ZKIT-1 Single-Ended Triode Amplifier Instructions

Model: SE84DIY

March 3, 2019

Website support can be found at: www.decware.com

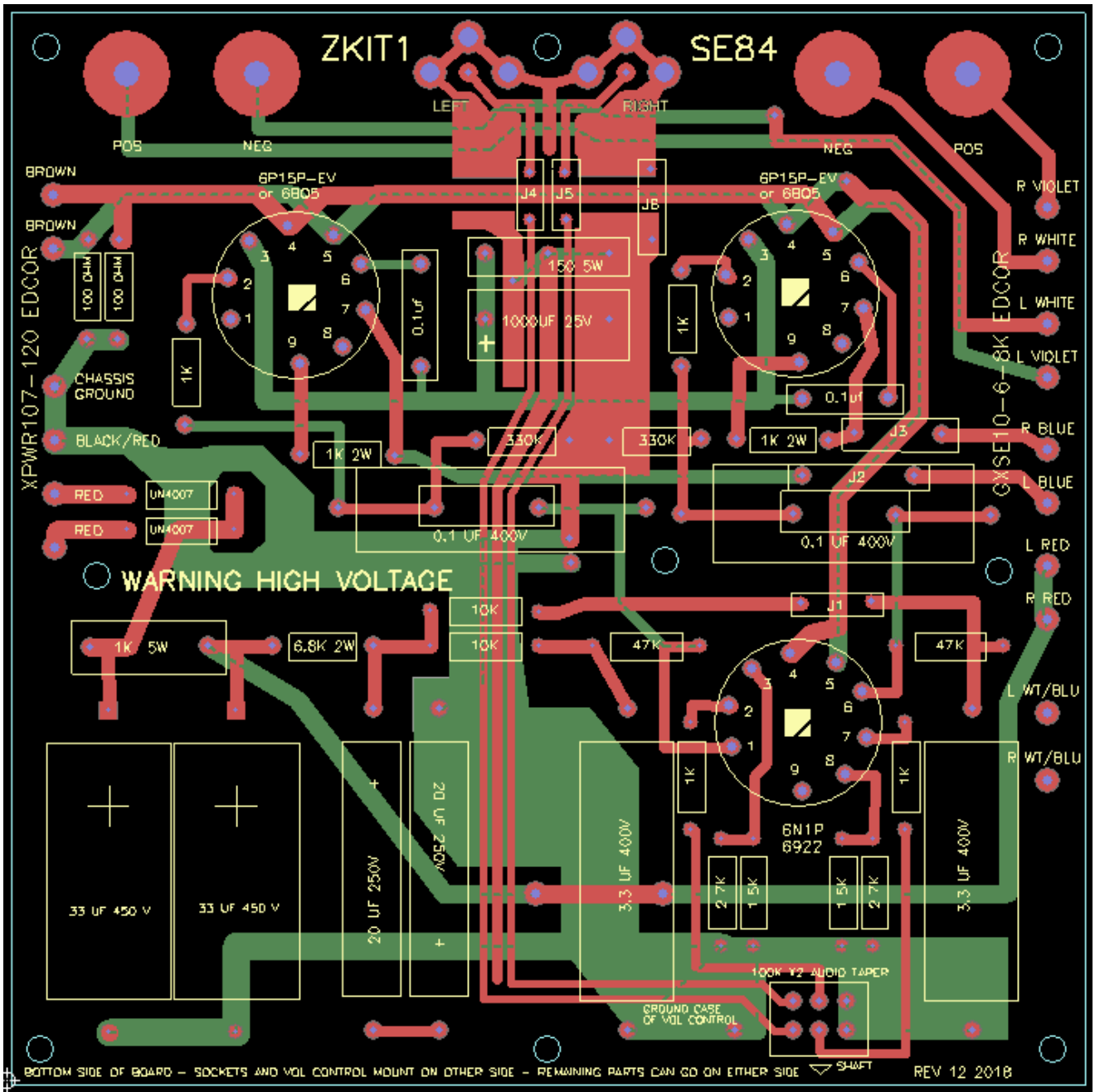
MOUNTING THE CIRCUIT BOARD

Objective

The circuit board has been designed to be used in 2 ways;

A) Mounted on stand-offs to a piece of wood and B) Mounted on stand-offs inside a metal chassis.

The see-thru picture below lets you see the traces on both sides of the board at the same time.



The silk screen is printed on the bottom side of the board. The tube sockets mount to the top side of the board only. Parts can placed on either side of the board depending on how the board is mounted:

A) Mounted inside a steel chassis parts (not tube sockets or volume control) are mounted on the bottom side with the silk screened parts layout.

B) Mounted on a piece of wood, the parts including tube sockets and volume control are mounted on the top side where there is no silk screened parts layout.

Some features of the board include:

- A) Self-canceling AC heater layout feeding pins 4 and 5 on each tube. One leg of the 6.3 Volts AC is run on the top side of the board while the other leg is run exactly below it on the bottom side. In a point-to-point wired circuit the heater wires would be twisted together and run a close to a metal chassis as possible.

- B) A separate ground buss to carry the circuit ground patterned after our point-to-point amplifiers to streamline the signal path. (The ground of a circuit is part of the signal path)

- C) A separate shield also known as a ground plane throughout the board to take the place of the natural shielding you would get from a metal chassis. This ground plane makes it possible to build this circuit for use on a piece of wood without fear of oscillations occurring.

When built on a piece of wood, it is imperative that both the circuit ground and the ground plane be tied together with a short jumper wire. In addition, an earth ground must be connected between the amplifier's ground plane and the ground lug of your power cord. Without an earth ground you will likely get high frequency oscillations.

PRECAUTIONS:

If you build this amp on a piece of wood make sure you strain relief the power cord by connecting it to the wood in some fashion. Do not rely on the transformer itself to hold the weight and constant tugging of a power cord.

The output transformers as part of their design have very fragile lead terminations. This means bending the wire excessively, or putting anything other than tiny amounts of pulling forces on it will result in the lead wire pulling completely out of the transformer at which point you will not be too pleased. To reduce or prevent this from happening it is a good idea to place several drops of super glue at the spot where each lead enters the transformers before you build your amp.

HIGH VOLTAGE — While it should be obvious, high voltage can kill. Never power up your amplifier without a fuse and never use anything larger than the recommended value. In this case the value is 3 amps for 120 volt operation and 1.6 amps for 240 volt operation. Also remember that capacitors store electricity. When you power up the amp the large electrolytic caps will have 470 volts DC on them until the tube heaters warm up the output tubes enough to draw current. This usually takes about 20 seconds or so. With the amplifier warmed up and the output tubes draw- ing current the voltage will drop to around 400 volts. Turning the amplifier off at this point will create a situation where the output tubes still conduct for several seconds after the power is shut off allowing them to drain the capacitors. This is a good thing. On the flip side if you power the amp on and then right back off the caps will be fully charged and stay that way possibly for weeks.

The proper way to discharge caps it to use a resistor around 100 ohms and connect it between the cap positive and ground. This allows the voltage to drain quickly without damage to the capacitor. Shorting the cap to ground should never be done.

If you build this amplifier on a piece of wood, DO NOT operate this amplifier in a residence where children or pets or other people can come in contact with the exposed high voltages! If you plan to ignore this warning please get an aluminum chassis from Hammond and punch the 3 tube socket holes on the top of the chassis followed by all the stand-off holes on the circuit board. That way you can safely mount the circuit board inside the chassis with only the tubes sticking out. If you choose a chassis with a 2 inch thickness you will have the option of mounting the output transformers inside the chassis.

Getting started:

Start by using the circuit board as a template to mark the wood or chassis for mounting.

Install the parts in the circuit board and solder them using a low residue solder such as Kester # 245 or similar. If you can't find a low residue solder then clean the board with alcohol when your finished soldering in the parts. Note: Be sure to install short jumpers in the 6 locations marked J1 through J6. These can be put on either side of the board. Also don't forget to install a jumper between the circuit ground and the board shield (ground plane). There is no specific location marked for this jumper.

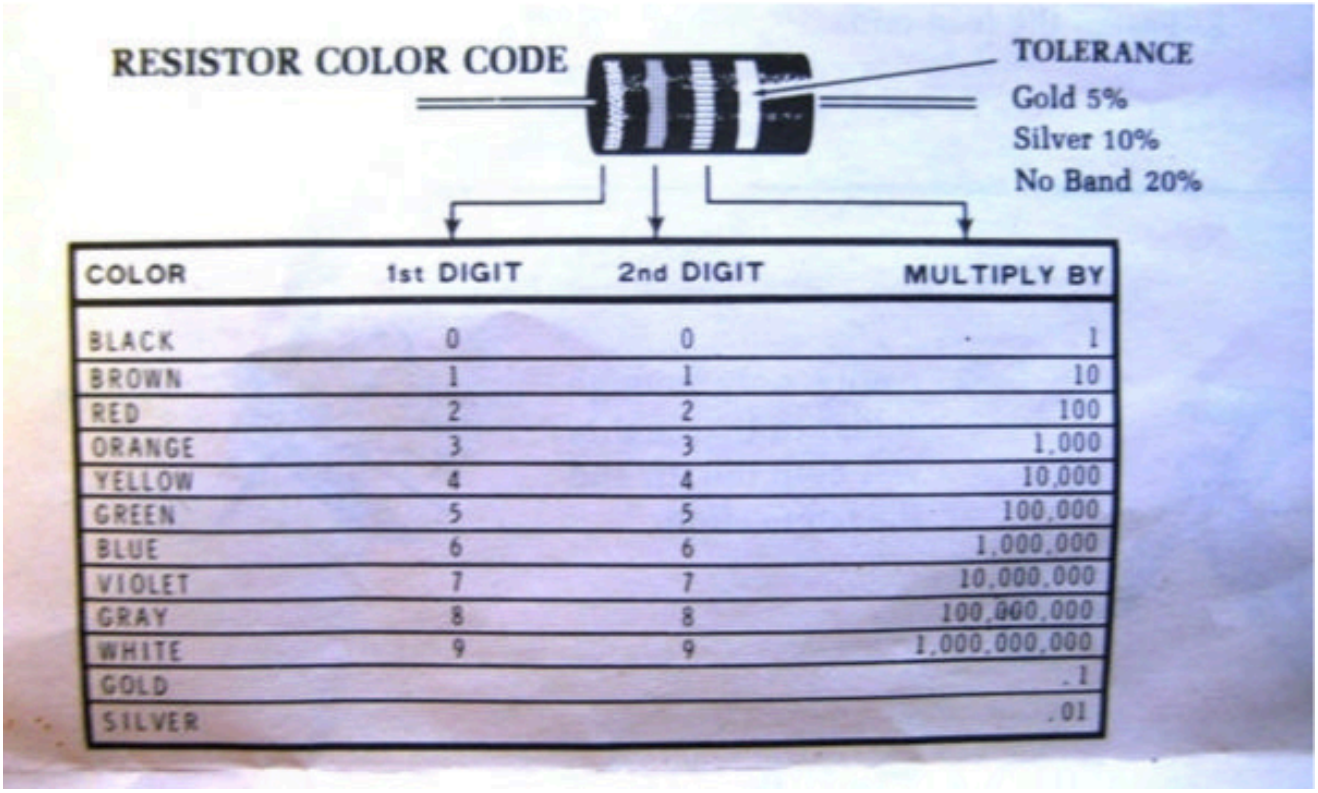
You are responsible for wire and hardware, such as screws etc. We have supplied stand-offs that work with 4-40 machine screws or anything similar in diameter. The length of the screw you use will depend on how to plan to fasten it to the board. If the wood is hardwood, such as maple, you can drill and tap the wood itself. If the wood is soft you can install brass inserts into the wood that are threaded for 4-40 machine screws. You can also simply drill all the way through the wood and use a long enough screw to receive a nut under the wood.

The power transformer in order to be mounted to a piece of wood needs to be raised enough to allow for the wires to exist between it and the wood. We have supplied 4 rubber feet that can be used to solve this problem. Stick them to the 4 corners of the transformer core and then set it on the wood and screw it down. The rubber feet provide some isolation and damping from vibration the result being better clarity in sound from less vibration reaching the tubes.

RESISTOR COLOR CODES

To determine the value of a particular resistor you can use the color bands on the resistor and then confirm the computed value with your resistance meter.

Use the first two bands to equal the first two digits in the value and then multiply that value by the third band and you will have the ohms of that resistor.



COLOR	1st DIGIT	2nd DIGIT	MULTIPLY BY
BLACK	0	0	1
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	10,000,000
GRAY	8	8	100,000,000
WHITE	9	9	1,000,000,000
GOLD			.1
SILVER			.01

INSTALLING THE PARTS

Generally the first thing to install is the tube sockets. Then install the resistors followed by every- thing else. Generally it's a good idea to solder each part and trim the excess part leads as you go. Double check the values of each part against the silk screen on the circuit board. Put the wrong value part in a location can make troubleshooting frustrating and difficult. If you can't read the resistor bands, or the resistors don't have bands, use your test meter to measure the ohms.

A 1k resistor can actually read +/- 10% of 1000 ohms depending on the type. If you get a reading of 986 ohms, for example, than you can assume that is a 1K resistor.

BENDING THE LEADS

Any time you are bending a part lead at a 90 degree angle or more, it is important to maintain somewhat of an arc to the bend. In other words don't use a pliers, use your fingers.

CAPACITOR LEADS

Capacitors come in several shapes and sizes. Electrolytic capacitors have a metal case where the ground lead and the case are connected together. The positive lead of the capacitor therefore must not be allowed to touch the case, even when the case is insulated with plastic as they often are. The capacitors should float above the circuit board with a small gap between them and the board to prevent possible shorts against the board. This is also true with resistors.

HIGH WATTAGE RESISTORS

These typically get warm to extremely hot depending on the circuit and value. In this amplifier, the part is a 1K resistor that has a 6 watt rating and is black in color. This part will get hot under normal use of the finished amplifier so it should be spaced at least 1 inch away from the surface of the circuit board and at least a 1/2 inch away from other parts.

SOLDERING IRONS

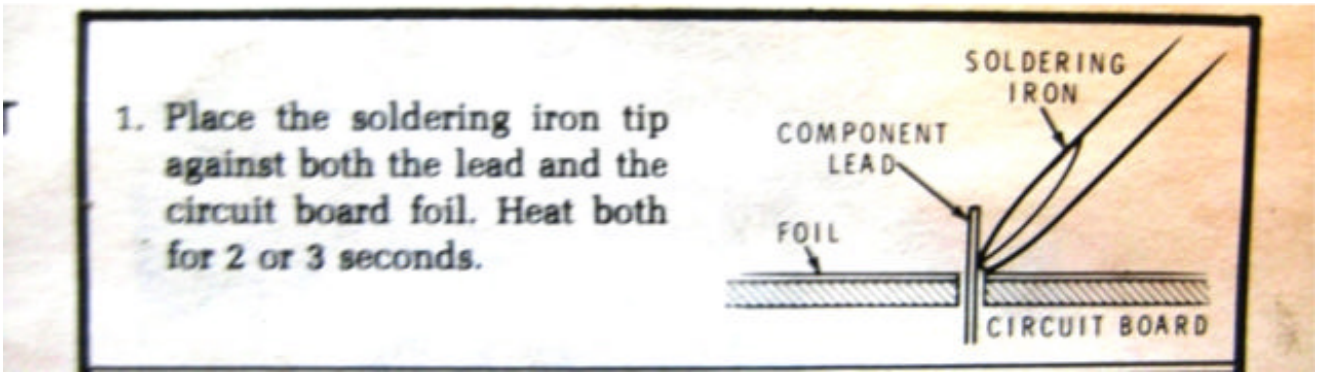
This kit can be assembled with a 25 ~ 40 watt soldering pencil or iron. A medium chisel tip is recommended. If you have an adjustable temperature soldering station, all the better.

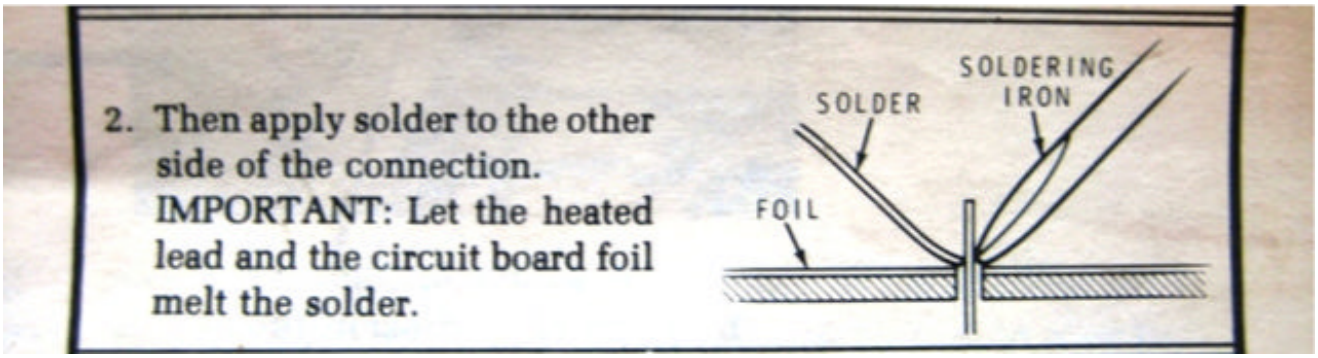
BEGINNERS

The next few pages are essential to understand if you've never soldered before! If you have some soldering experience, READ the following pages anyway. The quality of each solder joint can have as much impact on the sound quality as for example a pair of interconnects. Meaning a guy could spend $500 on a pair of really good interconnects and have poor soldering prevent him from hearing the advantages of those cables. On the flip side, his friend who solders like an expert is getting better sound from the same kit and a pair of $19 interconnects. Moral of the story, learn to solder. Here are some guidelines:

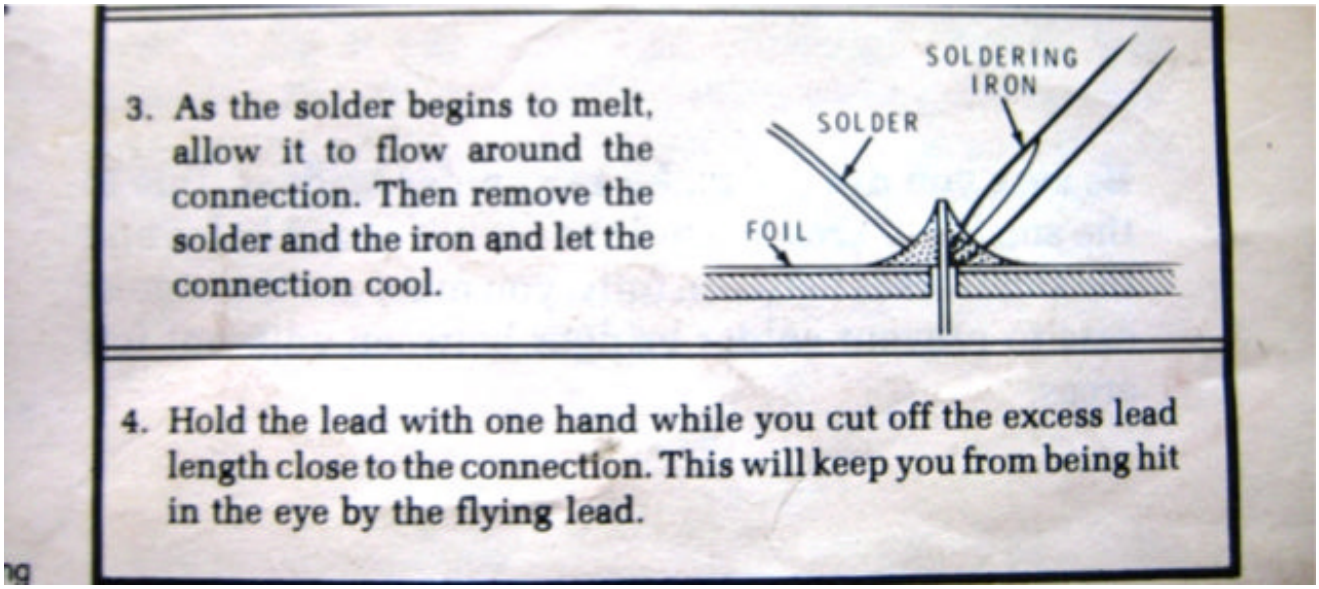
PROPER SOLDERING TECHNIQUE

Keep the soldering iron tip clean. Wipe it off on a wet sponge or cloth after it has come to temperature; then apply solder to it to give the entire tip a wet look. This "tinning" process will protect the tip and enable you to make good connections. When the solder tends to "ball" or not stick to the tip, the tip needs to be cleaned and re-tinned. Never use an acid core solder or paste fluxes. These will ruin your board. Below are some illustrations of the proper solder technique:

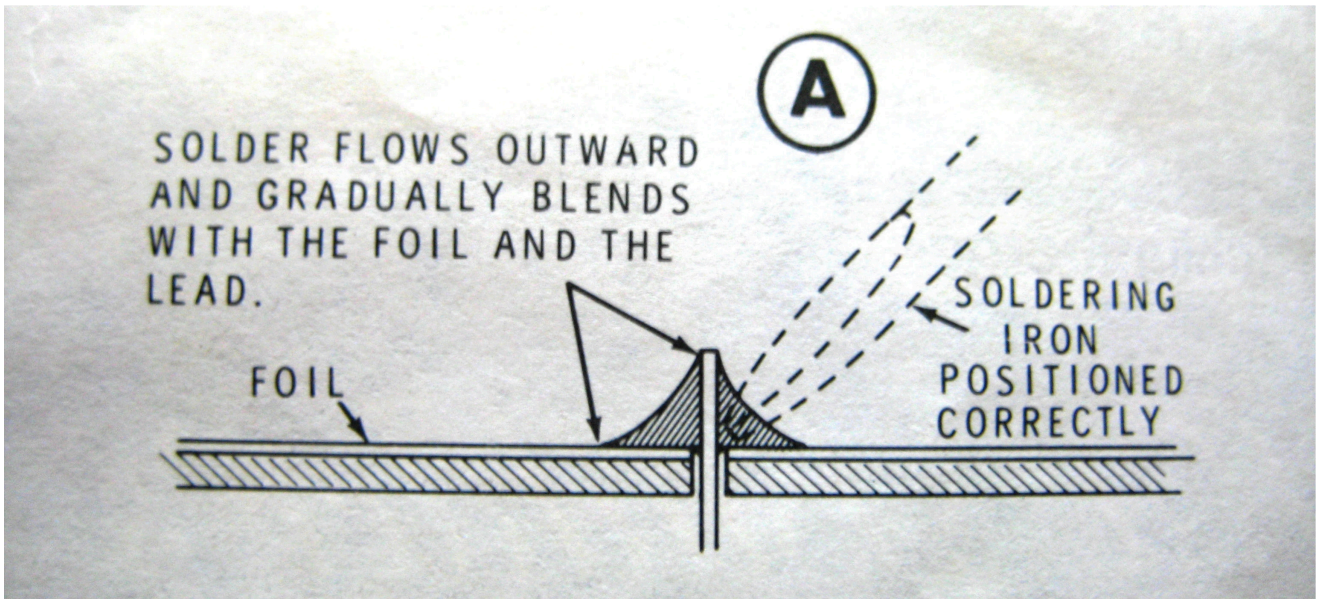




PROPER SOLDERING TECHNIQUE (cont)

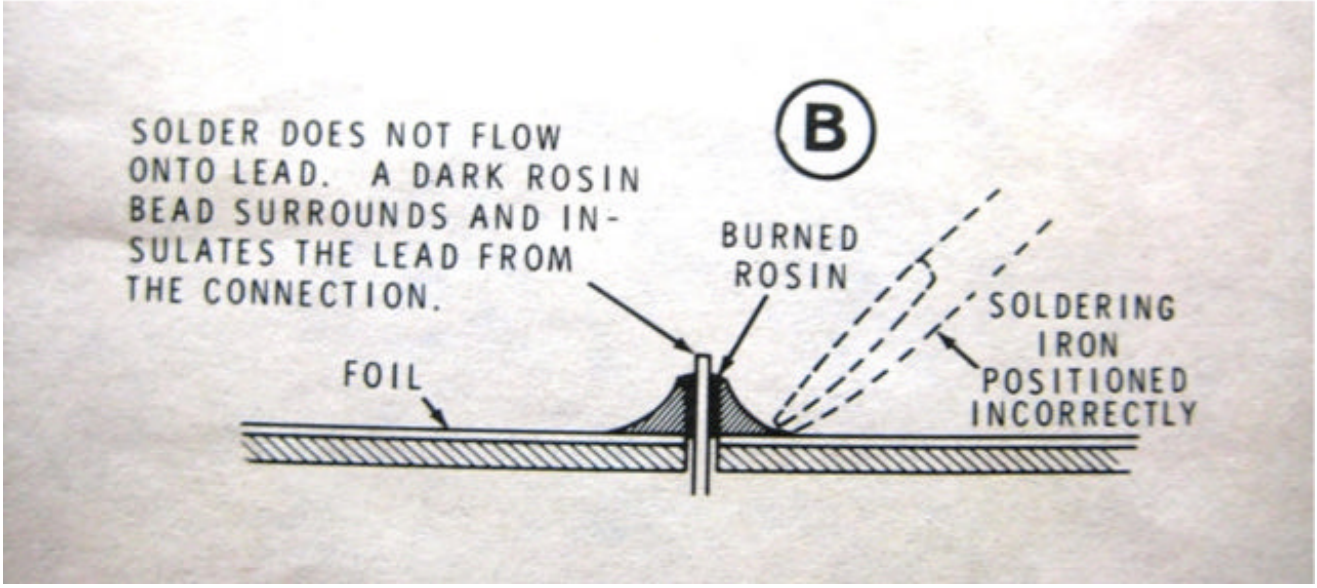


HOW TO CHECK YOUR SOLDERING JOINTS



A good solder joint is imperative for each and every joint you make. When both the lead and the circuit board foil are heated at the same, the solder will flow onto the lead and the foil evenly. See illustration A. The solder will then make a good electrical connection between the lead and foil. All your solder joints should look like this.

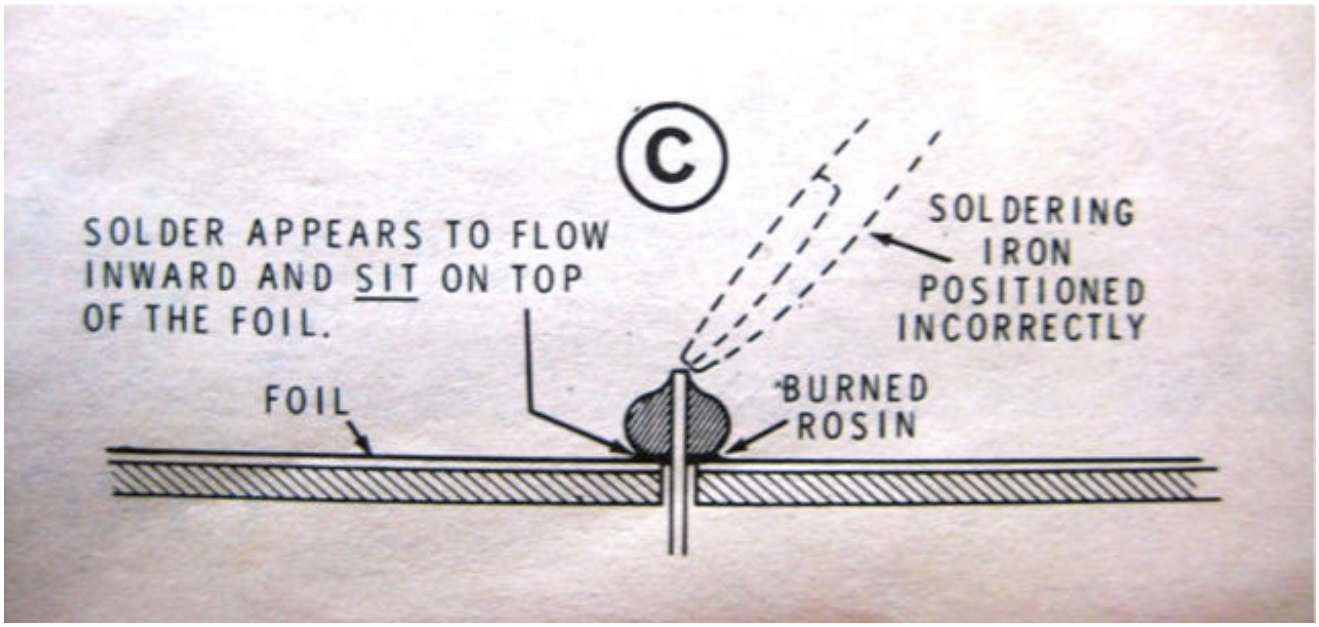
HOW TO CHECK YOUR SOLDERING JOINTS (cont)



When the lead is not heated sufficiently, the solder will not flow onto the lead as shown in illustration B. If this happens, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection as shown in illustration A.

When the foil is not heated sufficiently, the solder will blob on the circuit board as shown in illustration C. Reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection as shown in illustration A.

HOW TO CHECK YOUR SOLDERING JOINTS (cont)



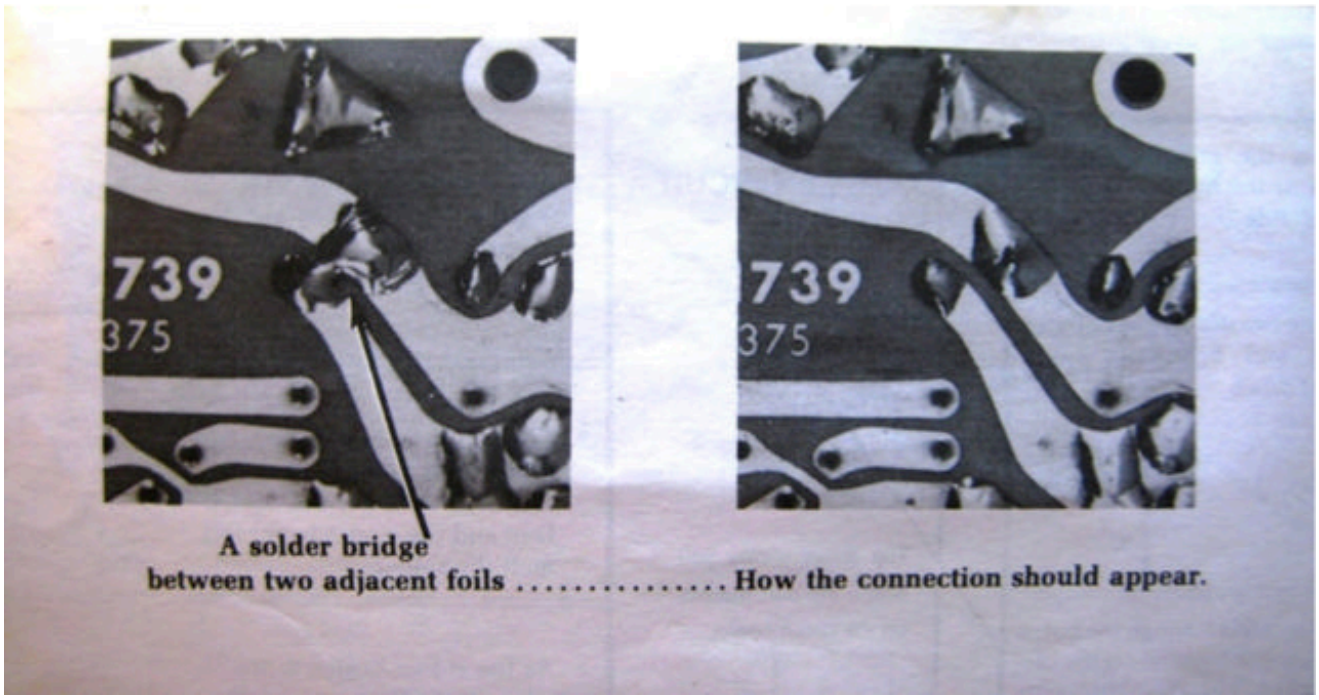
NOTE: Many soldering issues can be traced back to having a dirty (black colored) soldering tip. This condition can prevent the soldering tip from transferring heat to the part lead and circuit board foil. When the tip is contaminated by a black coating, solder will simply bead off it instead of flow to it. Trying to use a tip in this condition will only cause you to overheat the components and lead to frustration.

SOLDER BRIDGES

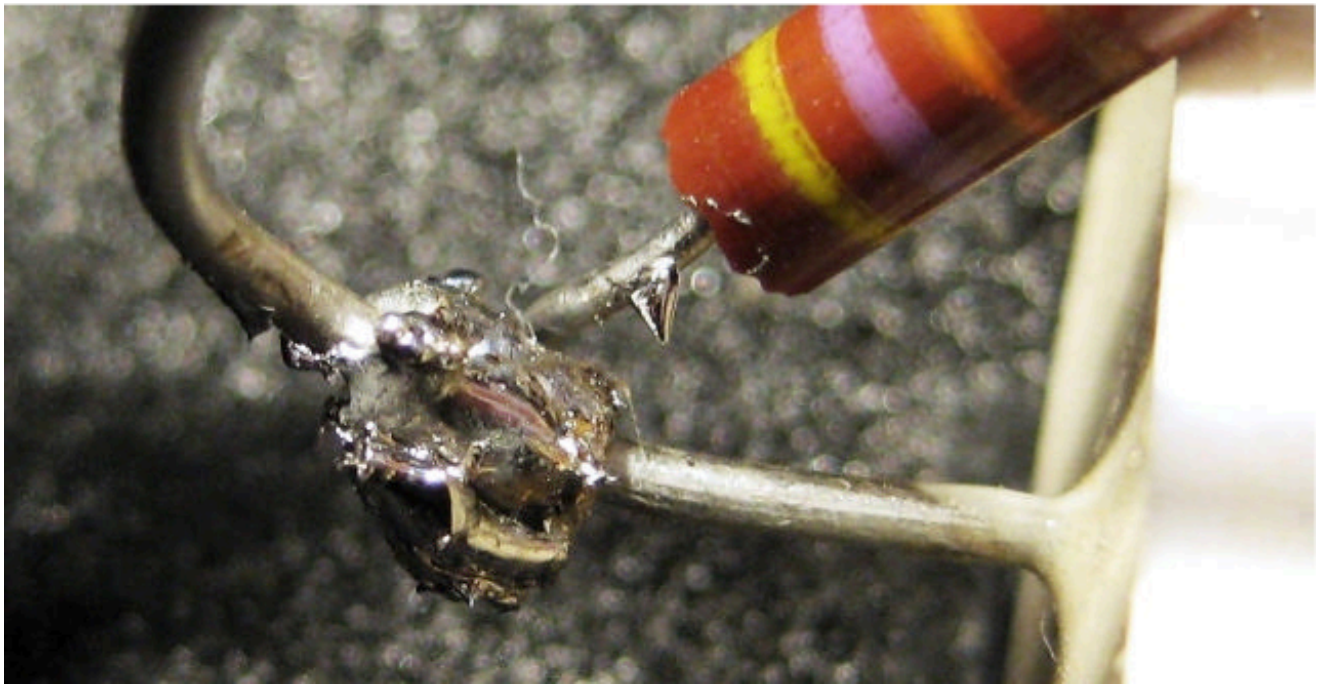
Be sure you didn't make any solder bridges. Due to the small foil area around the cir- cuit board holes and the small areas between foils, you must use the utmost care to prevent solder bridges between adjacent foil areas.

A solder bridge may occur if you accidentally touch an adjacent connection, if you use too much solder, or if you "drag" the soldering iron across other foils as you remove it from the connection. Always take a good look a t the foil area around each lead before you solder it. Then, when you solder the connection, make sure the solder remains in this area and does not bridge to another foil. This is especially important when foils are small and close together.

To see what a solder bridge looks like please refer to the illustration of a typical circuit board below.

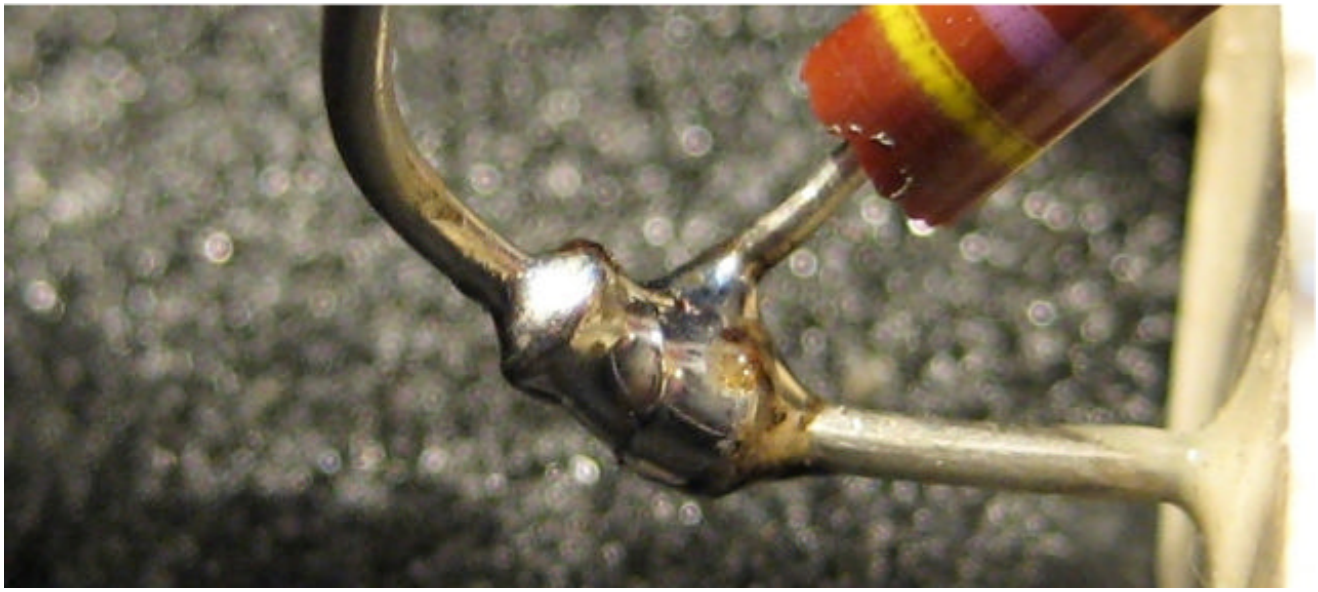


BAD SOLDERING RUINS GOOD SOUND



Above is an illustration of what happens when your soldering tip is contaminated (blackened) and won't transfer heat (or you just can't solder). The joint above is not making a good electrical connection. Below is the same joint after being properly soldered.

BAD SOLDERING RUINS GOOD SOUND (cont)



If you are new to the experience of soldering, please find some spare parts around and practice soldering things together until your work looks like the second picture above. Do not use your circuit board to learn on.

PRE-FLIGHT CHECK:

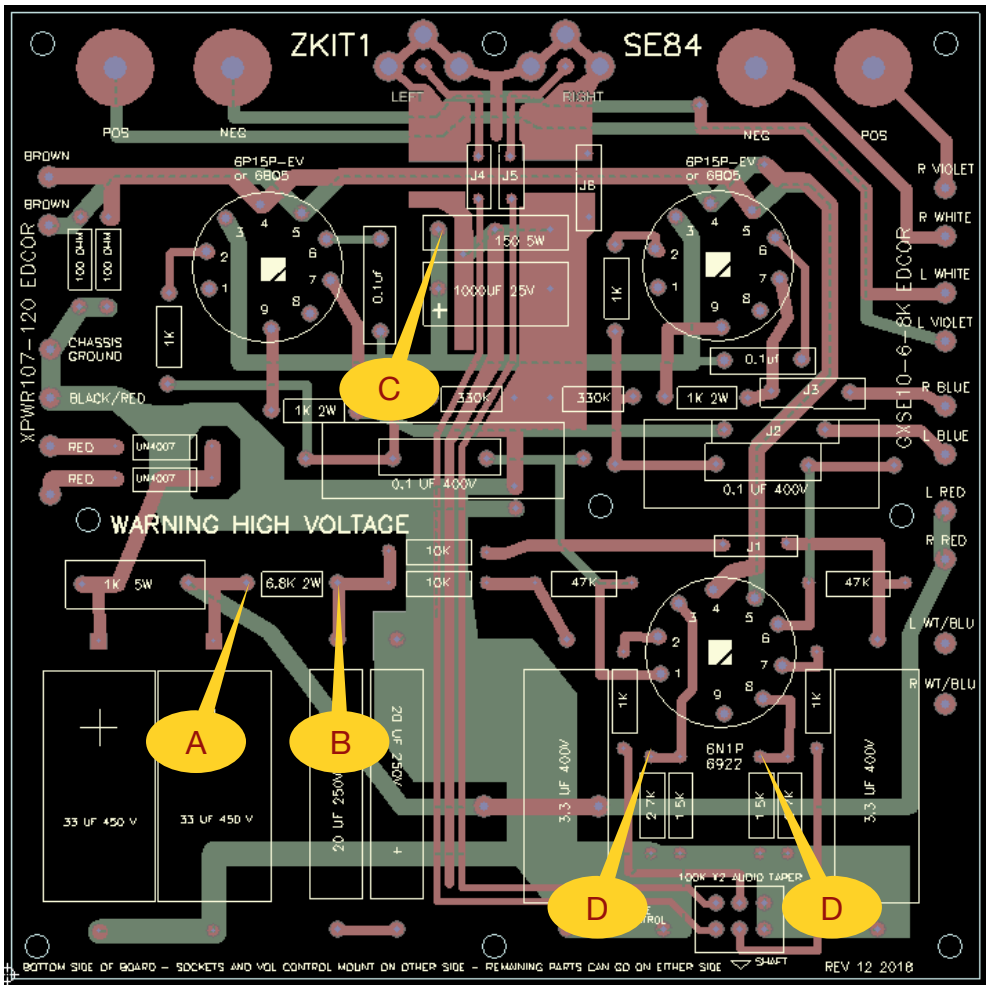
Before hooking the amplifier up to a pair of speakers, and before hooking up the inputs, turn the amp on, volume all the way down. Let it warm up. Check the following DC voltages at the following locations:

A) 346 VDC +/- 10 VDC

B) 309 VDC +/- 10 VDC

C) 10.25 VDC +/- 2 VDC

D) 2.60 VDC +/- 1/2 VDC

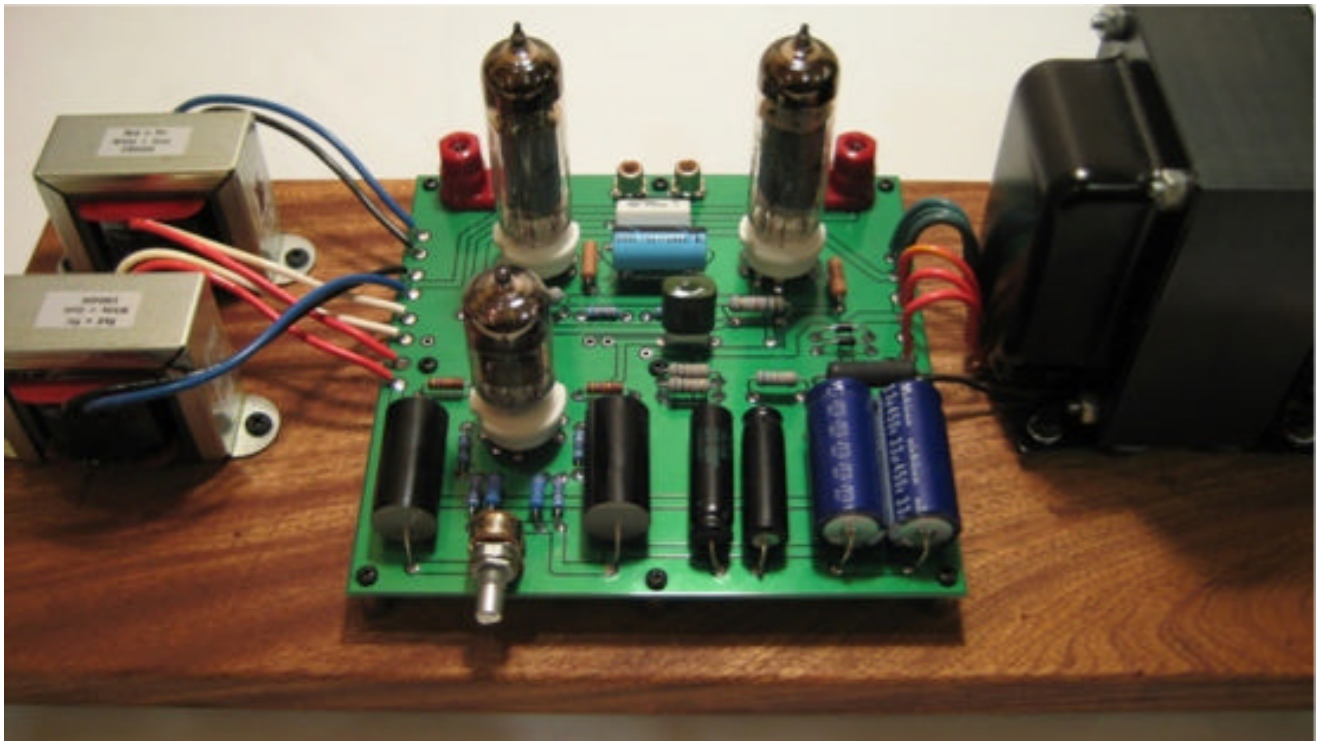


If all your voltages are close, it means that the tubes lit up and after warming up for several seconds begin to conduct current. This indicates that the amplifier is working. Next hook up a pair of speakers and turn the amp on with the volume control all the way down. If you don't hear any noise or hum, it's a good sign that all is well. Install a source and turn up the volume slowly. Your amplifier should be playing and it should sound good within 5 minutes. It will take around 50 hours before it fully breaks in and sounds it's best.

Tip:

If your building your amp on a piece of wood, you'll be putting most of the parts on the top side which has no silk-screening.

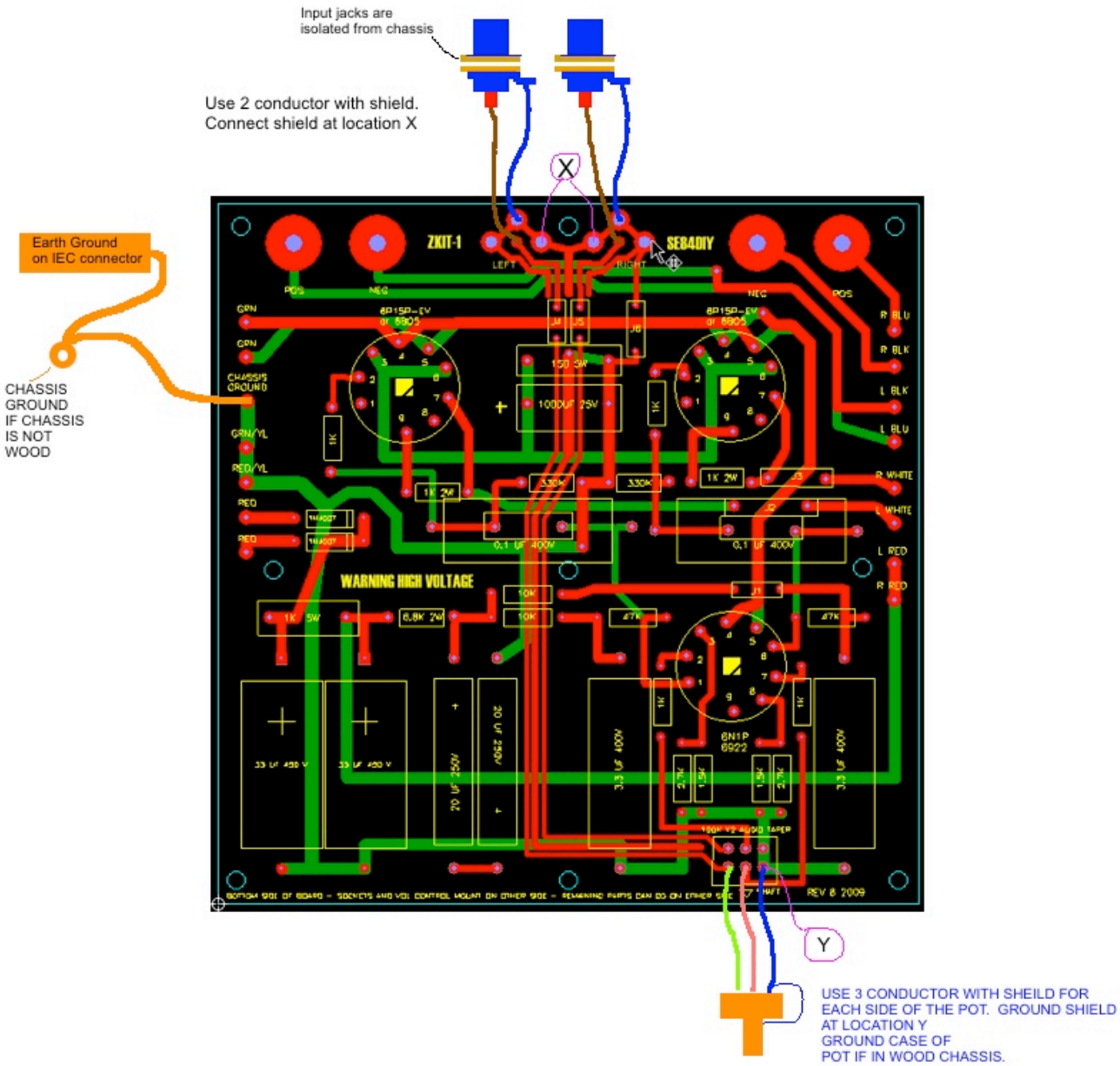
You might want to put a white dot on the top side of the board at each of the test points to help you find them after assembly.



Shown assembled with original Decware transformers which have different colored leads when compared to current version using Edcor transformers.

CHASSIS WIRING

Shown below on one of the earlier ZKIT1 circuit boards designed for Decware transformers. The present version should be handled exactly the same way.



TROUBLESHOOTING:

If you have technical difficulties with the amp and something does not appear to work correctly unplug the amp and double check each and every part to be sure it is the correct value for that location. Make sure the electrolytic caps are installed with the positive lead in the correct position. Make sure the diodes are installed with the stripe on the correct end. Check each solder joint to be sure it's good. Check for solder bridges. Check the tubes themselves. After all the above has been satisfied, turn it back on with the volume all the way down and re-check your voltages. Completing this process in it's entirety almost guarantees you will stumble upon the problem.

Hum and noise problems are usually either tubes, or ground issues. Make sure the board ground and the shield are tied together with a short jumper wire.

If the volume control works backwards, you put it on the wrong side of the board.

AMPLIFIER OVERVIEW:

It is a 2 watt x 2 SET amplifier made up from top grade USA made parts with proprietary Decware transformers. It is based around the 6P15P-EV aka SV83 output tubes which are one of the most linear tubes in the world. This tube was chosen over 300B, 2A3, 45's and so-on because of it's incredible speed and sonics.

This amplifier has only 1 capacitor and 2 resistors in the main signal path. Unlike other SET amps this one loves low impedances and increases in power all the way down to 2 ohms with outstanding dynamics. Wonderfully overbuilt design for a lifetime of service. Transparency and believable 3D imaging with near perfect timbre and unparalleled detail are just some of the areas larger more expensive amplifiers fall short on by comparison.

BRIDGING INTO MONO:

These amplifiers employee a unique floating output transformer scheme where the negative speaker wire is not tied to chassis ground. That means when the amp is bridged, both outputs may either be series or parallel wired. In series, both outputs work as one and transparency is preserved. In parallel as with most amps, the differences between the two channels work against each other and a slight reduction in transparency is seen.

So with no drawbacks to running the amps in mono, you can expect 6 dB of additional power rather then the expected 3dB. This is thanks to the power increase the amp has when it sees lower impedances. NOTE: To series the outputs, hook the left channel negative to the right channel positive with a length of wire. Use the remaining posts to drive the loudspeaker.

IDEAL SPEAKERS:

We have successfully driven hundreds of different loudspeakers ranging in efficiency from 90 to 100dB 1w/1m. On 90dB speakers it works nicely in smaller rooms or for late night out of body experiences. 94 to 96 dB speakers are almost ideal in that they let you play beyond a normal listening level and preserving the dynamic headroom. When this circuit was

first released in 1997 there were a minimal number of "high efficiency" speakers to choose from. Today that is no longer the case - they are everywhere. We also offer several different types of loudspeakers that will work with this amp. If you own speakers that you love and are afraid this may not drive them understand two things: A) It will drive them louder then you're expecting and B) you can bridge these amps into mono blocks. Because of the power increase into lower ohms, you will net 6dB of additional power. Same thing as doubling your power... twice.

TUBES:

This amp is designed for premium quality N.O.S. 6P15P-EV output tubes rated at 5000 hours. These Russian military spec tubes are the top grade of what we came to know in this country as the SV83. You can also use EL84's without adjustments of any kind. You'll find the SV83's to be unparalleled in speed and detail - in part because it is a video tube with much wider bandwidth then a normal audio tube. We think these are the best sounding most

transparent tubes available today. The EL84 (6BQ5) is a bit warmer sounding giving the amp a different signature by just switching output tubes.

The input tube is a single 6N1P, 6922 or 6DJ8 - your choice. 6N1P's have the warmest tone, 6922's have the best dynamics, 6DJ8's have the most air and micro-detail with a touch less bass. Again, a powerful tool for voicing your amplifier to your particular tastes.

Specifications:

Circuit type — Single ended Class A Triode

Power output — 2.3 watts RMS into 4 ohms, 5 watts RMS into 8 ohms when bridged

NOTE: Power increases as ohms decrease - Stable into 2 ohm speaker loads

Input voltage — 2.0 volts for full output

Noise / Hum — 1.5 millivolts

Response — determined by output transformer

Feedback — ZERO negative feedback used

Output tubes — SV83 or EL84/6BQ5

Signal tube — 6N1P or 6922 or 6Dj8

Biasing circuit — never needs adjustment

Consumption — 65 watts at full power

Suggested Speakers should be no less than 89dB 1w/1m — while 94dB 1w/1m or higher is ideal

SOME FINISHED ZKIT-1 AMPLIFIERS

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