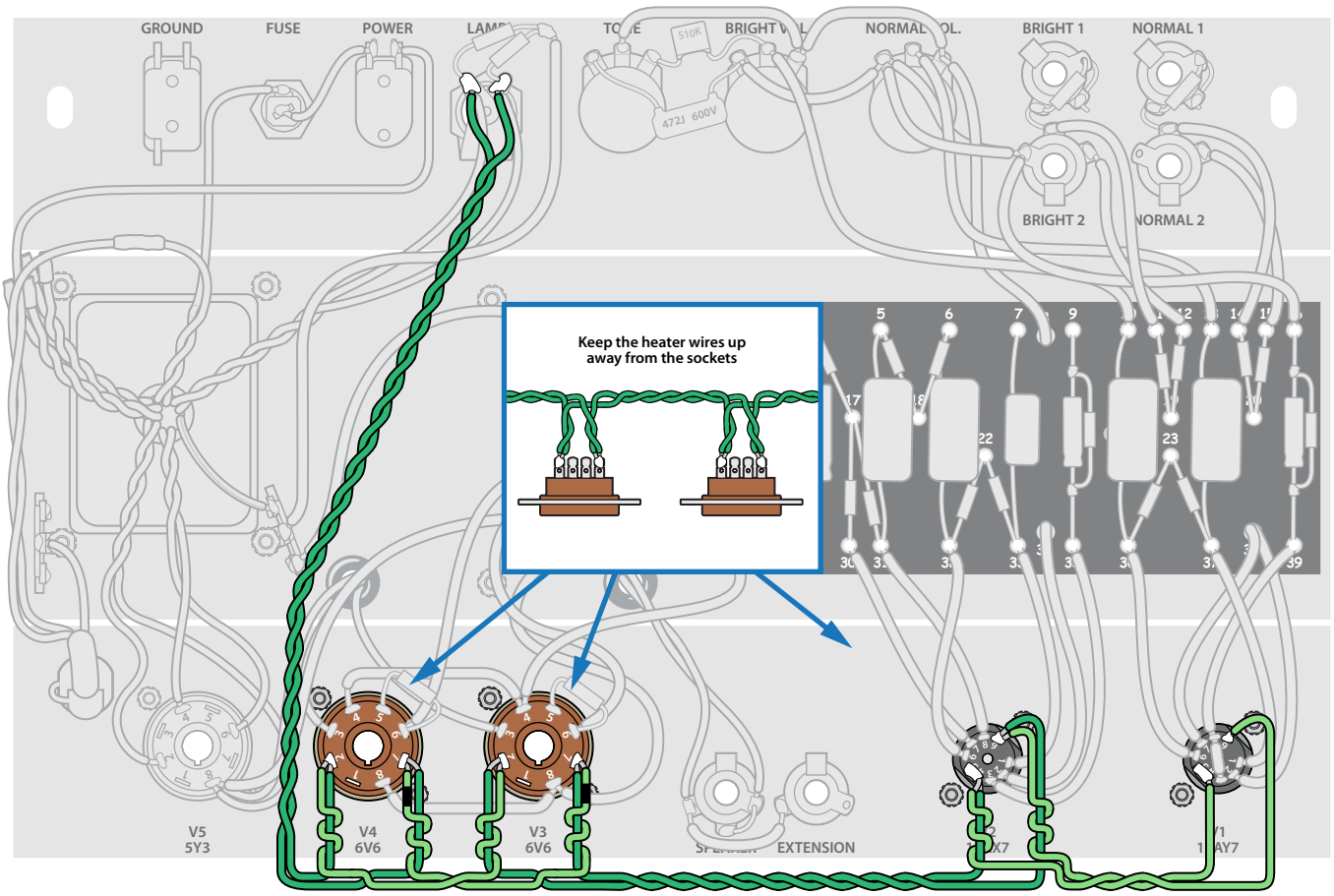
Twist the wires tightly

This reduces hum, the way opposite-wound coils do in a humbucking pickup. Twisted wires are easier to route away from signal wires.



Route them out and away

Let these wires stick out about an inch from the socket before bending them. This keeps the heater wires from mingling with the signal wires.



☐ STEP 84

Add two 7" green jumpers

Twist these jumpers together very tightly, leaving 1" of straight wire at each end.

Join these to the jumpers from the V4 socket by twisting the ends together. It doesn't matter which of these connects with the ink-blackened jumper.

Solder the pair of jumpers that includes the ink-blackened one onto pin 7 of the V3 socket.

Solder the unmarked pair to pin 2 of the V3 socket. Bend these so they stick out from the socket as before, with a 90-degree bend toward the V2 socket.

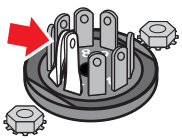
☐ STEP 85

Add two 4-1/2" green jumpers

Twist these jumpers together very tightly, leaving 1" of straight wire at each end.

At this point, you no longer need to keep track of which jumper is connected to an ink-marked lead. For the remaining two sockets, these green leads are interchangeable.

Twist the ends of these new jumpers onto the jumpers coming from the V3 socket.



On the V2 socket and the V1 socket, twist pins 4 and 5 toward each other so that their eyelets line up. Do this gently, because these pins are delicate.

Solder one pair of jumpers onto pins 4 and 5 of the V2 socket, combining those two pins in one solder joint.

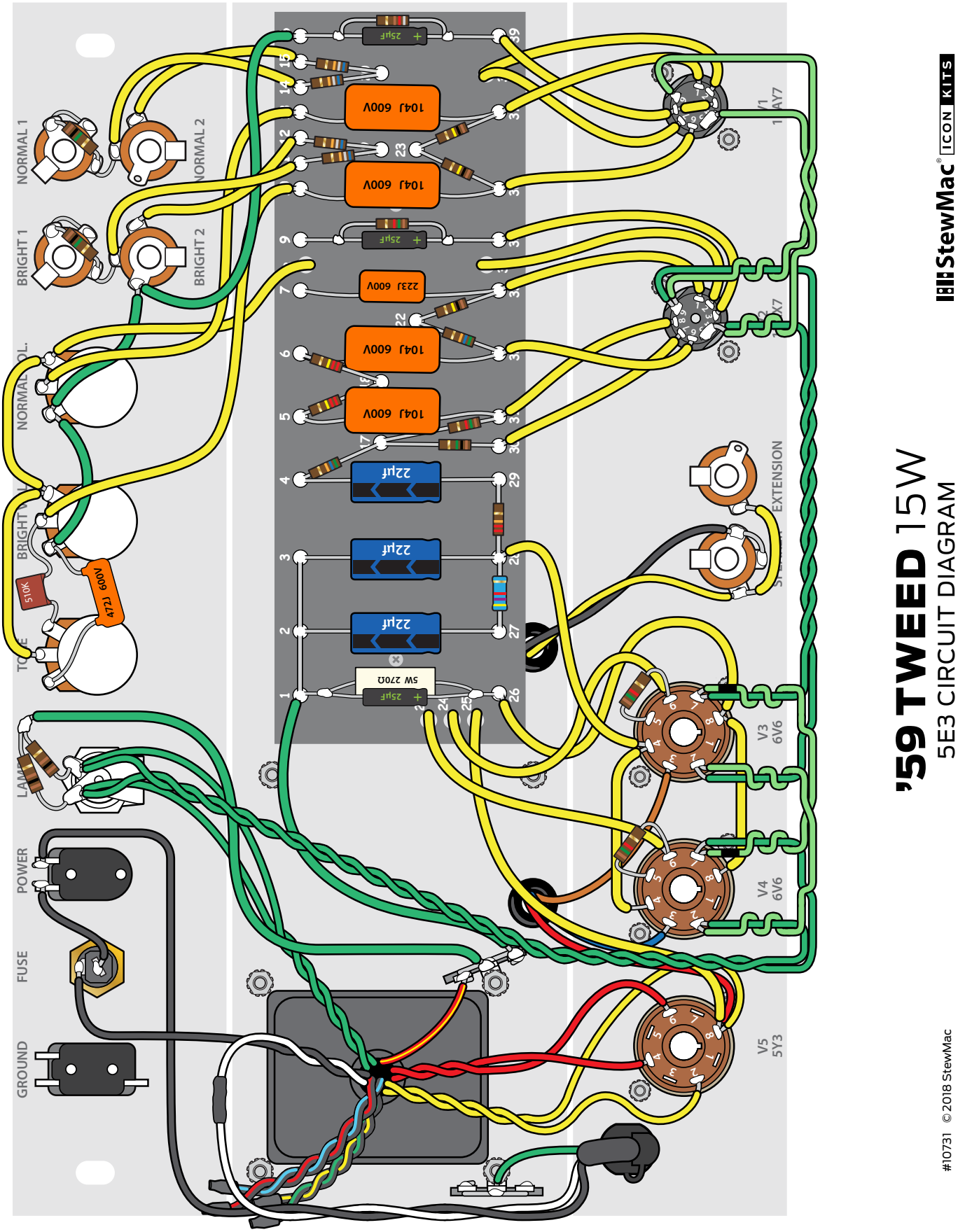
Solder the other pair of twisted wires in to pin 9 of the V2 socket. Run these twisted pairs up an inch from the tube socket and turn them at a 90-degree angle toward socket V5. Trim the excess wire.

Solder the one wire from this last heater run to pins 4+5 of the V1 socket and solder the other wire to pin 9 of the same socket.

Take a break!

Now that you've soldered the components and wires, stop and rest your eyes. Come back and review your work later, carefully looking again for any errors before moving on.

Completed 5E3 wiring



Final assembly

☐ STEP 86

Mount the chassis

Place the chassis into the cabinet and run the two 10-32 x 1-1/2" machine screws through the top of the cabinet, into the chassis. Fasten loosely with locknuts.

Hold the top back panel in place, flush with the edge of the cabinet. Move the chassis so it's flush with the back panel, and tighten the locknuts.

☐ STEP 87

Install the fuse

Insert the 2-amp fuse into the fuse socket from the front of the chassis. Make sure the socket cap is secure. Never use a fuse rated above 2 amps in this amplifier.

☐ STEP 88

Install the pilot lamp

Insert the pilot lamp bulb into its socket from the front of the chassis and twist until it locks back in place. Screw the red jewel lens over the socket.

☐ STEP 89

Install the three control knobs

Turn the shaft of each pot to zero and install the chicken head knobs so their indicator lines point to number 1.

☐ STEP 90

Clamp the power cord

Remove the cable clamp from the cabinet wall and wrap it around the power cord, about 6" from the chassis. Remount the clamp with the cord.

YOU'RE DONE WIRING!
DON'T INSTALL THE TUBES YET!
DON'T PLUG THE AMP IN YET!
FIRST YOU HAVE TESTING TO DO...

Any **multimeter** will work fine for the two types of tests we're about to do: checking **continuity** and reading **voltages**. The instructions that came with your meter will be helpful.

Continuity testing is simply making sure current flows between two points successfully. Touch the meter's red lead to one end of the section being tested, and the black lead to the other end. If the continuity is good, your meter will beep or register this on the display.

Voltage testing is where you need to be careful. Some steps require the amp to be plugged in and turned on. This becomes dangerous if you're not cautious. Respect the voltages and follow the directions, and these tests are safe and easy.

☐ STEP 91

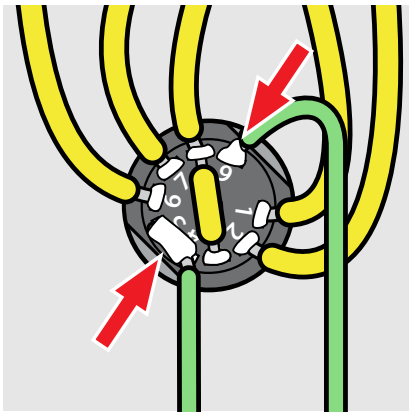
Perform a safe power-up

At this point, there should be no tubes installed, and the speaker should be disconnected.

Before plugging the amp in, turn the power switch to ON. Switching the amp on before the first power-up protects you from shock if a mistake in your wiring has created a short to the chassis. If this short exists, an indication would be that the pilot light will not turn on, since the AC current is going directly to ground.

Plug the power cord in. The pilot lamp should light.

For a few minutes, watch for smoke or unusual smells. If anything seems unusual, disconnect the power immediately and carefully review all your connections.



☐ STEP 92

Test the standard AC voltage

Set your multimeter to 20V AC. Check the heater voltage across pin 9 and pins 4+5 on the V1/12AY7 socket. This should read between 5-7V AC. If this reading is drastically different, unplug the amp and check your connections.

If the amp seems normal, unplug the power cord while still leaving the power switch ON.

☐ STEP 93

Test the dangerous DC voltage

The dangerously high DC voltage that passes through the rectifier tube and the filter caps is referred to as "B+". The next step is to test this B+ voltage.

With the amp still unplugged, install the 5Y3 rectifier tube while spreading the tension clip with the other hand.

Plug the power cord back in. The pilot lamp should light, along with the filament inside the 5Y3 tube.

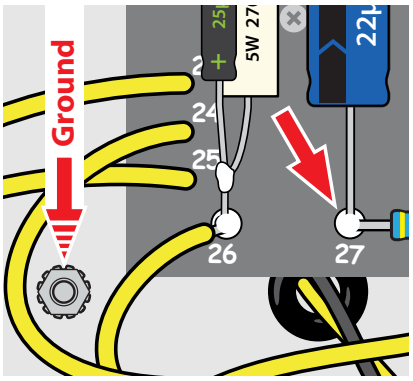
Again, spend a few minutes watching for smoke or smells.

At this point, dangerous voltage is forming in the filter caps. Always discharge them before working on the circuit, even if the amp is unplugged. See how to use a snuffer stick on page 6.

For safety, use only one hand to touch the amp during DC tests.

Keep your other hand behind your back when you need to probe a component. This way, you can't be a path between B+ voltage and ground—a mistake that would send a dangerous charge through your heart.

Seriously, keep one hand behind your back!



Set your multimeter to 500V DC and connect the black (negative) probe to ground. Once that probe is secured to ground, measure the DC voltage at eyelet 27. This B+ voltage should be roughly 510V DC.

☐ STEP 94

Test the preamp tubes

If your readings so far are correct and the amp's behaving normally, unplug it.

With the amp unplugged, you can now install your 12AY7 and 12AX7 preamp tubes. There are no indexing pins for these tube sockets, but there is only one way to install a tube in these sockets.

After this tube is correctly installed, plug the amp back in. The pilot lamp should light up. Let the amp warm up for a few minutes. Again, if you get smoke or smells, unplug immediately.

Connect your multimeter's negative lead to ground.

Set the multimeter to 5V DC and check eyelet 39, which should read around 2.1V.

Set the multimeter to 200V DC and check eyelet 37, which should read around 160V.

If the reading at eyelet 37 shows no voltage or low voltage, follow this test: unplug the amp, drain the filter caps with the snuffer stick (instructions on page 6), set your meter to read continuity, and make sure you have properly installed the behind-the-board jumpers from eyelet 29 to eyelet 23.

If all of these voltages come within approximately 10% of their expected values, **unplug the amp**.

☐ STEP 95

Test the 6V6 power tubes

With the amp unplugged, install the 6V6 power tubes.

Plug the speaker into the left speaker jack. The other jack is for an extension cabinet; if you plug the internal speaker into it, you'll get no sound.

Perform these next tests with the speaker turned away from you. If the amp starts to oscillate and squeal, this will help protect your ears.

Plug the amp in. After a few moments you should hear a low hum. If the hum becomes very loud, unplug it immediately and review your connections.

After the amp's warmed up for a few minutes attach your multimeter's negative lead to ground.

Set your multimeter to read 5V DC and test for voltage at eyelet 39. This voltage should read around 2.1V.

Set your multimeter to read 50V DC and test for voltage at eyelet 26. This voltage should read around 22V.

Set your multimeter to read 400V DC and test for voltage at eyelet 28. This voltage should read around 342V.

If your voltage readings are correct, plug a guitar in and begin playing at low volume. If the amp is behaving as it should, keep increasing the volume. It should start to break up nicely as you increase the volume.

If there are any strange oscillations, squeals, or the amp seems at all unstable, use a wooden chopstick to begin probing for loose connections:

- From the input jacks to the eyelet board
- From the tube sockets to the eyelet board
- From the tube sockets to the front panel controls.

It usually takes just a minor wiring adjustment, perhaps resoldering a loose joint, to correct this sort of distortion.

Let it rip!

If the amp is stable and your tests match the voltages specified, it's time to rock!

Play for a few minutes and test all the inputs. If everything seems normal, go ahead and turn off the amp and install the tube shields and the back panels.

Tube life

The life of the power tubes is affected by how hard you drive the amp. If you are overdriving the amp for hours every day, expect the power tubes to have a shorter life span.

We encourage you to experiment with different tube brands and find the brand that is most favorable to your ears and your wallet.

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Thanks for choosing this StewMac kit, and welcome to the world of amp building!

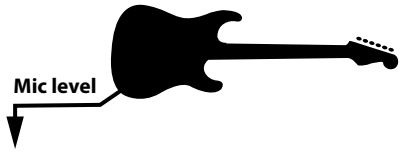
Learning more: secrets revealed in the schematic

You don't need to read a schematic to build this kit. But it's fun to see how the circuit works, and to see the different subcircuits that interact to shape your sound.

Working with the tiny signal from the guitar, the amp creates the power needed to drive the speaker. The signal is affected by the **gain**, **processing**, **output** and **power** stages as it passes through the circuit.

We've color-coded these stages on our schematic, to show how the parts work together. Symbols for components are in the key at the bottom of the frame.

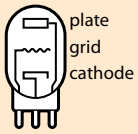
On the **wiring diagram** we build step-by-step in these pages, the parts are easier to recognize. But studying these color-coded stages will help you understand where each component fits into the creation of your sound.



Gain

Line level →

The gain circuit increases the signal to line level (about 1 volt), by passing it through a 12AY7 preamp tube. Inside the tube, electrons flow from a heated **cathode** to the anode **plate**. Between these is a **grid** receiving the guitar's signal and controlling the flow of electrons to the plate.



The 12AY7 and 12AX7 are each essentially two tubes in one housing. After processing, the signal passes back through the first half of the 12AX7 for another gain stage.

This amp's "dirty" sound comes from gain stages that are biased extremely hot with an 820Ω resistor. The third gain stage has a 1.5K bias (cathode) resistor. This small value resistor reduces headroom and increases preamp distortion.

Processing

Line level →

The processing stage shapes the **tone** of the signal. It only has three knobs, but this amp is anything but simple!

The Bright and Normal channel each have high and low gain inputs, and **both** volume controls change the gain no matter which input you use! The tone knob isn't typical, either: it affects volume, gain, EQ, and tone.

The real magic is at higher volumes. Set your volume at 9, and the unused channel's volume at 2—with tone at 9 or above. This is where to find Neil Young's infamous guitar tone from "Cortez the Killer." Increase the unused channel's volume for cleaner tones; decrease it for more gain.

Output

Speaker level →

The output stage increases the line level signal to **speaker level**, which is typically 8 volts or greater.

In this amp the signal is split, and half of it is inverted through the second half of the 12AX7 tube.

The split signal is then passed to the pair of 6V6 tubes for final amplification. Then the output transformer steps down the voltage and steps up the current to drive the speaker.

The output transformer adjusts the impedance to **8 ohms** to drive the speaker. Amp output is typically 4, 8, or 16 ohms.

An 8 ohm speaker is used in this amp.

Power

The power supply stage provides power to the other circuit stages, as well as the tube heaters and pilot light.

This circuit receives the **AC power** from your wall and passes it through the power transformer to create higher voltage. The electricity then goes to the rectifier, which converts it to a pulsing **DC current**.

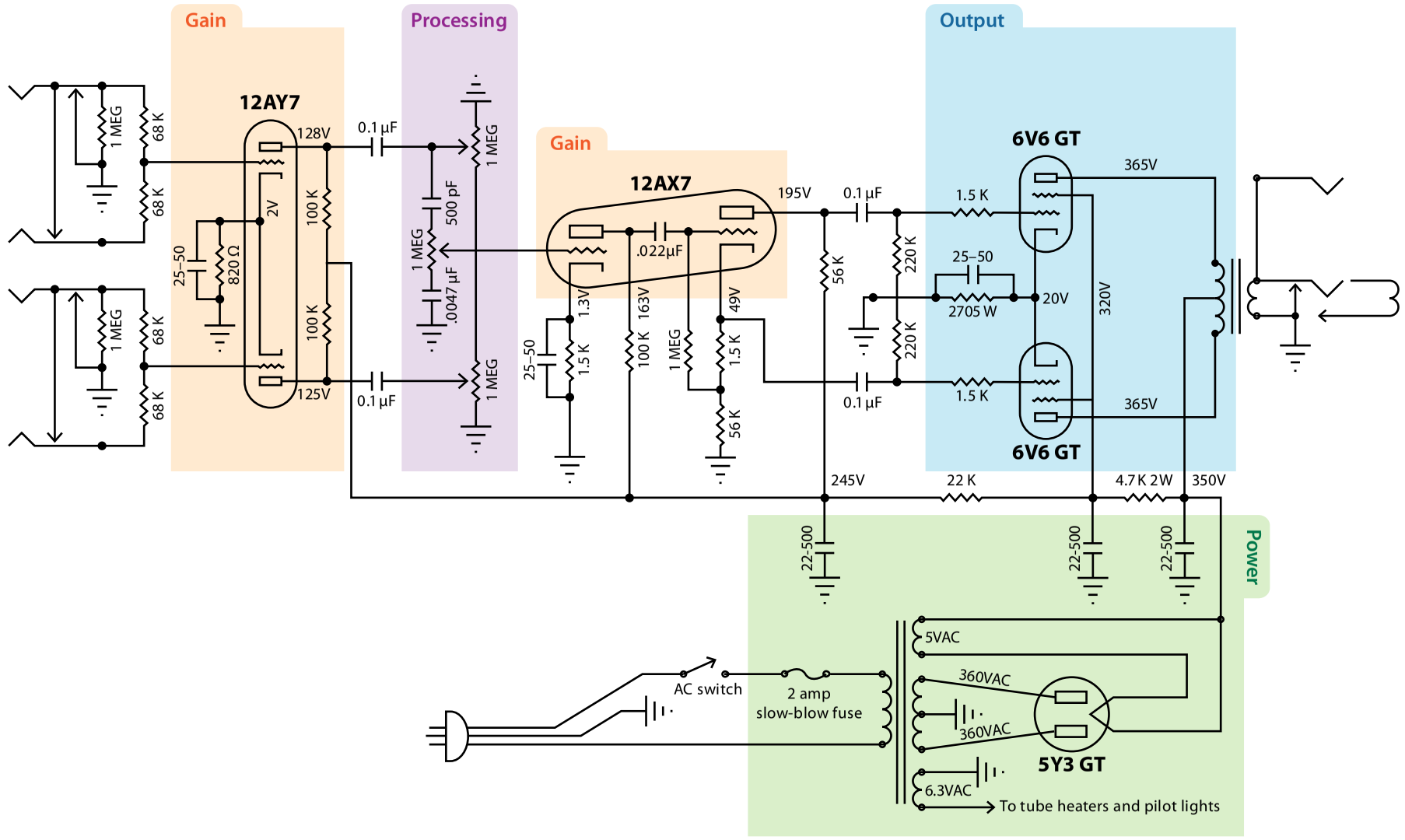
This then passes through a series of three large electrolytic capacitors which filter out the pulsing to create a smooth current. As each cap smooths a bit more, the current is also passing through resistors that lower the voltage.

As the signal from the guitar becomes more amplified, the ripple of DC current becomes less evident and the fully filtered current is sent to the most sensitive part of the amplifier, the first pre-amp tube in the gain stage.

Negative feedback

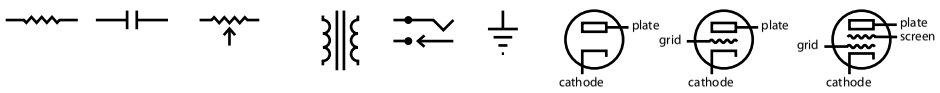
A negative feedback loop flattens and extends the frequency response, reducing distortion and giving the amp a cleaner, more hi-fi sound.

This amp, however, has no negative feedback loop. This results in the early breakup and legendary grit that this circuit is capable of.



StewMac® ICON KITS #10731

Resistor Capacitor Potentiometer Transformer Jack Ground Diode tube Triode tube Pentode tube



'59 TWEED 15W

5E3 CIRCUIT SCHEMATIC

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A timeless studio darling whose tiny size hides tremendous punch and versatility.

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DIFFICULTY
HOURS: **6**

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Dirty little devil that shaped guitar history.

With mysteriously fat saturated tone, this little monster makes it easy to achieve seismic distortion.

This amp's 5E3 circuit is an enigma: Why do the controls on the channel you're NOT using make your tone so great? The answer: Who cares? This is one of the greatest tone monsters ever created! Listen to Neil Young's *Rust Never Sleeps* while building this kit.

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DIFFICULTY
HOURS: **8**

'65 P-REVERB 15W AMP KIT

Sparkling bright, perfect for the surf.

Plug your single-coils straight in for that signature clean American tone, or go surfing with onboard effects.

The smallest member of the black-panel family to offer reverb and tremolo, this amp made its name as a jangly pop dream machine. Aficionados treasure its early low-end breakup powered by a pair of 6V6 tubes.

Listen to "Surfin' USA" and the great sounds of Ryan Adams.

#10734 15 WATTS / 10" SPEAKER / ORIGINAL AA1164 CIRCUIT

DIFFICULTY
HOURS: **12**

Beginner-tested. Pro quality.

StewMac **ICON KITS** are fun to build, with friendly instructions to guide you and loads of info to add to your knowledge.

'66 D-REVERB 22W AMP KIT

Famously clean, with enough guts to gig.

Perfect for recording as well as performing, the D-Reverb produces stinging clarity that absolutely refuses to get lost in the mix.

One of the most popular designs ever, this amp lives in the happy middle between bright clarity and rich distortion. It excels in the studio and on the stage. While capable of crystal clear tones at good volume, you can push this one into beautifully saturated, play-sensitive distortion.

It's all here: clarity, distortion, and rectifier tube sag.

#10737 22 WATTS / 12" SPEAKER / ORIGINAL AB763 CIRCUIT

DIFFICULTY

HOURS: **16**

'62 BRIT-PLEX 45W AMP KIT

The original British showstopper.

This amp started a revolution. It's been rocking the world for over 50 years, and we still can't get enough.

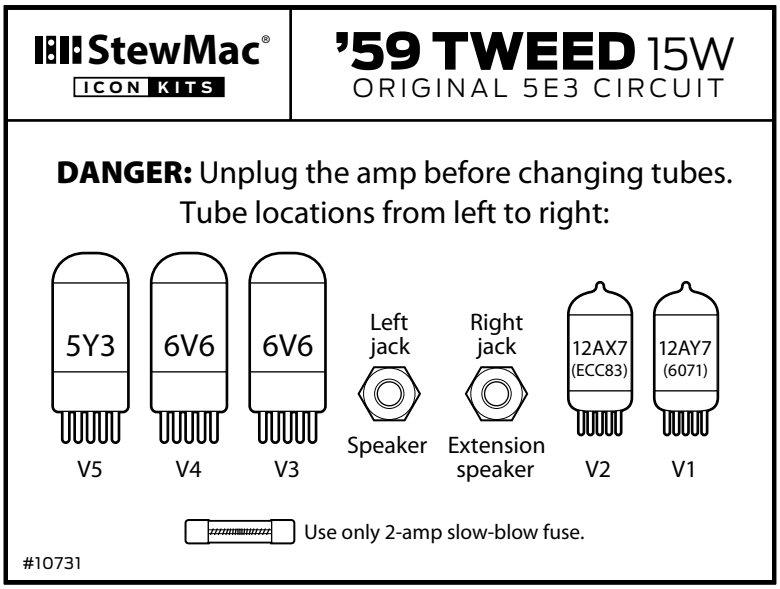
Favored by blues and rock players for exceptional sustain and rich creamy tone, the '62 Brit-Plex is chock-full of harmonic gain, yet it still stays articulate and even a little crispy. Put this head on a classic 4x12 cab and watch out!

While building, listen to Gary Moore's "Still Got The Blues."

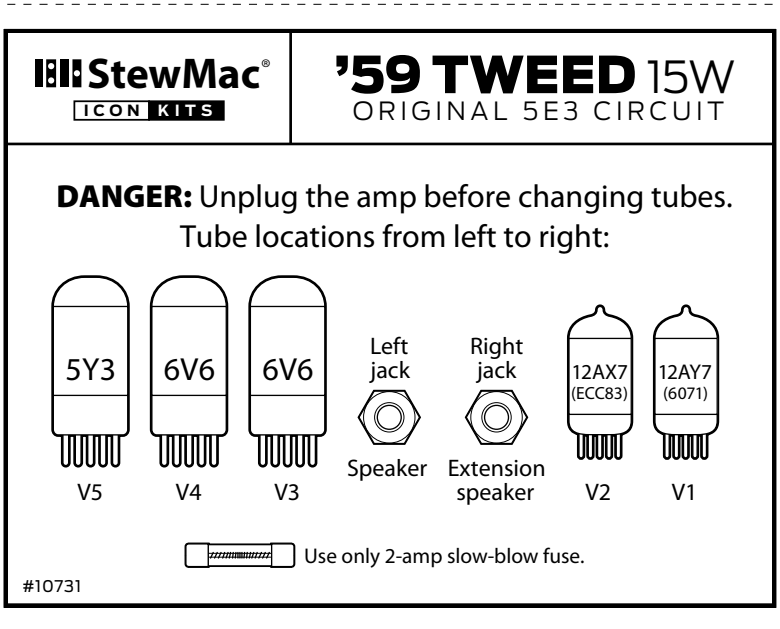
#10736 45 WATTS / ORIGINAL 1962 CIRCUIT

DIFFICULTY

HOURS: **12**



Cut this label on the dotted line with a razor knife and metal straightedge.
Fasten it to the bottom of the cabinet using thinned wood glue or contact cement.
The duplicate copy is included as a backup.



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9am-6pm weekdays Eastern time

How can we help?
stewmac.com/contactus

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