

Drake AC-4 Power Supply

I. Introduction.

Thank you for purchasing the Scotty's Sled Shed Custom Probe Modification Kit for Drake AC-4 Power Supplies. At time of this print, this kit has not been tested on an AC-3.

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

It is assumed the customer has already tested their supply is in working or restorable condition prior to installation of this kit.

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 time to complete is about the same as alternate kits on the market.

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. 1/8" drill bit.
10. Solder Flux/paste (optional but recommended)
11. Label maker or way to label wires.
12. This kit uses 3 different PCB Capacitor boards. Documents for each board are also provided.

This guide is lengthy due to including several pictures to help guide the customer through the process.

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- II. Before you get started there is a list of items to be aware of.**
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 manual if you do not have it. They are readily available online at: <https://www.manualslib.com/manual/899672/Drake-Tr-4c.html?page=12>.
 13. Read the original Drake manual. The process for replacing components will be nearly identical to the original installation.
 14. 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
 15. Some original components were pre 1970 (when the EPA was established). DO NOT CUT OPEN THE ORIGINAL CAPACITORS. There may be toxic chemicals inside.
 16. Protect yourself and remember to wear protective eye wear, use a fume extractor, and have a fire extinguisher nearby.

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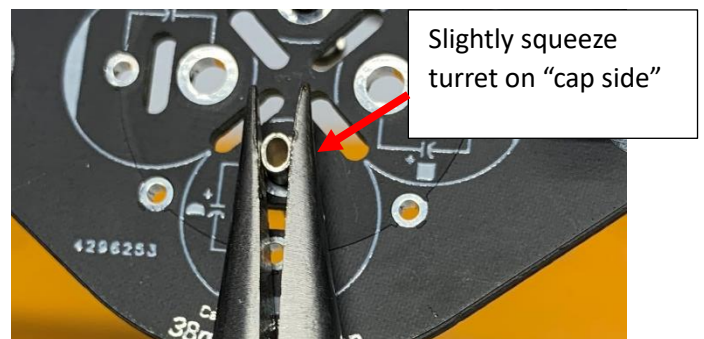
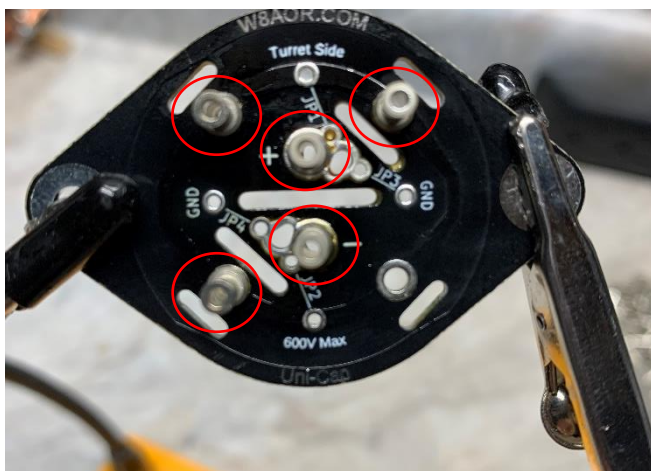
III. Preparation

Take lots of pictures and video if you need to, of the original assembly for future reference.

1. Print out an additional copy of the schematic.
2. Label wires/components as needed-tape, label maker, etc.
3. On the extra schematic, it may help to write down where each lead of capacitors, diodes and associated resistors are connected to the terminal strips. Example C5 (+) to lug 1, (-) to chassis ground.
4. Be sure that all capacitors are discharged.
5. Please read the RL Drake manual and study the OEM schematic.
6. 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". Solder paste will help with solder flow but isn't necessary.
 - 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, 7 o'clock and 10 o'clock positions.
7. You should have 5 total turrets installed and will look like the picture below.



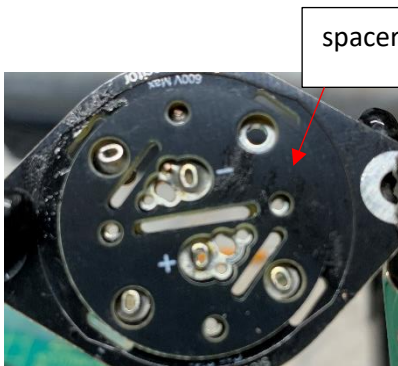
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8. Solder turrets in place on the "Cap side". Do not allow solder to fill the inside of the turret.
 - a. The boards are well made and will take a lot of heat, but still mind your dwell time.
9. Add a jumper (I use a lead from an old resistor or capacitor 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.

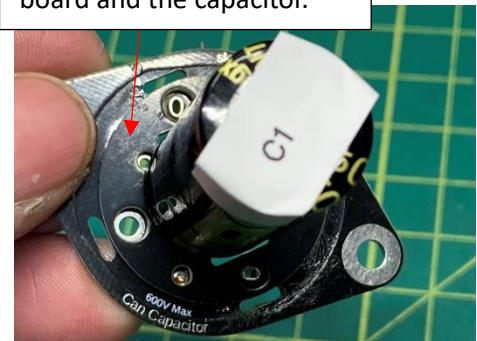


Insert Jumper across JP2 on Turret Side. Solder and snip lead on Cap side as close to board as possible.

10. Install the spacer by aligning the markings on the Cap Side and install the supplied 150uF 450V radial Electrolytic capacitors.
 - 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.
11. 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.



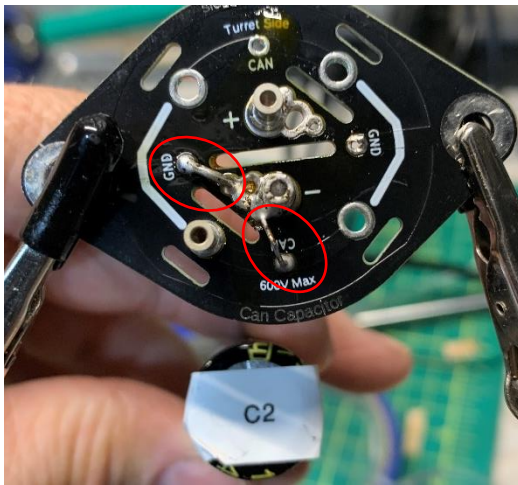
Spacer goes between the board and the capacitor.



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V. Capacitor C2 Assembly

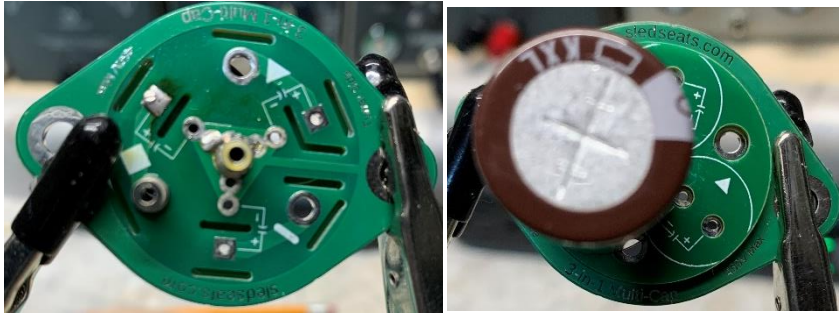
1. Capacitor C2 will assemble like C1 but will require less turrets.
2. Install Turrets in "+", "- "and 7 o'clock on the Turret Side.
3. As before, slightly pinch the short end on capacitor side and solder the three turrets.
4. Add a jumper from each hole next to the "- "(negative) turret at **JP2 and JP4**.
 - a. This will connect the negative to can-common and to 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 supplied label, mark as C2 and set aside with the #6-32 hardware and football flange.
9. C2 is complete.

**VI. Capacitor C3 (3 in 1 Multi-Cap)**

1. Open contents of package labeled C3. Note that this board is different from the UNI-Cap board as it was designed to replace the 1" style 37mm hole spacing 3-1 Multi-Sector twist tab capacitor. This is the same board I sell in the Heathkit IT-12/T-4 Restoration kit.
2. The capacitor leads will install into marked holes in the board, not inside the turrets.
3. Install a turret on the Turret Side (labeled on bottom, left of the "3 in 1 Multi-Cap") hole next to the Square and one in the center of the board.
 - a. The center hole connects all the negative leads to one common point and to chassis ground. We will be using an insulator to isolate the negative from ground.
4. Again, slightly squeeze turret on Cap Side to make oblong but do not close opening.
5. Solder in the turrets.
6. On the cap side align the spacer with the markings on the board.
 - a. The spacer will align exactly. These are center cut from the same board (before solder) to ensure the dimensions and markings align exactly with the Multi-Cap board.
7. With the spacer aligned on the Multi-Cap, install the 100uF 450V capacitor in + and – marked holes of spot marked with the square.
8. Bend your leads over and solder the capacitor in place on the Turret Side.

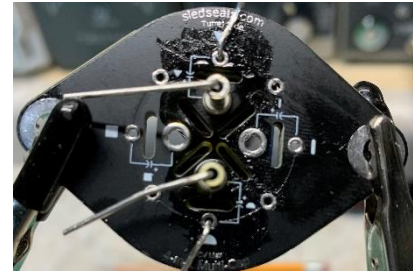
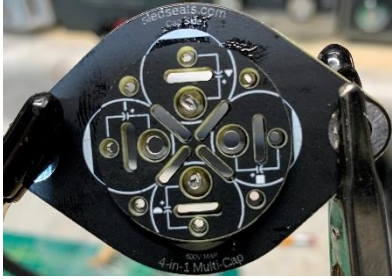
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9. Mark the capacitor with the attached label.
10. Set the oval insulator over the capacitor and set aside with the two #6-32 nylon bolt assemblies.
11. C3 is complete.

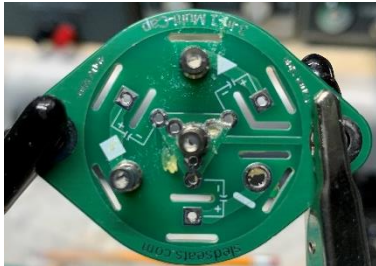
**VII. Capacitor C4 (4 in 1 Multi-Cap)**

1. Open the contents of the bag labeled C4.
2. Note that this is the 4 in 1 Multi-Cap board.
 - a. This is the same board I use in most of my restoration component kits that replaces the 1-3/8", 46mm spacing, Multi-Sector twist tab capacitors.
 - b. The Positive turrets are inside, like the original twist tab capacitors.
 - c. The outer holes are tied to the outer ring of the board, which connects to chassis ground for "can common ground".
 - d. The oval flange is the same diameter and mounting as the original flange mounted twist tab style capacitors.
 - e. The board is marked with symbols: Half-Moon, Square, Triangle, and Dash to align with original twist tab capacitors. As is the spacer board.
3. From the Turret Side install a turret in Half-Moon and Triangle only.
4. Solder the turrets from Cap Side.
5. Align spacer as before.
 - a. If your markings are not lining up exactly you have either solder turrets on the wrong side or your spacer is upside down.
6. The positive leg of each capacitor is installed INSIDE the turrets.
7. The negative lead goes in the outer hole.
8. Install the two capacitors with the positives inside each turret: Half-Moon, and Triangle.
 - a. It is a tight fit with the two 18mm capacitors, but they will fit.
 - b. Use a rubber band or zip tie to hold the two capacitors together to make it easier to keep them aligned so you can solder.
9. Bend leads over and solder the Negative lead only. Trim excess negative lead.
10. Mark with the attached label C4 and set aside with the two #6-32 hardware and #6 ground lug.
11. C4 is now complete.

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**VIII. Capacitor C5 (3 in 1 Multi-Cap)**

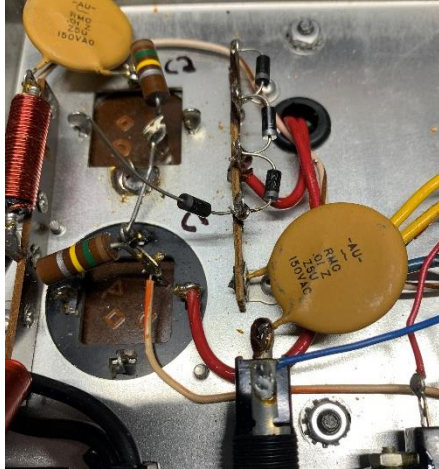
1. Open the contents of C5.
2. Note this is the same board as we used for C3.
3. Insert Turret in Square, Triangle and in the center, on the Turret Side.
4. Squeeze and solder turrets.
5. Align and set spacer on Cap Side.
6. Install the two 47uF 250V capacitors in the slots marked Square and Triangle
7. Bend over leads, solder, and trim.
8. Mark with supplied label and set aside with the nylon #6 hardware and insulator.
9. C5 is complete.



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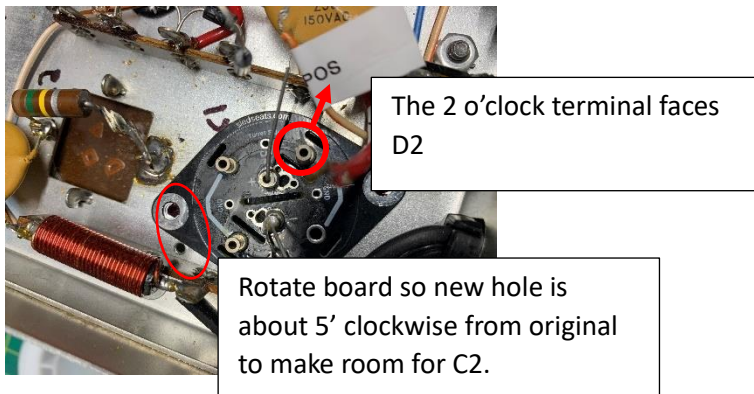
IX. Capacitor C1 and C2 replacement.

You can choose to remove and replace C1 independently if you wish. In this procedure I found it easier to remove both C1 and C2 at the same time since they are wired in series. You may also find it easier to mark each capacitor with a label maker or marker on the chassis. Take pictures before you remove anything.

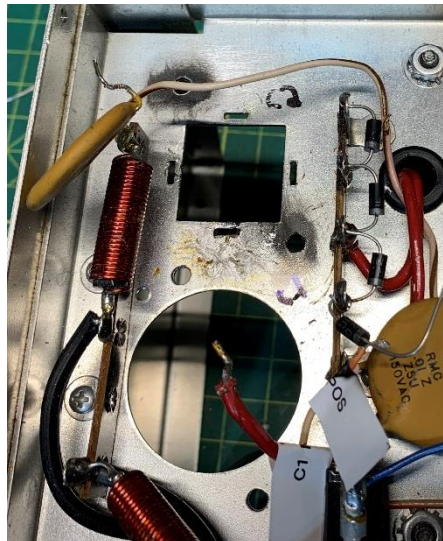
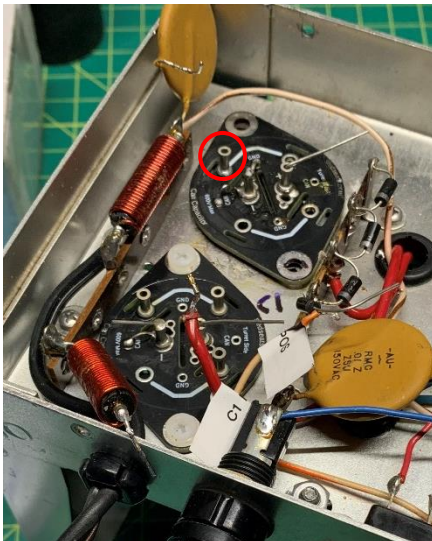


1. Remove and replace Diodes D1-D4 on the terminal strip next to C1 and C2.
 - a. D2 attaches to the Positive post of C1. Leave that unterminated on the Cathode side.
 - b. D4 attached to the grounded twist tab of C2. Just attach the Anode side to the last lug of the terminal strip if yours is connected to chassis ground.
2. You will replace the two 150k ohm 2W resistors so feel free to cut them out of your way if you don't want to unsolder.
3. Remove the 150k ohm resistor at C1.
4. Coil L2 will be in your way. Unsolder the lead at the fuse and move out of your way.
5. Label the orange and white wire to + of C1 as C1 POS. Unsolder and disconnect wire.
6. Label the red wire at the twist tab of C1 as C1 NEG. Unsolder and disconnect the wire.
7. Remove (unsolder or cut) the jumper that connects C1 twist tab to C2 Positive tab.
8. Remove the two screws holding in C1 and remove C1.
9. With the bottom side of supply still facing up, insert from top down the Uni-Cap assembly marked C1 so that the capacitor is going through the hole and the main board is on the solder side.
10. Turn the board clockwise about 5° so that the flange clears the terminal strip.
11. Mark the mounting holes through the flange to the chassis with a marker.
12. Remove the C1 Uni-Cap assembly.
13. Pilot drill and then final drill out with 1/8" drill bit.
14. Clean up shavings.

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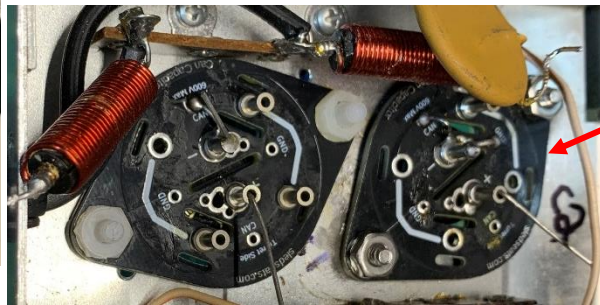
15. Remove resistor R2 (150K 2W) at C2.
16. Carefully unsolder C11 (ceramic disc) soldered to the twist tab of C2 and move out of your way without breaking leads of C11.
17. C2 is soldered to the chassis. Save you self some trouble and just break the other three twist tab leads off. Rock the capacitor back and forth until the last one breaks off.
18. Apply a very hot iron to the remaining solder tab until you can pull the twist tab out of the solder blob.
19. With soldering wick or desoldering station, remove the remaining solder blob.
20. Set C1 back in place temporarily using the two nylon bolts.
21. Set the C2 Uni-Cap assembly in same method as C1 so that it is parallel to C1 with the 7 o'clock turret facing L1 and C11. Mark and drill two 1/8" holes. Clean up shavings.
22. Wire brush around the two new holes for C2 to achieve a good ground.



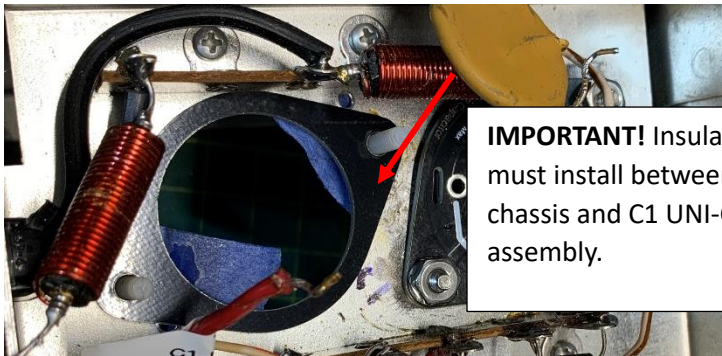
23. Insert the two #6-32 Nylon bolts into the holes for C1 so that the thread side is sticking up to the solder side of the chassis.
24. I use painters' tape to hold the head of the bolts in place to free up my hands.

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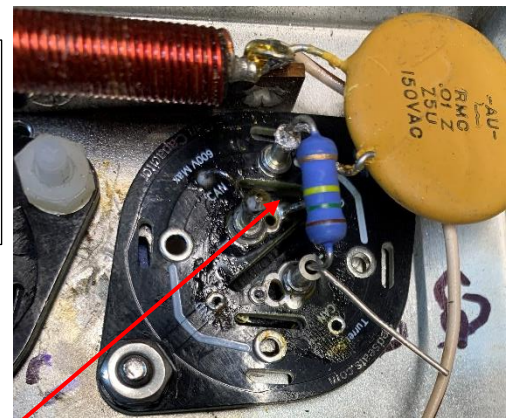
25. **IMPORTANT STEP:** Slide the oval insulator over the nylon bolts and then the C1 UNI-Cap board. Insulator is needed to isolate C1 from chassis ground. It must go between the board and the chassis.
26. Carefully secure with the nylon nuts. DO NOT OVERTIGHTEN! They will break if there is too much force.
27. Insert toothed washers on the #6-32 stainless steel bolts and insert through the holes for C2.
28. Painter's tape will help hold the bolt head in on the transformer side of the chassis.
29. Set football flange (as a spacer), then install the C2 UNI-Cap assembly over the bolts.
30. Add toothed washers over the bolts and secure with the #6-32 nuts.
31. Be sure it is tight to get a good chassis ground. Check for continuity with multimeter from the negative terminal of C2 and chassis for 0 ohms.



Add the extra football flange (as a spacer) between chassis and C2, to prevent board from bending.



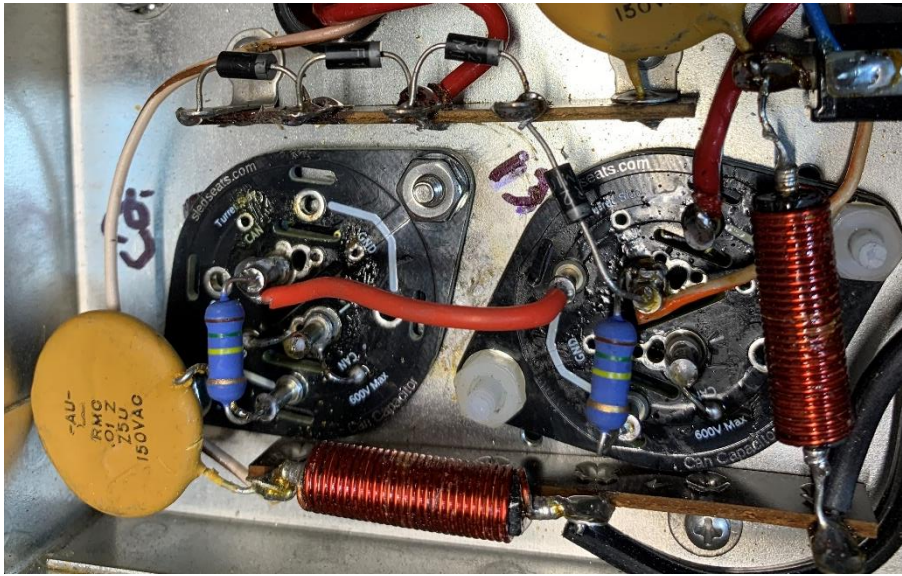
IMPORTANT! Insulator must install between chassis and C1 UNI-Cap assembly.



32. Insert the open leg of C11 (ceramic disc) into the 7 o'clock turret of C2. It should fit inside the hole. Do not solder yet.
33. Insert one lead of the supplied 150k ohm 2W resistor also into the 7 o'clock turret. The other end of the resistor goes inside the Positive (+) turret. Solder leads of C11 and the new R2 at both turrets on C2.
34. Make a 2 1/2" jumper, tin the ends, and install jumper from 10 o'clock turret of C1 to Positive turret of C2. Solder at both ends. C2 installation is complete.

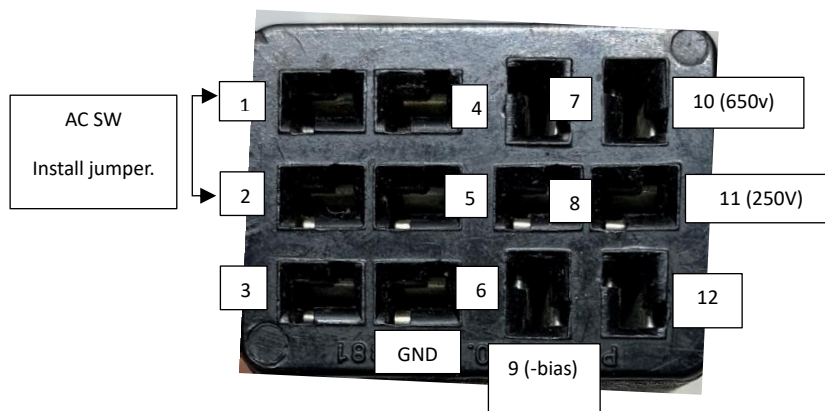
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35. Connect the following to C1:
- D2 Cathode to Positive (+) turret. I will fit inside the turret.
 - One lead of the supplied 150k ohm 2w resistor (R1) into the 7 o'clock turret of C1 and solder.
 - Wrap the other lead of R1 150k ohm around Positive (+) turret of C1.
 - Wrap lead of white/orange wire labeled C1 POS around the Positive (+) turret of C1.
 - Solder D2, R1 and white/orange wire to Positive (+) turret of C1.
 - Solder red wire marked C1 Neg to the 2 o'clock turret of C1.
 - Reattached L2 back to the fuse holder and solder.
 - C1 installation is now complete. Double check your work against the picture below.



The High voltage B+ is complete. If your power supply was working before the installation, this is a good time to stop and validate that the High Voltage side we just upgraded is working properly.

Before you plug the supply in, you will need to install a jumper between pins 1 and 2 of the rectangular plug to simulate AC switch. NOTE the image in the Drake Manual is in reverse of what you see facing the plug. See Image below.



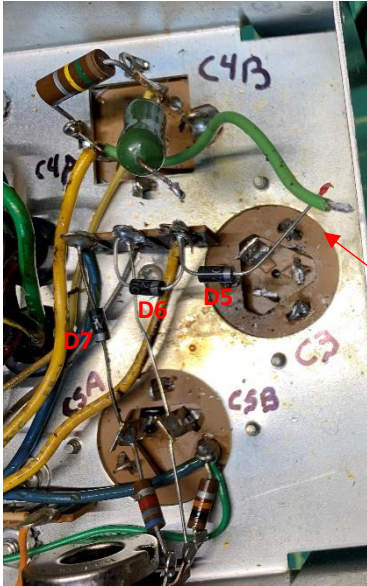
Check voltages from Ground (pin 6) to the HV (Pin 10), low voltage (Pin 11) and negative bias (Pin 9).

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X. Changing Capacitor C3.

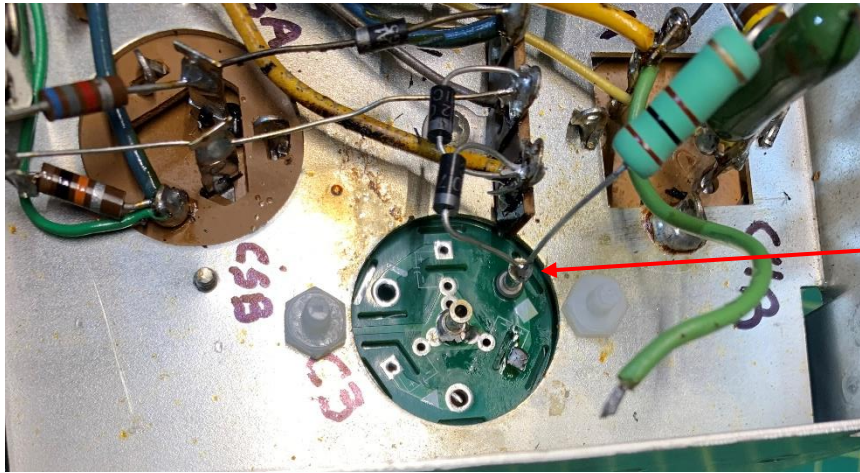
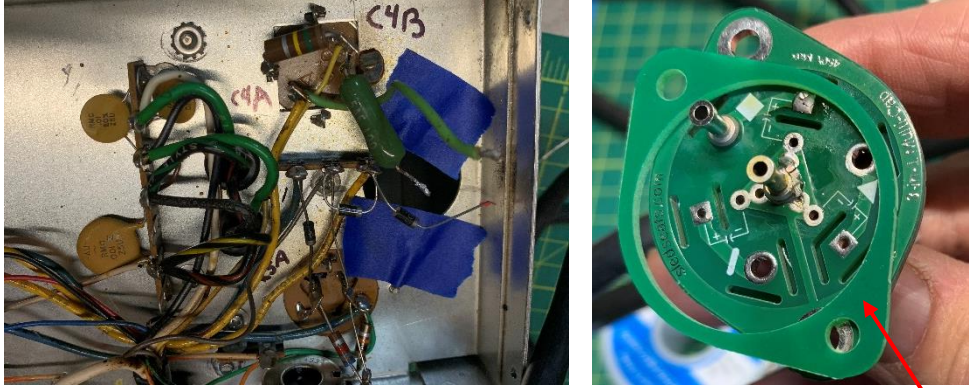
Be sure all capacitors are fully discharged if you tested the HV supply side. Be sure that you ground out your positive lead of your multi-meter between each check as it can hold high voltage on the lead for a short period of time and cause damage to components.

Mark out C3, C4 and C5 on the opposite side of the supply as we did with C1 and C2.



1. Replace Diodes D5 and D6. leaving the Cathode of D5 unconnected from C3 Positive.
2. Unsolder or remove R3 (100ohm 5w) resistor at Positive lead of C3. It will be easier to just replace it with the supplied resistor.
3. Unsolder jumper wire at C3 twist tab that is connected to C4A Positive.
4. Remove C3.
5. Drill out the original mounting holes with a 1/8" bit. Clean up shavings.
6. Insert a nylon #6 bolt from the bottom up (thread on transformer side) into both holes and tape the head to chassis to hold in place.
7. From the top side (transformer side, place the insulator over the nylon bolts then the new C3 Multi-Cap.
8. One at a time, reverse the orientation of the nylon bolts and secure one with the nylon nut, then repeat for the other bolt. I found this easier to work around the other large capacitors if you do not want to remove C3, C4 and C5 all at the same time.
9. Insert D5 Cathode side lead into turret marked Square.
10. Insert one lead of the supplied 100ohm 5W resistor also into turret marked Square of C3.
11. Solder D5 and R3 at Square Turret.
12. We will install the jumper from the center turret of C3 to C4A in a later step.

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IMPORTANT: Insulator must go between the Multi-Cap board and chassis. C3, C4 and C5 boards will mount from the top side (transformer side).

Solder D5 and R3 to turret at Square on C3. Label other end of R3 as C4B POS.

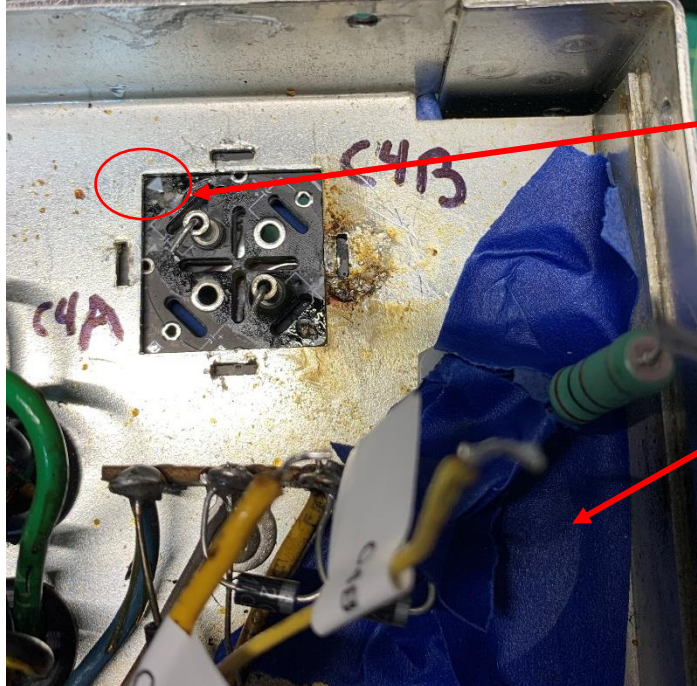
Turret at Square should be facing C4 near the terminal strip.

XI. C4 Replacement.

Again, Drake decided to use a chassis slotted mount instead of an oval flange mounted capacitor. Meaning you will need to remove C4 in the same manner as C2.

1. Unsolder the small yellow wire attached to C4B positive tab (Half-Moon), and mark it as C4B POS.
2. Cut off R4 (150K ohm 2w) between C4B pos and grounded twist tab.
3. Unsolder the thick yellow wire at C4A positive and label as C4A POS
4. Remove jumper wire at C4A POS that was previously connected to C3 twist tab and set aside.
5. Remove C4 the same way you removed C2. Break off the three twist tabs and rock the capacitor until the other tab breaks. Unsolder and clean up solder blob.
6. See pics below on how to position C4 to mark the holes to drill out. You will mark and drill the first hole from the top, then use that hole as an alignment hole to mark and drill the other from the bottom. The transformer is in the way of drilling one of the holes from the top. Unless you are doing a complete tear down and removing the transformer, this is the easier way.

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Set Multi-Cap C4 from the transformer side so that the center turrets are centered. The Triangle and Half Moon symbols should be visible in opposite corners.

Use painter's tape to hold in place. Also tape up C3 to protect from shavings.



Tape to hold in place. Double check both sides before final markings.

Mark and drill outside hole. Remove C4.

Insert bolt from top side, tape to hold in place.

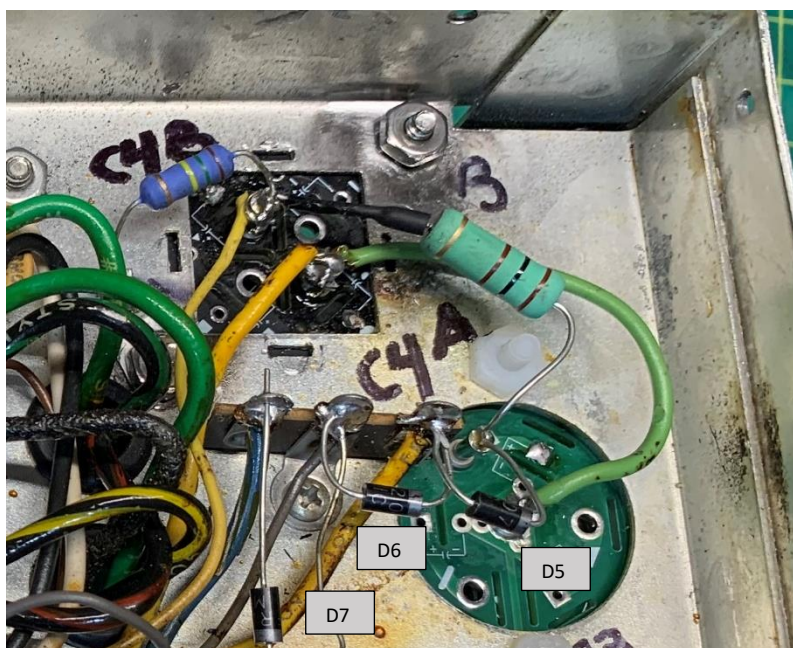
Put C4 on bottom as an alignment to mark and drill the other hole.



Tape up C3 to protect it from shavings when drilling.

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7. Install the new C4 in the same manner as you did with C2.
8. Clean the surface area around the mounting holes and install the assembly from the top side with supplied #6-32 stainless steel hardware kit. For the bolt near Triangle, install the supplied #6 ground lug.
9. Add heat shrink or spaghetti tubing to open end of the 100ohm (R3) resistor.
10. Connect R3, the small yellow wire (C4B) and one end of the supplied 150k ohm resistor (R4) to the positive turret marked Triangle (C4B) and solder.
11. Solder the other end of 150k ohm (R4) to the #6 ground lug.
12. Connect the thick yellow wire (C4A) to the Half-Moon Turret.
13. Reinstall, or make a new jumper from supplied wire to connect the C4A (Half-Moon) positive Turret to the center (ground) turret of C3.
14. This completes the installation of C3 and C4 for the low voltage power supply.
15. Test the supply for the 250VDC at Pin 11 (+) and Pin 6 (-).

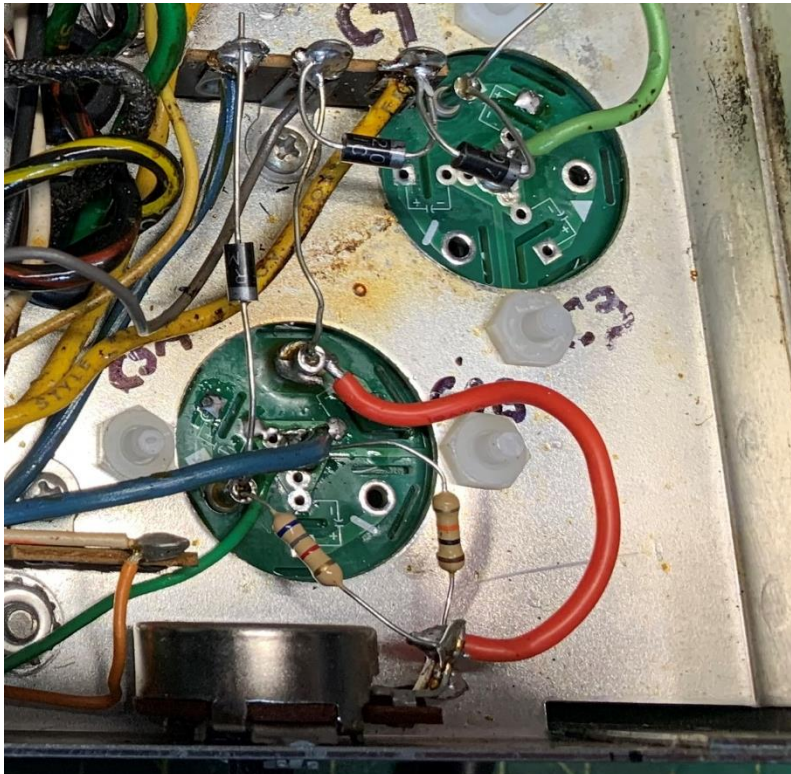


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XII. C5 Replacement

Almost done! C5 is straight forward and simple.

1. Replace D7 leaving the cathode side loose. Make sure you have enough length to reach the new board. Don't cut any lead length yet.
2. Remove resistors R5 (10k) and R7 (6.8k) from the bias pot.
3. Remove the blue and ground wire soldered to the twist tab of C5 and mark both as C5 NEG.
4. Remove the jumper between R6 Bias pot center and the grounded lug of the terminal strip.
5. Remove C5.
6. Drill out the mounting holes with 1/8" drill bit.
7. From the top side insert the **insulator** board then the new Multi-Cap C5. Aligning the Triangle pointing toward the terminal strip that has D5, D6, D7.
8. Secure with the #6-32 nylon hardware.
9. Attach and solder blue and green wire to the center turret of the new Multi-Cap C5.
10. Attach and solder jumper (can make new with supplied wire) from Triangle Turret of C5 and grounded lug of terminal strip.
11. Attach and solder jumper from Triangle turret to the center lug of R6 Bias potentiometer.
12. Insert D7 and one lead of supplied 6.8Kohm resistor into turret marked Square and solder.
13. Solder the other end of the 6.8k resistor to the upper terminal of Bias potentiometer R6.
14. Attach and solder new 10k ohm resistor to bottom terminal of bias pot and center Turret of C5 Multi-Cap.
15. Installation is complete.



Drake AC-4 Power Supply

Congratulations you have completed the upgrade. Be sure to check your work and validate the negative bias at Pin 6 (ground) and Pin 9 (-VDC) and that the bias pot adjustments do change the voltage.

I welcome feedback on any tips or tricks you find to make the project go faster.

Customer pics of final installations are always welcome.

If you find an error in this document, please kindly let me know at mysledshed@yahoo.com

Please be professional in your communique.

Thank you, and good luck!

73's

Scott

W8AOR