

Drake AC-3 Power Supply

I. Introduction.

Thank you for purchasing the Scotty's Sled Shed Custom Probe Modification Kit for Drake AC-3 Power Supplies. Please note that there are some variations in the AC-3. This kit will cover these variations. However, there may be isolated instances where Drake made a production change that may differ slightly.

If you discover one of these variations, please let me know so I can update the documentation.

This kit is intended for unmodified power supplies, configured in the original OEM configuration.

This kit was developed to help fellow vintage electronic enthusiasts. The Drake Power supplies are plentiful to find in restorable condition.

The difference between this kit and those that include an entire circuit board, is the ability to upgrade one component at a time, in the original locations of the power supply.

The Scotty's Sled Shed Drake AC-3 restoration kit alleviates the issues of transformer wires not being long enough to reach an aftermarket circuit board install standoffs and expose high voltages. It also does not require the customer to completely gut the power supply just to perform an upgrade service.

Additionally, you can test each subsection of the power supply at a time, or only upgrade one section of the power supply. There are three supplies in one: High Voltage (650VDC), Low Voltage (250VDC) and - Bias (-45 to -65VDC).

Be sure to discharge the capacitors between upgrade stages before going to the next stage.

You will need the following to install this kit:

1. Hot soldering iron (to remove chassis soldered original twist tab capacitors)
2. Desoldering tool or wick.
3. Solder
4. Painter's tape
5. Basic tools.
6. Eye protection suggested.
7. Fume extractor suggested.
8. Drill
9. 5/32" drill bit.
10. This kit uses 3 different PCB Capacitor boards. The documents for each board are provided in the downloads section of my website at: <https://www.w8aor.com/downloads>
11. Download the Multi-Cap 3in1, Multi-Cap 4in1, and Uni-Cap instructions.

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II. Before you get started.

1. Due to constant supply chain challenges, Scotty's Sled Shed reserves the right to substitute component OEMs. If there is an orange bodied resistor in installation guide images and you receive a blue bodied resistor, it is due to component substitutions.
2. You may see a blue capacitor in one pic and a yellow capacitor in another picture. Multiple pictures may have been taken over various kits with different capacitor values or manufacturers.
3. Scotty's Sled Shed LLC is only providing you with components for a DIY installation.
4. The following instructions are only a guide. Experienced users may have a preferred method of installation.
5. **CAUTION: Lethal voltages are present in these devices.** If you are not aware of that by now, you should NOT be performing this upgrade.
6. If you do not feel comfortable working around high voltages, please do not perform the upgrade. Find an experienced technician to perform or assist you.
7. Scotty's Sled Shed LLC is NOT liable for any damage caused to your equipment, bench, house, Power supply or that your spouse is mad at you for working on this 50-year-old piece of equipment. You are ON YOUR OWN.
8. Customer assumes all responsibilities and agrees to check all resistances, capacitance, and voltages before and after installation.
9. Customer assumes all responsibility to know how to read a schematic and perform the task this kit requires.
10. Customer assumes all responsibility to SAFELY perform procedures by following the RL Drake OEM manual.
11. You get the point; you are responsible for yourself.
12. Please be sure to download the OEM Drake manual if you do not have it.
13. References are made in this guide to component numbers associated with the original manufacturer manual. Customers should familiarize themselves with what the components are. IE C4, C5, D7, R8
14. Some original components were pre 1970 (when the EPA was established). DO NOT CUT OPEN THE ORIGINAL CAPACITORS. There may be toxic chemicals inside. The power supply you have may have been modified.
15. Protect yourself and remember to wear protective eye wear, use a fume extractor, and have a fire extinguisher nearby.

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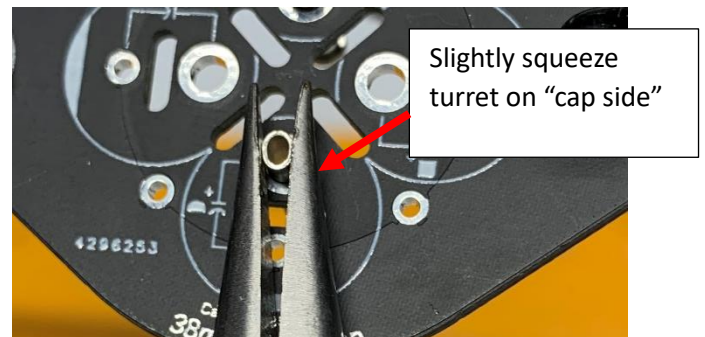
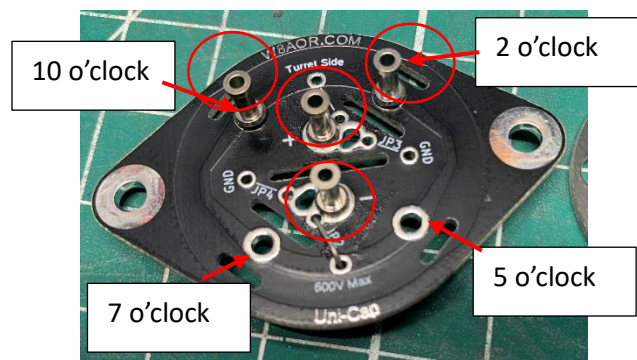
III. Preparation

1. Take lots of pictures and video if you need to, of the original assembly for future reference.
2. Print out/copy an additional copy of the schematic. (Schematics of both versions are shown at the end of this document).
3. Ability to label wires/components as needed-tape, label maker, etc.
4. On the extra schematic, it may help to write down where each lead of Capacitors C5, C6, C7 and associated resistors are connected to the terminal strips. Example C5 (+) to lug 1, (-) to chassis ground.
5. Be sure that all capacitors are discharged.
6. READ THE Drake AC-3 OWNER/INSTALLATION MANUAL!
7. Solder paste will improve the efficiency of soldering and de-soldering.

IV. C1 Capacitor Assembly (Uni-Cap)

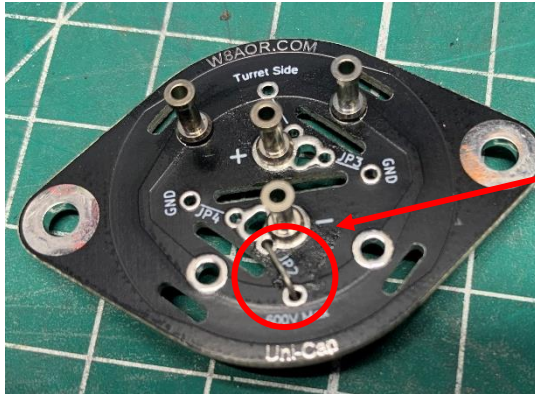
1. Find the bag that is labeled C1 and put the contents on the bench.
2. Start with adding the solder post "turrets".
3. The turrets will be installed on the side of the capacitor board (Uni-Cap) labeled "Turret Side".
 - a. "Cap Side" and "Turret Side" will be labeled just below the WWW.W8AOR.COM on the top side of the board.
 - b. The URL is considered the top part of the board, and we will note that as the 12 o'clock position.
 - c. There are 6 total holes large enough for the soldering turret.
 - d. One is labeled "+" and one is "-" for positive and negative.
 - e. The other four turret holes are in the 2,5,7 and 10 o'clock positions.
4. Install a turret into the "+" hole from the "Turret side".
5. On the other side (Cap Side), slight squeeze the turret sticking out to barely make it oblong. This will keep it from falling out during soldering. Do not squeeze too hard, it only takes a little pressure.
6. Repeat the same for the "-", 2 o'clock, and 10 o'clock positions.

You should have 4 total turrets installed and will look below:



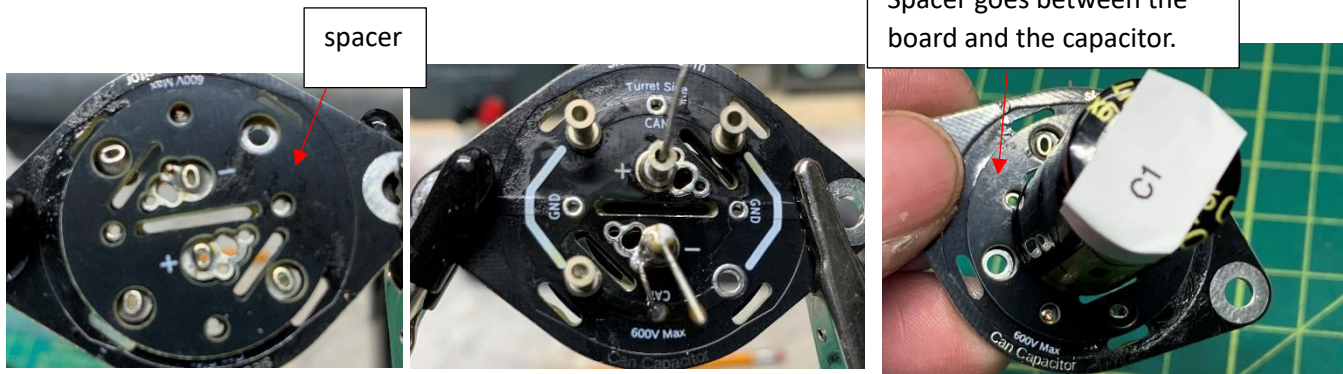
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7. Solder turrets in place by soldering from the "Cap side". Do not allow solder to fill the inside of the turret.
 - a. The boards are well made and will take a lot of heat, but still mind your dwell time.
8. Add a jumper (I use a lead from an old resistor or capacitor laying around) between the hole next to the negative (-) turret and "can" labeled JP2 on the Turret Side.
 - a. This will connect the negative (-) to the 4 outer turret holes, to make this "can common negative". This does not connect the negative to ground. C1 isolated from chassis.



Insert Jumper across JP2 on Turret Side. Solder and snip lead on Cap side as close to board as possible.

9. Install the spacer by aligning the markings on the Cap Side and install the supplied 150uF 450V radial Electrolytic capacitor.
 - a. The leads of the capacitor go inside the hollow turret. Positive to positive, negative to negative.
 - b. Bend the leads over the edge of the turret to hold them in place.
 - c. Solder only the negative lead on the Turret side. Do not solder the positive lead.
10. Place the oval insulator over top of the capacitor and use the label included to put label C1 on the capacitor set aside with the #6-32 nylon nut and bolt assemblies. C1 assembly is complete.



V. Capacitor C2 Assembly (V1).

There are two versions of components for C2. One version has a 5ohm 5W resistor between D4 and chassis ground, with a TP (Test Point). The schematic (see at end of this document) calls for this test point to be stand alone. However, all installs seen has the test point is attached to a metal screw, going to the chassis on the flange of C2.

The other version does not have a Test Point, nor does it have the 5ohm 5W resistor. Version with resistor, the capacitor is "can common", and chassis isolated.

Version without resistor, the capacitor is can common and chassis grounded.

Version 1 C2 assembly (with 5 ohm resistor, can common, chassis isolated)

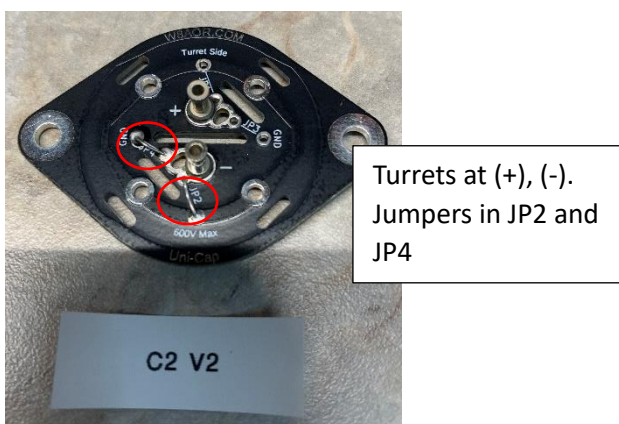
1. Capacitor C2 will assemble like C1 but will require less turrets.
2. Install Turrets in "+", "- ", **10 o'clock**, and **2 o'clock** on the Turret Side.
3. As before, slightly pinch the short end on capacitor side and solder the three turrets.
4. Add a jumper from the hole next to the "- "(negative) turret at **JP2**.
 - a. This will connect the negative to can-common only.
5. Insert spacer on Cap Side as before.
6. Install supplied 150uF 450V capacitor, positive to positive, negative to negative with leads inside the turrets.
7. Bend over legs but do not solder either turret.
8. Use supplied label, mark as C2 and set aside with the nylon #6-32 hardware and oval insulator flange.



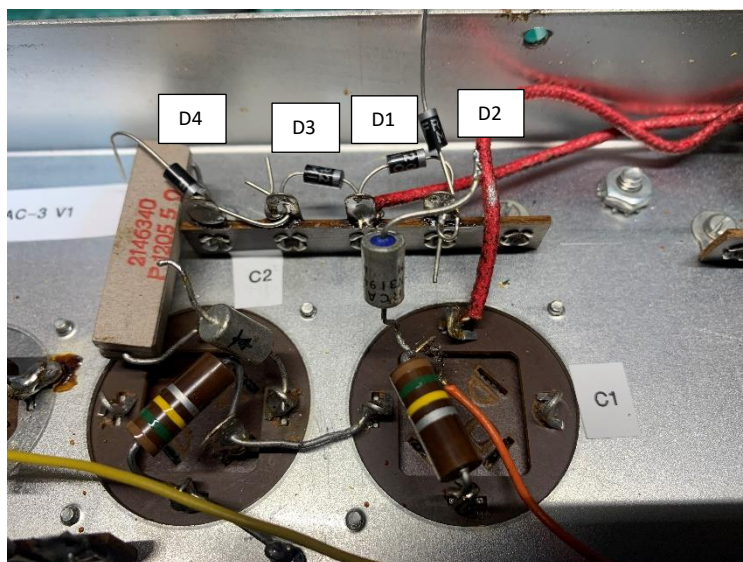
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C2 Version 2 assembly (no resistor-can common, chassis ground)

1. Capacitor C2 V2 will assemble like C1 but will require less turrets.
2. Install Turrets only in "+", "- ", on the Turret Side.
3. As before, slightly pinch the short end on capacitor side and solder the three turrets.
4. Add a jumper from each hole next to the "- "(negative) turret at **JP2 and JP4**.
 - a. This will connect the negative to can-common, and chassis ground.
5. Insert spacer on Cap Side as before.
6. Install supplied 150uF 450V capacitor, positive to positive, negative to negative with leads inside the turrets.
7. Bend over legs but do not solder either turret.
8. Use the label to mark as C2 and set aside with the #6-32 SS hardware. Insulator is not used.

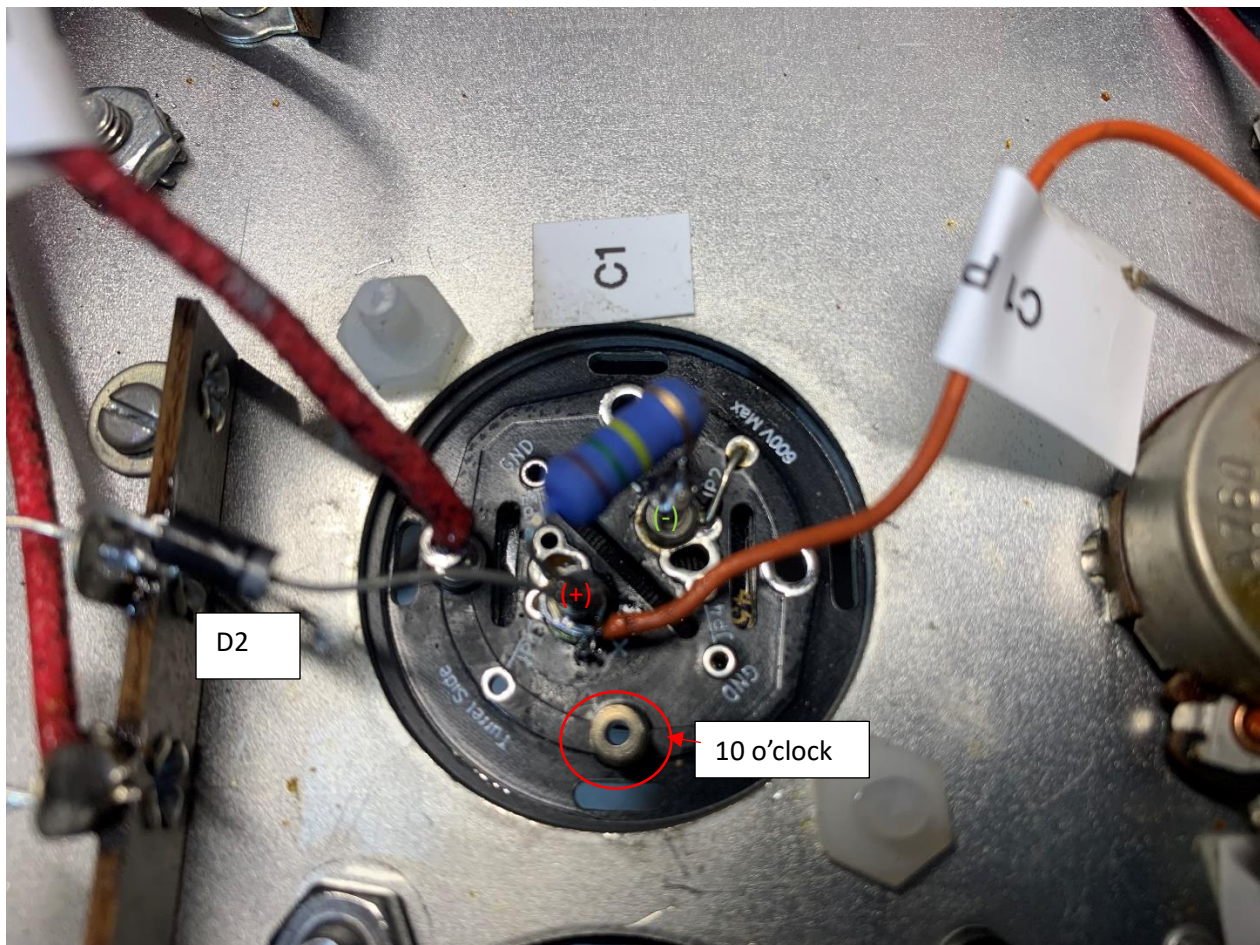
**VI. C1 Replacement**

1. Start by replacing the 4 rectifier diodes D1, D2, D3 and D4.
2. Leave the Anode of D4 at C2 unconnected.
3. Leave the Cathode of D2 at C1 unconnected.



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4. Mark the red wire at twist tab of C1 as **C1 Neg**. Desolder and disconnect.
5. Mark the thin orange wire at the terminal tab of C1 as **C1 POS**. Desolder and disconnect.
6. Unsolder the jumper wire that connects C1 twist tab to C2 Positive terminal.
7. Remove C1
8. Drill out the mounting holes with 5/32" drill bit for C1. Clean up any shavings.
9. From the transformer side (top side), Install the new C1 with the Oval Insulator **BETWEEN** the chassis and the capacitor board. Very important.
10. Position C1 so that the 2 o'clock turret faces D2 (terminal strip) and the 10 o'clock turret faces C2.
11. Secure with supplied #6-32 Nylon nut/bolt. DO NOT OVERTIGHTEN. The nylon bolts break easily so just need to be snug.
12. Wrap the red wire marked C1 Neg around the 2 o'clock turret and solder.
13. Wrap the orange wire marked C1 POS around the (+) turret of C1 (do not solder yet).
14. Insert the Cathode of D2 into the center hollow end of the (+) turret of C1. Do not solder yet.
15. Insert one leg of the new supplied 150k ohm resistor into the (+) turret of C1. You may want to trim the leads a bit on this resistor first.
16. Insert the other leg of the 150k ohm resistor into the (-) turret of C1.
17. Solder the leads into (+) and (-) turrets.

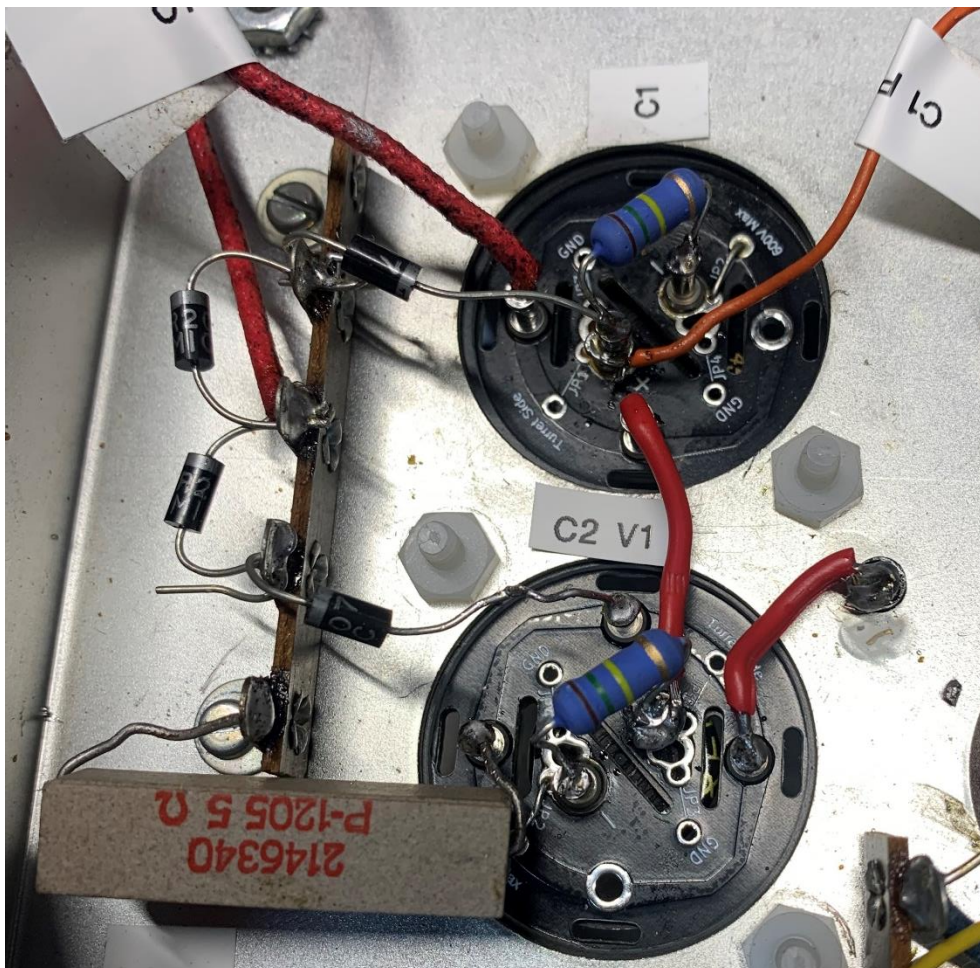


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VII. C2 Replacement Version 1 with 5 ohm resistor and Test Point.

If do not have, or you plan to omit the 5 ohm resistor and Test Point, skip down to the Version 2 installation.

1. Carefully desolder the 5 ohm resistor from the twist tab of C2.
2. Unsolder the jumper to the Test Point.
3. Remove C2.
4. Drill out the mounting holes with 5/32" drill bit.
5. Position the new C2 so that the 10 o'clock turret is facing C1 and the 7 o'clock turret is facing D4/Terminal strip.
6. From the top side, Install Oval flange **between** C2 and the chassis.
7. Secure with #6-32 nylon nut and bolt.
8. Use supplied wire to make a 2" jumper. Connect the jumper to 10 o'clock turret of C1 and the (+) turret of C2. Solder at C1 turret only.
9. Install 150k ohm resistor into the center of (+) and (-) turrets of C2. Solder both turrets, leads and jumper wire.
10. Insert Anode of D4 into the 10 o'clock turret of C2 and solder.
11. Connect the 5 ohm resistor to the 7 o'clock turret of C2 and solder.
12. Make a 2" jumper and solder it to the TP and 2 o'clock turret of C2.

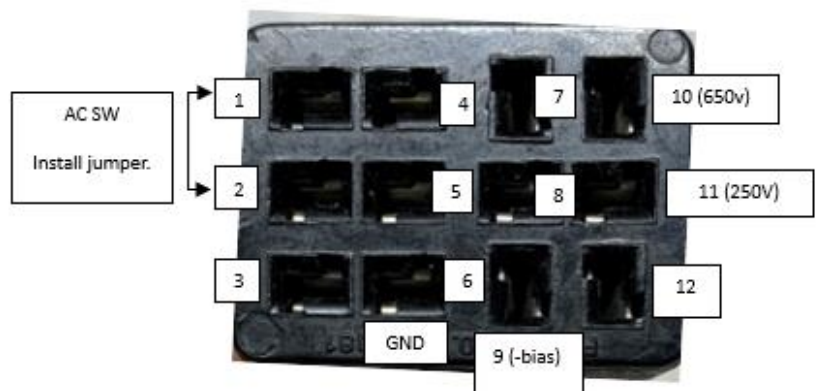
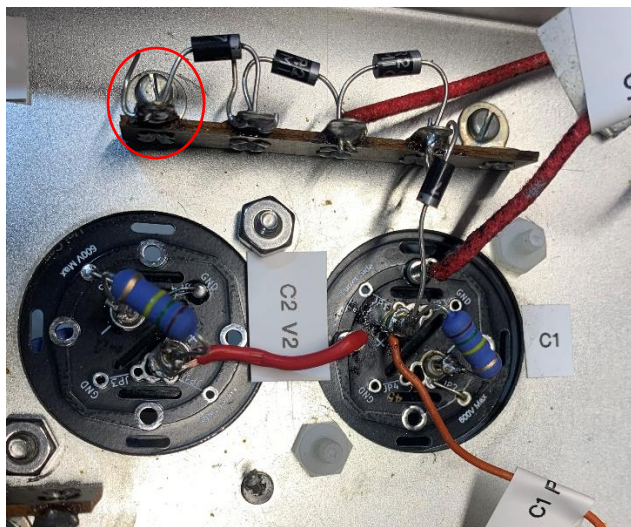


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VIII. C2 Version 2 (no 5W resistor, no Touch point).

1. C2 should already have all leads disconnected by now.
2. Remove C2.
3. Drill out the holes with 5/32. Clean the area around the holes with wire brush to make a good chassis connection.
4. Position C2 so that (+) faces C1 and install C2 from top side. Secure with #6-32 stainless steel hardware supplied. Be sure this is tight but not over torqued. Toothed washers need to bite into the solder area around the mounting holes of the Uni-Cap board and the chassis.
 - a. Bolt->washer->UNI Cap->chassis->(underside)washer->nut.
5. Solder Anode of D4 to the 1st hole on terminal strip that goes to chassis ground.
 - a. Or insert Anode into the (-) turret of new C2.
6. Insert 150k Ohm resistor into the (+) and (-) turrets of C2. Solder leads at (-) turret.
7. Connect the other end of 2" jumper from C1 10'clock turret to the (+) turret of C2. Solder wires and leads at C2 (+) turret.

C1 and C2 are finished. You can test the power supply to ensure you have 650+ VDC at positive turret of C1. Be sure to discharge the capacitors if you test the HV upgrade before you continue.



Check voltages from Ground (pin 6) to the HV (Pin 10), low voltage (Pin 11) and negative bias (Pin 9).

NOTE this is from the view of you facing the female plug of the power supply.

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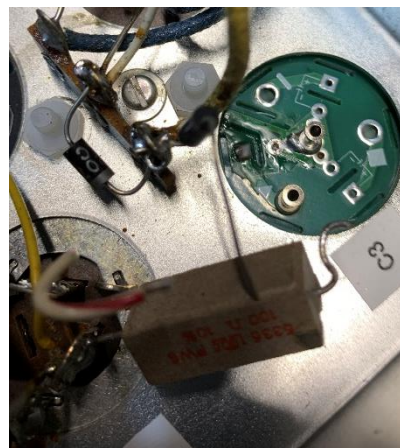
IX. Capacitor C3 assembly.

Capacitor C3 uses the smaller 3 in 1 Multi-Cap board.

1. Install turret on the "Turret Side" in the center and one marked Triangle.
2. Align markings and install spacer on Cap Side and then install the 100uF 450V capacitor.
 - a. Negative lead goes inside, positive lead goes outside on this version of the 3in1 Multi-Cap. Solder both leads and trim excess length.
 - b. Set oval insulator and nylon bolt hardware to the side.

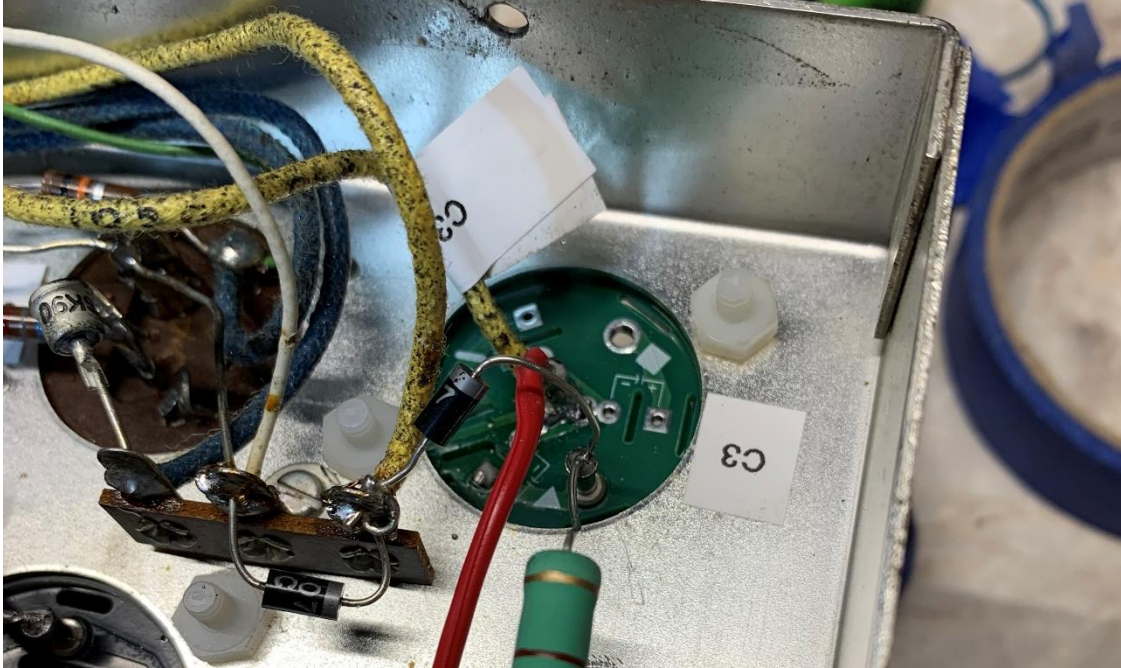
**X.** Capacitor C3 replacement

1. Replace Diodes D5 and D6. Leave Cathode of D5 unattached for now with enough lead to reach where the new C3 will install.
2. Unsolder the 100ohm resistor from the Positive terminal of C3. You can remove the resistor completely if you want as there is a replacement supplied in your kit.
3. Remove the white/red jumper from the negative terminal (tab) of C3 that connects to C4. We will replace this jumper later when we replace C4.
4. Mark the yellow/black wire from the negative twist tab of C3 as C3 NEG and desolder/disconnect.
5. Remove C3
6. Drill out the mounting holes with 5/32" drill bit.
7. Position the new C3 so that the Triangle Turret is pointing toward C4.
8. Install the new C3 with the oval insulator between the capacitor and the chassis.
9. Secure with nylon #6-32 nylon hardware



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10. Insert Cathode of D5 and one leg of supplied 100ohm 5W resistor into the turret marked Triangle and solder.
11. Wrap the yellow/black wire marked C3 Neg around the center (negative) turret and solder, but do not fill the center of the turret as we need that for the jumper to C4.



- XI. Capacitor C4.**
 There are two versions known for capacitor C4. This kit provides components for both versions.
 Version 1 is the 1" size capacitor like C3.
 Version 2 is the 1 3/8 size capacitor like C1 and C2.
 The green 3in1 Multi-Cap is for the 1" V1 version.
 The black 4in1 Multi-Cap is for the 1 3/8" V2 version.
 You can use the 4in1 Multi-Cap if you have a V1, it will require you to drill new holes.

C4 V1 Assembly.

1. With the 3in1 Multi-Cap board, install turrets in Center, Square and Triangle.
2. Align the spacer board and install the two 100uF supplied capacitors in the areas marked for Square and Triangle.

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3. These capacitors will fit tight as the board was not designed for multiple 18mm diameter capacitors. I use a zip tie to hold the two capacitors together while soldering the leads to keep them in place. If you find this too difficult, consider switching to the larger 4in1 Multi-Cap board provided.
4. It will be easier to install the #6-32 bolt on the side with cap in Triangle before final soldering of the capacitors.

**C4 V2 Assembly.**

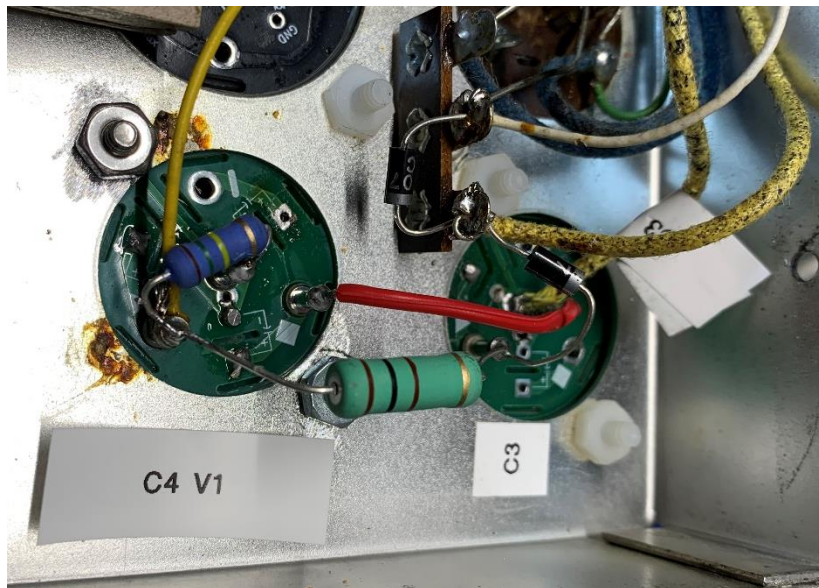
1. With the 4in1 Multi-Cap board, install turrets in Triangle and Half Moon (Dome).
2. Align the spacer and install the two 100uF capacitors. The positive lead goes into the hollow center of the turret. Solder only the negative leads and trim.



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C4 Replacement.

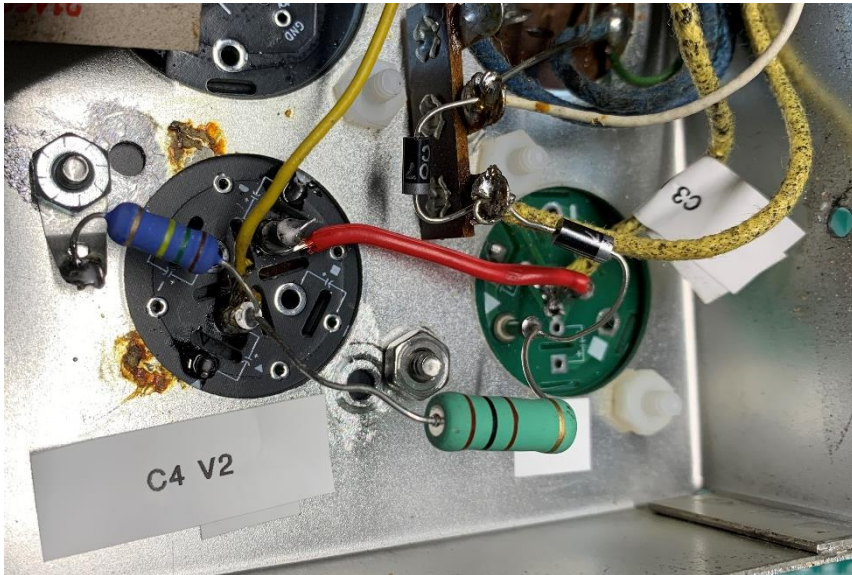
1. Mark the thin yellow wire as C4B, desolder and disconnect.
2. If your twist tabs are soldered to the chassis, you will need to unsolder those before you can remove the capacitor.
3. Remove C4.
4. Drill out the mounting holes with 5/32" drill bit.
 - a. If you are upgrading the from the 1" to the 1 3/8", use the new C4 Multi-Cap board as a guide to mark and drill new holes.
8. Install the new C4. This mounts direct to the chassis.
 - a. The V1 3in1 will be positioned with Square facing C3.
 - b. The V2 4in1 will be positioned with Half-moon toward the terminal strip.
9. Bolt the new C4 in with the #6-32 Stainless Steel hardware.
 - a. The V2 version with 4in1 Multi-Cap will need the #6 ground lug attached to the bolt closest to C2.
- 10. V1 3in1 connections (Version 2 with 4in1, jump to step 11):**
 - a. Make 2" jumper, tin ends and connect one end to the center turret (-) of C3. The other end to Square Turret of C4. Solder both ends.
 - b. Install the open leg of the 100ohm 5w resistor that is connected to C3, to the turret marked Triangle of C4. Do not solder yet.
 - c. Wrap the thin yellow wire marked C4B around the turret of C4 Triangle.
 - d. Connect the 150k ohm resistor between the center turret (-) and into the Triangle turret of C4. Solder connections.

**11. V2 4in1 Multi-Cap connections.**

- a. Make 2" jumper, tin ends and connect one end to the center turret (-) of C3. The other end to Half-Moon Turret of C4. Solder both ends.
- b. Install the open leg of the 100ohm 5w resistor that is connected to C3, to the turret marked Triangle of C4. Do not solder yet.
- c. Wrap the thin yellow wire marked C4B around the turret of C4 Triangle.

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- d. Connect the 150k ohm resistor between the #6 ground lug and into the Triangle turret of C4. Solder connections.



The low voltage power supply is now complete. You can test the supply for ~250+VDC at C4 Triangle (yellow wire).

XII. Capacitor C5

The Negative Bias Capacitor will use the 3in1 Multi-Cap board with the insulator.

1. Prepare the Multi-Cap board with a turret in Center, Triangle and Square-solder turrets.
2. Align and install the spacer board, and the two 47uF capacitors in the Triangle and Square locations. Positive leads go on the outside, negative in the center. Solder leads and trim.
3. Set aside the cap with the oval insulator and nylon bolt hardware.
4. Mark the blue (or blue/black) wire at C5 twist tab as C5 Neg
5. Mark the thin green wire at C5 twist tab as C5 Neg.
6. Desolder and remove the blue and green wires from C5
7. Unsolder the 10kohm and 6.8kohm resistors at R7 (bias potentiometer).
8. Unsolder the jumper from center leg of R7.
9. Unsolder the jumper from C5 at the terminal strip.
10. Replace Diode D7 with the Anode at the Terminal strip and Cathode unconnected.
11. Remove C5.
12. Note that the lug for the Test Point (TP) on Version 1 is attached to one of the screws of C5.
13. Drill out the mounting holes with 5/32" drill bit.
14. From the top side, install the C5 Multi-Cap with the Insulator Flange BETWEEN board and chassis.
15. The Square and Triangle Turrets should be facing R7 Potentiometer.
16. Secure with the #6-32 nylon hardware.

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17. For the V1 with Test Point, the original configuration used a metal screw with the eyelet to the chassis. Which rendered the TP unusable. To make it usable, install on to C1 nylon bolt or remove the ring terminal to leave the TP standalone.
18. For V2 that did not use the TP and 5ohm resistor, disregard and move to the next steps.



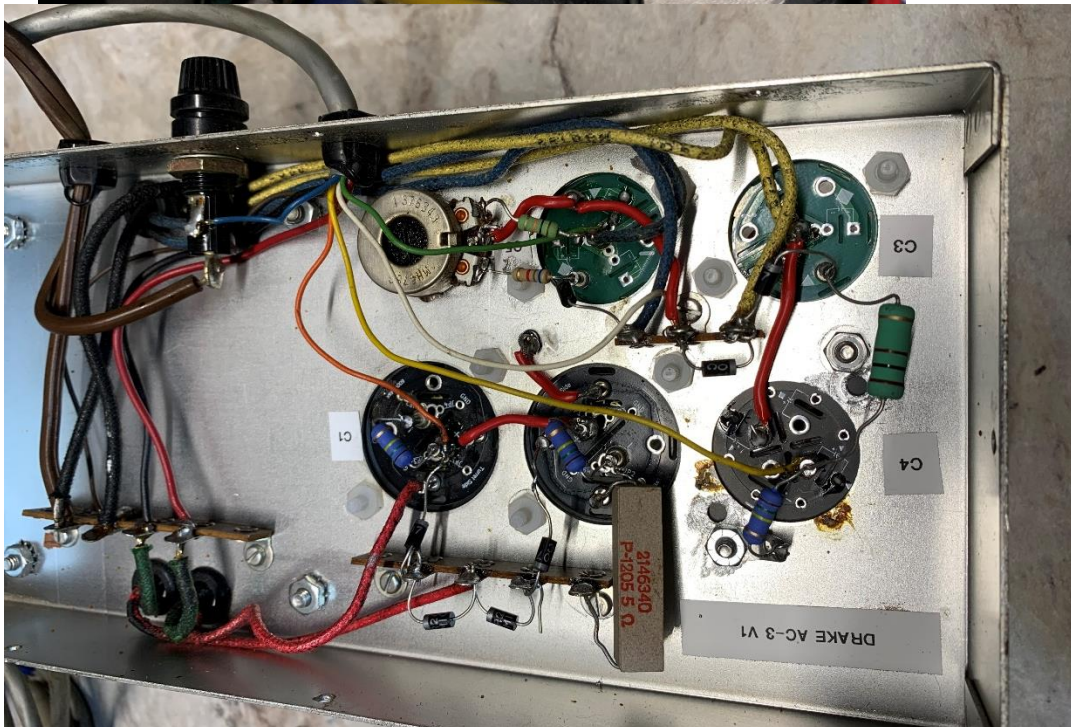
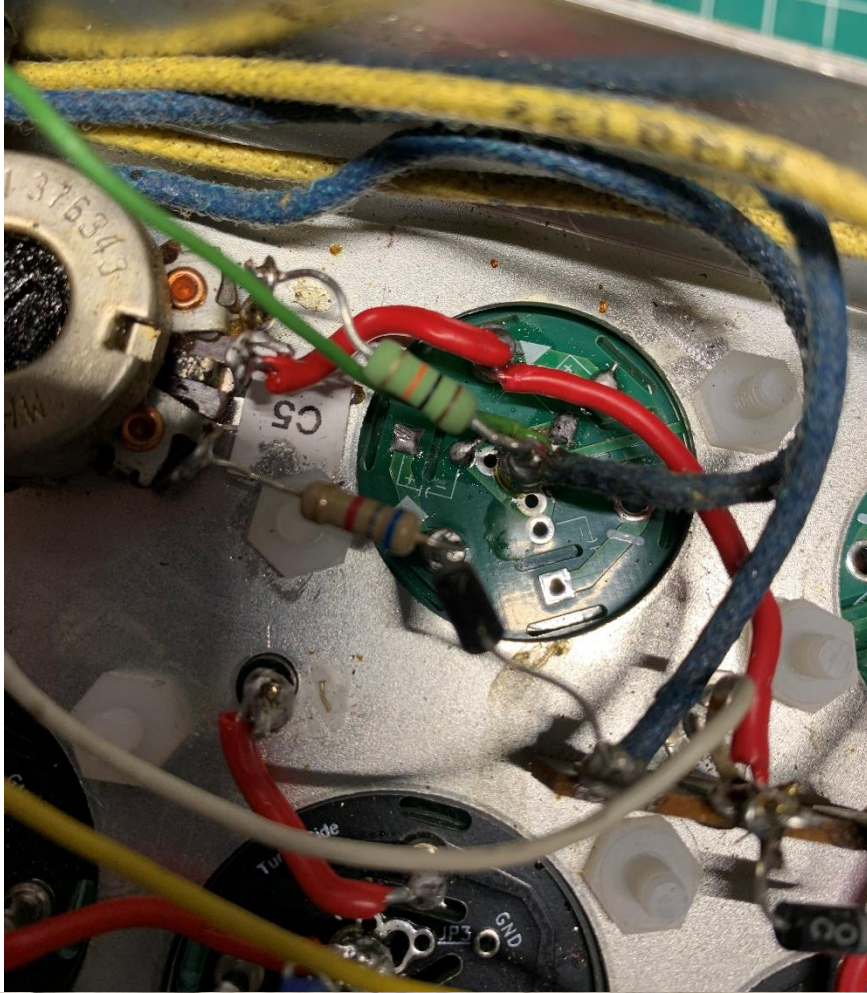
Version 1 config only.

Do not connect the TP ring terminal to T5. This will tie C2 and C5 together which are independent from each other.

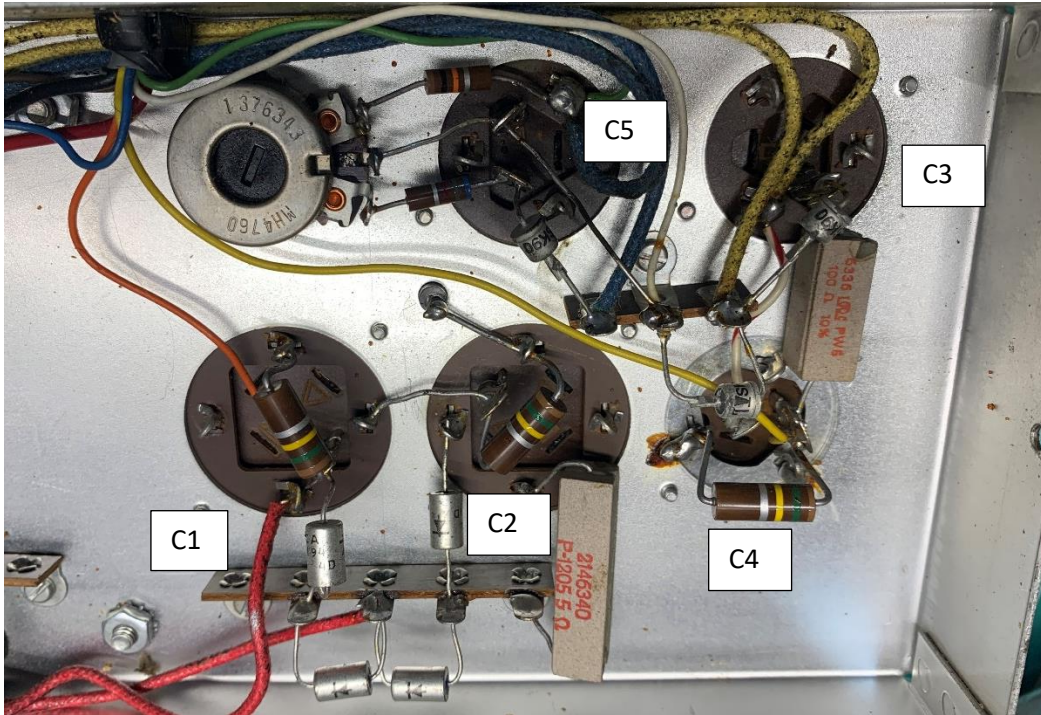
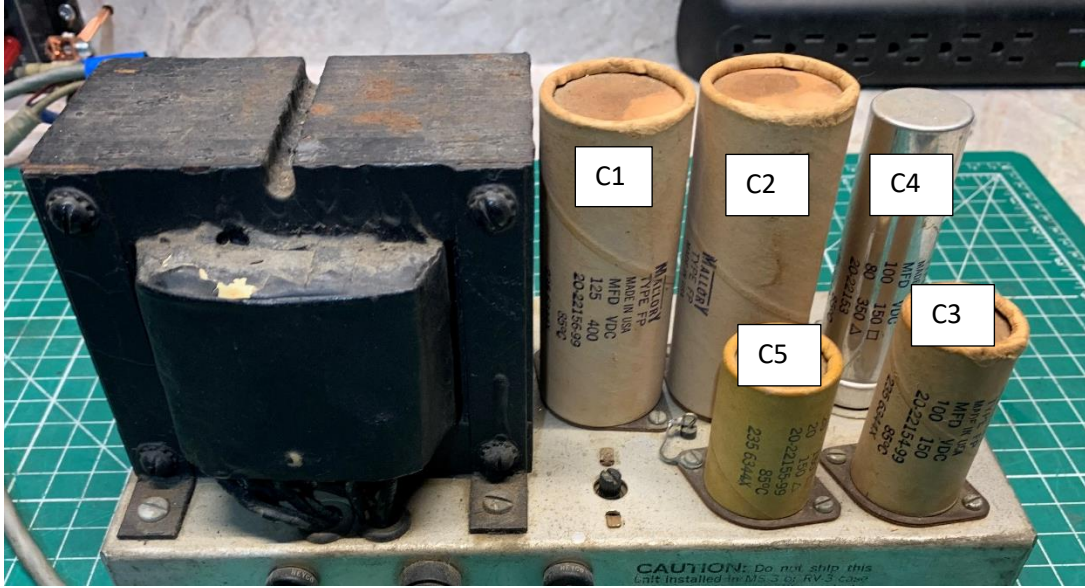
Remove ring terminal so TP is stand alone or attach to C1 bolt as the capacitors are not tied to chassis ground.

19. Wrap the green and blue wires marked C5 Neg, to the center (negative) turret of the new C5.
20. Install one leg of the supplied 10k ohm resistor inside the center turret. Solder blue and green wires and lead of 10k ohm resistor.
21. Connect the other lead of the 10k ohm resistor to the outer (right side, closest to chassis) lead of the R7 bias potentiometer.
22. Install the Cathode lead of D7 and one leg of the 6.8k ohm resistor into C5 Turret at Square. Solder leads at C5 Square Turret.
23. Install the other lead of the 6.8k ohm resistor to the left lead of R7 bias potentiometer and solder.
24. Make a 1 ½" jumper to connect center lead of R7 and C5 Turret at Triangle. Solder at R7 only.
25. Make a 2 ¼" jumper to connect C5 Turret at Triangle and the tab on the terminal strip that connects to chassis ground and the thin white wire. Solder at C5 and terminal strip.
26. -Bias is now complete and so is the power supply upgrade.

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