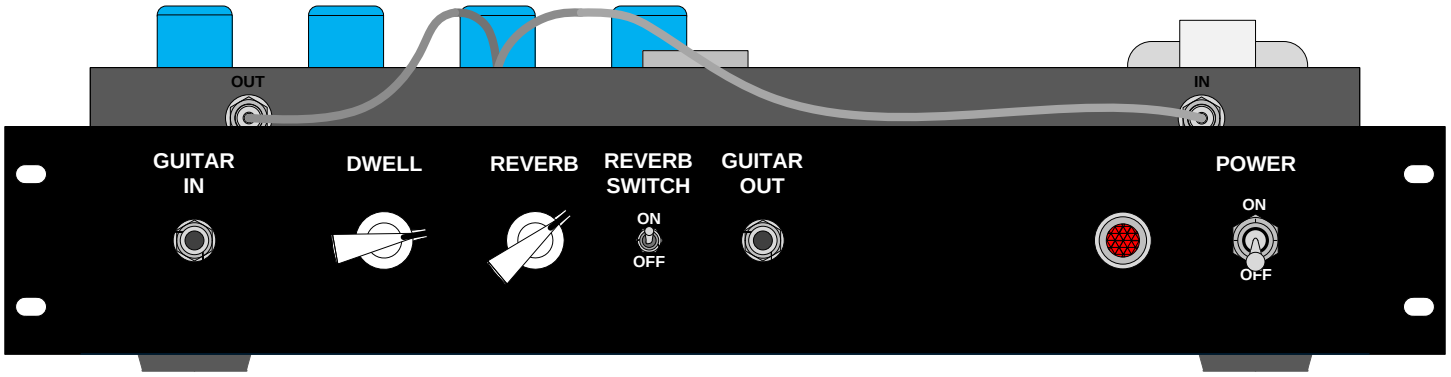
The Wave (K-MOD103)



Please note, there are no labels for this kit. The controls, switches and connectors have only been labeled on this drawing to indicate their function.

Rear Panel

The Wave is an advanced project that can be challenging for experienced builders. If you have any doubts about your ability to safely complete this project, we highly suggest seeking guidance or waiting until you have enough experience. Please use the attached troubleshooting guide for all potential build issues.

Use these instructions to learn:

- How to build a stand-alone tube reverb unit.
- How to prepare shielded wire.
- How to make vintage style RCA cables.

The Wave is a versatile stand-alone, tube driven spring reverb unit. It can be used in front of your guitar amp or as a line-level, analog reverb effect for the recording studio. Two controls allow you to serve up a wide range of wetness, from just a touch to over the top psychedelia. The "dwell" control adjusts the input signal level driving the tank and the "reverb" control adjusts the level of output reverberations from the tank.

Features

- Rack Mountable - requires 3U of rack space
- RCA connections - (1) Phono In and (2) paralleled Phono Outs
- Footswitch Jack - cuts signal to the reverb tank input only, allowing the last reverberations to decay fully. *(Use a standard one button latching footswitch box with a mono ¼" plug).*
- Reverb Switch - provides an instantaneous cut of the reverb signal before and after the tank.

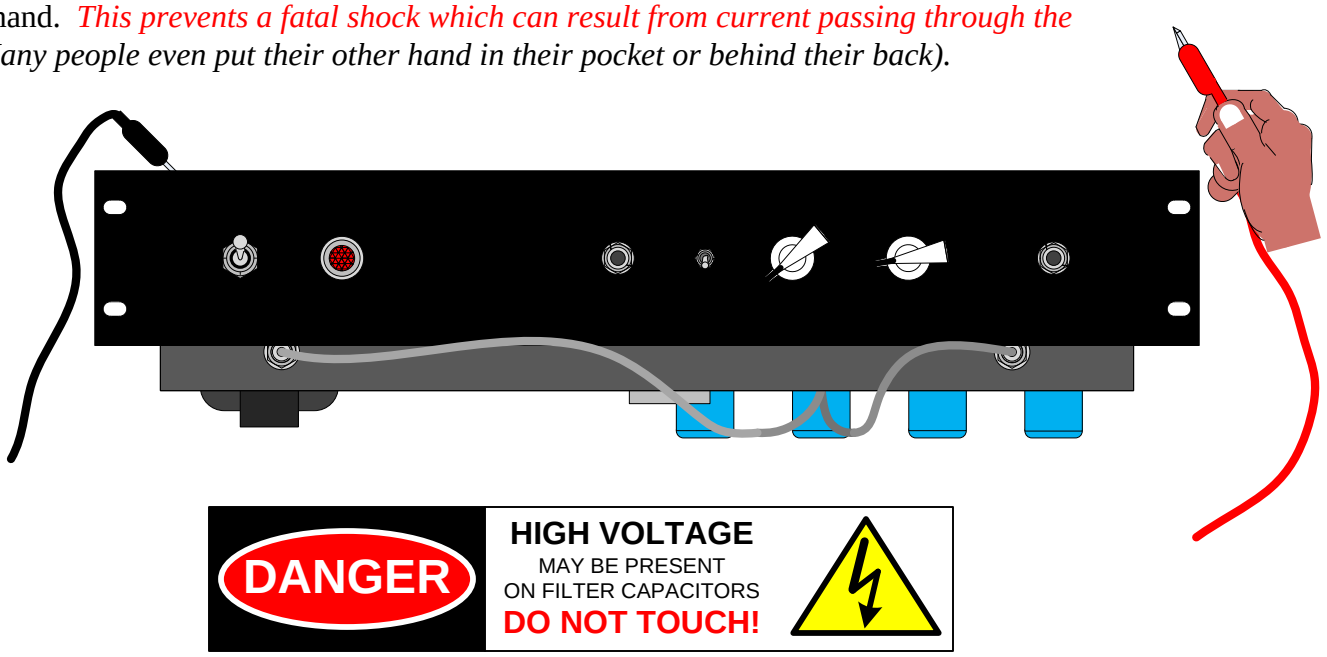
TABLE OF CONTENTS

SAFETY

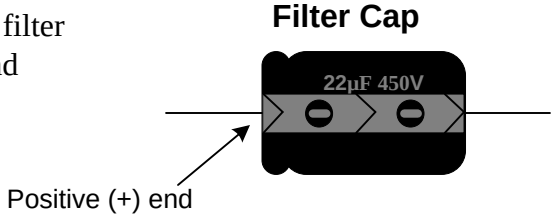
Tube amps operate at high voltages that have the potential to injure and kill. Please remember the following when working on this project.

- Only work on tube amps when you are wide awake and sober.
- Do not plug the amp in until you have gone through all of the instructions, checking and re-checking each step.
- Be aware that tubes become very hot when the amp is on and can take several minutes to cool down after power is turned off.
- Work in a ventilated area when soldering.
- Always follow the one hand rule when working with an amp that is connected to power or may have voltage present. *(Any amp that has been plugged in at one time, may have high voltage present).*

The one hand rule (pictured below): is a safety precaution for working on an amp that is plugged in or could potentially have high voltages present. Using alligator clips with your DMM, clip the ground side to the chassis and use the other side to probe at various test points with one hand. *This prevents a fatal shock which can result from current passing through the heart. (Many people even put their other hand in their pocket or behind their back).*



Always probe a tube amp for dangerous voltages present on the filter capacitors before working on it, even if it has been turned off and unplugged for months.

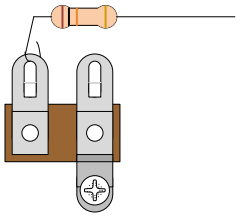


SOLDERING TIPS

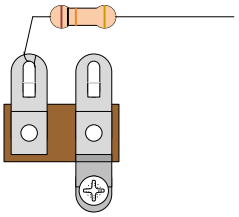
It is important to make a good solder joint at each connection point. A cold solder joint is a connection that may look connected but is actually disconnected or intermittently connected. (A cold solder joint can keep your project from working.)

Follow these tips to make a good solder joint. *Take your time with each connection and make sure that all components are connected and will remain connected if your project is bumped or shaken.*

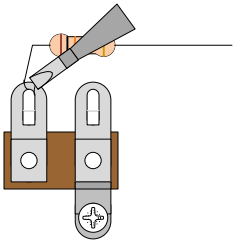
1. Bend the component lead or wire ending and wrap it around the connection point.
   - Make sure it is not too close to a neighboring component which could cause an unintended connection.
2. Wrap the component lead so that it can hold itself to the connection point.
3. Touch the soldering iron to both the component lead and the connection point allowing both to warm up just before applying the solder to them.
4. Be sure to adequately cover both component lead and connection point with melted solder.
   - Remove the soldering iron from your work and allow the solder joint to cool. (The solder joint should be shiny and smooth after solidifying.)
   - Cut off any excess wire or component leads with cutting pliers.
   - Clean the soldering iron's tip by wiping it across the wet sponge again after making the solder joint.



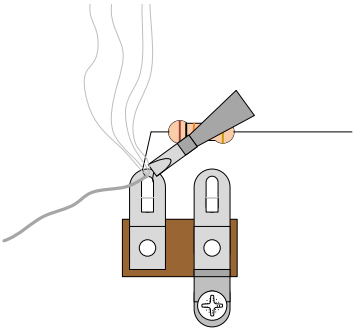
1. Bend the component lead and wrap it around the connection point.



2. Wrap the component lead so that it can hold itself to the connection point.

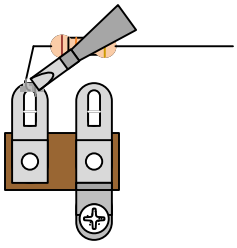


3. Heat up both component lead and connection point with the soldering iron.

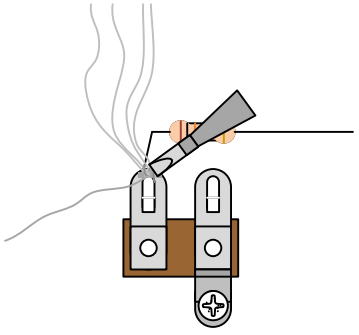


4. Apply solder to both component lead and connection point.

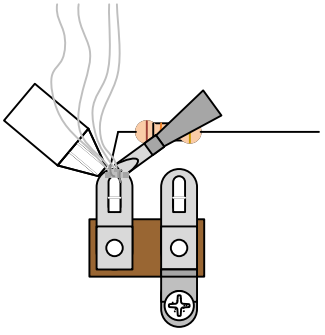
De-Soldering Tip



1. Heat up old solder joint with the soldering iron.



2. Apply fresh solder to mix in with old solder joint



3. Use a de-soldering tool to remove the old solder joint while it is heated.

WIRING TIPS

There are 4 different types of wire included with this kit. It's important to use the correct wire type at the right place in the instructions since each type serves a specific function.

Stripping wire, tinning wire and soldering. Throughout these instructions you will be told to strip and tin numerous lengths of wire. Unless noted otherwise, cut the wire to the length stated in the instructions. Then strip ¼" of insulation off each end. Twist each end of the stranded wire, and apply a small amount of solder to each end (i.e. tin the wire ends). This will prevent the stranded wire from fraying and will make the final soldering much easier.

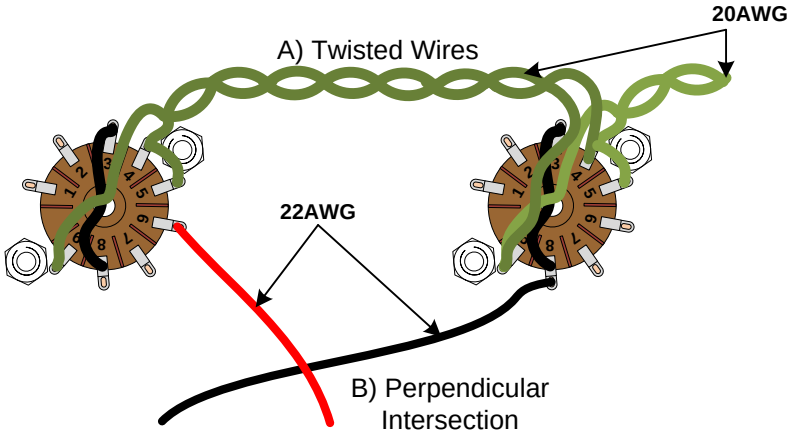
green 20 AWG solid core cloth-covered wire

Green wire is commonly used for filament wire in tube amps. 20 AWG wire is rated for 3.7A of current and that's plenty for the filament connections in this kit. Solid core wire has been selected to make it easier when making connections to the tube socket pins. (You do not need to tin the ends of solid-core wire before connecting).

- Because of the electro-magnetic properties of current traveling through a wire, there are a few conventions used when making wire connections.

A) Twist the wires together where indicated in the instructions.

B) If two wire paths intersect, try to have them cross over each other as perpendicular as possible. (You should follow the path of the wires shown in the instructions).



blue 22 AWG stranded hook-up wire

The blue stranded wire will be used for most of the circuit connections. Stranded wire was chosen because it's not as likely as solid core wire to break off at the ends. Your connections will be substantially improved if you take the time to tin the stranded wire ends before making connections.

- Be careful not to strip away strands of wire when you remove the insulation from the wire ends.

shielded 26 AWG stranded wire

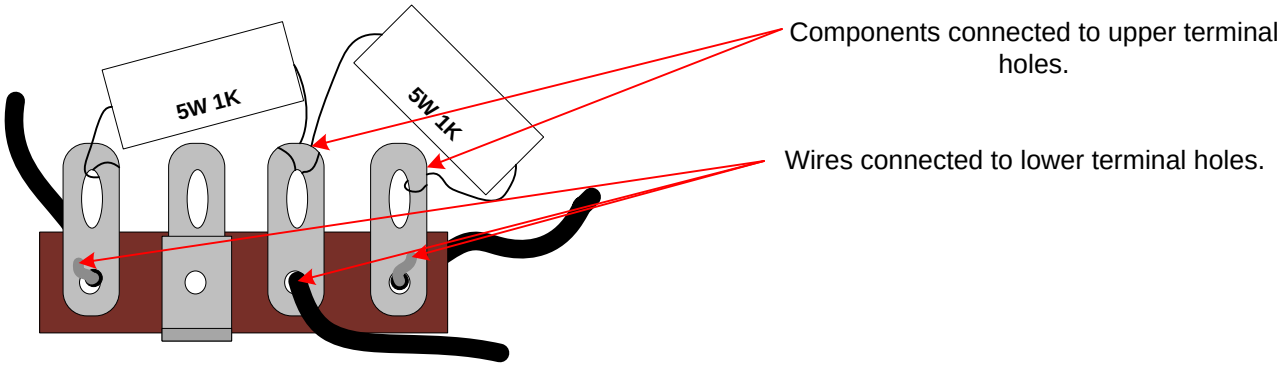
This type of shielded wire will be used for shielding the guitar signal at sensitive areas in the layout. These instructions will walk you through the process.

tin braid 22 AWG stranded wire

This type of shielded wire will be used for making customized RCA cables for connecting to the spring reverb tank and fit the layout of the kit perfectly. These instructions will walk you through the process.

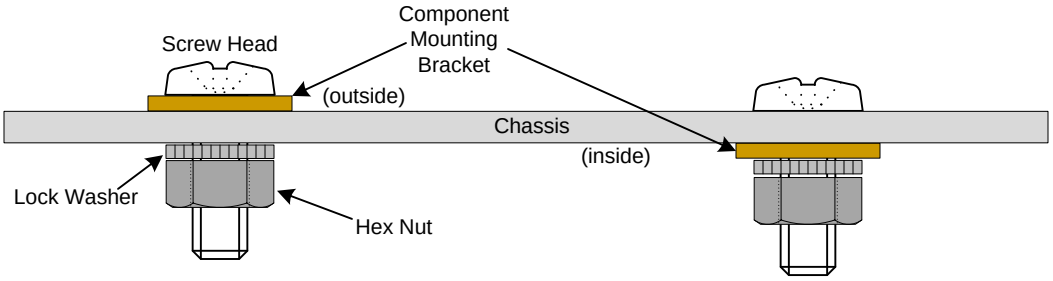
- Be careful not to burn the insulation of nearby wires with the soldering iron.

- With the terminal strips used in this kit, you might want to connect the wires to the lower holes and components to the upper holes. (Doing this can make it easier to change components for modification).



HARDWARE FASTENING TIP

When fastening components with mounting hardware (screws, lock washers, and hex nuts), the lock washer and hex nut should be fastened on the other side of the chassis from the head of the screw as shown in the drawing below.

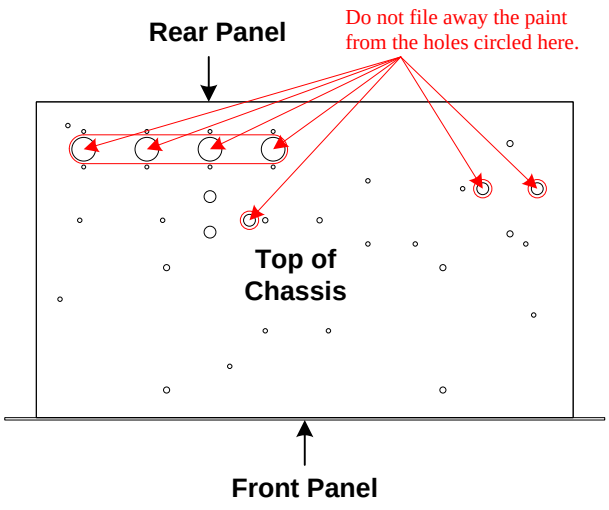


STEP BY STEP ASSEMBLY

Please refer to the assembly drawings indicated for each section.

SECTION 1 – Mounting of Top Components

Please refer to assembly **Drawings 1 – 3**.

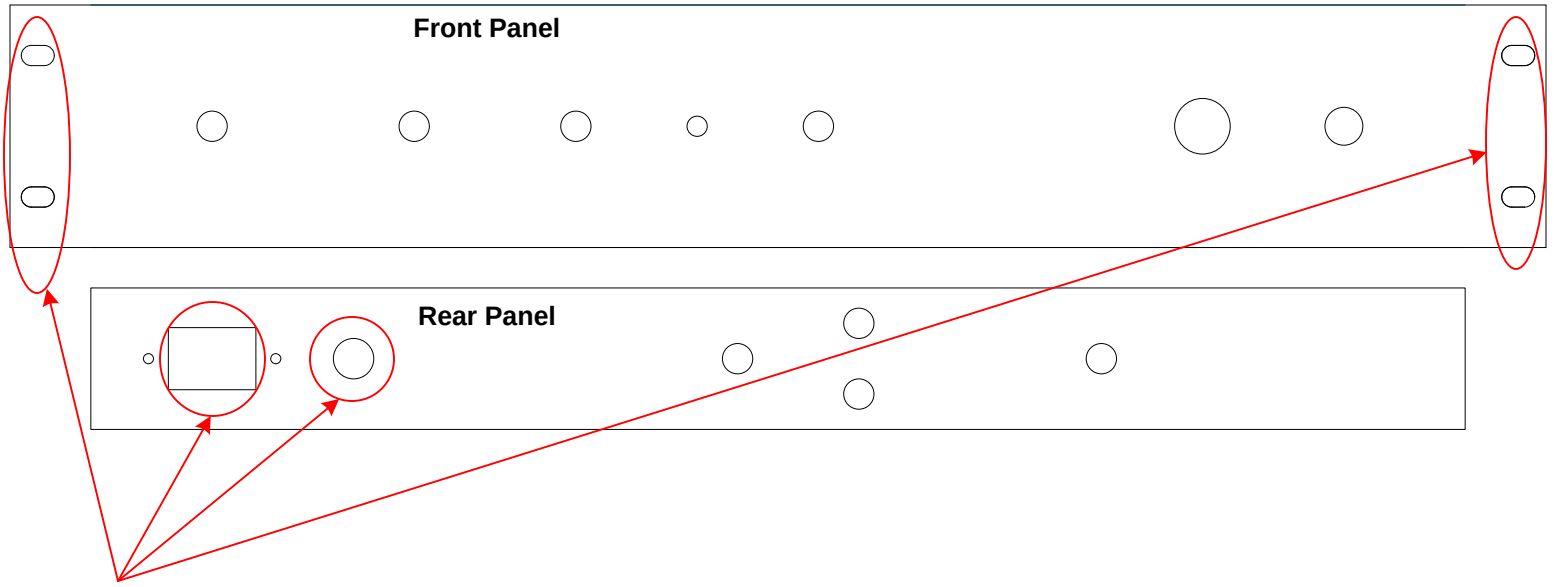


Step 1 – File the chassis holes

Except for the holes circled in the drawings on this page and the next, use a miniature round file to remove the paint coating from the inside edges of each chassis hole.

(The chassis provides the ground connection for many components so it is important that the inner edges of these holes are not insulated by the paint coating).

- It's not necessary to file away the paint from the holes on the cover plate.



- Do not file away the paint from the holes circled here.

After filing away the paint from each hole, you might want to check for electrical continuity between one hole and all of the rest using a multi-meter to make sure that you didn't miss anything and that the paint was filed away sufficiently.


(3)

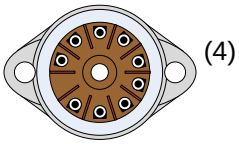
Step 2 – Mount the rubber grommets

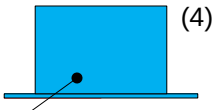
Drawing 1 shows where to mount the three rubber grommets. Squeeze the grommet into the hole and push it into place with your fingers.

Step 3 – Mount the 9 pin miniature tube sockets and shields

Drawings 2 & 3 show where to mount the four 9 pin miniature sockets. Make sure that pins 1 & 9 are away from the rear edge of the chassis. (Except for the locking lugs, use #4 hardware).

Tube Socket Name	Rear Hole	Front Hole
V1	Lock washer	Locking lug
V2	Lock washer	Locking lug
V3	Lock washer	Locking lug
V4	Lock washer	P-0401H & Lock washer

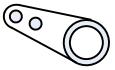

(4)


(4)

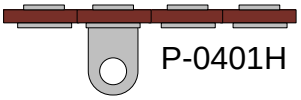
Shield bases are mounted on top of the tube sockets before inserting the #4 mounting screws through the top of the chassis.


(8)


(5)

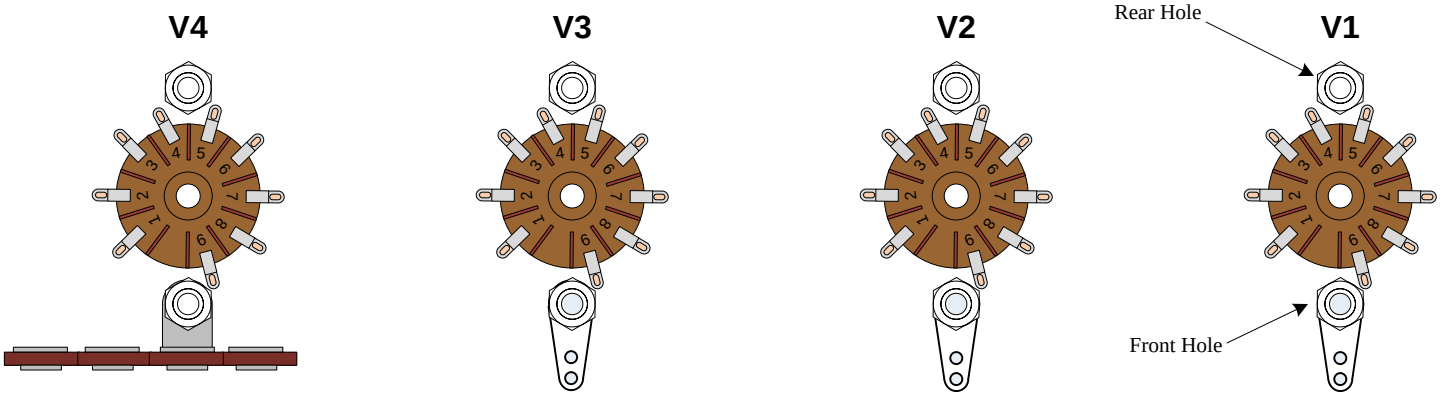

(3)


(8)



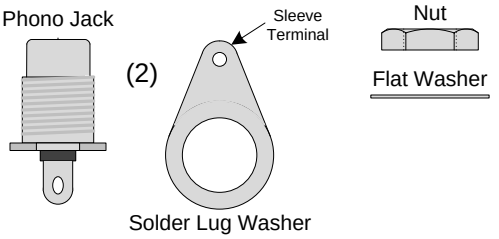
(1)

See Drawing 3 (Inside Chassis View)



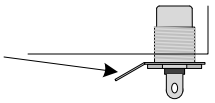
Step 4 – Mount the tank in & out phono jacks

Drawings 2 & 3 show where to mount these two phono jacks.



- Place the solder lug washer over the phono jack before inserting the jack through the 3/8" hole from the inside of the chassis.

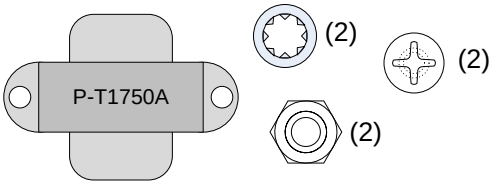
Put a slight bend in the solder lug washer before mounting the phono jack so that the sleeve terminal will not be flat against the chassis surface.



- Place the flat washer over the phono jack on the outside of the chassis and fasten the nut while making sure the sleeve terminals of both solder lug washers are pointing toward the TR1 side of the chassis as shown in **Drawing 3**.

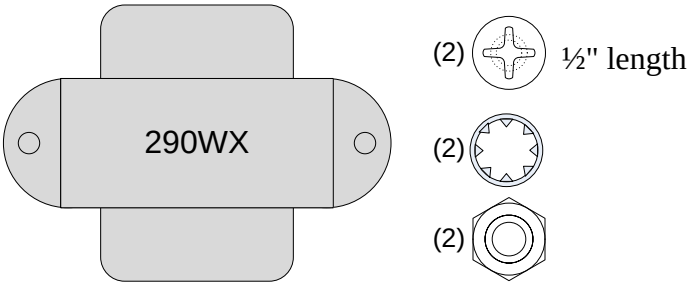
Step 5 – Mount the output transformer "TR2"

Drawing 2 shows where to mount the output transformer. Insert each of the four wires through Grommet 1 and use #8 hardware to fasten the transformer to the chassis.



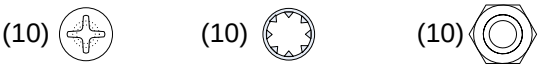
Step 6 – Mount the power transformer "TR1"

Drawing 2 shows where to mount the power transformer. Insert each of the seven wires through their respective grommets as listed on Drawing 2. Use #10 hardware to fasten the transformer to the chassis. Make sure to use the ½" long #10 screws.



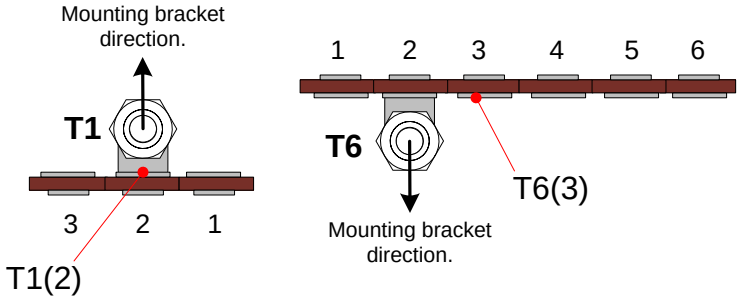
Step 7 – Mount the terminal strips

There should be nine terminal strips remaining. **Drawing 3** shows where to mount each one. Be sure to mount them with the same orientation as shown in the drawing. Use #6 hardware.



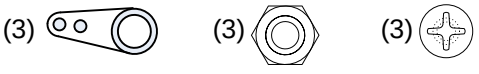
Terminal Strip Naming Convention

Each terminal strip has been assigned a name T1 through T10. The terminals are numbered from left to right as seen with mounting bracket directed toward the viewer. T6(3) will be the notation used for referring to terminal number 3 on T6.



Step 8 – Mount the remaining top surface locking lugs

Drawing 3 shows where to mount each of three more locking lugs. Be sure to mount them with the same orientation as shown in the drawing. Use #6 hardware.

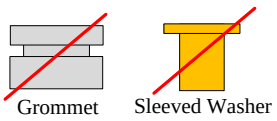


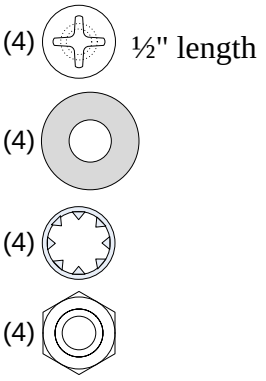
At this point, the only open holes on the top surface of the chassis should be the four holes for mounting the reverb tank.

Step 9 – Mount the reverb tank

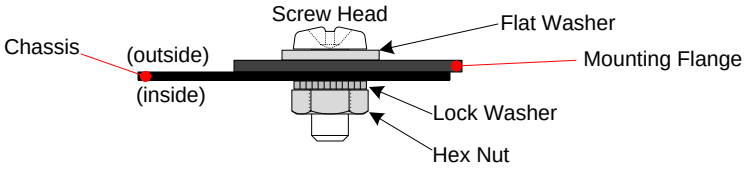
Drawing 3 shows the four mounting holes for the reverb tank. The tank should be mounted on the outside of the chassis with its input and output connectors facing the front panel of the chassis. Use #10 hardware. Make sure to use the ½" long #10 screws.

- Remove the four grommets and sleeved washers from the reverb tank. They will not be useful for mechanical isolation in this application.





- Remove all foam pieces from the inside of the reverb tank.
- The screw heads and flat washers go on the outside of the chassis, on top of the reverb tank's mounting flange. The lock washers and hex nuts should be fastened on the inside of the chassis.



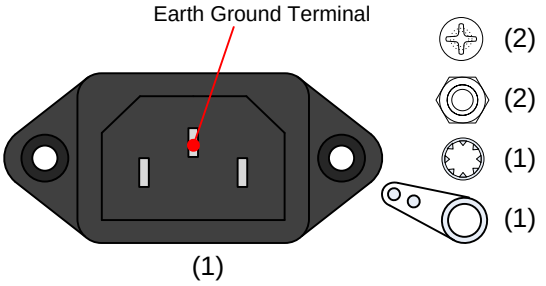
At this point, all of the top mounted components should be in place. Fastening the tube shield tops to their shield bases can help keep the chassis more stable for the rest of the assembly process, but we do not recommend installing the tubes until after the kit is completely assembled.

SECTION 2 – Mounting of Rear Components

Please refer to assembly **Drawing 4**.

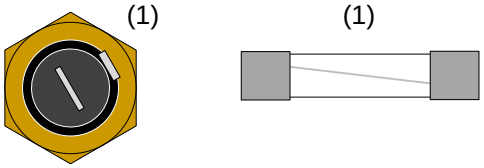
Step 1 – Mount the power cord receptacle

Mount the power cord receptacle in the square hole as shown in Drawing 4 so that the earth ground terminal is positioned closest to the chassis opening. Except for the locking lug, use #4 hardware. Make sure that the locking lug is mounted to the same screw and in the same orientation as shown in the drawing.



Step 2 – Mount the fuse holder

Mount the fuse holder in the next hole over from the power cord receptacle and insert the 1A fast blow fuse along with the fuse holder's cap.

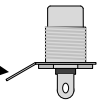


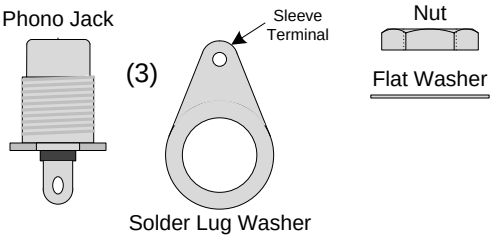
Step 3 – Mount the phono in and out jacks

Drawings 4 shows where to mount these three phono jacks.

- Place the solder lug washer over the phono jack before inserting the jack through the 3/8" hole from the inside of the chassis.

Put a slight bend in the solder lug washer before mounting the phono jack so that the sleeve terminal will not be flat against the chassis surface.

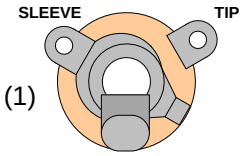




- Place the flat washer over the phono jack on the outside of the chassis and fasten the nut while making sure the sleeve terminals of both solder lug washers are oriented as shown in **Drawing 4**.

Step 4 – Mount the footswitch jack

Mount the footswitch jack in the one remaining rear panel hole as shown in Drawing 4. This is the ¼" jack with only two solder lugs (tip & sleeve).

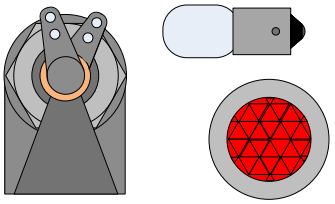


SECTION 3 – Mounting of Front Components

Please refer to assembly **Drawing 4**.

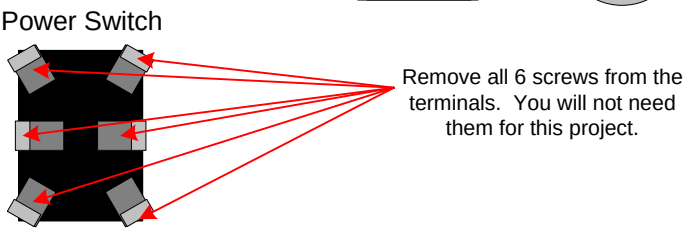
Step 1 – Mount the lamp holder

Drawing 4 shows where to mount the lamp holder. (Once the lamp holder is mounted you may screw in the bulb and then the jewel).



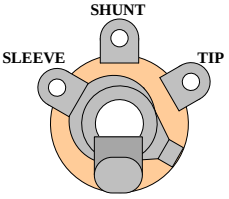
Step 2 – Mount the power switch

After removing the screws from its terminals, mount the power switch in the 15/32" chassis hole on the front panel as shown in Drawing 4.



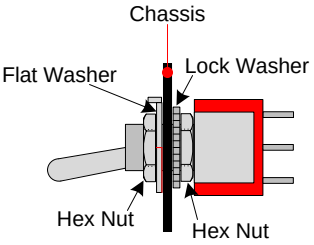
Step 3 – Mount the output jack

Mount the output jack in the next 3/8" hole over from the lamp holder as shown in Drawing 4.



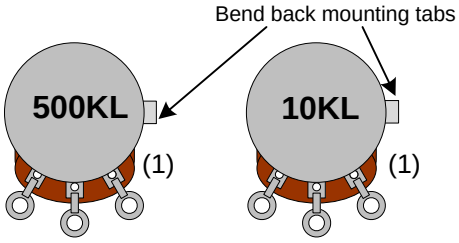
Step 4 – Mount the reverb on/off switch

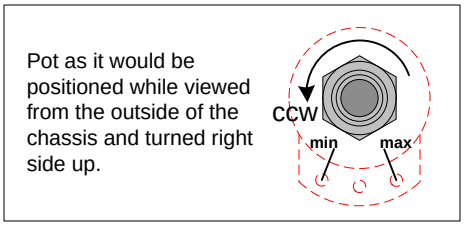
Mount the reverb on/off mini toggle switch in the next 1/4" hole over from the output jack as shown in Drawing 4.

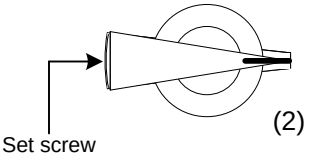


Step 5 – Mount the 500K reverb and 10K dwell pots

Drawing 4 shows where to mount the reverb and dwell pots. When they are mounted, turn their shafts all the way counter-clockwise. (Once you have done this, you can mount the chicken head knobs while pointing to where you want the minimum level setting to be positioned).

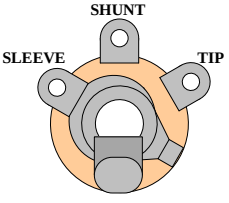






Step 6 – Mount the input jack

Drawing 4 shows where to mount the input jack.



SECTION 4 – Making Wire Connections

Please refer to assembly **Drawings 5 & 6**. Review the soldering and wiring tips on pp. 4 - 6 if you haven't already.

Before you make a new connection at a particular terminal or solder lug, look at **Drawing 6** and notice how many other connections will be made at that terminal. That way you can decide whether it's best for you to solder the connection and leave space open for future connections or hold off on soldering until after every connection at that location has been made.

Step 1 – Connect the output transformer (TR2) wires

- Cut the green wire to a length of about 1 ¾" (above the grommet) and connect it to the center lug of the RCA jack labeled "Tank (In)" in Drawing 5.
- Cut the black wire to a length of about 1 ½" and connect it to the sleeve terminal of the same RCA jack.
- Cut the blue wire to a length of about 4 ¼" and connect it to V2 pin 1. *Make sure to leave space at pin 1 for another wire connection later in the instructions.*
- Cut the red wire to a length of about 5 ¼" and connect it to T3(5). *There will be one more wire connected to this terminal so if you are connecting wires to the lower terminal holes, do not solder this connection until the other wire connection is mentioned below.*

Step 2 – Connect the power transformer (TR1) wires

- Cut both red wires to a length of about 1 ½". Connect one red wire to T2(2) and the other to T2(4).
- Cut the white wire to a length of about 7 ½" and connect it to the power switch terminal labeled "T-On" on the A-side of the switch as shown in Drawing 5.
- Cut the black wire to a length of about 2 ¾" and connect it to the power receptacle's "N" terminal.
- Cut the green/yellow wire to a length of about 4". Connect it to T1(2).
- Twist the two green wires together and cut this twisted pair of wires to a length of about 4". Connect one of the wire ends to T1(1) and the other to T1(3).

Step 3 – Connect the power switch

- Connect the 1Ω, 5 watt resistor from the power switch terminal "T-Off" on the B-side of the switch to the nearest locking lug as shown in Drawing 5. (This will drain filter cap voltage when power is turned off).
- Strip and tin an 11" length of the blue hook-up wire and connect it from the power switch "P" terminal on the A-side of the switch to the solder lug on the side of the fuse holder as shown in Drawing 5.
- Strip and tin an 8" length of the blue hook-up wire and connect it from the power switch "P" terminal on the B-side of the switch to T3(5).

Step 4 – Connect the power cord receptacle

- Strip and tin a 2" length of the blue hook-up wire and connect it from the center lug of the fuse holder to the "L" lug of the power cord receptacle.
- Strip and tin a 2" length of the blue hook-up wire and connect it from the "E" lug of the power cord receptacle to the nearest locking lug as shown in Drawing 5.

Step 5 – Connect the filaments

The main idea when connecting the filament wires is to avoid transferring filament hum from the power transformer's filament winding (green wires) to the signal path of the circuit. In order to minimize filament hum, we will be twisting wires together and routing them along the chassis surface. Avoid touching tube pins 2 and 7 with the filament wires as these are where the guitar signal enters each tube triode.

The wire lengths given are recommended starting lengths. You may decide to clip off some of the wire length as you bring each twisted pair of wires near their connection points.

- Cut two 6" lengths of the green cloth-covered wire. Connect one of these wires to T1(1) and the other wire to T1(3). *Leave room for two more wires to be connected to each of these terminals.* Twist these two wires together, route them along the chassis surface toward the lamp holder and connect the wire ends to opposite lugs on the lamp holder as shown in Drawing 5.

- Cut two 12" lengths of the green cloth-covered wire. Connect one of these wires to T1(1) and the other wire to T1(3). Twist these two wires together and route them along the chassis surface toward tube socket V4. Connect one of these wire ends to pin 9 and the other wire end to both pins 4 and 5. Solder the connections at T1 now.

- Cut two 5" lengths of the green cloth-covered wire. Connect one of these wires to V4 pin 5 and the other wire to V4 pin 9. Solder the connections at V4, now. Twist these two wires together and route them along the chassis surface in a path similar to what's shown on Drawing 5. Connect one of the wire ends to V3 pin 9 and the other wire end to both V3 pins 4 and 5. Do not solder these connections, yet.

- Cut two more 5" lengths of the green cloth-covered wire. Connect one of these wires to V3 pin 5 and the other wire to V3 pin 9. Solder the connections at V3, now. Twist these two wires together and route them along the chassis surface in a path similar to what's shown on Drawing 5. Connect one of the wire ends to V2 pin 9 and the other wire end to both V2 pins 4 and 5. Do not solder these connections, yet.

- Cut two more 5" lengths of the green cloth-covered wire. Connect one of these wires to V2 pin 5 and the other wire to V2 pin 9. Solder the connections at V2, now. Twist these two wires together and route them along the chassis surface in a path similar to what's shown on Drawing 5. Connect one of the wire ends to V1 pin 9 and the other wire end to both V1 pins 4 and 5.

Step 6 – Connect the power supply wires

- Strip and tin a 2" length of the blue hook-up wire and connect it from T2(1) to T2(5).
- Strip and tin a 2" length of the blue hook-up wire and connect it from T2(1) to T3(6).
- Strip and tin a 3 ½" length of the blue hook-up wire and connect it from T3(3) to T4(4). Do not solder the connections, yet.
- Strip and tin a 7" length of the blue hook-up wire and connect it from T3(3) to T6(5). Solder the T3(3) connection, now.

- Strip and tin a 2" length of the blue hook-up wire and connect it from T4(4) to V4 pin 1. Solder the T4(4) connection, now.

When making connections to the tube sockets, the filament wires should be low and touching the chassis surface. Try to make all of the other tube pin connections from above and routed through the air so that the wires and component leads do not touch the filament wires.

- Strip and tin a 9" length of the blue hook-up wire and connect it from T3(1) to T8(5).

Step 7 – Connect the reverb driver wires and components

The V2 socket will hold the tube that works in conjunction with the output transformer (TR2) to drive the spring reverb tank. The pins of this socket must be connected so that the two triodes of the tube are connected in parallel with each other (plate connected to plate, grid to grid and cathode to cathode).

- Strip and tin three 2" lengths of blue hook-up wire and connect:
  V2 pin 1 to V2 pin 6 (plates)
  V2 pin 2 to V2 pin 7 (grids) – *Leave room to connect two more wires, one at pin 2 and one at pin 7.*
  V2 pin 3 to V2 pin 8 (cathodes) – *Leave room to connect a cap and resistor to pin 3.*

- Connect both a 1.5K resistor and 25µF capacitor from V2 pin 3 to the locking lug as shown in Drawing 5. Make sure to connect the positive end of the capacitor to pin 3.

- Strip and tin a 2" length of blue hook-up wire and connect it from V2 pin 2 to the footswitch jack's tip lug. *Warning: Be very careful not to burn the insulation of nearby wires with your soldering iron.*
- Strip and tin a 3" length of blue hook-up wire and connect it from V2 pin 7 to T8(7).
- Cut a 3" length of blue hook-up wire. Strip ½" of insulation off of one end and the usual ¼" of insulation off of the other end. Tin both ends and connect the ½" end to both "T-off" terminals on the mini-toggle switch. The other end connects to T7(2).

- Strip and tin a 9" length of blue hook-up wire and connect it from T8(7) to the mini-toggle switch's B-side pole lug.
- Connect a 220K resistor from T8(7) to T8(8).

Step 8 – Wire the phono jacks

- Strip and tin a 9" length of blue hook-up wire and connect it from T9(1) to the center lug of the "Phono In" jack.
- Strip and tin a 11" length of blue hook-up wire and connect it from T9(4) to the input jack's "shunt" lug.
- Strip and tin a 9 ¾" length of blue hook-up wire and connect it from the output jack's "shunt" lug to the center lug of the "Phono Out (2)" jack. *Leave room at the "Phono Out" jack for one more wire.*
- Strip and tin a 2" length of blue hook-up wire and connect the center lugs of both "Phono Out" jacks.

Step 9 – Wire the front panel components

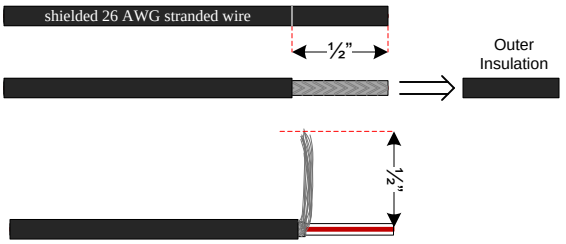
- Strip and tin a 3" length of blue hook-up wire and connect the "P" terminal on the A-side of the mini-toggle switch to T6(1).
- Strip and tin a 3" length of blue hook-up wire and connect the output jack's "tip" lug to the "T-on" terminal on the A-side of the mini-toggle switch.
- Strip and tin a 3" length of blue hook-up wire and connect the output jack's "tip" lug to T5(1).
- Strip and tin a 2" length of blue hook-up wire and connect the 500KL pot's "hot" lug to T7(1).
- Strip and tin an 7" length of blue hook-up wire and connect the 10KL pot's "hot" lug to T8(2).
- Strip and tin an 9 ½" length of blue hook-up wire and connect the 10KL pot's "wiper" lug to V1 pin 7.
- Strip and tin a 3" length of blue hook-up wire and connect the 500KL pot's "cold" lug to T7(2). *Leave space on this "cold" lug for another wire connection.*
- Strip and tin a 4 ½" length of blue hook-up wire and connect the 10KL pot's "cold" lug to T7(2).

Step 10 – Prepare and connect the shielded wires

- Cut a 9 ½" length of shielded 26 AWG wire and prepare it for connection by following the steps below:

1) On one end, carefully remove ½" of the outer insulation.

The outer insulation is very thin so apply your wire strippers around the wire very lightly while gently rotating the wire to create a ring around the insulation. The goal is to pull off ½" of the outer insulation without cutting into the shielding beneath it.

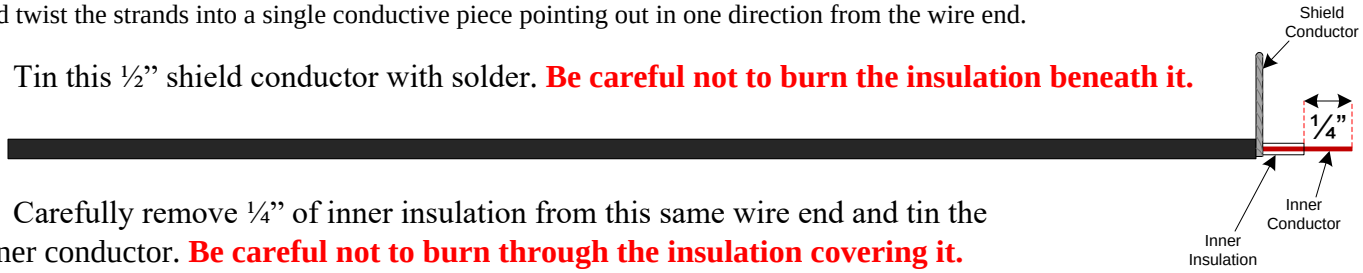


2) Create a single ½" length conductor out of the shield ending.

Pull the shielding away from the inner insulation with your fingers. Push the shielding back down toward the outer insulation and twist the strands into a single conductive piece pointing out in one direction from the wire end.

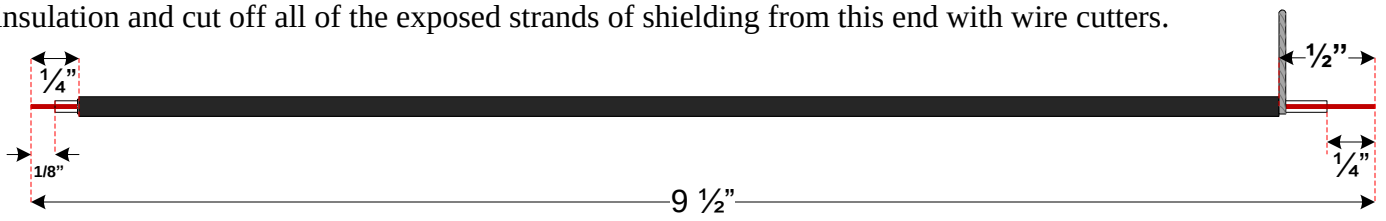
3) Tin this ½" shield conductor with solder. **Be careful not to burn the insulation beneath it.**

4) Carefully remove ¼" of inner insulation from this same wire end and tin the inner conductor. **Be careful not to burn through the insulation covering it.**



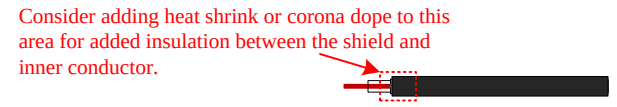
The goal is to pull off ¼" of the inner insulation without cutting into the inner conductor beneath it. When you are ready to pull off the inner insulation from this wire end, grasp the wire at the inner insulation with your fingers to avoid accidentally pulling the outer insulation down further.

5) On the other end of the wire, remove ¼" of the outer insulation, pull the shielding away from the inner insulation and cut off all of the exposed strands of shielding from this end with wire cutters.

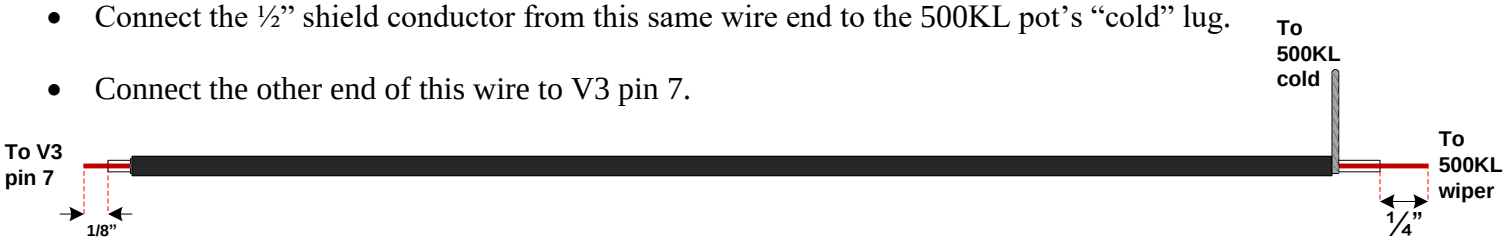


6) Remove 1/8" of inner insulation from this end and tin the inner conductor. **Be careful not to burn through the insulation covering it.**

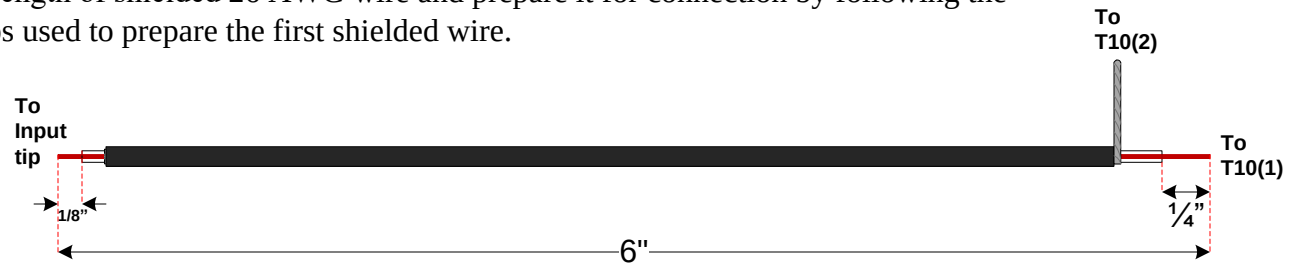
Tip: Some people may like to add insulation over the shielded end that has been cut away to prevent the possibility of having an accidental short.



- Connect the ¼" inner conductor end to the 500KL pot's "wiper" lug.
- Connect the ½" shield conductor from this same wire end to the 500KL pot's "cold" lug.
- Connect the other end of this wire to V3 pin 7.



- Cut a 6" length of shielded 26 AWG wire and prepare it for connection by following the same steps used to prepare the first shielded wire.



- Connect the ¼" inner conductor end to T10(1).
- Connect the ½" shield conductor from this same wire end to T10(2).
- Connect the other end of this wire to the input jack's tip lug.

Check for shorts in the shielded wire:

Make sure the shield in not accidentally shorting out the inner conductor of the shielded wire by taking resistance measurements with an ohm meter. If the wire is shorted, the signal will be grounded out.

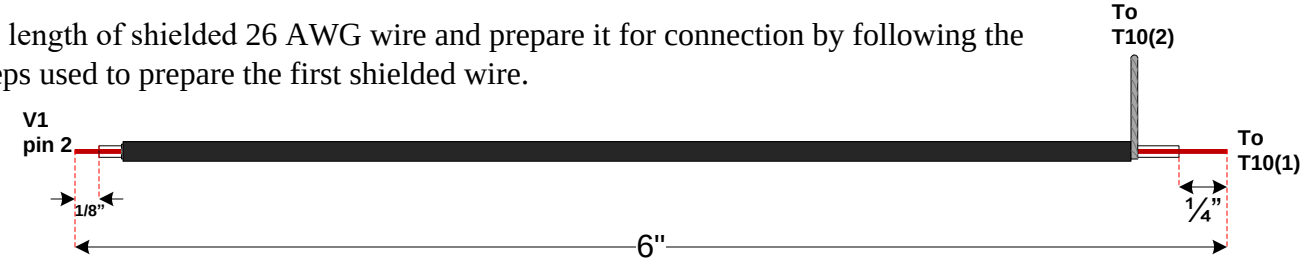
- Measure resistance between T10(2) and the 500KL pot's "wiper" lug. With this pot turned all the way down, you should measure about 0 ohms. *(You might actually measure 2 or 3 ohms, but that's close enough to zero).* With the pot turned all the way up, you should measure about 500KΩ).

  If you measured close to 0Ω with the 500KL pot turned all the way up, the wire has a short and you will need to prepare a new shielded wire being careful not to overheat the shielding or inner conductor so that the insulation is compromised.

- Measure resistance between T10(1) and T10(2). You should measure an open circuit (or resistance that is too high for your ohm meter to measure, infinite resistance).

  If you measured close to 0Ω, the wire has a short and you will need to prepare a new shielded wire being careful not to overheat the shielding or inner conductor so that the insulation is compromised.

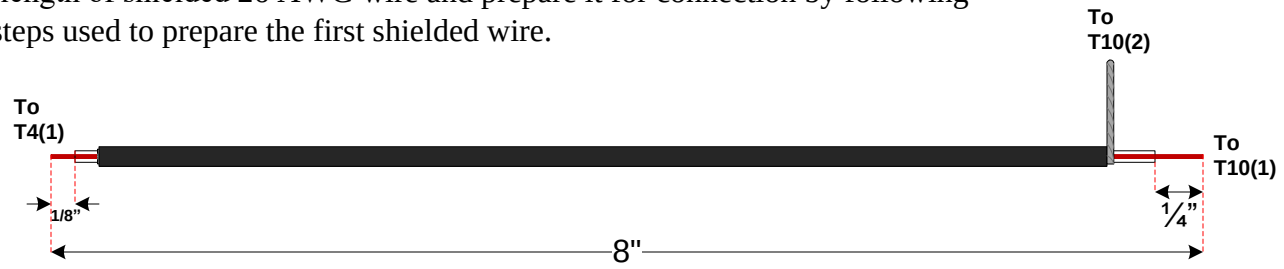
- Cut a 6" length of shielded 26 AWG wire and prepare it for connection by following the same steps used to prepare the first shielded wire.



- Connect the ¼” inner conductor end to T10(1).
- Connect the ½” shield conductor from this same wire end to T10(2).
- Connect the other end of this wire to V1 pin 2.

Again, measure resistance between T10(1) and T10(2) to make sure this shielded wire is not shorted.

- Cut an 8” length of shielded 26 AWG wire and prepare it for connection by following the same steps used to prepare the first shielded wire.



- Connect the ¼” inner conductor end to T10(1).
- Connect the ½” shield conductor from this same wire end to T10(2).
- Connect the other end of this wire to T4(1).

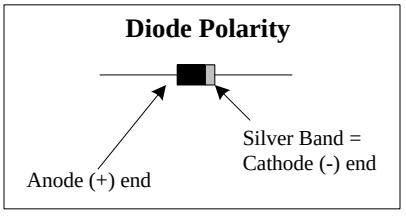
Again, measure resistance between T10(1) and T10(2) to make sure this shielded wire is not shorted.

Step 11 – Connect the remaining tube socket wires

- Strip and tin a 3" length of blue hook-up wire and connect T8(6) to V1 pin 6.
- Strip and tin a 3" length of blue hook-up wire and connect T8(3) to V1 pin 1.
- Strip and tin a 7" length of blue hook-up wire and connect T6(3) to V3 pin 6.
- Strip and tin a 6" length of blue hook-up wire and connect T6(6) to V3 pin 1.
- Strip and tin a 2" length of blue hook-up wire and connect T4(3) to V4 pin 2.
- Strip and tin a 6 ½" length of blue hook-up wire and connect T5(4) to V4 pin 3.

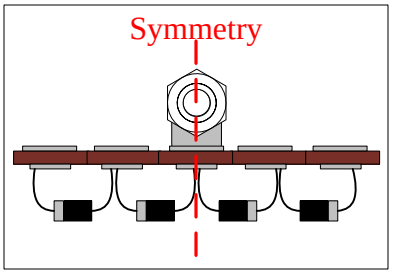
SECTION 5 – Mounting Electronic Components

Please refer to assembly **Drawing 6**.



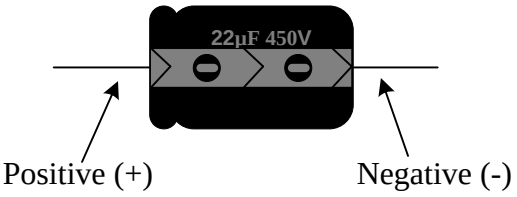
Step 1 – Connect the diodes

- Connect the four diodes to T2. It is very important to connect each of the diodes with the correct polarity as shown in Drawing 6. (Notice there is symmetry with respect to the center “ground” terminal). These diodes create a full-wave bridge rectifier.



Step 2 – Connect the filter caps and resistors

- Connect the 1K resistor from T3(6) to T3(5).
- Connect a 10K resistor from T3(5) to T3(3).
- Connect another 10K resistor from T3(3) to T3(1).
- Connect a 22µF capacitor from T3(6) to the nearest locking lug. *Make sure to connect the negative end of the filter caps to the locking lug (ground) and the positive end to the terminal strip.*

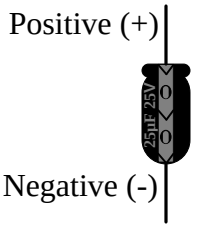


- Connect another 22µF capacitor from T3(5) to the nearest locking lug. *Make sure to connect the negative end to the locking lug and the positive end to the terminal strip.*
- Connect another 22µF capacitor from T3(3) to the nearest locking lug. *Make sure to connect the negative end to the locking lug and the positive end to the terminal strip.*
- Connect the remaining 22µF capacitor from T3(1) to the nearest locking lug. *Make sure to connect the negative end to the locking lug and the positive end to the terminal strip.*

Step 3 – Connect the "phono in" components

- Connect a 470K resistor from T9(1) to T9(3).
- Connect the 220pF capacitor from T9(3) to T9(4).

Step 4 – Connect the V1 components



- Connect the 1M resistor from T10(1) to T10(2).
- Connect a 1.5K resistor and a 25µF capacitor from V1 pin 3 to the nearest locking lug. Make sure you connect the negative end of the capacitor to the locking lug.
- Connect the 2.2K resistor from V1 pin 8 to the nearest locking lug.
- Connect a .01µF cap from T8(2) to T8(4).
- Connect a 100K resistor from T8(3) to T8(4).
- Connect a 10K resistor from T8(4) to T8(5).
- Connect a 100K resistor from T8(5) to T8(6).
- Connect the 500pF capacitor from T8(6) to T8(7).

Step 5 – Connect the V3 components

- Connect a 1.5K resistor and the remaining 25µF capacitor from V3 pin 8 to the nearest locking lug. Make sure you connect the negative end of the capacitor to the locking lug.
- Connect the remaining .01µF cap from V3 pin 2 to the center lug of the "Tank Out" jack. Leave room at V3 pin 2 for a resistor connection.

- Connect the remaining 220K resistor from V3 pin 2 to the nearest locking lug.
- Connect the remaining 1.5K resistor and the 1µF capacitor from V3 pin 3 to the sleeve terminal of the "Tank Out" jack. *(This capacitor is not polarized so it doesn't matter which lead is connected to ground).*
- Connect a .1µF capacitor from T6(1) to T6(4).
- Connect a 100K resistor from T6(3) to T6(4).
- Connect the remaining 10K resistor from T6(4) to T6(5).
- Connect a 100K resistor from T6(5) to T6(6).
- Connect a .1µF capacitor from T6(6) to T7(3).
- Connect the remaining 470K resistor from T7(1) to T7(3).

Step 6 – Connect the V4 components

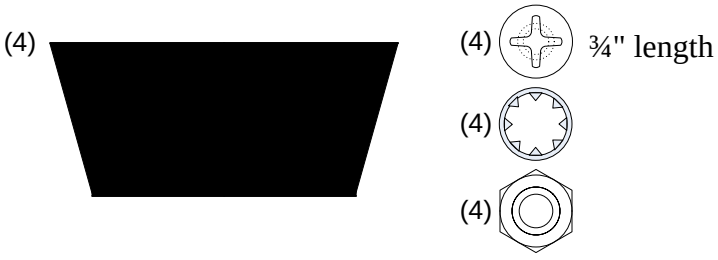
- Connect a 2M resistor from T4(4) to T4(3).
- Connect the remaining 2M resistor from T4(3) to T4(2).
- Connect the .047µF capacitor from T4(3) to T4(1).
- Connect the remaining 100K resistor from T5(4) to T5(2).
- Connect the remaining .1µF capacitor from T5(1) to T5(4).

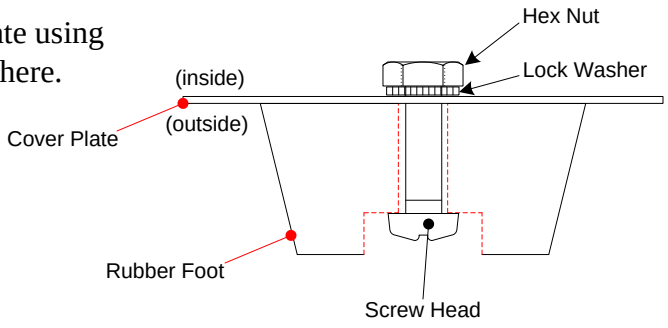
SECTION 6 – Assemble and Fasten the Cover Plate

At this point, the internal circuitry should be complete. Take the time now to carefully double check your connections and make sure they match up with Drawing 6.

Step 1 – Mount the rubber feet

- Mount the four rubber feet to the four holes in the cover plate using the remaining #10 screws, nuts and lock washers as shown here.

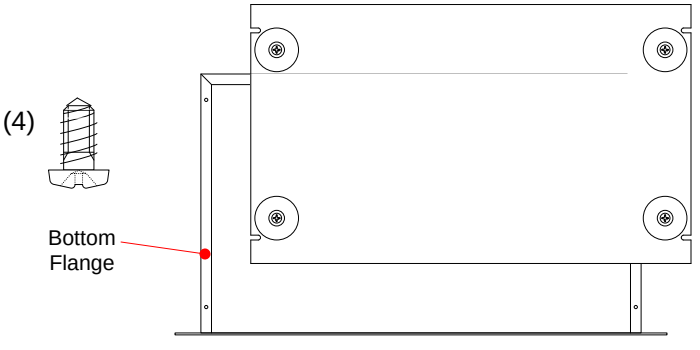




Step 2 – Mount the cover plate

- Use the four self-tapping screws to fasten the cover plate over chassis opening.

You may have to use a lot of force to initially insert the self tapping screws through the holes in the bottom flange of the chassis.



SECTION 7 – Make and Connect the RCA Cables

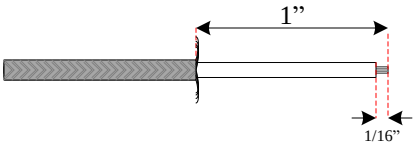
In this section we will make two vintage style RCA cables for connecting the spring reverb tank to the drive and recovery circuits.

Step 1 – Make the 12" output cable

- Cut a 12” length of 22 AWG tin braided wire and follow the steps below:

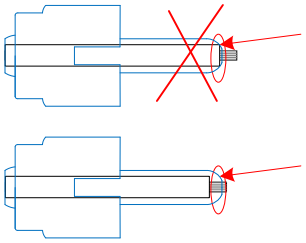
1) Push down the shielding on one end of this wire to expose about 1” of the insulation. Fan out the shielding at the end by pulling it away from the insulation with your fingers.

2) Strip away about 1/16" of the insulation from this wire end and tin the wire.



3) Insert this wire end through one of the RCA plugs so that the 1/16" wire end comes out of the hole in the tip of the plug. Solder the 1/16" wire end to the tip of the plug.

The insulation burns easily, so when soldering the wire to the tip try not to rest the tip on the end of the insulation.

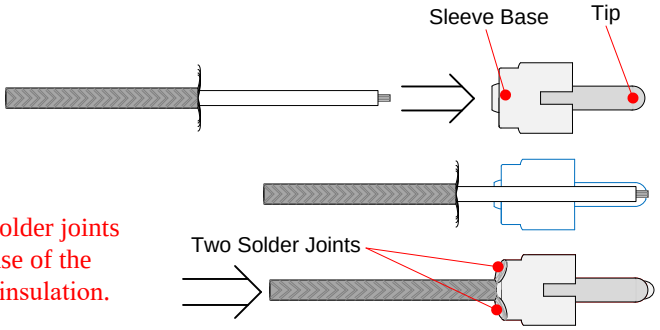


Bad: The plug tip is resting on the end of the wire’s insulation and will likely burn through it while soldering.

Good: The plug tip is positioned away from the end of the insulation to avoid burning it.

4) Let the tip cool and then push the shielding back up toward the RCA plug’s sleeve base. Solder the frayed shield end to the sleeve base, being careful not to burn through the wire’s insulation.

Solder the shielding to the sleeve base by forming at least two solder joints on opposite sides of the base. Touch the soldering iron to the base of the RCA plug only, do not apply the soldering iron over the wire’s insulation.



5) Measure resistance between the sleeve and the tip of this RCA plug with an ohm meter to make sure they are not accidentally shorted together.

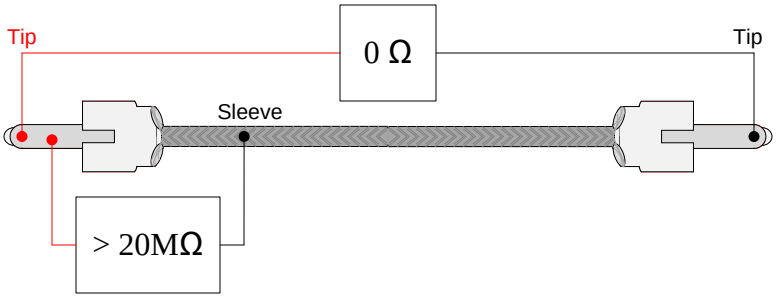
6) Repeat the same process to add another RCA plug to the other end of this wire.

Step 2 – Make the 14 ½" input cable

- Cut a 14 ½” length of 22 AWG tin braided wire and use the remaining RCA plugs to make another cable just as you did for the 12" cable above.

- Check the resistance on both cables from tip to tip and from tip to sleeve.

From tip to tip you should measure 0 ohms and from tip to sleeve you should get a resistance that is too high to measure.



Step 3 – Connect the cables to their respective phono jacks

Please refer to assembly **Drawing 7**.

- Connect the 12" cable from the reverb tank's "OUT" connector to the phono jack closest to V3.
- Connect the 14 ½" cable from the reverb tank's "IN" connector to the other phono jack on top of the unit.

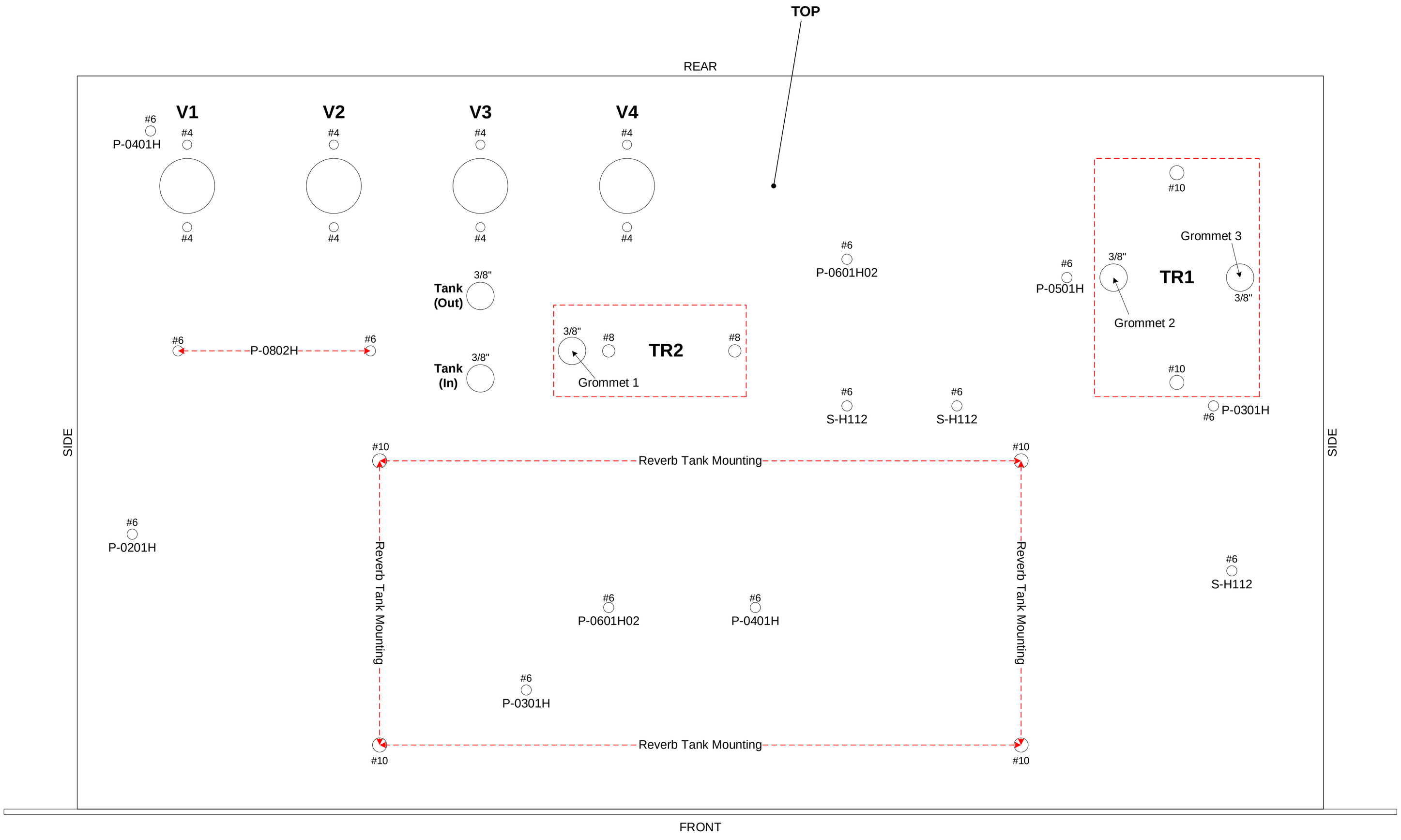
SECTION 8 – Finishing Up

- Plug the tubes into their respective sockets as indicated on Drawing 7. There is only one 12AT7 (a.k.a. ECC81) and it should be plugged into socket V4. All the other tubes are 12AX7's (a.k.a. ECC83).
- Plug the detachable power cord into its receptacle on the rear panel.

Note: The Wave is capable of delivering extreme levels of reverb. It is best to keep the Wave off of your speaker cabinet if you plan to play at loud volumes with the reverb controls turned up past half-way. Otherwise, the mechanical vibrations may cause oscillations.

ASSEMBLY DRAWINGS

Drawing 1



Drawing 2

TOP
(Outside of the Chassis)

REAR

V1 **V2** **V3** **V4**

#6 P-0401H

#4 #4 #4 #4

#4 #4 #4 #4

#6 P-0802H #6

3/8" **Tank (Out)**

3/8" **Tank (In)**

TR2

Grommet 1

#8 P-T1750A #8

#6 P-0601H02

#6 P-0501H

Grommet 2
1. Green
2. Green
3. Green/Yellow
4. Red
5. Red

#10 290WX #10

Grommet 3
1. White
2. Black

#6 P-0301H #6

#6 S-H112

#6 S-H112

SIDE

SIDE

#10 Reverb Tank Mounting #10

#6 P-0201H

Reverb Tank Mounting

Reverb Tank Mounting

#6 P-0601H02

#6 P-0401H

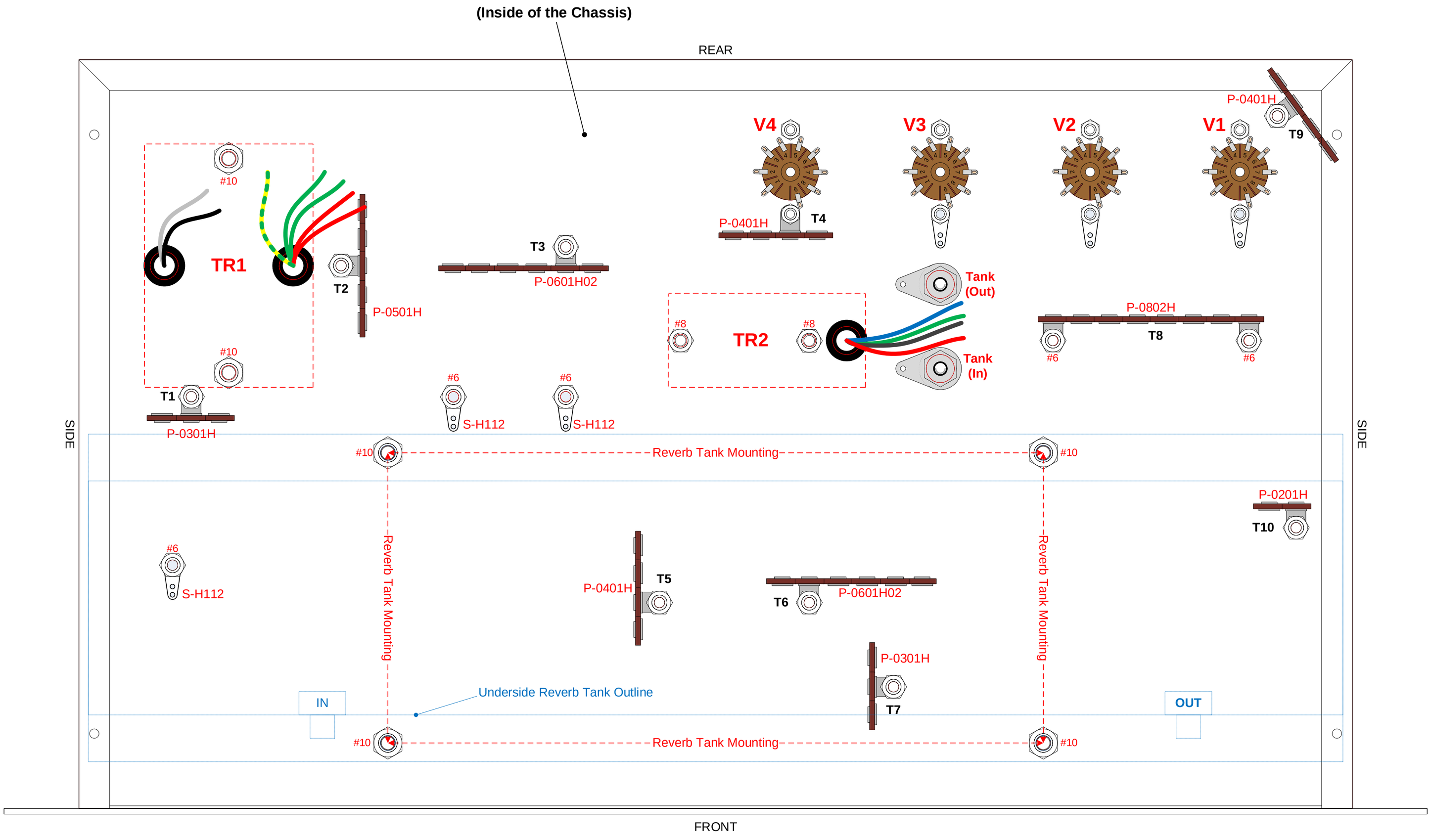
#6 S-H112

#6 P-0301H

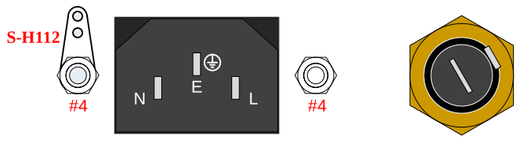
#10 Reverb Tank Mounting #10

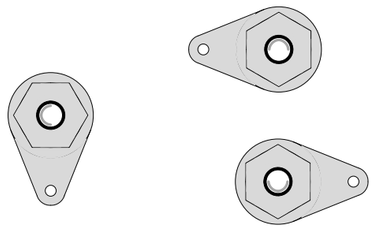
FRONT

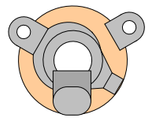
Drawing 3

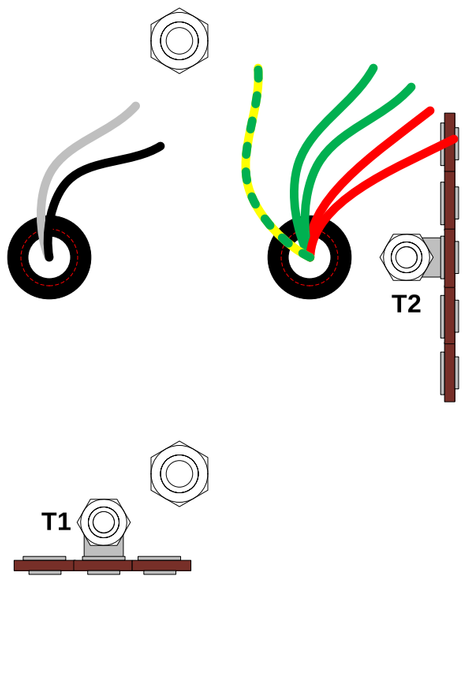

(Inside of the Chassis)
REAR
FRONT
SIDE
SIDE
#10
TR1
T2
P-0501H
T1
P-0301H
#10
T3
P-0601H02
#6
S-H112
#6
S-H112
V4
P-0401H
T4
V3
V2
V1
P-0401H
T9
#8
TR2
#8
Tank (Out)
Tank (In)
P-0802H
T8
#6
#6
#10
Reverb Tank Mounting
#10
#10
Reverb Tank Mounting
#10
P-0201H
T10
#6
S-H112
Reverb Tank Mounting
P-0401H
T5
T6
P-0601H02
P-0301H
T7
Reverb Tank Mounting
IN
Underside Reverb Tank Outline
OUT
#10
Reverb Tank Mounting
#10

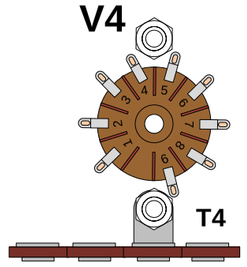
Drawing 4

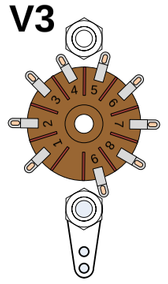

S-H112
#4
N
E
L
#4

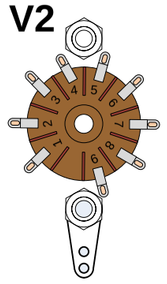


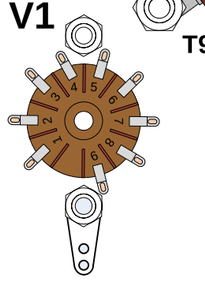


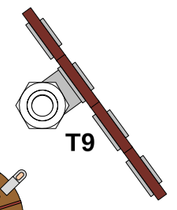

T2
T3
T1

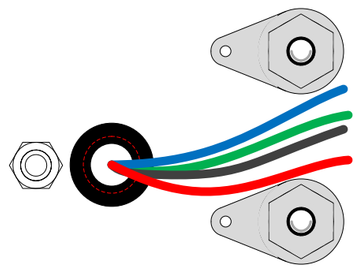

V4
T4

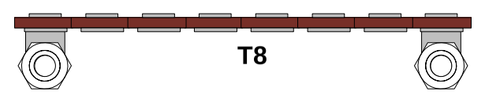

V3


V2

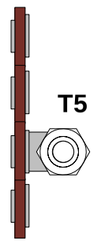

V1

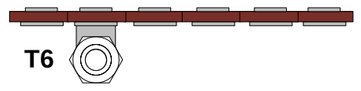

T9

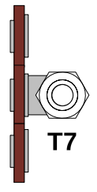


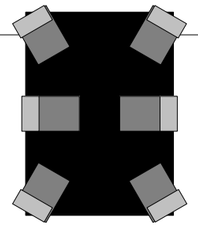

T8

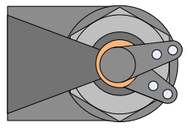
T10

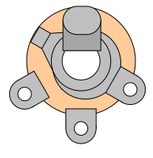

T5

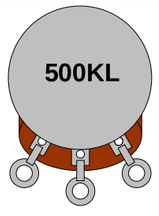

T6

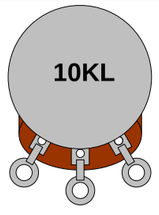

T7

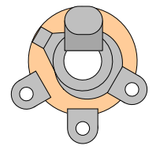




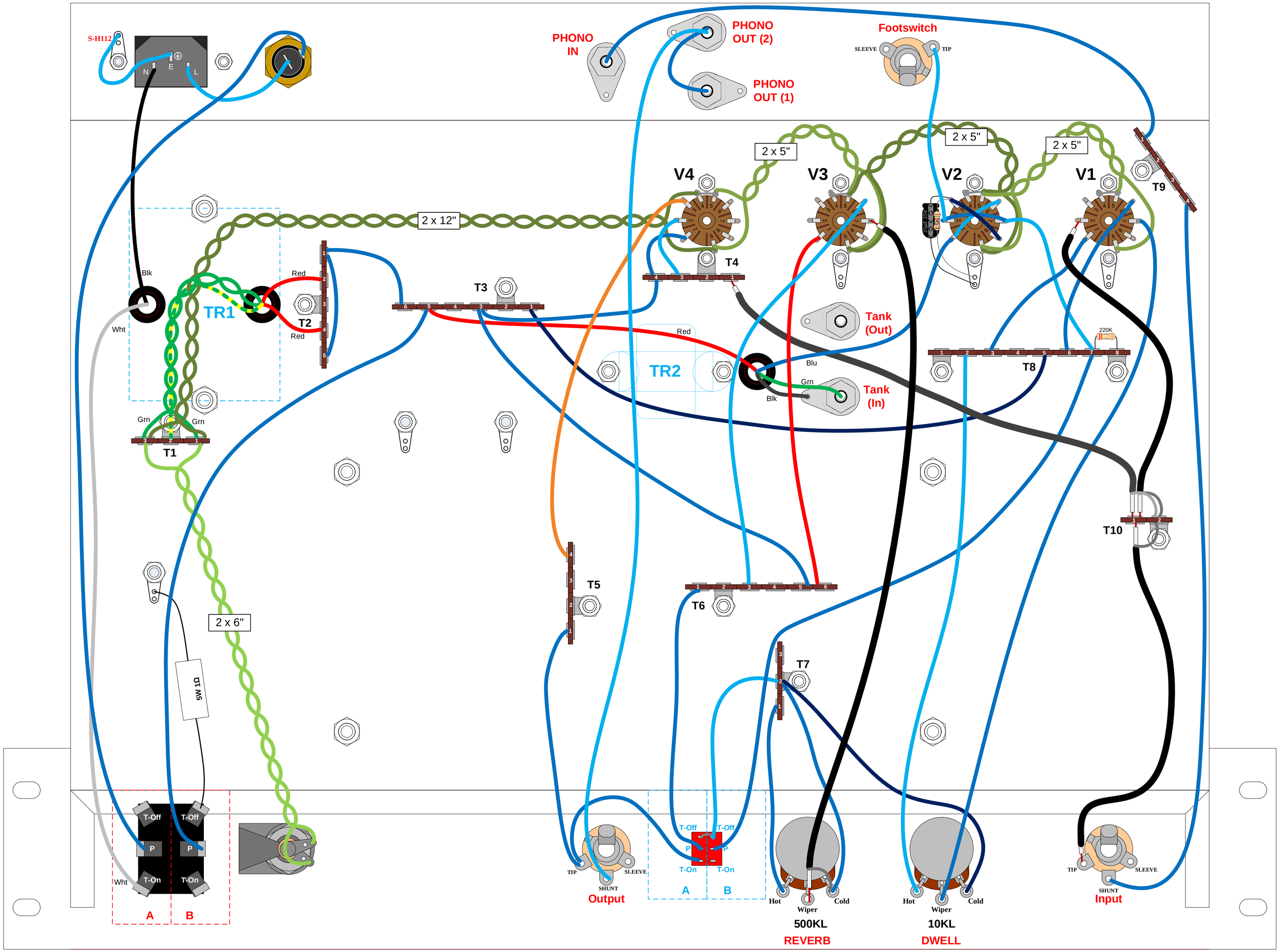

Output


500KL

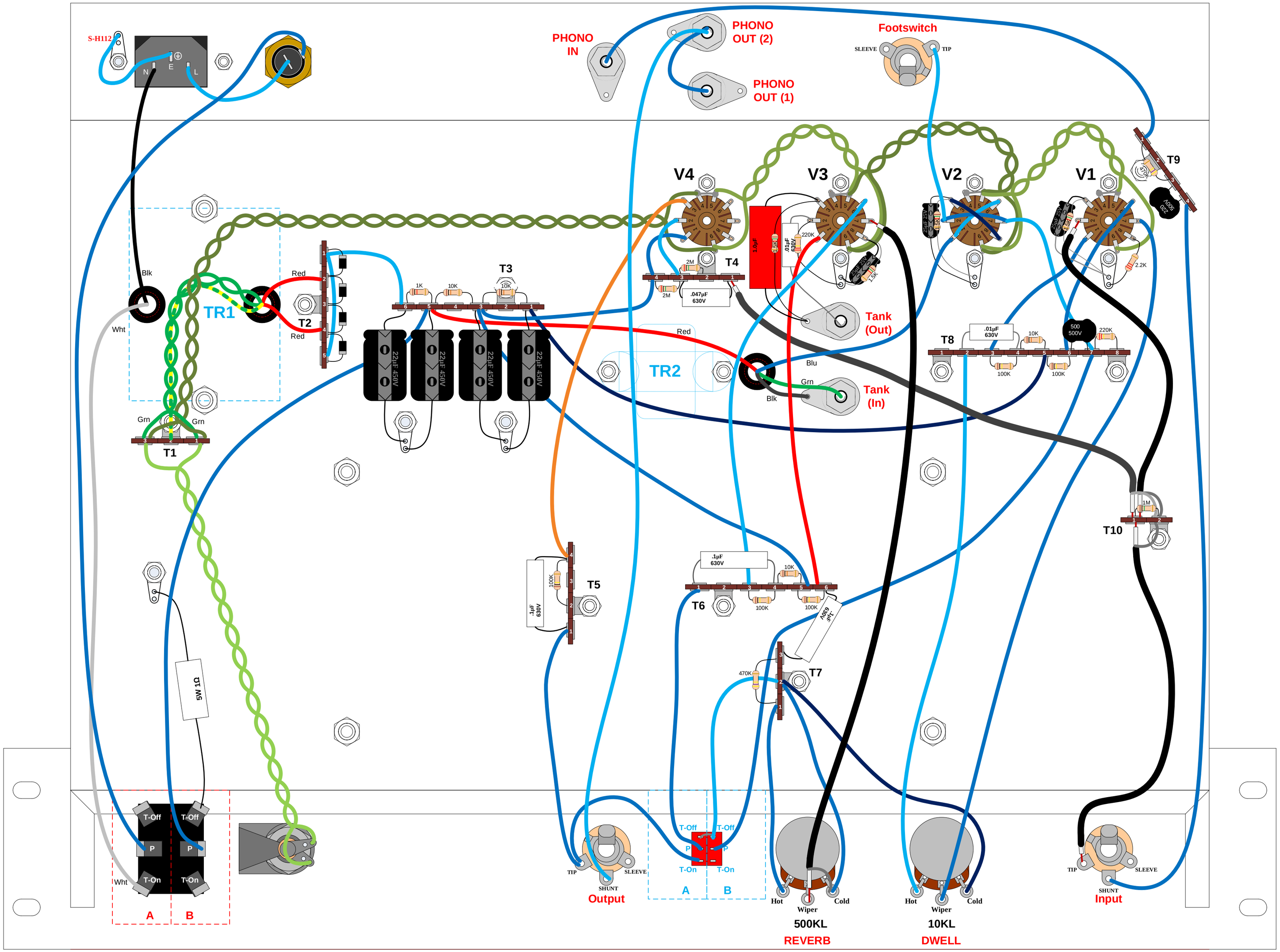

10KL


Input

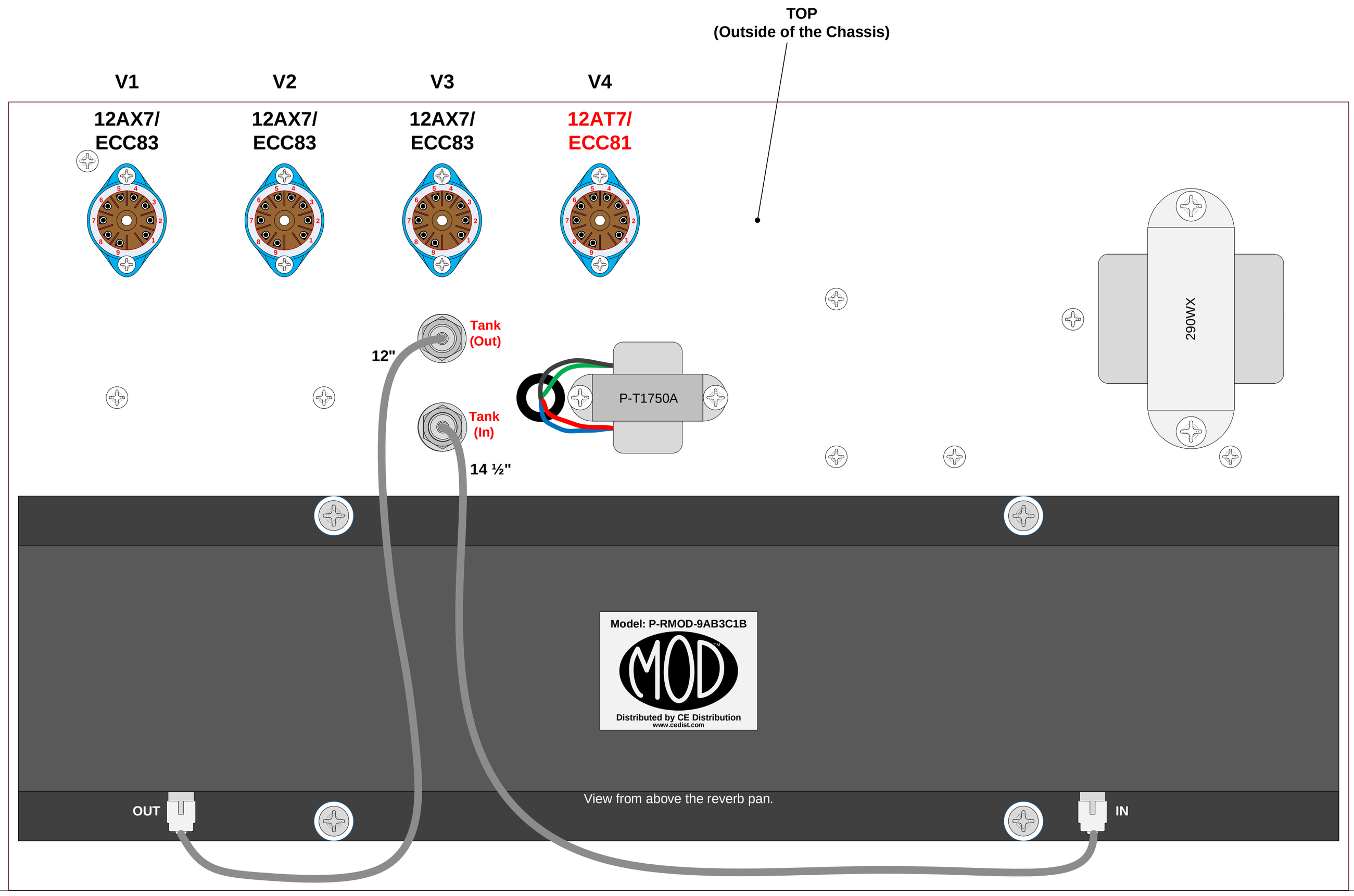
Drawing 5


S-H112
N
E
L
PHONO IN
PHONO OUT (2)
PHONO OUT (1)
Footswitch
SLEEVE
TIP
2 x 5"
2 x 5"
2 x 5"
V4
V3
V2
V1
T9
2 x 12"
T4
T3
Blk
Red
TR1
T2
Red
Wht
Red
TR2
Blu
Grn
Blk
Tank (Out)
Tank (In)
220K
T8
Grn
Grn
T1
T10
T5
T6
T7
2 x 6"
5W 1Ω
T-Off
T-Off
P
P
T-On
T-On
Wht
A
B
TIP
SLEEVE
SHUNT
Output
T-Off
T-Off
P
P
T-On
T-On
A
B
Hot
Wiper
Cold
500KL
REVERB
Hot
Wiper
Cold
10KL
DWELL
TIP
SLEEVE
SHUNT
Input

Drawing 6

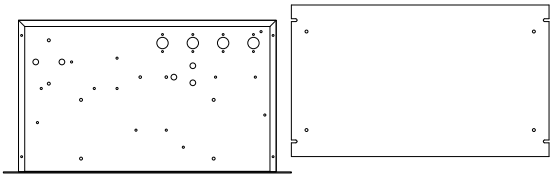

S-H112
N
E
L
PHONO IN
PHONO OUT (2)
PHONO OUT (1)
Footswitch
SLEEVE
TIP
V4
V3
V2
V1
T9
T4
T3
T2
T1
TR1
TR2
T8
T10
T5
T6
T7
Blk
Wht
Red
Grn
Blu
1K
10K
2M
.047µF 630V
.01µF 630V
220K
15K
.1µF 630V
100K
.01µF 630V
500 500V
220K
2.2K
1M
22µF 450V
Tank (Out)
Tank (In)
5W 1Ω
T-Off
P
T-On
A
B
Output
SHUNT
Hot
Wiper
Cold
500KL
REVERB
10KL
DWELL
Input

Drawing 7


TOP
(Outside of the Chassis)
V1
V2
V3
V4
12AX7/
ECC83
12AX7/
ECC83
12AX7/
ECC83
12AT7/
ECC81
Tank
(Out)
12"
Tank
(In)
14 ½"
P-T1750A
290WX
Model: P-RMOD-9AB3C1B
MOD
Distributed by CE Distribution
www.cedist.com
OUT
IN
View from above the reverb pan.

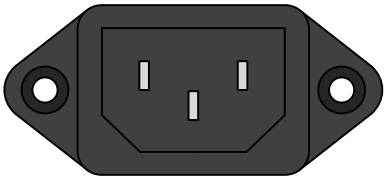
PARTS LIST DRAWINGS

K-P103-CHASSIS (1)
steel chassis & cover plate

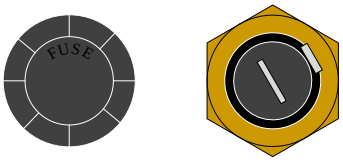


S-W124 (1)
detachable power cord

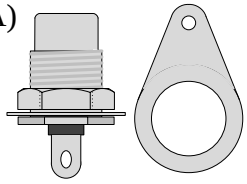
P-SP2-106 (1)
power cord receptacle



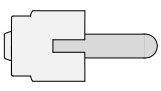
S-H201 (1)
fuse holder



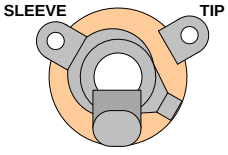
W-SC-3501FR (5)
phono (RCA) jacks



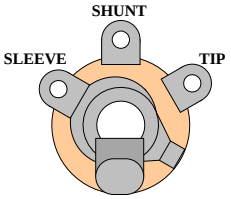
W-SC-3501MX (4)
phono (RCA) plugs



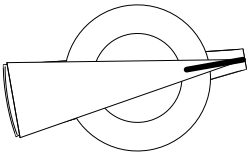
W-SC-11 (1)
¼" mono jack (non-shorting)



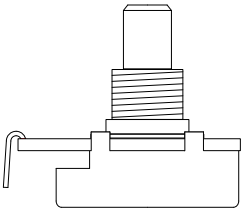
W-SC-12A (2)
¼" mono jack (tip shunt)



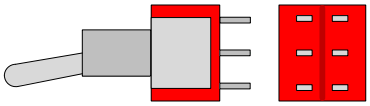
P-K300W (2)
chicken head knobs - white



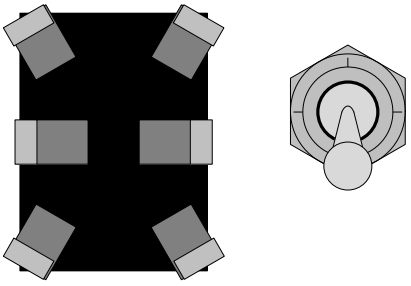
R-V38-10KL (1)
10kΩ "dwell" potentiometer
R-V38-500KL (1)
500kΩ "reverb" potentiometer



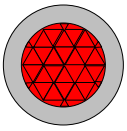
P-H541 (1)
DPDT Mini Toggle Switch



P-H35-146 (1)
power switch (DPDT)

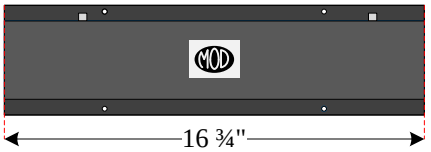


P-L115 (1)
jewel lens - red

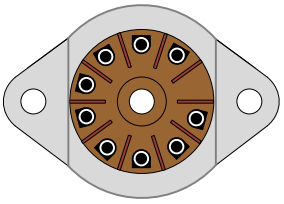


P-H9107 (4)
rubber feet

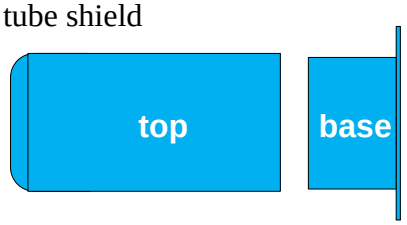
P-RMOD-9AB3C1B (1)
spring reverb tank



P-ST9-600 (4)
9 pin miniature tube socket

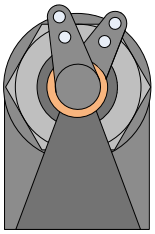


P-SS9-325-BL (4)
tube shield

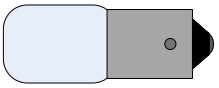


F-ZF010 (1)
fuse (1A Fast Blow)

P-L124-P (1)
lamp holder

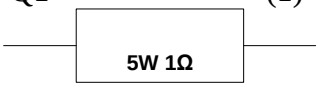


P-47 (1)
bulb/lamp (bayonet base)



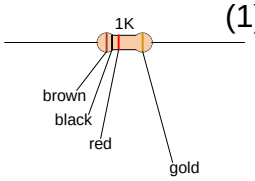
1Ω, 5W resistor

R-Q1 (1)



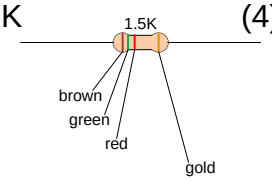
1kΩ Resistor ½ W

R-A1K (1)



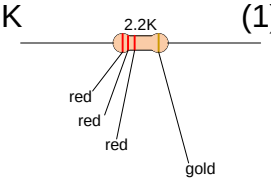
1.5kΩ Resistor ½ W

R-A1D5K (4)



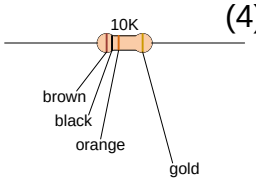
2.2kΩ Resistor ½ W

R-A2D2K (1)



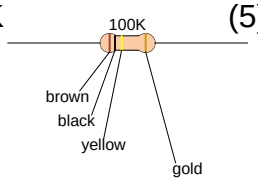
10kΩ Resistor ½ W

R-A10K (4)



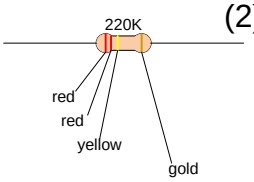
100kΩ Resistor ½ W

R-A100K (5)



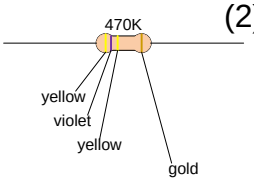
220kΩ Resistor ½ W

R-A220K (2)



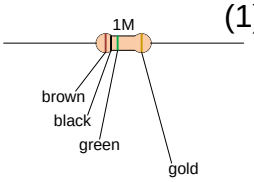
470kΩ Resistor ½ W

R-A470K (2)



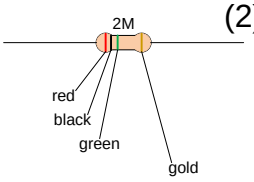
1MΩ Resistor ½ W

R-A1M (1)



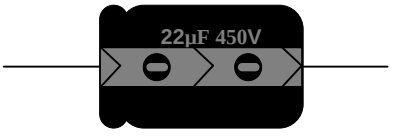
2MΩ Resistor ½ W

R-A2M (2)



C-ET22-450 (4)

22µF, 450V capacitor



C-ET25-25 (3)

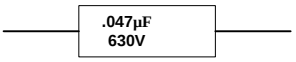
25µF, 25V capacitor

C-MKP1-400 (1)

1µF, 400V capacitor

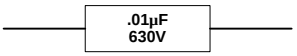
C-MD047-630 (1)

.047µF, 630V capacitor



C-MD01-630 (2)

.01µF, 630V capacitor

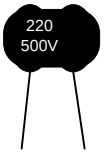


C-MD1-630 (3)

.1µF, 630V capacitor

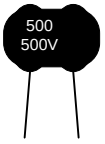
C-SM220 (1)

220pF, 500V capacitor



C-SM500 (1)

500pF, 500V capacitor



P-Q1N4007 (4)

solid state diode

S-W807L-M (7 ft)

green 20 AWG solid core cloth-covered wire

K-P01-0006-BLU (16 ft)

blue 22 AWG stranded hook-up wire

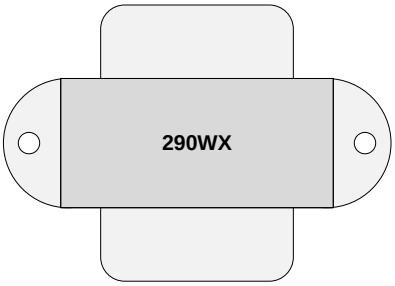
S-W111 (4 ft)

tin braid 22 AWG stranded wire

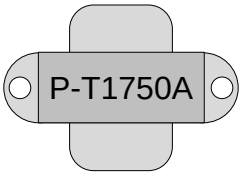
S-W112 (3 ft)

RG 174/U shielded 26 AWG stranded wire

P-T290WX (1)
power transformer



P-T1750A (1)
audio transformer

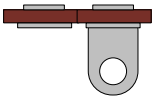


T-12AX7-S-JJ (3)
ECC83/12AX7 tube

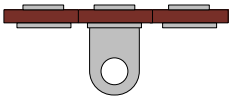
T-12AT7-JJ (1)
ECC81/12AT7 tube

P-G038 (3)
rubber grommets

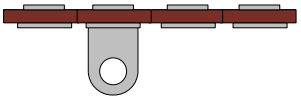
P-0201H (1)
terminal strip w/ 2 terminals



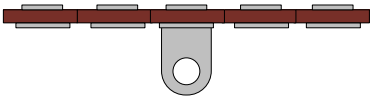
P-0301H (2)
terminal strip w/ 3 terminals



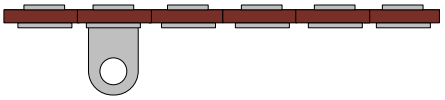
P-0401H (3)
terminal strip w/ 4 terminals



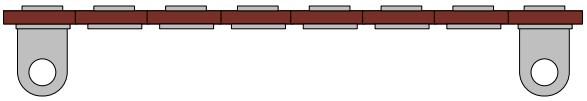
P-0501H (1)
terminal strip w/ 5 terminals



P-0601H02 (2)
terminal strip w/ 6 terminals



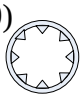
P-0802H (1)
terminal strip w/ 8 terminals



S-HS1032-34 (4)
#10 screw, ¾" length

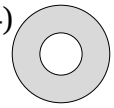
S-HS1032-12 (6)
#10 screw, ½" length

S-HLW10 (10)
#10 lock washer



S-HHN1032 (10)
#10 hex nut

S-HW10 (4)
#10 hex nut

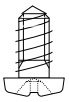


S-HS832-12 (2)
#8 screw, ½" length

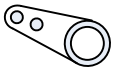
S-HLW8 (2)
#8 lock washer

S-HHN832 (2)
#8 hex nut

S-HST8-38 (4)
#8 self-tap screws



S-H112 (7)
#6 locking lug



S-HS632-38 (13)
#6 screw, 3/8" length

S-HHN632 (13)
#6 hex nut

S-HLW6 (10)
#6 lock washer

S-HS440-38 (10)
#4 screw, 3/8" length

S-HHN440 (10)
#4 hex nut

S-HLW4 (6)
#4 lock washer

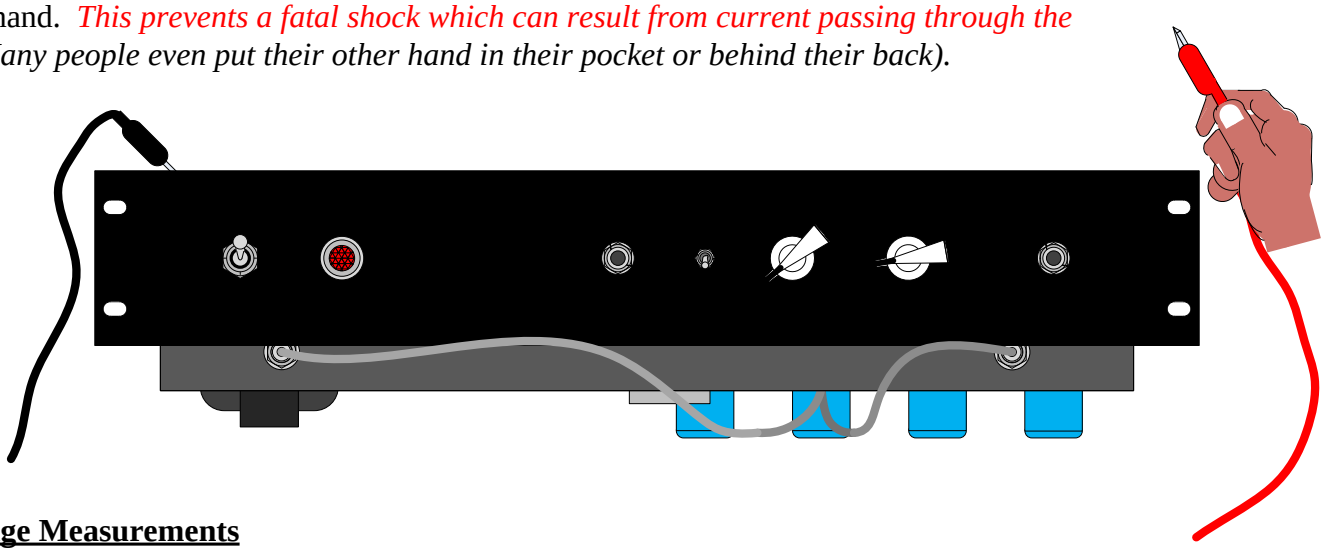
TOOL LIST

- Wire Strippers
- Needle Nose Pliers
- Cutting Pliers
- Desoldering Pump
- Solder (60/40 rosin core)
- Soldering Station
- Phillips Head Screwdrivers
- Slotted tip screwdrivers (3mm tip)
- Digital Multimeter (DMM)
- Alligator Clip Test Leads (to fit DMM)
- Channellock Pliers (or similar type)
- Miniature Round File (fine cut)

The Wave Troubleshooting Supplement

The next step after thoroughly double-checking your connections is to take voltage measurements to help locate problem areas. Please keep safety first and always remember the one hand rule.

The one hand rule (pictured below): is a safety precaution for working on an amp that is plugged in or could potentially have high voltages present. Using alligator clips with your DMM, clip the ground side to the chassis and use the other side to probe at various test points with one hand. *This prevents a fatal shock which can result from current passing through the heart. (Many people even put their other hand in their pocket or behind their back).*



DC Voltage Measurements

First, make sure all of your DC voltage measurements are in order. Use the layout drawing (or schematic) to find the locations of the DC voltage measurements listed below. Your measurements should be in the same ballpark, but do not expect to measure the exact same values listed here.

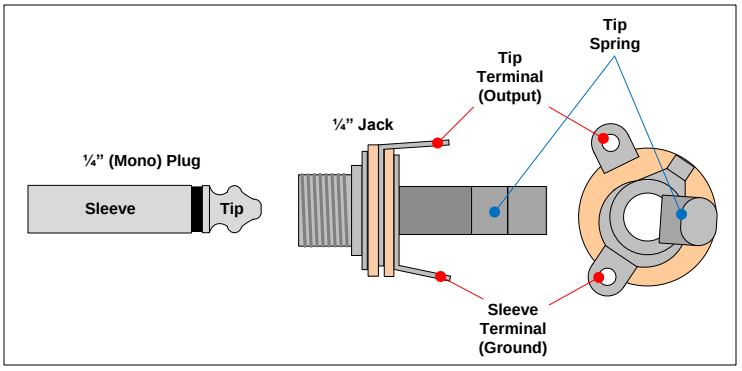
Test Point	Measurement
HV	330 VDC
A	320 VDC
B	271 VDC
C	255 VDC
D	246 VDC
E	157 VDC
F	1.3 VDC
G	178 VDC
H	1.7 VDC
I	316 VDC
J	5.8 VDC
K	182 VDC
L	1.3 VDC
M	263 VDC
N	176 VDC
O	1.3 VDC
P	123 VDC
Q	135 VDC

Measuring AC Voltages from the Guitar Signal

Once your DC voltages are in order, if your kit is still not working properly, you can measure AC voltages along the signal path to troubleshoot further.

You will need a volt meter that can measure the small signal AC voltages that electric guitars put out. The output signal from your guitar will likely be less than 1 V.

First, measure the output signal directly from your guitar. You can do this by plugging your guitar cable into the guitar and leaving the other end of the cable disconnected. Connect your meter across the disconnected ¼" plug's "tip" and "sleeve" sections. Make sure your guitar's volume and tone controls are turned up and strum a chord. When you strum, you should see the AC voltage reading on the meter quickly rise to some maximum value and then fall back to 0 VAC when you stop strumming and the strings come to a rest.



Once you are able to measure the output signal from your guitar directly, plug the guitar into the input jack of your kit and use the AC test points to measure the guitar signal along the signal path. Start with test point one and move along in order. You should be looking to identify the last test point where the signal seems normal and the first test point where the signal seems unusual or where it is no longer even present.

The AC voltages on the layout drawing and schematic are numbered 1 through 11 and were measured while strumming an open E chord on a strat switched to the neck pickup only position. All test points (except test point 5) were measured with respect to ground. *AC signal voltage levels may vary dramatically from one instrument to another depending on the electronics and how hard you strum.*

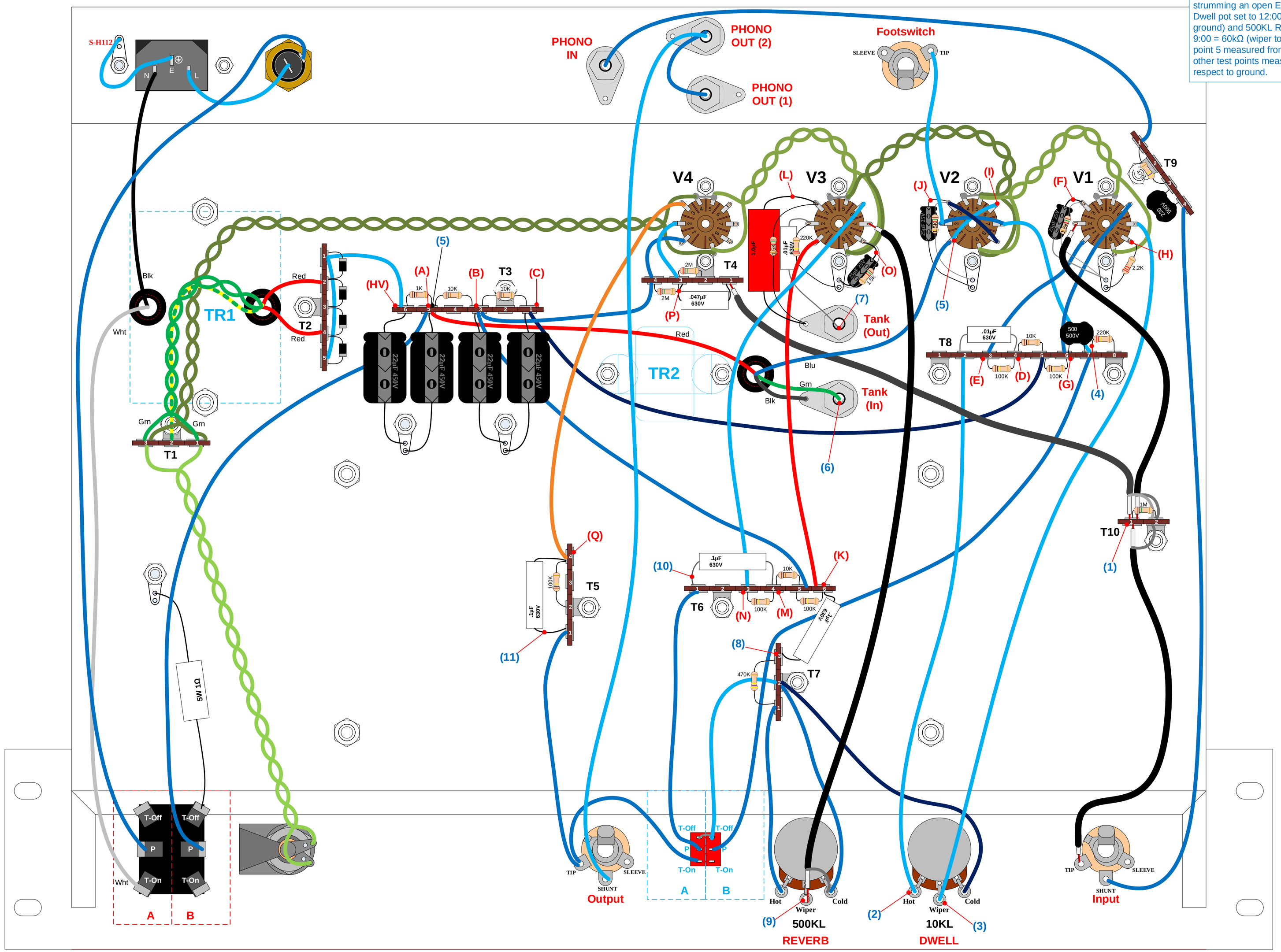
Test Point	Measurement
1	0.16 VAC
2	0.17 VAC
3	0.10 VAC
4	0.62 VAC
*5	23.0 VAC
6	0.48 VAC
7	0.01 VAC
8	0.70 VAC
9	0.07 VAC
10	0.13 VAC
11	0.13 VAC

- The 10KL dwell pot was set to “12:00” = 5kΩ (wiper to ground).
- The 500KL reverb pot was set to “9:00” = 60kΩ (wiper to ground).
- *Test point 5 was measured from TR2's blue wire to red wire.

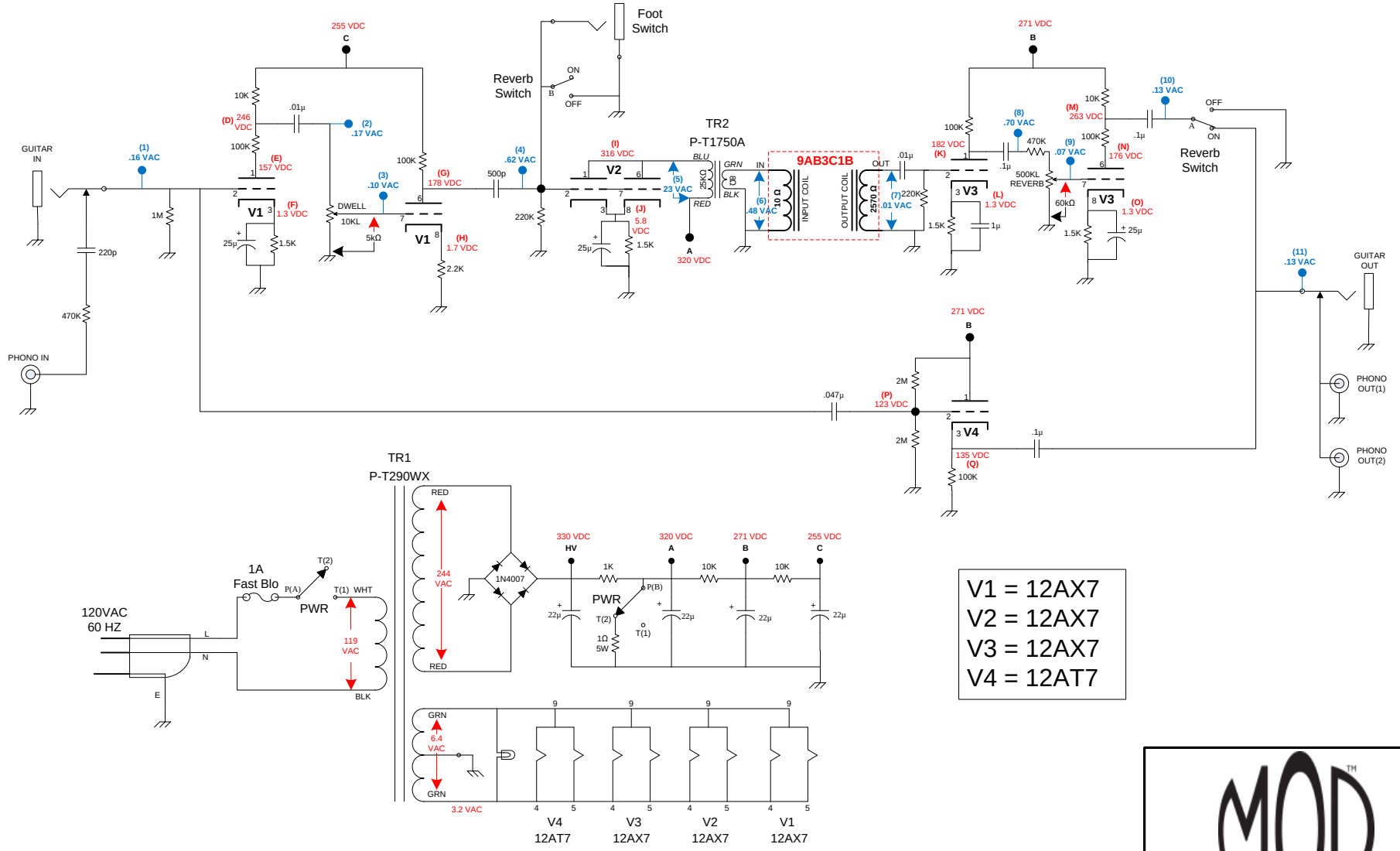
Test Point Layout Drawing

- DC test points are lettered
- AC test points are numbered

AC voltages were measured from a strat in neck pickup position, strumming an open E chord with 10KL Dwell pot set to 12:00 = 5kΩ (wiper to ground) and 500KL Reverb pot set to 9:00 = 60kΩ (wiper to ground). Test point 5 measured from Blue to Red, all other test points measured with respect to ground.



- DC voltages were measured with respect to ground.
- AC voltages measured from strat neck pickup position, strumming an open E chord with 10KL dwell pot set to 12:00 = 5kΩ and 500KL reverb pot set to 9:00 = 60kΩ. Test point 5 measured from Blue to Red, all other test points measured with respect to ground.



"The Wave" (K-MOD103) Schematic