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August 29, 2015

Thank-you for purchasing the ES4AC-4 power supply rebuild kit for the Drake AC-4 power supply.

First, a few words about SAFETY:

Electronic equipment like the AC-4 power supply contains voltages which can be considered LETHAL and capable of causing INJURY or DEATH. Please exercise CAUTION at all times when working on any electrical equipment.

Tools you will need:

Phillips screwdriver, Size 1 preferred
Long nose pliers
Side cutters, flush cutters, or lead trimmers
Soldering iron and a bit of 60/40 electronic solder

Tools that may be helpful:

3/32” drill
Wire strippers
Forceps or hemostat clamp
Tablet and pencil for taking notes
Digital camera for documenting
Masking tape to tag wires during disassembly

Procedure:

Determine the operating status of the power supply and radio BEFORE taking things apart. Is the radio working now? Is the power supply working now? You need to know where you are starting from or you may have difficulty finding your way home again.

The rebuild kit was specifically designed for an easy fit into early and later versions of the AC-4 power supply from the RL Drake Company. The “early” version (A) had all of the large electrolytic capacitors mounted by means of plates and sheet metal screws. The “late” version (B) had two of the large capacitors C2 and C4 soldered directly to the chassis, capacitors C4 and C5 were moved and the transformer was slightly larger with a thicker core. The (A) and (B) reference is applied to two sets of mounting holes on one of the circuit boards. Only one set will line up on either chassis.

The instructions are step-by-step. It is strongly recommended you read each step completely before starting the step. There may be a bit of information gleaned at the end of the step that you wished you had read just a minute earlier.

Tagging wires: The process of tagging wires is strongly recommended on any repair or rebuild project. True, the phasing on the secondary leads is not critical and they are color coded but it is a good idea to tag them anyway as referenced in the instructions. Masking tape and a ball point works fine.

(A) Unplug the AC power cord from the mains outlet.
(B) Disconnect the power supply cord from the powered equipment TR4, T4X, etc.
(C) Make sure you have completed step 1 and unplugged the AC power cord from the mains outlet.
(D) Do not plug the power cords in and reapply power until you have completed your work AND inspected it and removed any accidental short circuits and stray wire clippings.
(E) You may now remove the top and bottom covers on the AC-4 supply and place these items and the hardware aside.

Before beginning the installation please take whatever time is necessary to familiarize yourself with the power supply as built. An enlarged copy of the original Drake schematic and pictures identifying the original components has been provided. The component designations on the new kit have been chosen to agree with the original nomenclature in an attempt to eliminate any confusion in the conversion. Take the schematic copy and take the time to trace out the wiring. Make certain that the unit you are going to work on is in agreement with the documentation provided. Make the information presented there “your own”. Do not assume or get in a hurry. There is no prize for being fast, only for being right. If something doesn’t look right, contact me before proceeding. It is much easier to provide assistance before it becomes a pile of loose parts. Manufacturers have been known to deviate from what is generally accepted as “gospel” in the midst of a production run and that can make life interesting.

Now that you are intimately familiar with the AC-4 supply you are ready to proceed with the disassembly stage:
You did unplug the supply from the mains outlet, right?

With the supply resting on its top and the cables and bias pot toward you the HV section is on your left and the LV / BIAS section is on your right. In this orientation the rear chassis apron is closest to you and instructions referring to the bottom end of a terminal strip will be the end closest to you. Start with the HV section, it is easier and brings that sense of accomplishment sooner.

(0) Unsolder and remove the four diodes (D1, D2, D3, D4) from the terminal strip which has the RED transformer wire (X1) connected to it. It is located immediately to the right of the two large capacitors C1 and C2.
(1) Unsolder and disconnect the RED transformer wire (X0) from negative end (-) of C1. Relocate this wire to the now vacant lug on the terminal strip directly below the other RED transformer wire (X1). Do not solder the connection at this time. Another RED wire from the new circuit board will be attached later.
(2) Unsolder and disconnect the WHITE/ORANGE wire (HV) from the positive end (+) of C1.
(3) Unsolder and remove the line capacitor C11 located in the upper left corner of the chassis. It is connected between the ground lug of capacitor C2 and the terminal strip with the line choke and the WHITE/BROWN wire which goes to either the line voltage selector switch or the transformer primary, depending on which version supply you have. If you don't want to unsolder the capacitor from the terminal strip you may just clip it. The new capacitor will be mounted in a different location later. If you do unsolder it, take a moment to touch up the terminal strip connection now. Don't leave it to be forgotten later.
(4) Remove the capacitors C1 and C2 and the resistors R1 and R2 from the chassis. If you have the older version of the supply the capacitors are mounted on small plates easily removed by removing the two mounting screws at each capacitor. If you have the newer version only C1 is mounted with a plate to isolate it from chassis. C2 is soldered to the chassis and can be a bit of the challenge to unsolder and remove it.
(5) Remove the AC line fuse from the fuse holder. Unsolder and remove the line capacitor C12 connected between the rear terminal of the fuse holder and chassis ground. Clean the old solder from the lug of the fuse holder and the ground connection at the terminal strip.

(6) Select one of the two new BLUE 0.01µfd line capacitors from the parts bag and install one lead of the capacitor through the rear lug of the fuse holder and the remaining lead through the ground lug on the terminal strip. Solder both connection points and trim the leads after soldering. Reinstall the fuse in the holder.

(7) The new HV board ES4AC-4PS-1 is mounted on top of the chassis by two #4 x ½" sheet metal screws and two ¼" #4 spacers. Four mounting holes are provided in the board lining up with the original mounting holes for C1 and C2. However, only two screws and spacers are required for a secure connection. The two holes at opposite corners of the board are recommended as easiest to access. If you have the newer (B) chassis where the capacitor C2 was soldered direct to the chassis you must drill one 3/32" diameter hole for the mounting point located nearest the connection point labeled HV. Optionally, you can use the two holes where C1 was mounted but I prefer the improved support afforded using the holes at corners of the board. Even if you have to drill a hole it is easy enough to do. Just utilize the board as a template by holding it in place locating one hole directly over an existing mounting hole and mark the new hole location with a pencil.

(8) Mount the board in place oriented with the two large capacitors near the end of the chassis. Hold a spacer in place with long nose pliers, insert a screw through the board from the top and partially tighten. Install the second screw and spacer in like fashion and completely tighten both screws. Use care not to over tighten the screws lest you strip out the holes and have to dash to the hardware store to procure alternative hardware. Even though the mounting locations are actual mechanical ground connections a separate ground wire connection is provided so you don't need to "bury" the screws to achieve a good connection.

Return the chassis to the bottom up orientation and make the following connections:

(9A) Route the WHITE/ORANGE wire HV, +650 VDC, WH/OR from the circuit board to the terminal strip lug with the ORANGE wire from the power supply output cable. Remove the original Drake WHITE/ORANGE wire and connect the new WHITE/ORANGE wire in its place. Older supplies this terminal is near the fuse holder. Newer supplies have it located near the BIAS potentiometer.

(9B) RED wire connected to circuit board X0 goes to the RED transformer lead X0 previously re-located to a vacant terminal on the terminal strip. Solder 2.

(9C) Red wire connected to circuit board X1 goes to the Red transformer lead X1 on the terminal strip lug. Solder 2.

(9D) Route the GRAY wire from the circuit board GND to the vicinity of vacant ground lug at the bottom of the terminal strip near center of chassis. Do not solder at this time. Additional wires will be added later. In some supplies there is no vacant lug here. In those cases you will use the leftover two terminal strip in steps below.

(10) Inspect the work just completed steps 1 through 9D. Take a break, you are half done!

Proceed to the LV/BIAS area on the right hand end of the chassis.

(11) Unsolder and disconnect the 6.8KΩ resistor from the one end of the BIAS potentiometer. This should be connected to the lug nearest the bottom cover of the supply.
(12) Unsolder and disconnect the 10KΩ resistor from the other end of the BIAS potentiometer. This should be the lug nearest the chassis deck.
(13) DO NOT remove the bare wire from the center terminal of the BIAS potentiometer. Instead, cut this bare wire near the terminal strip ground lug where it is soldered. You do not need all of the wire but you will need some of it so unsolder and pull it through the lug on capacitor C5 where it is connected
(14) Unsolder the BLUE transformer lead and GREEN power output cable lead connected to (-) C5. BLUE is referenced as X4 on new drawing and GREEN is the BIAS lead.
(15) Unsolder the remaining BLUE transformer lead where it connects to the small terminal strip located between C3 and C4. This lead is referenced as X5 on the new drawing.
(16) Unsolder the YELLOW transformer lead where it connects to the junction between the (+) terminal of C4A and the (-) terminal of C3. This lead is referenced X2 on the new drawing.
(17) Unsolder the remaining YELLOW transformer lead that connects to the terminal strip at the junction of D5 and D6. This lead is referenced X3 on the new drawing.
(18) Unsolder and remove the three diodes D4, D5, D6 connected between terminal strip and capacitors C3 and C5.
(19) Unsolder the small gauge YELLOW (LV) wire from the power output cable where it connects to capacitor (+) terminal of C4B. DO NOT just cut the wire, it is short enough already in some supplies.
(20) Unsolder the GRAY wire from the power supply output cable from the ground lug of the two terminal strip (now vacant) located between capacitors C3 and C4. You may remove the empty terminal strip. Hint: You may want to save the terminal strip for a later project. The terminal strips are getting hard to find. Hint: You may need this strip if there was no vacant terminal mentioned in step 9D above
(21) Remove the three can capacitors C3, C4, C5 from the chassis. Again, older supplies utilized mounting plates and they are easily removed by removing the two mounting screws at each capacitor. Newer supplies require the can lugs be un-soldered from the chassis.

Please read the entire next step (22) before proceeding.

(22) The new board ES4AC-4PS-2.2 is mounted in same manner as the first board. The correct position is when the electrolytic capacitors are nearest the end of the chassis. There are six circuit board mounting holes provided that line up with the original capacitor bracket mounting holes on the chassis. There are two holes (A), two holes (B) and two holes (A/B).
The holes (A/B) line up with the mounting holes for the old C3.
The holes (A) line up with mounting hole for the old C5 on one end and a mounting hole for old capacitor C4 on the other end.
The holes (B) line up with a mounting hole for the old C5 and a hole that is used to secure a small terminal strip under the chassis for two transformer leads. The extra small terminal strip was required to facilitate transformer primary wiring if a line voltage selector slide switch was included on the front apron of the chassis. Most all “late” version supplies have the switch. If you are working on a “late” version supply and it does not have the switch or the small terminal strip you will need to drill a 3/32” hole at this location.
If the terminal strip is present, remove its mounting screw. You will be replacing that screw with a #4 x ¾” machine screw and nut during the mounting of the circuit board. If there is no terminal strip, drill a 3/32” hole at that location using the hole in the board as a template to mark the hole.
Mount the board using three #4 x ½” sheet metal screws with ¼” spacer under holes (A/B) and at hole (B) at the rear edge of the chassis.
Install a #4-40 x ¾” machine screw and ¼” spacer into the second hole (B) and into terminal strip mounting hole or a newly drilled hole. It is a snug fit but the screw will thread into the hole without need to enlarge the hole. With the terminal strip foot in place over the new machine screw install a #4-40 nut with captive lock washer to secure the terminal strip to the chassis. If the terminal strip is not present, just install the #4-40 nut at that location.

(23) With the board mounted in place make the following connections:

(24A) Solder the WHITE/GREEN wire from the board to the lug of the BIAS potentiometer nearest the chassis deck.
(24B) Place 1-¼” of clear spaghetti tubing over the bare wire connected to the center terminal of the BIAS potentiometer. Trim the bare wire leaving ¼” for connection, insert into pad P2 and solder it. Push the wire through the hole in the board and solder from the top side of the board.
(24C) Solder the WHITE/BLUE wire from the board to the lug of the BIAS potentiometer nearest the bottom plate of the chassis.

(24D) Insert the stripped end of the small gauge GREEN wire from the outgoing power cable into the board pad labeled BIAS and solder it from the top of the board.
(24E) Insert the stripped end of the small gauge YELLOW wire from the outgoing power cable into the circuit board pad labeled LV, +250 VDC and solder it from the top of the circuit board.
(24F) Route the GRAY wire from the circuit board GND to the vicinity of the bottom lug of the terminal strip near the center of the chassis. If there is no open lug at the bottom of that terminal strip you will have to use the vacant two lug strip from Step 20 above.
(24G) Insert the stripped end of the BLUE transformer wire from Step (14) into the circuit board pad labeled BU/X4 and solder it from the top of the board.
(24H) Insert the stripped end of the remaining BLUE transformer wire from Step (15) to the circuit board pad labeled BU/X5 and solder it from the top of the board.
(24J) Insert the stripped end of the YELLOW transformer wire from Step (16) into the circuit board pad labeled YL/X2 and solder it from the top of the board.
(24K) Insert the stripped end of the remaining YELLOW transformer wire from Step (17) into the circuit board pad labeled YL/X3 and solder it from the top of the board.

That completes the connections to the second circuit board and you are nearly done. Take a moment to inspect the top of the circuit board looking for inadequate connections or solder bridges between adjacent pads.

The remaining steps are performed at the large terminal strip near the center of the chassis.

(25) Select the new blue 0.001µfd ceramic capacitor from the parts kit, put 3/4” of clear spaghetti tubing on each lead and replace the old 0.001µfd disc ceramic capacitor C10 located between the bottom #1 (GND) lug of the terminal strip (nearest the rear apron of the chassis) and the lug that is 4th from the bottom where the BROWN small gauge wire from the outgoing power cord connects to the transformer primary lead(s). Insert the capacitor lead into the LOWER (round hole) part of the terminal strip lug but DO NOT solder the connection yet. More leads will be added later.
(26) Select the remaining 0.01µfd new BLUE capacitor from the parts kit and install it between the bottom #1 (GND) lug on the terminal strip and the lug that is 2nd from the bottom where the small gauge WHITE/BROWN wire from the Neutral line connection terminal strip in the upper left corner of the chassis. Insert the capacitor lead into the BOTTOM part of the terminal strip lug and solder the two capacitor lead connections leaving the top part of the lug open.

(27) Insert the three small gauge GRAY wire leads from the two circuit boards and the outgoing power cable into the top part of the terminal strip bottom ground connection. Solder the three GRAY wires at this time. If there is no vacant lug here you will use the empty two terminal strip from above or a ground lug somewhere. The object is to have all three GRAY wires connected together at a common ground point.

At this point you have completed the installation of the conversion kit! Please make one final inspection for loose wire clippings and quality solder connections.

Test and reassembly:

If you have a multi-meter capable of measuring at least +700 VDC it is always prudent to make a few tests to verify the rebuilt supply is working correctly before closing it up and connecting the radio. It is time to test the completed supply.

EXERCISE EXTREME CAUTION IN THE FOLLOWING STEPS

Connect the power supply output cable to the radio set OR you may elect to test the supply stand-alone by jumping the AC line switch connections.
Plug in the AC power cord to the mains supply outlet. Switch on the radio if connected. With multi-meter set to measure HV and the negative lead connected to chassis there should be approximately +680 to 740 VDC on the ORANGE wire in the power cable (pin 10). There should be approximately +240 to 300 VDC on the YELLOW wire in the power cable (pin 11). The BIAS voltage on the GREEN wire in the power cable (pin 9) should be variable from -40 VDC to -75 to -100 VDC. The bias will be set after the radio is connected per the radio set instructions. Please remember the readings above are “typical” values measured with a TR4-C connected and in receive mode and they may vary and are dependent on individual AC power line voltages. No load voltages obtained by jumping the line switch leads without a radio connected will be higher than values shown above.

Assuming everything has checked out correctly you may proceed
Unplug the AC power cord from the mains outlet.
Disconnect the power supply output cable from the radio.
Install the top and bottom covers on the power supply.
Connect the output power supply cable to the radio.
Plug the line cord into the mains outlet and switch on the radio.

Enjoy your rebuilt power supply which should continue to provide many additional years of service.

CONTENTS

Each ES4AC-4 kit contains the following:
(1) ES4AC-4-1 circuit board for HV supply
(1) ES4AC-4-2.2 circuit board for LV/BIAS supply
(2) 0.01 µF @ 250 VAC ceramic line capacitors
(1) 0.001 µF @ 250 VAC ceramic line capacitors
(5) #4 x ½" sheet metal screw
(6) #4 x ¼" spacer
(1) #4-40 x ¾" machine screw
(1) #4-40 nut with captive lock washer
(2.5") #20 clear spaghetti tubing

SOLDERING AND VINTAGE ELECTRONICS:

Many times when working on vintage electronics I have found that old connections do not want to re-solder properly. Old wiring, transformer leads, and terminal strip connections seem the worst. The wiring gets contaminated from the insulation jacket material. The lugs have oxidized. These surfaces usually need a bit of cleaning by sparingly applying a bit of flux, heating the part to get the flux to do its job, re-tinning with new solder, and cleaning away any flux residue. Then the connection is ready to be re-soldered with the new or added component.

I mention this because I just encountered it on one of the AC-4 supplies I rebuilt. The connection at the terminal strip with the Red transformer leads soldered, looked satisfactory at a glance, but the supply did not operate! Closer inspection revealed that the solder had all but avoided the old transformer wire leaving it disconnected. The Blue and Yellow transformer leads were also in need of cleaning before attaching them to the new circuit board. Capacitor leads inserted into the bottom of the terminal strip lugs were being stubborn about soldering to the lug. The solder just does not want to flow properly.

Just a tiny bit of flux applied to these areas completely resolves the problem. Usually I just assume I will have a problem and remove all the leads from a lug, apply a speck of flux, heat the lug and work the flux around with the soldering iron tip until the lug is clean. I wash off any flux residue with a cotton swab soaked in rubbing alcohol before proceeding to assembly.

I sincerely hope that your power supply rebuilding experience with the ES4AC-4 is trouble free and rewarding. Please do not hesitate to contact me with any questions or comments.

Paul K0UYA

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April 17, 2013

hank you for purchasing the ES4AC-4 power supply rebuild kit for the
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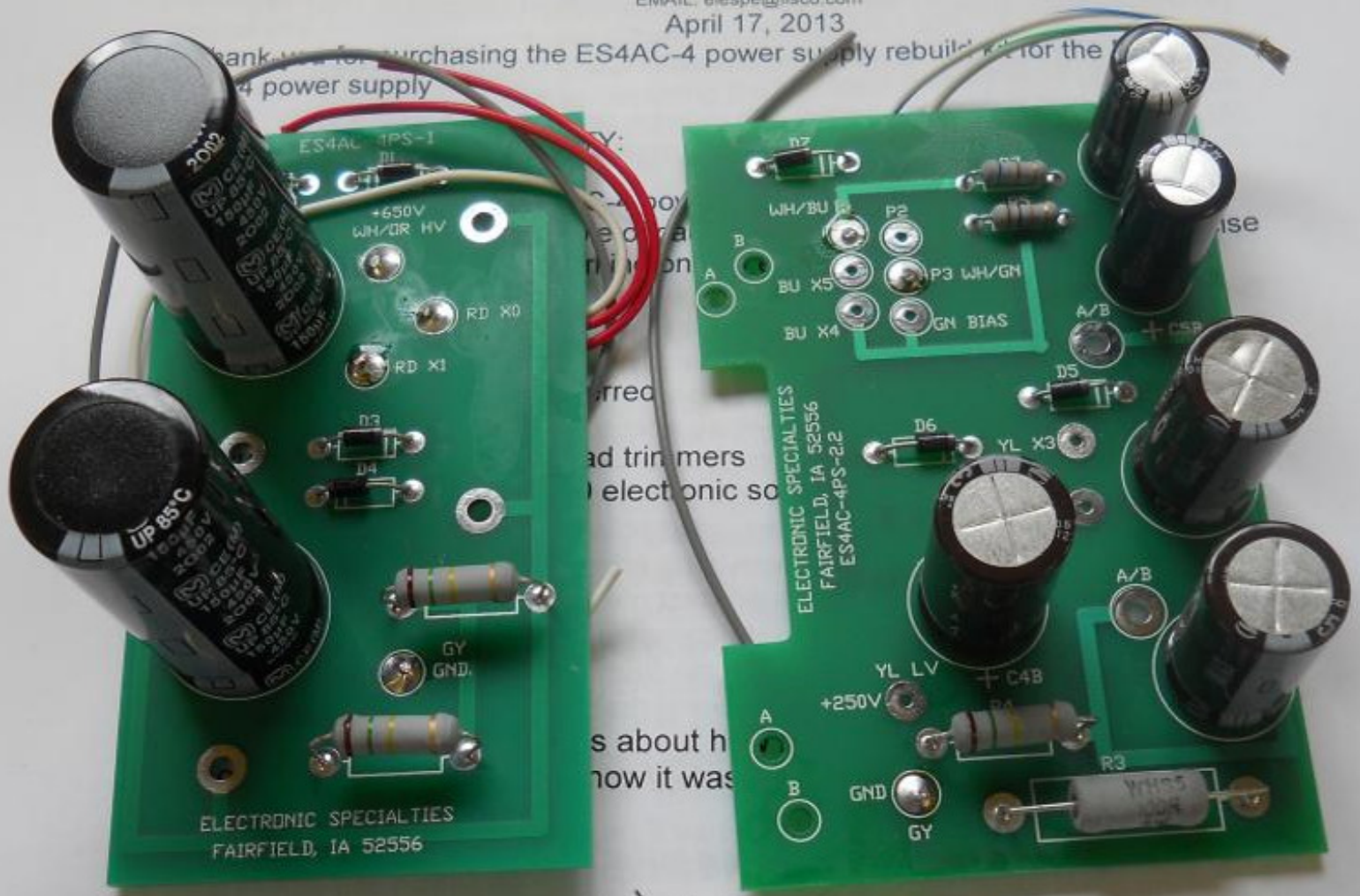
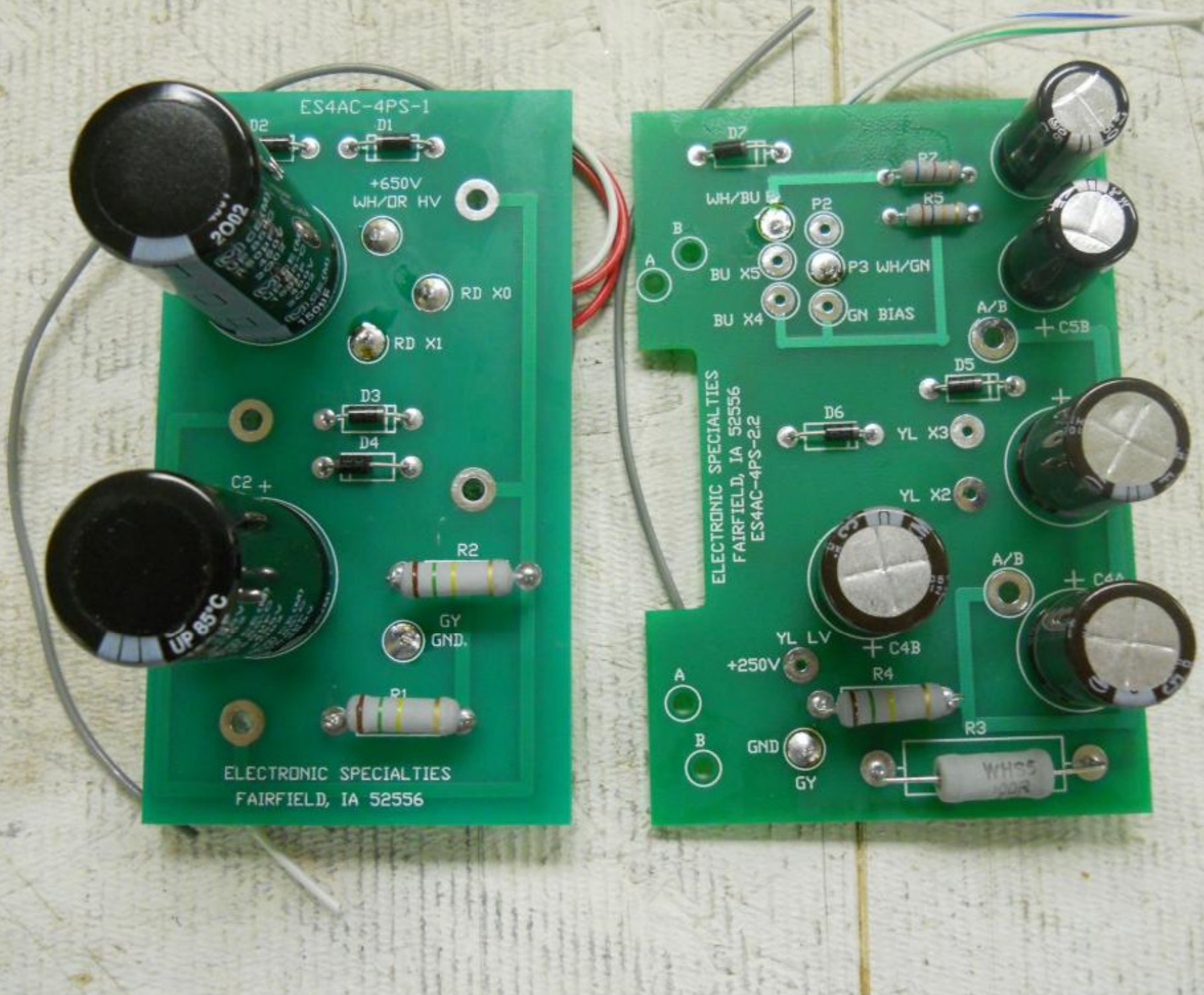


Determine the operating status of the supply and radio BEFORE taking *things apart. Is the radio working* power supply working now? You *need to know where you are starting from or you may have difficulty finding your way home again.*

The rebuild kit was it into early and later *versions of the AC-4 supply* Orake. The "early" version (A) had all of the large electrolytic capacitors mounted by means of plates and sheet metal screws. The "late" version (B) had two of the large capacitors C2 and C4


ES4AC-4PS-1
D2
D1
+650V
WH/OR HV
RD X0
RD X1
D3
D4
C2 +
R2
GY
GND.
R1
ELECTRONIC SPECIALTIES
FAIRFIELD, IA 52556
D7
P7
WH/BU
P2
R5
B
A
BU X5
P3 WH/GN
BU X4
GN BIAS
A/B
C5B
D5
D6
YL X3
YL X2
ELECTRONIC SPECIALTIES
FAIRFIELD, IA 52556
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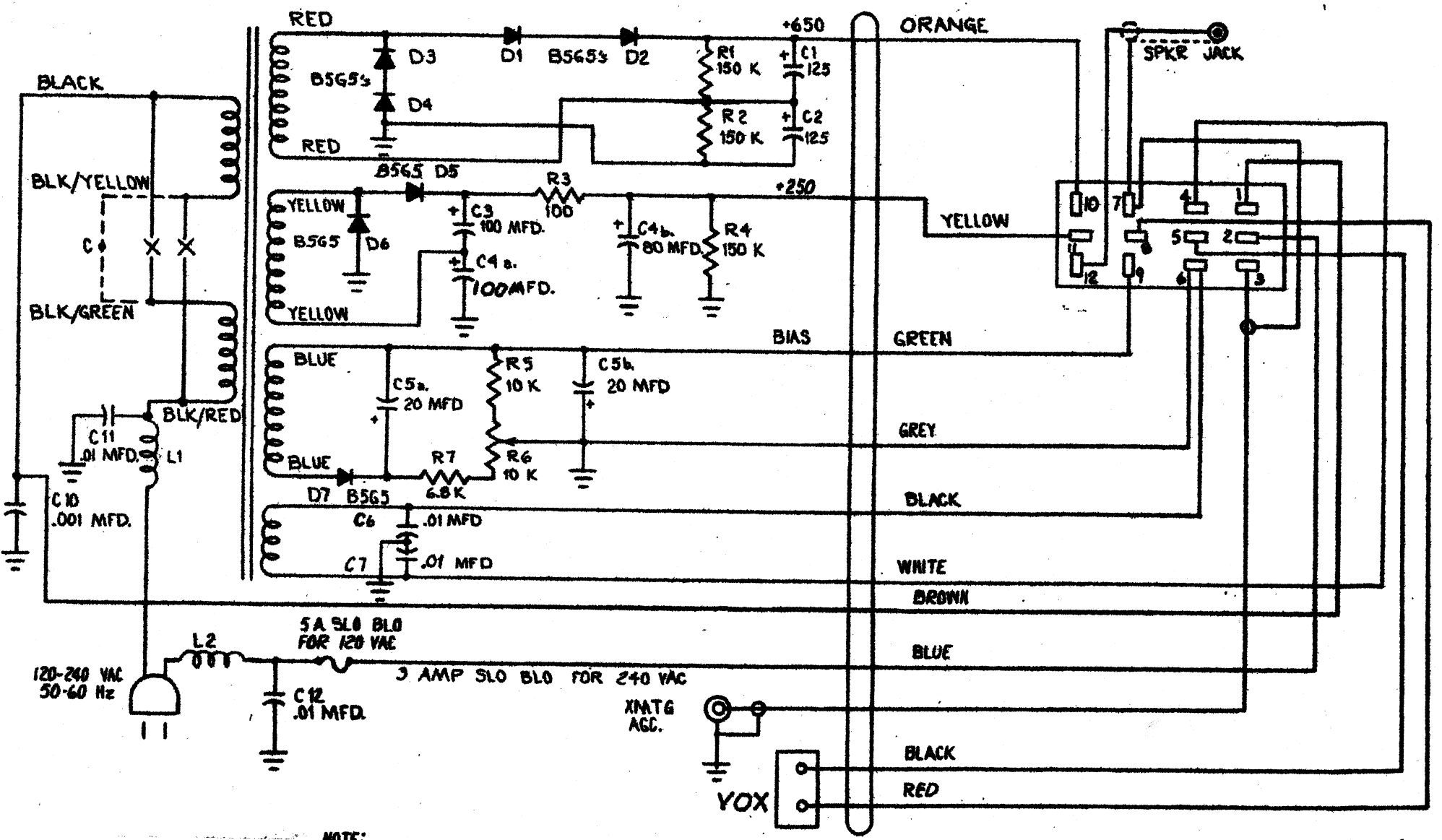
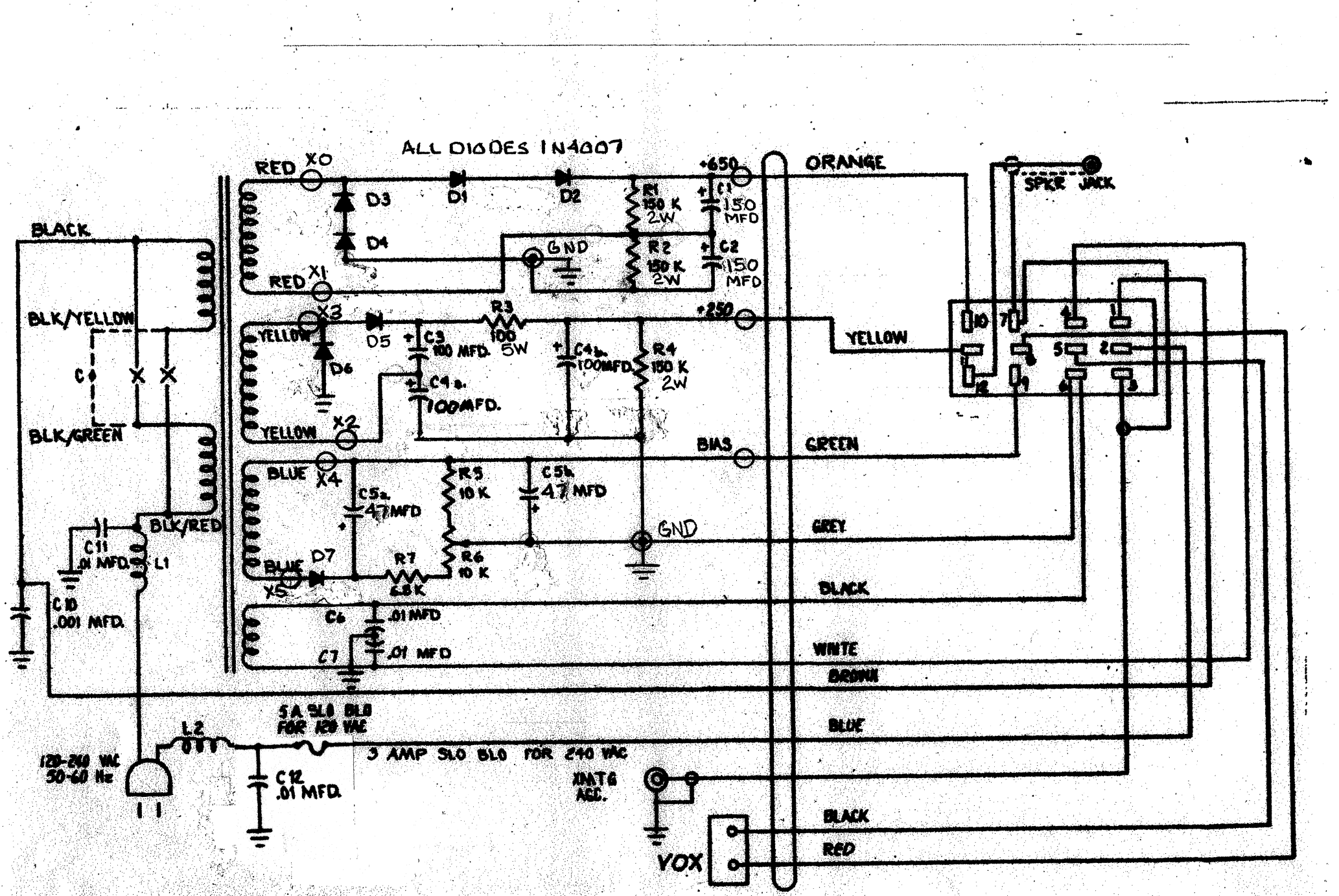


NOTE:
FOR 240 VAC OPERATION DISCONNECT WIRES MARKED ——X—— AND CONNECT - - - - - - . AN EXTRA TERMINAL IS PROVIDED FOR CONNECTION C.

DRAKE

MODEL AC-4 POWER SUPPLY

Original Drake AC-4 power supply "as built"



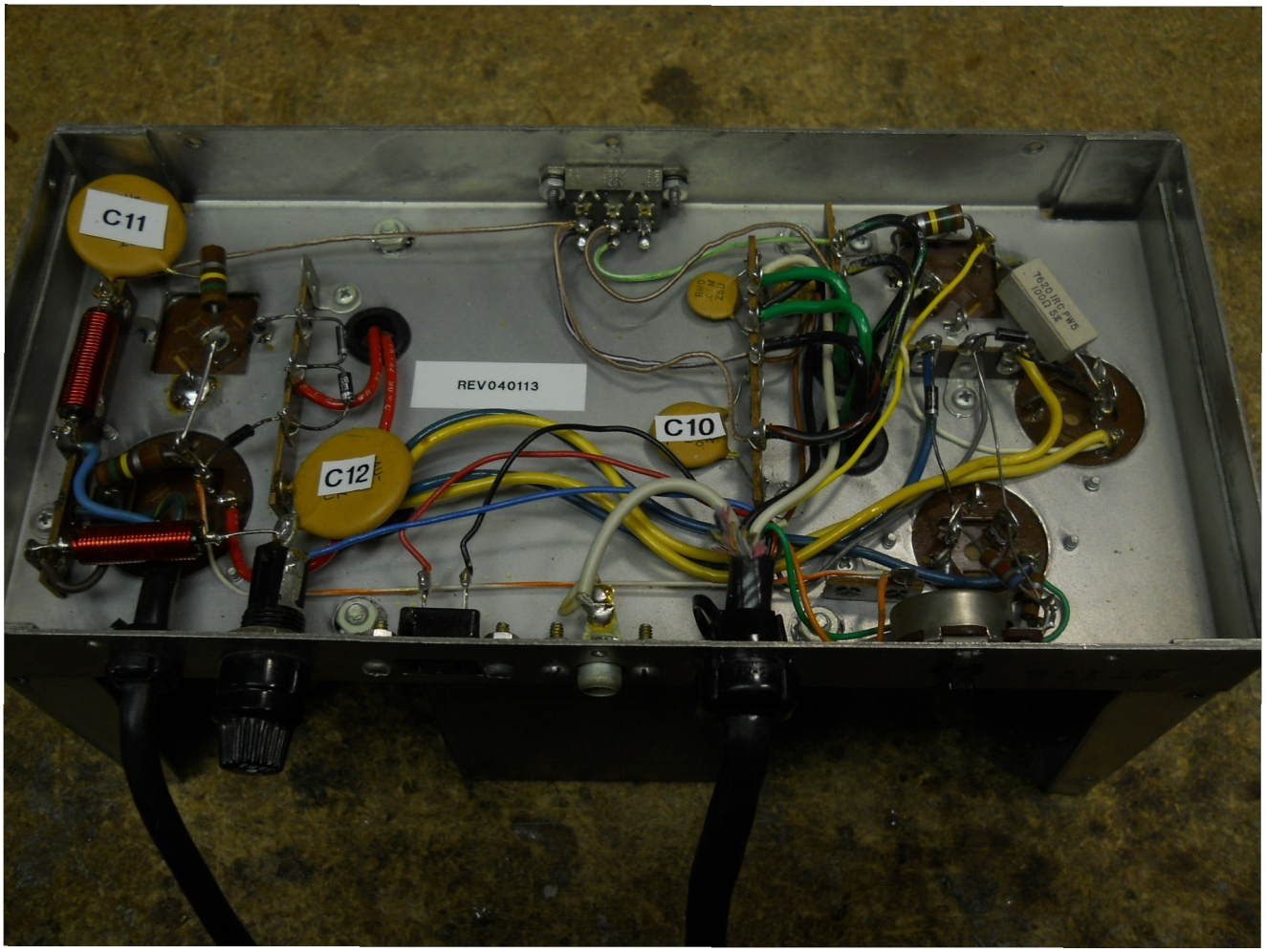
NOTE:
FOR 240 VAC OPERATION DISCONNECT WIRES MARKED —X— AND CONNECT ------. AN EXTRA TERMINAL IS PROVIDED FOR CONNECTION C.

DRAKE

MODEL AC-4 POWER SUPPLY

AC-4 supply modified with ES4AC-4PS

—⊖— denotes circuit board connection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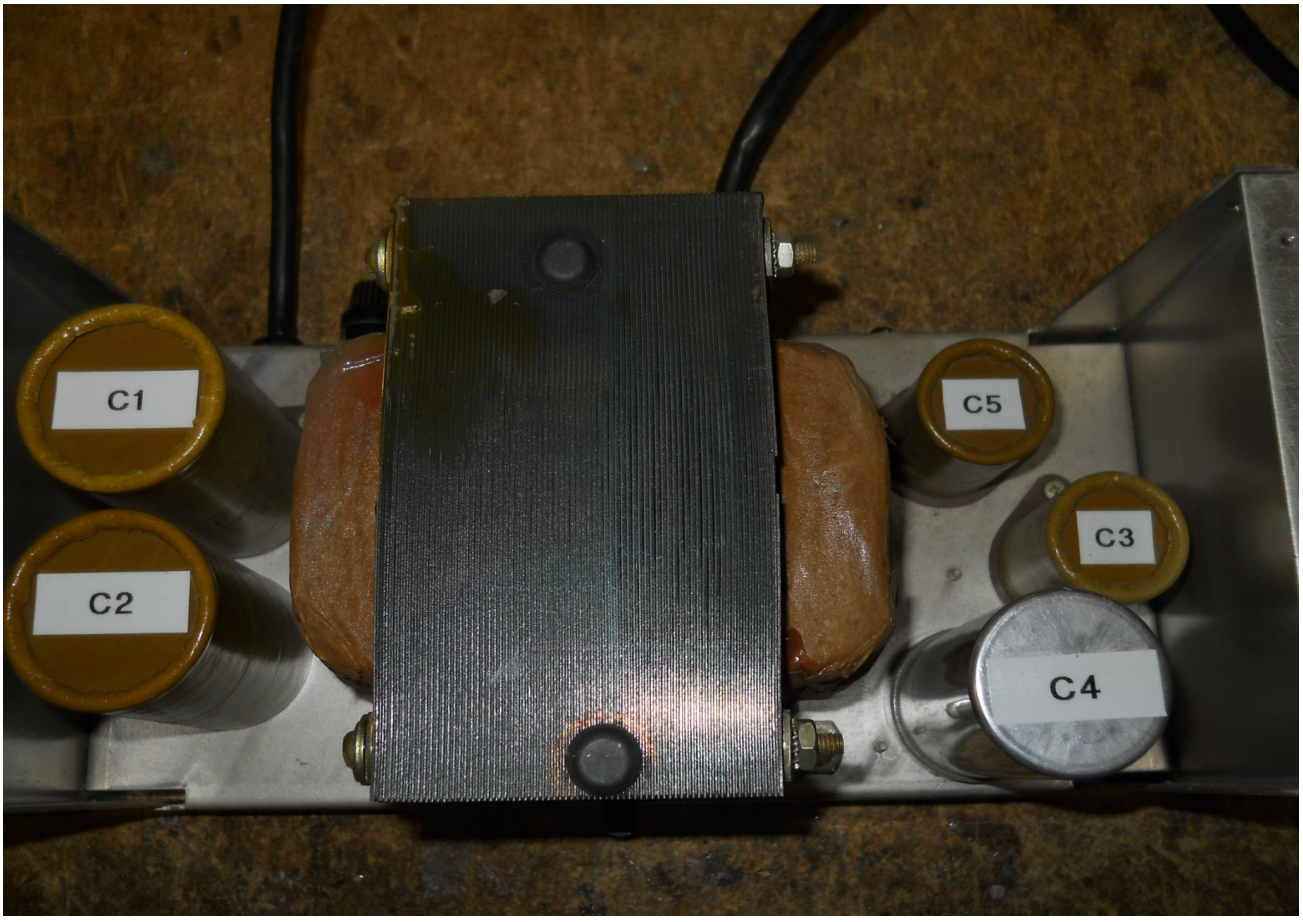
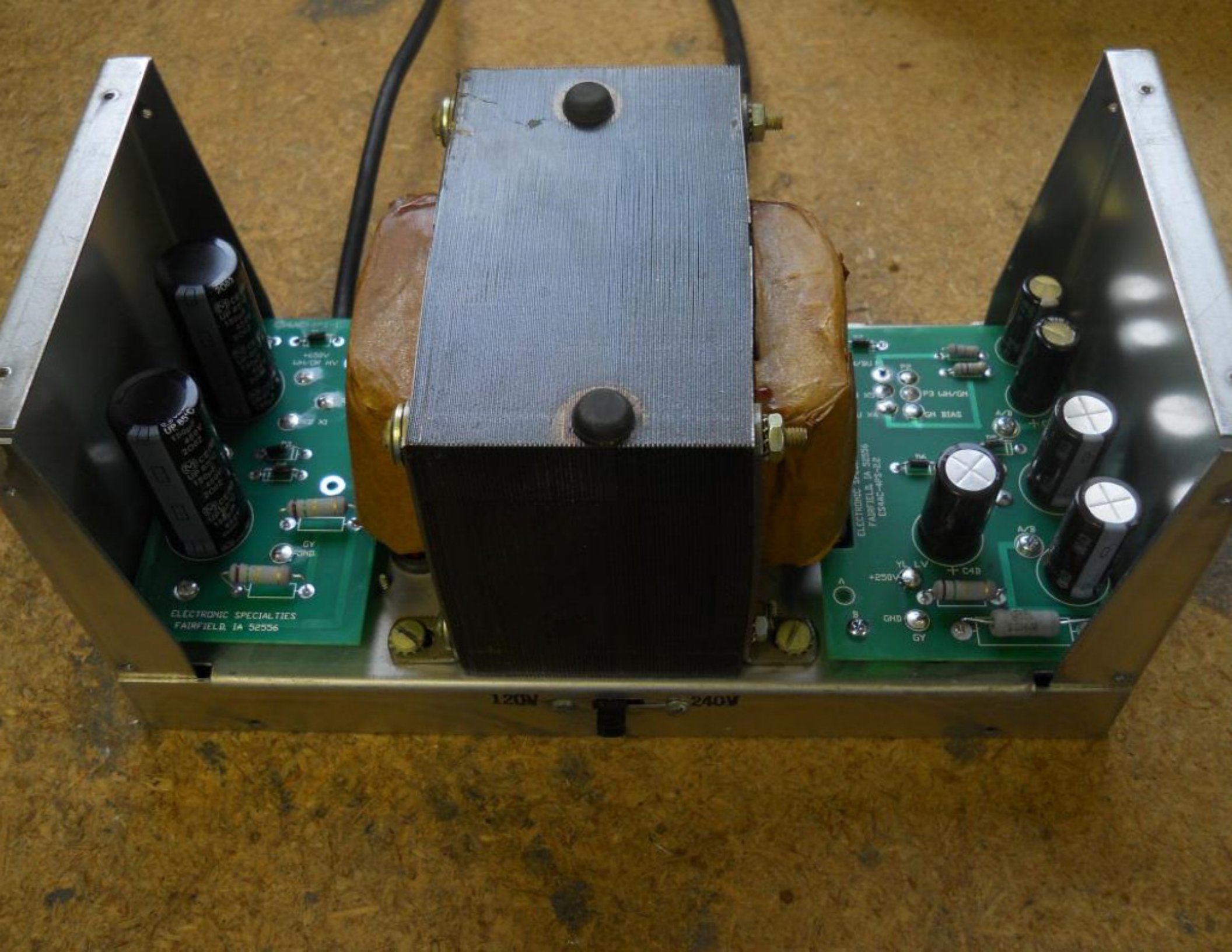
REV040113
C10
C12


C1
C5
C3
C2
C4


ELECTRONIC SPECIALTIES
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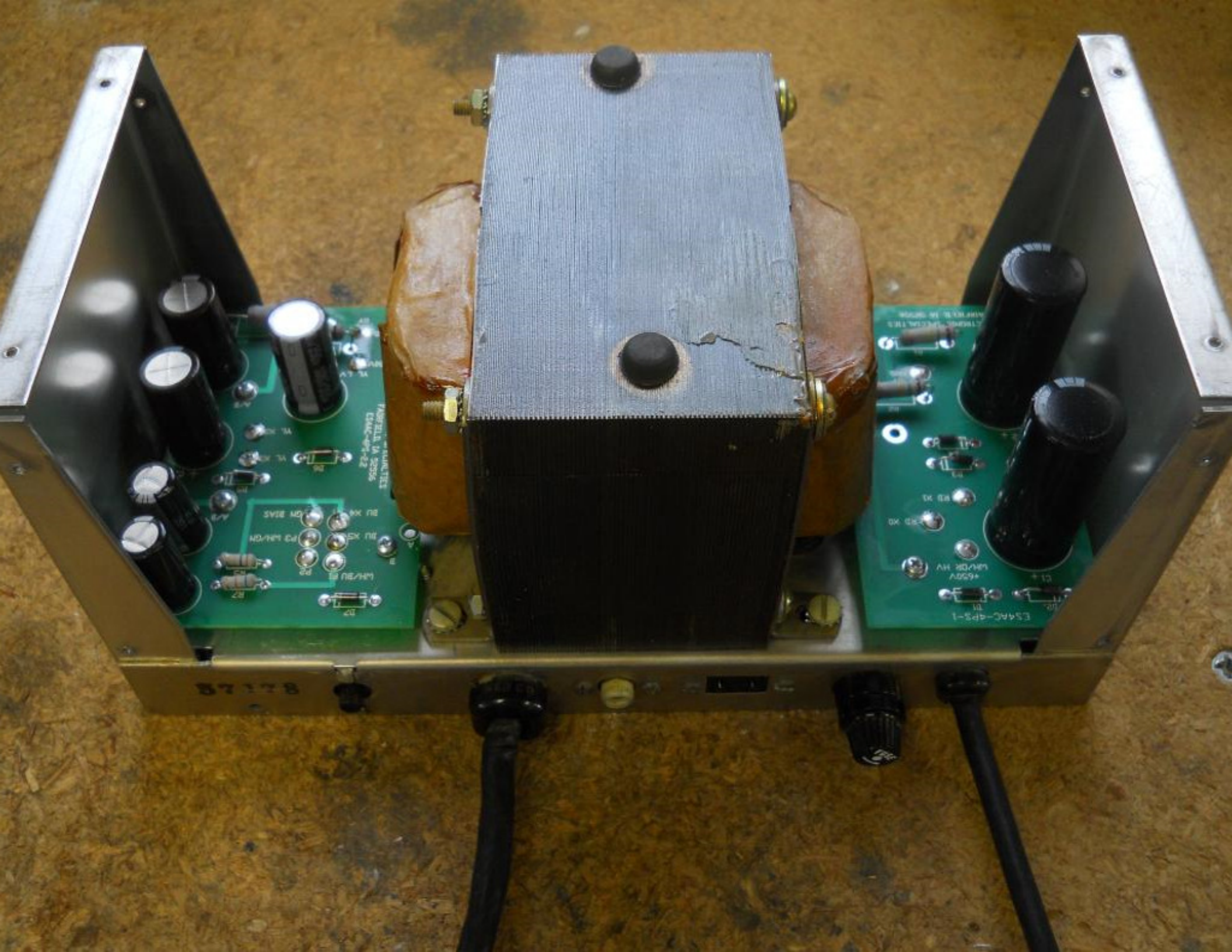
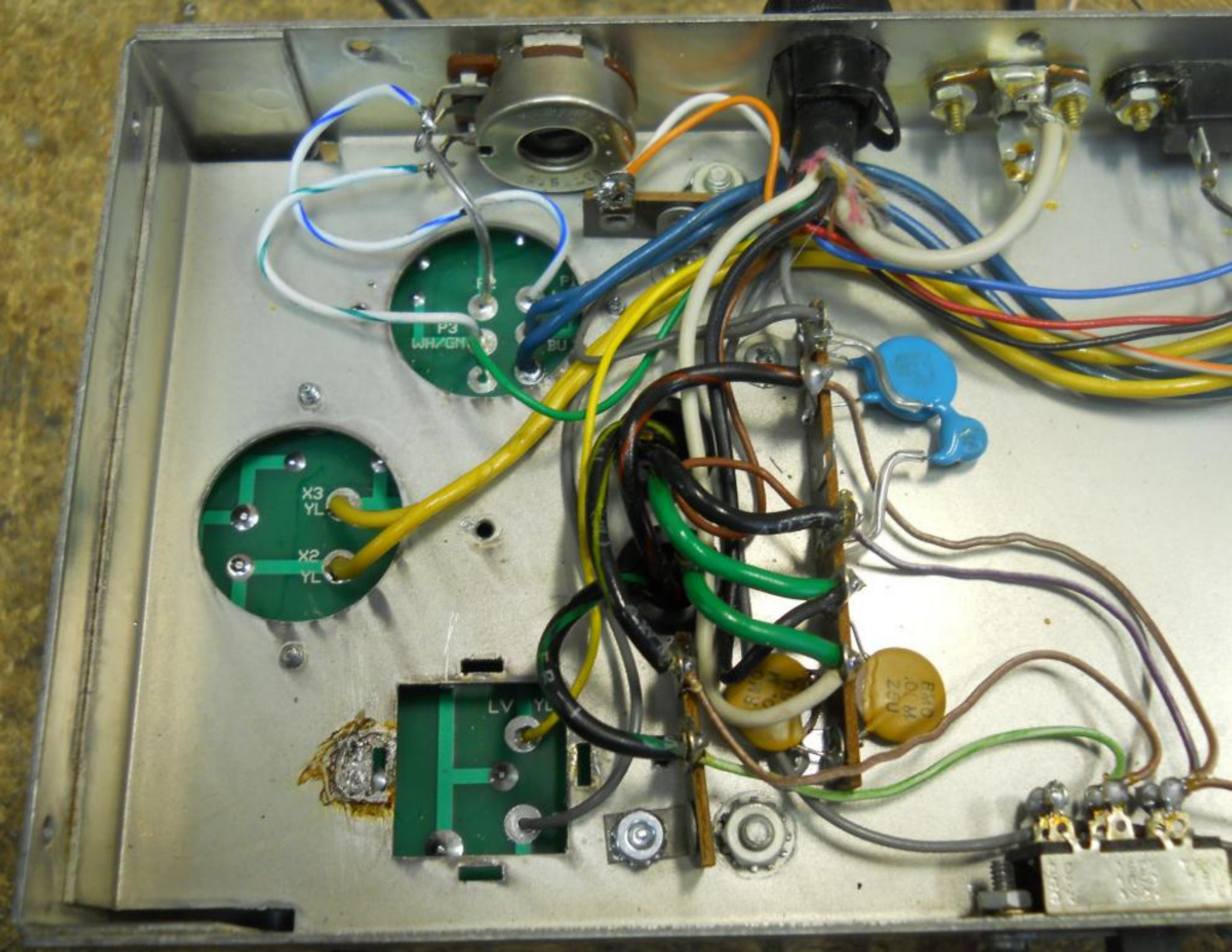
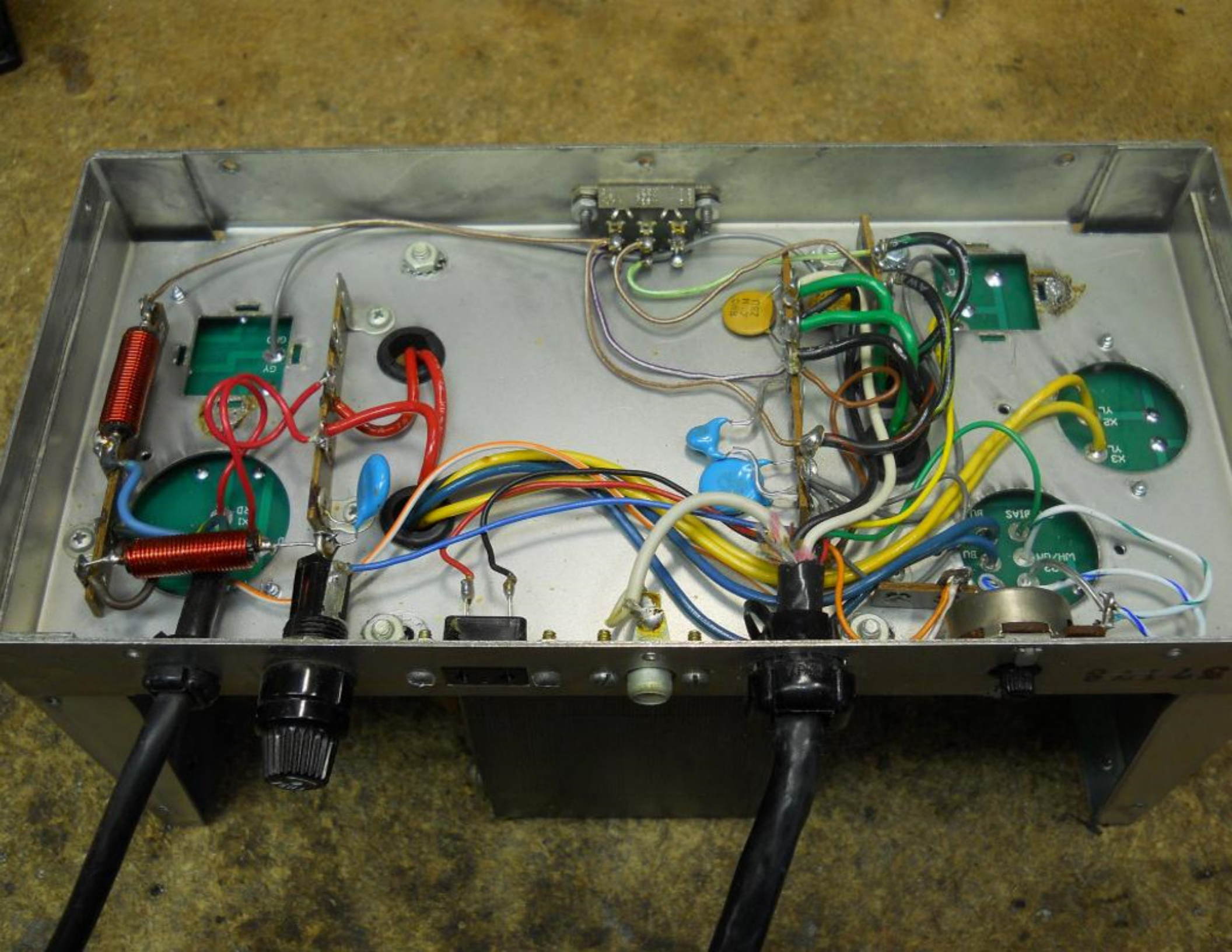
120V
240V
+250V
GND
GY
YL
LV
P3 GH/GN
GH BIAS




P3
WH/GN
BU
X3
YL
X2
YL
LV
YL




X3
YL
X2
YL
LV
GY