

I. Introduction

This document provides a step by step instruction for rebuilding and restoring the Dynaco Stereo-70 power amplifier. It discusses most of the typical and a few atypical problems that may be encountered with the restoration of the vintage Dynaco Stereo-70 power amplifier and provides the solution needed to resolve these problems. Most of these problems are age related and therefore any unit that has not been in service for over six months should be subjected to the Post Storage Start Up Procedure (Addendum 2). If your goal is to repair a problem with your Stereo-70 (such as hum, noise, fuse tripping, etc.) you should review our [Stereo 70 Troubleshooting Repair Guide](#) available at our website.

The most problematic components in the Dynaco power amplifiers are (in order of severity) the Quad electrolytic capacitor, selenium rectifier, output tube sockets, output tubes, and driver pc board. Of those, it is mandatory to replace the first three since if not defective they are certain to be soon. In particular, the original Quad electrolytic capacitor, encountering 21st century mains voltages, is operating at or near its design limits and accordingly is simply unreliable. This is the main reason that we do not recommend replacing it with another having the same ratings but rather one of the aftermarket modules that extend the operating voltage and also moderately increase the energy storage capacity. CAE offers two capacitor modules that meet these objectives and additionally include a complete new bias circuit (that also replaces the selenium rectifier). This is essentially a completely new power supply with higher ratings and energy capacity.

The second most problematic component is the output tube sockets which corrode and lose conductivity over time. These failures can be very costly since contact failures will zero bias the output tubes causing the tube to conduct maximum current (you may have seen the glowing red elements) dramatically shortening the life of the tube (if not destroying it altogether). Unfortunately the degree of cleaning necessary to remove the oxidation also removes the nickel plating (preferable to gold) thereby rendering the cleaning process short lived. The solution is inexpensive - replace the sockets completely using ceramic based sockets. This is a very worthwhile investment easily paying for itself considering the cost of premium replacement tubes.

Finally the original Dynaco pc driver board is subject to failure not due to limitations of the components (although the tube sockets are questionable) but rather due to the substrate material of the board itself. The majority of the original boards were made from an inexpensive and common consumer electronics composite phenolic base material. It is prone to moisture absorption and retention and with the varying temperatures encountered inside the Stereo-70, has expanded and contracted to the extent that the pc foil either has or is about to delaminate. This material also becomes coated with grime that is impossible to remove without harming the board. The symptoms of a defective drive module are noises, popping and crackling of your amplifier. We realize that many

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of you wish to preserve the exact sound of your amplifier and to meet that goal we have available an identical pc module replacement using mil-sped fiberglass composite (CAE # ASM-3R). Additionally for those wishing to retain the midrange of the original Stereo-70 but extend those midrange qualities to the bass and high frequencies (the stock amp's bass is loose and uncontrolled and its high frequencies are muted in comparison to the midrange) we offer our all triode upgrade module (CAE# ASM-3U). The price is the same for either module.

At the end of this document you will find restoration packs that address either the restoration or the upgrade alternatives. Each pack includes the Quad capacitor replacement module, ceramic tube sockets, Mil-Spec Teflon wire, and one of the driver modules. Also included are the various hardware specified in this document. We also have available replacement tubes as needed. Finally, we also provide this restoration service in our lab. The price depends upon the option you select and therefore we suggest that you contact us (www.dynaco-doctor.com) to discuss your situation and your options accordingly.

A. Tools & Documents Required - Before you begin you must have a few basic tools on hand – these items are essential for a successful restoration. Additionally, you should have available associated documentation. Please obtain the items as follows:

- RCA shorting plugs (Fabricate using Radio Shack # 274-339)
- Digital Voltmeter (Inexpensive Model from Radio Shack or Equivalent)
- Tools, Soldering Iron & Soldering Tools, and general DIY guidelines (See the CAE Tech Note @ [THE DIY Bible: - Kit Builders Guide](#))
- Wire Jumpers with Alligator Clips (Radio Shack # 270-180)
- 100 ohm 2 Watt resistor (not a critical value, any value near 100 ohms will be fine)
- 100K ohm 3 to 5 Watt resistor
- 20 fuses rated at 1Amps, Slo-Blo (not larger nor smaller)
- 3 fuses rated at 3 Amp, Slo-Blo
- Original Dynaco Stereo-70 Owners / Assembly Manual – (Full manual available at our web site [Stereo-70 Original Dynaco Owners Manual \(full\)](#))
- Quad capacitor / power supply replacement module documents (available from the CAE website @ [ASM-S7U-B Documentation](#))
- Restoration or Upgrade Driver Module documents (available from the CAE website @ [ASM-3R Restoration Module Documentation](#) or [ASM-3U Upgrade Documentation](#))

B. Your Safety

In this document, I hope to provide you with some methods and techniques that will guide you to resurrect a long term out of service Stereo 70 or a unit that has begun to show the effects of age and restore it to better than new operation. It is absolutely critical that you are certain that you have the skills to safely operate the tools recommended and that you always remember that you will be working with lethal voltages. In particular, the

electrolytic capacitors will continue to store and present even after you have removed the power and disconnected the line cord. Once again, always assume that lethal voltages are present and work accordingly. That means never place yourself in a position to be the conductor between the circuit and ground (let the jumper become the more direct current path).

II. Stereo 70 Overview :

Although not mandatory, it will be very helpful for you to understand the operation of your Stereo 70 and the three principal functional sections and how they interact. The next section discusses each section briefly.

Tube power amplifiers are relatively simple devices and consist three main sections:

- 1) **The Power Supply** – The power supply consists of
 - a. The line cord,
 - b. Fuse & Fuse Holder
 - c. Power switch,
 - d. Power transformer,
 - e. Rectifier (tube is stock, modified may be diodes) & Tube Socket
 - f. Choke,
 - g. Filter capacitor (the Quad electrolytic “can”), and
 - h. Bias supply. The Bias supply consists of the rectifier diode (in the original it was a selenium “stack”), filter capacitors (2), fixed resistors (2), and bias pots (2, one for each channel).

Because the power supply is common to both channels, symptoms that effect both channels (dead amp, fuse tripping, hum in both channels, weak power in both channels, etc.) is usually the result of a problem in the power supply.

- 2) **The Output Stage** – There are two output stages, one for each channel. Each output stage consists of :
 - a. the output transformer,
 - b. output tubes (2 per channel), and
 - c. cathode bias resistor (the original value was 15.6 ohms and had the appearance of a white ceramic tubular device connected to pins 1 & 8 of both output tubes).
 - d. The output tube sockets should also be considered a “component” in the output stage – they have a higher incidence of failure than the typical mechanical component due to the constant high temperature exposure.

That’s it – really simple. It is important for you to know that the output stage tubes are meant to conduct a little “bias” current when the amp is idle. This bias current is controlled by placing a negative voltage at the control grid (pin 5 of the EL34 output tubes). Note - if this negative voltage were to disappear, the control

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grid will fall to zero volts and at this point the tubes will conduct way too much current causing the familiar glowing red plate elements (from the heat). Eventually the fuse will trip or, if too late, the tubes will be destroyed. The negative voltage needed to keep the tubes conducting the desired current is produced in the bias supply (located in the power supply section) and is delivered to the control grid (pin 5) via the tube socket. Therefore should the tube socket corrode or otherwise fail to connect to the tube control grid pin (5), the voltage appearing at the control grid (pin 5) will fall to zero causing the tube to conduct excessive (and destructive) current. You may want to think of the negative control grid voltage as the adjustable safety valve. Because each tube differs from unit to unit, it is necessary to make this voltage variable and user adjustable. This adjustment is made via the BIAS ADJUSTMENT pots (located on the amp between the rectifier tube and Quad filter capacitor). As the user adjusts the voltage on the control grid, the current flowing through the tube (from plate to cathode) flows into the Cathode Bias Resistor (the 15.6 ohm resistor discussed above) causing a voltage drop to appear across this resistor (via ohms law). The user then measures the voltage across the resistor as an indicator of the current flowing through the tube (via ohms law $Voltage = Current \times Resistance$). Since the current flowing through each tube should be about 50mA, and since both tubes (in one channel) have their cathode current flowing through a single common Bias Resistor, the total current through the bias resistor will total 2X 50mA, or 100mA. By Ohms law, $100mA \times 15.6 \text{ ohms} = 1.56 \text{ Volts (DC)}$ – and this is the Bias Voltage specified by Dynaco. Failures in the output section usually manifest themselves as bias difficulties (too much or too little) usually the result of problems in the bias supply, weak or shorted tubes, defective tube sockets (loose or corroded terminals), or (rarely) defective output transformers.

- 3) **The Driver Amplifier & Phase Splitter** – This is perhaps the most complex part of the Stereo 70 power amplifier. It is the 7" X 4" (approximate) PC board located in the front center of the amp between the two pairs of output tubes. It houses two identical channels each consisting of a 7199 signal tube and associated resistors and signal capacitors. The 7199 contains two sections – the pentode section (where the input signal from your preamp is initially amplified), and a triode section where the signal is split into two equal, but out of phase signals (out of phase means that one signal is the mirror image of the other). For push pull amplifiers (like the Stereo 70) it is necessary to deliver two out of phase signals to the output section. Failures in the driver section usually manifest themselves as differences in channel level, distortion, buzzes, crackles, hissing, or other disharmonious sounds. Most often the problem appears in only in one channel. The signal from the driver board circuit is sent to each of the four output tubes (individually) via a coupling capacitor (0.1uF). Note that the voltage on the driver side of the coupling capacitor is at hundreds of volts (positive) and the voltage at the output tube side of the coupling capacitor is at the output tube control grid's (pin 5) negative voltage. If the capacitor becomes only moderately leaky, current

will flow into the bias circuit of the output stage and as a result it will be impossible to bias the output tube correctly. This is an uncommon failure however it is worth mentioning since it is in concert with our discussion in the output section.

Frankly, the driver stage is one of the two sections of the Stereo 70 that was not designed with longevity in mind. The board material is phenolic (really pressed paper) that absorbs moisture and does not hold up well to the typical heat / cool cycles present inside the Stereo 70. The solder traces are very thin and the pads are small and combined with the inferior board material the adhesion is marginal. This makes the removal and replacement of components very difficult usually causing board damage. Therefore we strongly recommend replacing the driver section should the diagnosis point towards the driver board. In fact, it is recommended that the driver board be replaced irrespective of the analysis to dramatically improve reliability and performance.

III. Restoration Process

A. Preparation

- 1) You will first remove the top and bottom covers by removing the 4 (6 on some units) located on the right and left sides of the amplifier. Both covers should be free to be released.
- 2) Next, remove the tubes (4X output tubes, 2X driver tubes, 1X GZ-34 rectifier tube) and label each to their respective positions if you are planning on retaining the original tubes.
- 3) Using a 2" paintbrush and a vacuum cleaner hose gently dislodge and vacuum all dust and dirt from the topside and underside of the amplifier. Be careful to get into the small crevices under the transformers.
- 4) Before we proceed, it is important to confirm the operation of the power and output transformers since you may want to reconsider the value of the project should and of the transformers be defective. If you amplifier has been in service before you began, it is fair to assume that the transformers are functional and therefore you may omit the transformer tests and move to the next phase. The transformer tests are described under Addendum 1: Testing the Stereo-70 Transformers.

B. Disassembly

During the disassembly, there are some components that will be retained and reused while others will be discarded. Obtain a small box to hold the hardware and parts that will be reused. When identified as retained, carefully de-solder all leads and wire remnants, thoroughly clean the leads of all remaining solder and store them in a safe

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place for later reuse. You may simply cut the leads on those components that are identified as discarded. You may find that the 3 transformer leads are worn and discolored – if this is the case, using Figure 1 and the data from the original Stereo-70 manual, be certain to label each lead for identification later. Your most valuable tools in this section will be a clean quality soldering station and Edsyn de-soldering tool. Let's begin with the items you will be retaining:

- 1) De-solder the line cord from the fuse post and power switch. Use the Edsyn Desoldering tool to clear as much solder as possible from the connections. You can now remove the line cord and rubber grommet. If necessary you may have to cut and re-strip these connections for reuse.
- 2) De-solder the black wire from the power transformer connected to the remaining center lug of the fuse holder. Remove and store the fuse holder.
- 3) De-solder the remaining black wire from the power transformer connected to the power switch and remove the power switch. Remove the power switch for reuse.
- 4) De-solder the four left output transformer wires (yellow, orange, brown, black) from the left speaker connector. De-solder the remaining black wires connected to the outer terminals of the left speaker connector. Clean and remove the speaker connector for reuse.
- 5) Repeat step 4 for the right speaker connector.
- 6) On terminal #1 (no symbol) of the Quad electrolytic capacitor de-solder the two red wires going to the output transformers and the one choke lead.
- 7) On terminal #2 (round symbol) of the Quad electrolytic capacitor disconnect the other choke lead. You may cut the remaining wire connected to this lug that connects to pin 8 of the rectifier tube.
- 8) Cut the two remaining wires connected to the terminals #3 (square symbol) and #4 (triangle symbol) of the quad electrolytic capacitor (they connect to the Dynaco pc board). The resistors connected to these terminals may remain. Finally, de-solder and remove all of the wires connected to the ground lugs of the quad electrolytic capacitor. Depending upon how your amplifier was originally assembled, it is possible that the mounting lugs have been soldered to the chassis. If this is the case, you should thoroughly heat each lug until the solder freely flows and then while molten use the Edsyn solder sucker to remove all of the solder. It may be necessary to re-apply new solder and repeat this in order to thoroughly clean the solder. After you have removed all of the solder on the mounting lugs, use gas pliers to rotate each lug so that its surface is perpendicular to a line radiating from the center of the quad cap to remove the capacitor. If you are planning on keeping the original appearance of your Stereo-70 you should retain this capacitor - otherwise it may be discarded.
- 9) Carefully de-solder the three terminals (five wires) connected to the left bias potentiometer (immediately to the left of the original selenium rectifier). Be sure to clean all of the wire and solder remnants from this control. Remove and store the potentiometer.
- 10) Repeat step 9 for the right bias potentiometer.

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- 11) De-solder the power transformer lead (Red / Yellow) connected to system ground lug located immediately to the left of the Quad capacitor. You may cut any remaining wires connected to these lugs and then remove and discard.
- 12) Next, examine the dual RCA input connector. If it is cracked or worn or you plan to replace it, you may cut the wires to all four posts and discard. Alternatively if it is clean and re-useable, carefully de-solder and clean each post and store.
- 13) Immediately to the left of the input connector you will find the stereo-mono switch. De-solder and clean its lugs and store for reuse.
- 14) The two 8 pin octal sockets located on the front of the amplifier will be retained however we will only be using them for bias adjustment purposes. Therefore you may cut all of the wires except pin 8. De-solder and clean pin 8 on both sockets. Remove both and store for reuse.
- 15) Locate the 7 pin terminal strip immediately to the left of the power transformer (below the left output transformer). De-solder completely terminals 5, 6, & 7 (See Figure 1). These terminals mount a 3 leaded ceramic (small flat circular) capacitor and two power transformer leads (Green/Yellow and Brown/Yellow). Carefully remove the ceramic capacitor and clean the solder on its leads. You may cut the remaining wires and components connected to pins 1 through 4 connected to this terminal strip.
- 16) Locate Left Output tube socket associated with V2 (left side nearest the center). De-solder the wires connected to pins 2, 3, 4 & 7. This will free all of the power and output transformer leads for the left channel. Using your ohmmeter, measure the resistance of the 15.6 ohm bias set resistor connected from V2/pins 1&8 and ground. If it is not open carefully de-solder it, clean its leads and store for reuse.
- 17) Repeat step 16 at V7 on the right channel.
- 18) De-solder the power transformer Red/ Black Stripe lead connected to the selenium rectifier. Cut the remaining wire connected to the other selenium rectifier terminal and remove and discard the selenium rectifier.
- 19) De-solder all of the wires connected to the rectifier socket (V1). The socket will be replaced but the four power transformer wires (2X yellow and 2X red) will be reused. Remove and discard the tube rectifier socket.
- 20) Next, you may remove the three transformers. Begin with the power transformer and next remove the two output transformers. The power transformer is held in place with 8-32 nuts on posts originating from the transformer. There are also wire hold-down clamps. Be sure you keep all of this hardware.
- 21) Once you remove the three transformers, you should now have access to the hardware securing the choke and seven lug terminal strip. Remove and store the choke. Remove and discard the 7 pin terminal strip.
- 22) The remainder of the parts mounted on the chassis may be now removed. Since they will not be retained they may be discarded. You may want to keep all of the mounting hardware for spares. If you will be retaining the original Dynaco driver pc board (not recommended) you can de-solder the wires connected to the 23 terminals associated with this board.

III. Cleaning & Preparation

Before you begin the steps to reassemble and restore your amplifier you will probably want to clean and prep your chassis and the transformers for reuse.

Depending upon the condition of your chassis, it may require moderate or extensive cleaning and if sufficiently pitted, resurfacing. The extent of your effort depends not only on the condition of your chassis but also your expectation regarding its appearance. In either case, its electrical and audible performance will not be impacted regardless of how you approach the physical restoration of the chassis. We have restored many Dynaco power amplifiers and always begin by cleaning the amplifier chassis in a strong solution of dishwasher detergent (Dawn) with a mild addition of ammonia (not too strong as it may lift the printing). Using a soft nylon brush (and toothbrush) we remove much of the surface dirt and oxidation. I advise against abrasive pads like scotchbrite that can scratch and dull the finish. After the amplifier is completely dry we follow this with automobile chrome cleaner to remove another layer of imbedded dirt and even some rust. Again, be careful to not get too aggressive as you may harm the lettering. For those of you that don't care about retaining the original Dynaco lettering, you can use more aggressive cleaning solutions to remove all surface rust. You can always try your method initially on the inside of the chassis to sample the effect. It should be noted that many builders like the satin metal look that can be achieved using scotchbrite in a controlled moderately aggressive manner. Finally you may wish to investigate local metal finishing houses that will re-chrome your chassis for a nominal fee.

Next you will want to clean the transformers. You will obtain very good results using common window cleaner. Be careful to not get any liquid inside the transformer end bells or on the metal laminations. If your end bells are sufficiently tarnished you should remove them and have them painted using high temperature automotive paint.

Many of the early transformer leads used cloth insulation. This insulation when subjected over time to the environment under the Stereo-70 chassis may have become very hard and brittle and will crack once moved. I suggest using 1/8" heat shrink tubing to re-insulate each of the effected leads. Be sure to slide the heat shrink all the way down to the full length of the lead and above all be certain to label each lead with its original color code identity.

After you have cleaned and prepared your chassis and transformer you will begin to re-assemble your amplifier.

IV. Reassembly

You will begin to reassemble your Stereo 70 by installing the new tube sockets, and most of the hardware. To ease the wiring the transformers will be installed as late as possible thereby making orientation of the amplifier easier.

A. Initial Hardware Installation (Refer to Figure 1)

1. Begin by install the four new ceramic output tube sockets. Orient each socket such that the location notch that identifies pins 1&8 is pointing away from the center of the amplifier. You will also need to install a ground lug between the chassis on the tube socket on the outer hole of both V7 and V2 (nearest pins 1&8).
2. Install the two bias adjust potentiometers and orient so that their three terminal are facing towards up (towards the pc board cutout).
3. Next, install the new ceramic rectifier tube socket (V1). Orient its location tab (pins 1&8) so that it is facing towards the center of the amplifier.
4. Next, install a 4 lug terminal strip (3 free with 1 ground) at the location originally occupied by the selenium rectifier (the hole between the two bias potentiometers). Orient it so that it is parallel to the side of the amplifier and that the two free lugs are towards the front of the amplifier while the single free lug is towards the rear of the amplifier.
5. Next, install a 3 pin terminal strip (free - ground - free) at the original location of the original ground lugs (immediately to the left of the Quad electrolytic capacitor). Orient the terminal strip it easily clears the two bias potentiometers. You may need to rotate it so that it not perfectly parallel to either the front or the side of the amplifier. It is important that it will clear the right bias potentiometer and the Quad electrolytic capacitor (not yet installed). Secure it firmly since this will become your central ground point.
6. Install the choke in its original location and orientation.
7. Install the new (or cleaned) Dual RCA input connector in its original location. This mounts from the inside of the chassis. Be sure to place the original phenolic insulator between the assembly and the inside of the chassis.
8. Install the original Stereo-Mono switch on the front panel of the amplifier,
9. Install the two 8 pin octal sockets on the front panel of the amplifier. Both should have their location tab (pins 1&8) pointing towards the left.
10. Install the two speaker connectors on the rear panel of the amplifier. These mount from the outside of the amplifier with the tabs orientated so that they are nearest the amplifier surface.
11. Install the original fuse holder.
12. Install the original power switch and orient so that the outer terminal is located nearest the amplifier chassis surface.
13. Install the Quad capacitor replacement module in the area originally occupied by the 7 pin terminal strip. Be certain to follow the instructions for preparation as

outlined in the documentation for the ASM-S7U-B module (available from www.dynaco-doctor.com).

14. Finally install the original power and output transformers. Be certain to place the left output transformer (the one with the longest red lead in the correct location).

B. Initial Wiring - Using Figure 2 as your guide, make the following connections (using only 20 or 22 ga Teflon insulated wire):

15. Starting on the left channel, solder a loop of $\frac{3}{4}$ ' solid bare wire (you can use an old component lead) from pin 1 to pin 8 of V3. Do the same for V2.
16. Next connect a 3" black wire from pin 8 of V3 to pin 1 of V2. Locate the 15.6 ohm power resistor originally removed from your amplifier and connect one end to pin 8 of V3. Solder the other end of the 15.6 resistor to the ground lug near V2.
17. Finally connect a 4.5" black wire to pin 1 of V3. The other end will be connected to pin 8 of the front panel left octal socket. Solder securely these four tube pins (V3 pins 1 & 8 and V2 pins 1 & 8).
18. Next, connect a 3" black wire from pin 2 of V2 to pin 2 of V3. Next, connect a 7" black wire to pin 2 of V3. Solder securely pin 2 of V3.
19. Next, connect a 3" black wire from pin 7 of V2 to pin 7 of V3. Next, connect a 7" white wire to pin 7 of V3. Solder securely pin 7 of V3. Orient the 7" white wire from this step and the 7" black wire from the previous step towards to front of the amplifier and slightly twist together throughout their entire length. This pair will eventually terminate on the new driver board and therefore should be oriented towards the front inner edge of the amplifier.
20. Connect a 4" white wire to pin 5 of V3.
21. Connect a 4" white wire to pin 5 of V2.
22. Locate the left output transformer blue/white and green/white leads. Lightly twist together and orient along the left outside edge of your amplifier. Trim to length and connect the green/white lead to V2/pin4. Next connect the blue/white lead to V2/pin3.
23. Locate the left output transformer blue and green leads. Lightly twist together and orient along the left outside edge of your amplifier. Trim to length and connect the green/white lead to V3/pin4. Next connect the blue/white lead to V3/pin3.
24. Locate the power transformer two green leads (these are quite heavy gauge). Lightly twist together and orient along the surface of the chassis towards the left aiming at V2. Trim to length and connect one of the wires to V2/pin 7 and the remaining green wire to V2/pin 2. You may want to orient these wires so that they approach V2 from the left.

OK – the left channel output tube connections are completed. We will now perform the same steps for the right channel:

25. Solder a loop of $\frac{3}{4}$ ' solid bare wire (you can use an old component lead) from pin 1 to pin 8 of V6. Do the same for V7.

26. Next connect a 3" black wire from pin 1 of V6 to pin 8 of V7. Locate the 15.6 ohm power resistor originally removed from your amplifier and connect one end to pin 1 of V6. Solder the other end of the 15.6 resistor to the ground lug near V7.
27. Finally connect a 4.5" black wire to pin 8 of V6. The other end will be connected to pin 8 of the front panel left octal socket. Solder securely these four tube pins (V6 pins 1 & 8 and V7 pins 1 & 8).
28. Next, connect a 3" black wire from pin 2 of V7 to pin 2 of V6. Next, connect a 7" black wire to pin 2 of V6. Solder securely pin 2 of V6.
29. Next, connect a 3" black wire from pin 7 of V7 to pin 7 of V6. Next, connect a 7" white wire to pin 7 of V6. Solder securely pin 7 of V6. Orient the 7" white wire from this step and the 7" black wire from the previous step towards to front of the amplifier and slightly twist together throughout their entire length. This pair will eventually terminate on the new driver board and therefore should be oriented towards the front inner edge of the amplifier.
30. Connect a 4" white wire to pin 5 of V6.
31. Connect a 4" white wire to pin 5 of V7.
32. Locate the right output transformer blue/white and green/white leads. Lightly twist together and orient along the right outside edge of your amplifier. Trim to length and connect the green/white lead to V7/pin4. Next connect the blue/white lead to V7/pin3.
33. Locate the right output transformer blue and green leads. Lightly twist together and orient along the right outside edge of your amplifier. Trim to length and connect the green/white lead to V6/pin4. Next connect the blue/white lead to V6/pin3.
34. Locate the power transformer two brown leads (these are quite heavy gauge). Lightly twist together and orient along the surface of the chassis towards the right aiming at V7. Trim to length and connect one of the wires to V7/pin 7 and the remaining green wire to V7/pin 2. You may want to orient these wires so that they approach V7 from the right.
35. Connect a 3.5" black wire from terminal #1 of the left bias pot to terminal #1 of the right bias pot as shown in figure 2.
36. Now, connect a 3.5" white wire from terminal #3 of the left bias pot to terminal #3 of the right bias pot as shown in figure 2.

You will now complete the wiring of the transformers, choke, and other components (Refer to Figure 1):

37. Connect the original ceramic capacitor (flat round capacitor with three leads) to the 4 pin terminal strip (located between the bias potentiometers) so that its outer leads are connected to lugs 1 & 2 (the first two counting from the front of the amplifier) and so the ceramic capacitor center lead is connected to the ground lug (#3 counting from the front end) of the terminal strip. Note that this is not a direct lead to lug relationship. It is important that the center lead of the ceramic cap be connected to the ground lug of the terminal strip.

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38. Trim to length and connect the four Left output transformer leads (Yellow, Orange, Brown, Black) to the Left speaker output terminals as shown in figure 1.
39. Prepare a 15" black / green twisted pair of 22 ga. Teflon insulated wire. From one end connect the black lead to the speaker output terminal that is connected to the left output transformer Black lead. At the same end connect the green lead to the speaker terminal connected to the left output transformer Yellow lead. Route the twisted pair along the left edge of the amplifier and then along the front of the amplifier so that it arrives near the input terminals.
40. Trim to length and connect the four Right output transformer leads (Yellow, Orange, Brown, Black) to the speaker output terminals as shown in figure 1.
41. Prepare a 15" black / red twisted pair of 22 ga. Teflon insulated wire. From one end connect the black lead to the speaker output terminal that is connected to the Right output transformer Black lead. At the same end connect the red lead to the speaker terminal connected to the right output transformer Yellow lead. Route the twisted pair along the right edge of the amplifier and then along the front of the amplifier so that it arrives near the input terminals.
42. Connect the shorter of the two power transformer black leads to the center lug of the fuse holder as shown in Figure 1.
43. Connect the remaining (longer) black lead of the power transformer black leads to terminal 1 of the power switch as shown in Figure 1.
44. Locate the two the Power transformer (not output transformer) Red leads and lightly twist them together orienting them toward the left past the underside of V1 (rectifier tube socket). Trim to length and connect one to V1/pin 4. Connect the remaining red wire to V1/pin 6.
45. Locate the two the power transformer White (due to age these may also appear as Yellow) leads and lightly twist them together orienting them towards the V1 (rectifier tube socket). Trim to length and connect one to V1/pin 2. Connect the remaining red wire to V1/pin 8.
46. Locate the power transformer Green/Yellow lead and the power transformer Brown/Yellow lead. Twist (if possible). Trim to length and attach one lead to the first lug (nearest the front of the amplifier) of the 4 pin terminal strip (this lug also connects to one of the outer leads of the ceramic cap). Trim to length and connect the remaining lead to the third lug of the 4 pin terminal strip (this lug also connects to the remaining outer leg of the ceramic capacitor).
47. Locate the power transformer Red/Black lead and connect this to lug #4 (the remaining free lug, nearest the power transformer) of the 4 pin terminal strip mounted between the bias potentiometers.
48. Locate the power transformer Red/Yellow lead and securely connect it to the ground lug (center lug) of the 3 lug terminal strip located to the right of the right bias potentiometer (near the original Quad electrolytic capacitor). Make Note - This is system ground.
49. Locate the Red leads for each of the output transformers and route each to appear near the 3 lug terminal strip. Trim to length and attach to lug #3 (nearest the

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- choke) of the 3 lug terminal strip. Locate the shorter of the two choke leads and after trimming to length connect to this same lug (#3).
50. Locate the remaining choke lead and after trimming to length connect to lug #1 (nearest the front of the amplifier) of the three lug terminal strip (to the right of the right bias potentiometer).

You are nearly finished. All that is necessary to complete your restoration is to install the new driver module (restoration or upgrade) and wire in the quad capacitor module. The documentation cited at the introduction of this document should be referenced for the correct procedure to install, wire, and power up these modules.

Item	Description	CAE Part Number	Quan	Notes
X1	Octal Tube Socket, Octal	S7-SKT-90	1 Set	5/Set
X2	Teflon Wire Kit	TWK	1 Set	4X 10' / Set (1)
X3	3 Lug Terminal Strip	Lug-3	1	
X4	4 Lug Terminal Strip	Lug-4	1	
X5	Quad Cap Module	ASM-S7U-B	1	Kit or Assembled
X6a	Restoration Driver Module	ASM-3R (2)	1	Kit or Assembled
X6b	Upgrade Driver Module	ASM-3U (3)	1	Kit or Assembled
X7	Dual RCA Input Connector	D-RCA	1	Optional
R1	Bias Adjust Resistor 10 ohm / 3W / MO	283-10	2	Opt (Replacing the original 15.6)

Notes:

1. The Teflon wire kit includes 4 sections of 22 ga. Teflon insulated wire in various colors (Red, Black, White & Green) specified by this project.
2. X6a is available in kit or assembled versions. Kit P/N is KIT-3R; Assembled P/N is ASM-3R. Available option is polypropylene signal capacitors.
3. X6b is available in kit or assembled versions. Kit P/N is KIT-3U; Assembled P/N is ASM-3U. Available options are polypropylene signal capacitors; DC Balance and AC balance adjustments.

A complete kit including all of the items listed in the Bill of Materials is available from CAE. Version 1 includes the Restoration Driver Module (X6a). Version 2 includes Upgrade Driver Module (X6b). To order specify the part number as follows:

CAE P/N	Notes
Kit-S7R	Stereo-70 Restoration Package – Kit
ASM-S7R	Stereo-70 Restoration Package – Assembled Modules
Kit-S7RU	Stereo-70 Restoration / Upgrade Package – Kit
ASM-S7RU	Stereo-70 Restoration / Upgrade Package – Assembled Modules

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Figure 1 Original Dynaco Stereo 70 Wiring Diagram

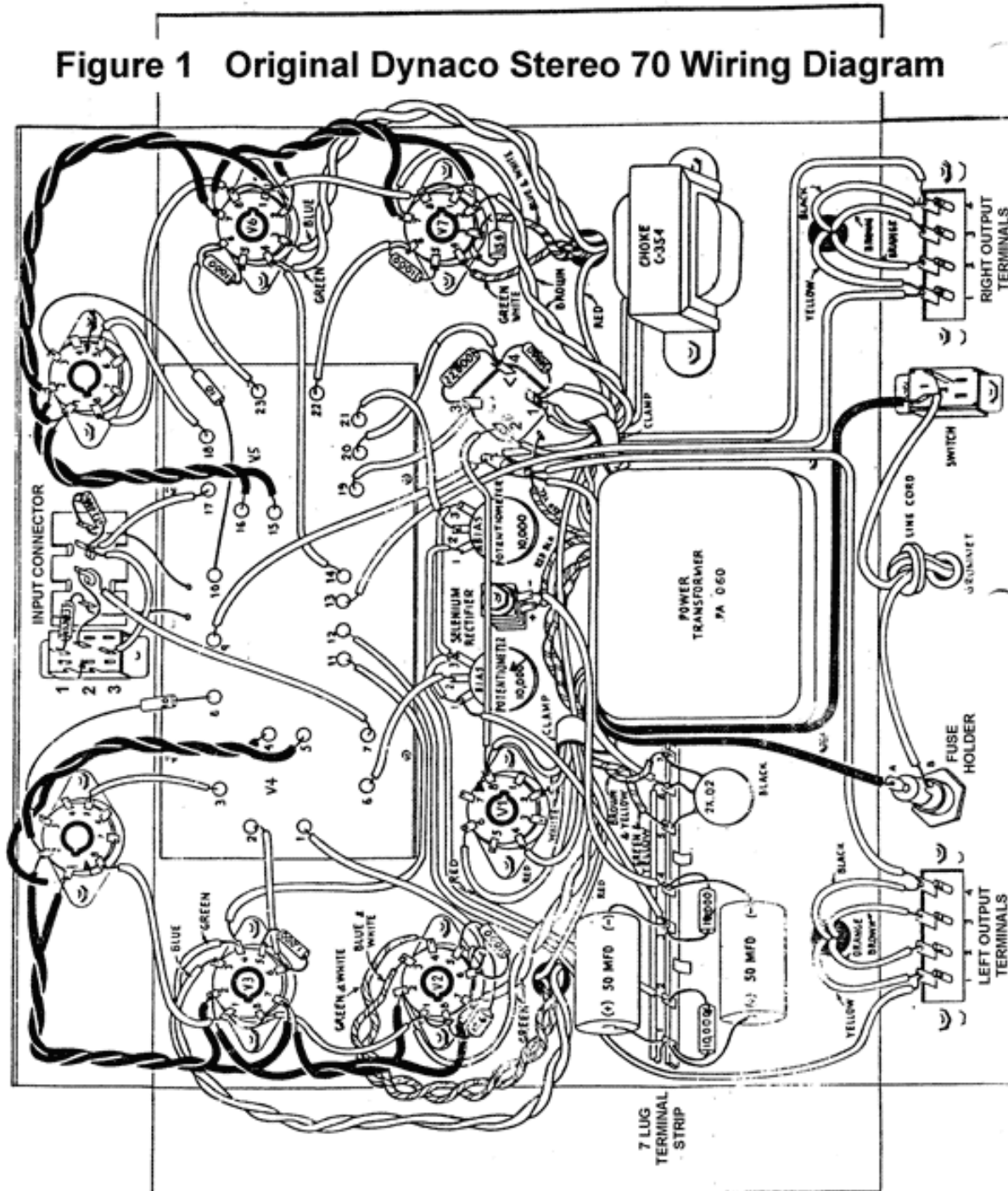
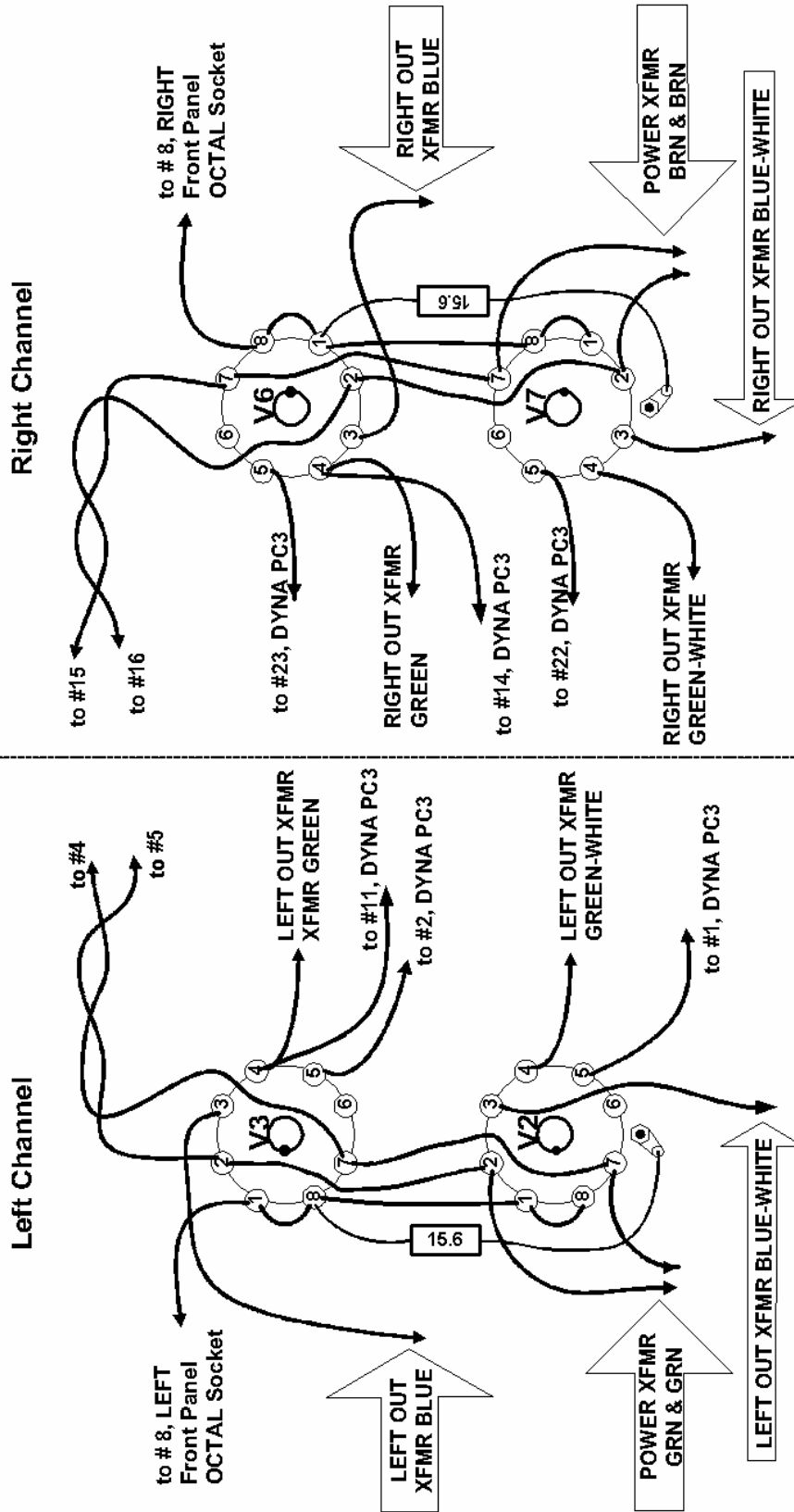
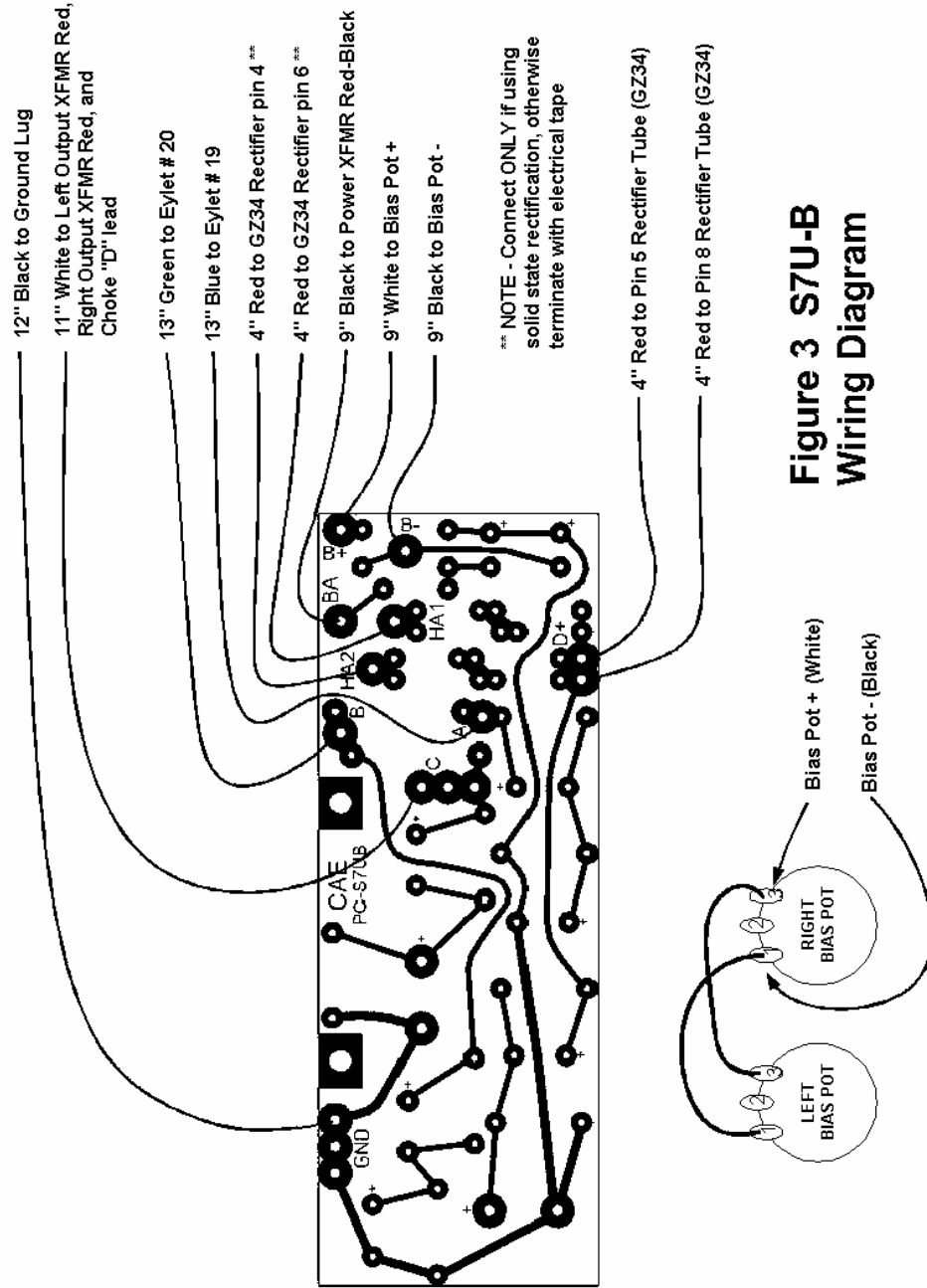


Figure 2 Dynaco Stereo-70 Output Tube Socket Wiring Diagram



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Addendum 1 Testing the Dynaco Stereo-70 Transformers

A. Power Transformer

1. Remove all tubes (4X output tubes, 2X driver tubes, 1x GZ-34 rectifier tube)
2. Disconnect the Red/Black Stripe wire connected to the Selenium rectifier – cover this end with tape or 1/8” shrink tubing to prevent contact with other items
3. Install a 0.1A fuse
4. Connect the amplifier to 120VAC mains.
5. Switch on the amplifier (for approximately 1 minute)
6. Switch off the amplifier
7. Remove and examine the fuse
8. If the fuse is not tripped, the power transformer has passed the short test
9. Install a 1.0 amp fuse
10. Switch on the amplifier
11. Measure the AC voltage from chassis to pin 4 of the GZ-34 rectifier tube (should be approx. 330VAC)
12. Measure the AC voltage from chassis to pin x of the GZ-34 rectifier tube (should be approx. 330VAC)
13. Measure the AC voltage from chassis to the Red/ Black Stripe lead of the power transformer (should be approx 60 VAC)
14. Measure the AC voltage ACROSS pins 3 & 8 of the GZ-34 – should be 5 VAC
15. Measure the AC voltage ACROSS pins 2 & 7 of the right channel output tube V7 - should be 6.3 VAC
16. Measure the AC voltage ACROSS pins 2 & 7 of the left channel output tube V2 - should be 6.3 VAC
17. If all of the above voltages are within 10% the power transformer is functional.
18. Switch off the amplifier and return the original fuse.

B. Output Transformers – This procedure checks both the left and right output transformers simultaneously. A defect in either transformer will result in a test fail result. It is beyond the scope of this document to delineate further details concerning any failures without instrumentation specified in this document. However, if one of the output transformers (in the pair) is defective it is questionable as to if further investment into this particular amplifier is warranted and therefore we consider this test useful for go / no-go purposes.

1. Remove all tubes (4X output tubes, 2X driver tubes, 1x GZ-34 rectifier tube).
2. The Stereo-70 must be completely disconnected from the AC mains and all inputs and outputs must be disconnected.
2. Using a alligator jumper, temporary connect V3/pin3 to V6/pin3.
3. Using another alligator jumper, temporary connect V2/pin3 to V7/pin3.

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4. Obtain another “test” receiver (preferably tube but not mandatory) and connect the output of one channel to the Dynaco Stereo-70 Right Channel Speaker Terminals 8 Ohm and Ground.
5. Obtain a 8 Ohm “Test” Loudspeaker and connect it to the Dynaco Stereo-70 Left Channel Speaker Terminals 8 Ohm and Ground.
6. Have the other channel of the service amplifier directly connected to another loudspeaker (control speaker) identical to the test loudspeaker. Set the test receiver to monophonic operation.
7. Starting at very low levels (with the volume control of the test receiver fully attenuated) bring up the level until you have a soft level available from both the test and control loudspeaker. Note – it is not necessary to operate the test receiver at high or even moderate volumes – it is only necessary to raise the level sufficiently to be able to discern equal loudness from both the test and control loudspeaker.
8. With the balance control of the test receiver centered, the sound from both speakers should be nearly the same. If there is a noticeable difference one of your output transformers is defective.

Addendum 2 Dynaco Stereo-70 Post Storage Startup Procedure

Dynaco vacuum tube amplifiers incorporate components that may undergo electrochemical changes if left in a de-energized state over a long period (approximately 6 months). To preserve the operation of the components and operator safety it is generally recommended that the reapplication of power be conducted in a controlled manner. It is the purpose of this document to describe a suitable procedure for the typical owner without access to laboratory test equipment.

The following components and test equipment will be required:

1. Digital DVM (inexpensive model from Radio Shack or equivalent)
2. 100K ohm / 3 to 5 Watt Resistor
3. 3" length of 1/8" heat shrink tubing

Procedure:

1. You will first remove the top and bottom covers by removing the 4 (6 on some units) located on the right and left sides of the amplifier. Both covers should be free to be released.
2. Remove the rectifier tube (GZ-34).
3. Connect the amplifier to 120VAC mains.
4. Switch on the amplifier (for approximately 1 minute). Examine the four output tubes and two small driver tubes to confirm the illumination of the filaments.
5. Locate the 7 pin terminal strip on the underside of the amplifier to the left of the power transformer. Using your digital voltmeter (set to DC volts) Measure the DC voltage on lug # 4 (counting from the left edge of the amplifier) and confirm a reading of approximately negative 65 VDC (+/- 10%) relative to the chassis. Failure to achieve this voltage suggests a defective selenium rectifier or other bias supply problems.
6. Switch off the amplifier and disconnect from the AC mains.
7. Remove the remainder of the tubes (4X output, 2X 7199 driver) and label to identify for re-positioning later. Install the Rectifier tube (GZ-34).
8. De-solder the red wire connected to lug 2 (See figure 1) of the Dynaco Quad electrolytic capacitor (the other end is connected to V1/pin8).
9. Slide the 3" length of the 1/8" heat shrink tubing down the free length of the red wire removed during the previous step. Tack solder one end of the 100K ohm / 3Watt resistor to the free end of the red wire removed in the previous step. Slide the heat shrink tubing upwards to completely cover the exposed any wire including the resistor lead. Connect the remaining free end of the 100K / 3Watt resistor to lug #2 of the Dynaco quad electrolytic capacitor.
10. Set your voltmeter to DC volts and set the range of your voltmeter to be capable of reading 500VDC. Securely connect the Black Test lead of your voltmeter to V1/pin8. Securely connect the remaining Red Test lead to Lug # 2 of the Dynaco Quad electrolytic capacitor. During the tests that follow it is important to remember that your DVM will be

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floating at nearly 500 VDC relative the amplifier chassis. Most DVM's are suitably insulated however you should be advised nonetheless and take the appropriate precautions.

11. Connect the amplifier to 120VAC mains.
12. Switch on the amplifier. Examine the Digital Voltmeter reading. It will begin at a very high voltage (nearly 550 VDC) and begin to drop over time. This voltage represents the normal charging of the quad electrolytic capacitor and actually is re-forming the capacitor simultaneously via the 100K ohm resistor. Observe the reading over a 15 to 30 minute period. If after approximately 1 hour the voltage reading of the DVM fails to drop to 10 volts or less, the condition of the Quad electrolytic capacitor is suspect and should be replaced.
13. Switch off the amplifier, disconnect it from the AC mains, and wait at least one hour.
14. Slide back the heat shrink tubing and de-solder the 100K / 3Watt resistor from both the red wire and lug #2 of the quad electrolytic capacitor.
15. Re-connect the red-wire from the previous step to lug #2 of the Quad electrolytic capacitor.
16. Install the output tubes – the two small driver tubes will be installed later. Rotate the bias adjustment potentiometers (located near the center of the chassis) completely counterclockwise.
17. Connect the amplifier to the AC mains and apply power. Re-adjust the bias per the Dynaco Owners manual.
18. Switch off the amplifier and re-install the two remaining driver tubes (7199).
19. Replace the covers and return your amplifier to service.