Modification Manual
Audio Research Corporation
ST-70-C3 Super Modification Kit
for the
Dynaco Stereo 70
Power Amplifier

PRICE $4.00
Audio Research Remakes Dynaco's Stereo 70

by Edward T. Dell, Jr.

The impulse to make the good better, runs deep in the craftsman. The simplicity and elegance of the Dyna circuitry in the Mark II and the near modern Stereo 70 asserts a strong pull on the mind of anyone who regards an amplifier circuit with the same sort of pleasure rising in him that accompanies the first taste of a good wine.

That impulse lay behind the editor’s project of a craftsmen's version of the Stereo 70 back in 1966. (Stereophile, No. 4, 1976, reprint available for $1.50 from TSA.) The Dyna amplifier circuit was left virtually unchanged with only an AC balance and a metering circuit added, but military grade components were used throughout. The power supply was doubled, and modified to provide more filtering and much more capacitance.

What moved William J. Johnson of Audio Research Corporation to undertake modification of Dyna’s Stereo 70 only he knows. I would guess it grew out of Johnson’s habit of making the good product even better. The result is a lower powered cousin of The Audio Research SR-76-A whose amplifier configuration is shifted from the space economical simplicity of Dyna’s three tube circuit (Fig. 1) to the balanced completely push-pull elegance of the DNA (Fig. 2). The result of the changes are evident in Fig. 3. The modified ST-70 is a lower powered unit, of course: 30 Watts versus 75 Watts per channel in the DNA.

In amplifier configuration, the ST-70-C3 lacks only the constant current source stage of the DNA. The other differences are those of output, tubes and transformer, and a much larger, partially regulated power supply. The modified unit has a zener regulated supply for its input tube and a D.C. filament supply for its well. The power supply uses the Dyna transformer, fuse, line cord, and power switch, but adds silicon diode rectifiers and 5300pF total filtering of the high voltages. The experimental prototype used a thermistor in the ac line but proved to have little usefulness. But, strictly speaking, the ST-70-C3 is not a modification at all. It is a transformation. The result isn’t a modified Dynaco product—it’s an Audio Research power amplifier using Dyna transformers and chassis.

Is the transformation worth the effort and the cost? Dynaco Stereo 70s are bringin about $50 to $70 second hand these days and the modification kit price raises that to well above $200. For this quality of amplifier, however, the price tag is not out of line. The parts in the kit are first quality and were chosen to give long service.

Those who want to build the design from scratch can probably do so for slightly less money although output transformers of the quality of the Dyna product are relatively rare. The Dynaco line began around the outstanding features of their output transformers. Dyna does not any longer sell output transformers.

The completed Audio Research ST-70-C3 stereo amplifier.

Fig. 1. Block diagram of the Dynaco Stereo 70, one channel. The + and - signs on this and Figs. 2 and 3 denote instantaneous signal polarity with respect to input 2-f. Power supply is unregulated, 60uF total capacitance.
to experimenters as they did in the early days, however. Those who find good substitutes such as the old Peerless, Acrosound, or UTC can make themselves a first-class unit with this design, at a lot less cost with variations.

Before you begin make certain your old dynas ST-70 has replaceable parts that are working satisfactorily enough to perform well in the new unit. The three transformers, the fuse, post, on/off switch and line cord ought to be checked if the unit is not in operating condition. Check continuity with an ohmmeter. If the transformer windings show you a new one for $2 postpaid is recommended.

If the unit is functioning, check the voltages against those in the manual. If it is within ±25% of normal, your unit is alright. You can also pull all the tubes (or the C5-34 only) turn it on and carefully check all the A.C. voltages at the tube sockets.

Next you should check the color of the transformer leads, particularly the one on T1 which tend to fade. If they are failing badly it is a good idea to label them before you unplug them if any are seriously decaying insulation you wish to cover them with shrink tubing or replace them.

Remove the end bells and cut the wire to 1” length, strip V’ and twist together. Solder neatly with a new wire of the same size and color to replace the old one. Solder together and clip a piece of 2” hose shrink tubing over the splice and as near the windings as possible. Shrink the tubing and replace the bell.

Construction Manual

Schematic Diagram 70-To-C5

Before you begin

Please read through the manual thoroughly first. Check the parts in the kit against the schematic diagram. You will need a No. 10 pencil, a supply of Dominant brand resistors, good quality capacitors, and a wire stripper. Several pieces of copper tubing are helpful but not absolutely essential.

The conversion can be accomplished in about a dozen to 15 hours. Please allow yourself plenty of time to do a thorough and correct job. Off each step as you do it. Take a recess from the work before time to time.

Bad solder joints are the cause of 99% of the problems in this construction. Time to make good live joints. Make sure the parts are clean and dry. Solder all joints, hold the terminal or wire, never to the soldering iron. The solder goes on the circuit board and is filled all together. If you tin your wires with solder before attaching them to the circuit board, you should not use any more solder on the board’s surface. Heat the electrolytically and strip the wire on an iron. Check body for any holes in the board for a smooth, uniform joint.

Introduction

1. Make sure the unmodified ST-70 is working. As you may be aware, that the parts listed below are not defective or damaged.

2. All location and component designations will refer to the drawings and schematics in their appropriate order. If you are not sure about one of the component from which the connections come, it will be less cumbersome without a dandy line cord.

3. All directions refer to the unit up-side-down with the rear of the chassis facing you.

Original Dynaco Stereo 70 parts used in ABC ST-70-C5 modification:

- cover (see text)
- chassis
- control plate
- power transformer
- fuse holder
- mains switch
- line cord

SECTION A. ASSEMBLY

A-1) Remove cover (see notes), tubes, and bottom plate (save).

A-2) Refer to Table 2 and make sure all transformer leads and other wiring are correct. Re-mark or tag any leads that might not be tied correctly later.

A-3) Remove the two metal hold-down clips at the bottom of the transformer mounting screws. Return the lock washers and nuts. Install all power transformer leads. You’ll need a large iron or ‘grip’ tool for this. The black part that connects to the fuse holder and switch.

A-4) Install all output transformer loads.

A-5) Cut the two wires attached to each channel to the chassis. C.

A-6) Install the small wire carrying the ground log of the large chassis mounted capacitor with the chassis ground log. Clip all other wires and resistors at the capacitor terminals. Straighten the mounting lugs and remove.

A-7) Remove the output transformers. IMPORTANT: their layout lengths are different, so make sure to mark them as they are removed. Later refer to the same side of the chassis from which the components come. Their layout lengths will be less cumbersome without a dandy line cord.

A-8) Using hand tools, remove EVERYTHING from the chassis except the last four items in the parts list below. The FCU boxes, tube sockets and other wiring will simply fall out as a unit.

A-9) Clean chassis thoroughly with any good brand of home or automobile chrome cleaner or metal polish.

SECTION B. MECHANICAL ASSEMBLY

Refer to Fig.1 for the following steps. An ‘+’ location indicates a move away from the chassis. A ‘−’ indicates a move towards the chassis. “Here” means into the chassis. "Here" means out of the chassis. A completely assembled dynacore is a completely assembled chassis. "In this" means into the chassis. "In this" means out of the chassis.

B-1) Mount the power slide switch SW-1 in its original hole using the original 4-40 x 1/4" screw, position it so the end with the solder terminals faces forward.

B-2) Mount the fuse holder with its side terminal facing up (front). (Copper holder, if any, is outside chassis.)

B-3) Mount the two short shafted potentiometers (R93 and R94) in the two holes in front of the power transformer using the panel washers and nuts. Position the tube in tube face the power transformer hole.

B-4) Mount two four-terminal strips (T-1-12) to the left of the power transformer two indicated, using for each a 61/2 x 1/4" phillips screw, #6 flat washer, star washer, and nut.

B-5) Cut the two wires attached to each channel to the chassis. C.

B-6) Install the small wire carrying the ground log of the large chassis mounted capacitor with the chassis ground log. Clip all other wires and resistors at the capacitor terminals. Straighten the mounting lugs and remove.

B-7) Remove the output transformers. IMPORTANT: their layout lengths are different, so make sure to mark them as they are removed. Later refer to the same side of the chassis from which the components come. Their layout lengths will be less cumbersome without a dandy line cord.

B-8) Using hand tools, remove EVERYTHING from the chassis except the last four items in the parts list above. The FCU boxes, tube sockets and other wiring will simply fall out as a unit.

B-9) Clean chassis thoroughly with any good brand of home or automobile chrome cleaner or metal polish.

SECTION C. ELECTRICAL ASSEMBLY

Refer to Table 2 for the following steps. A ‘+’ location indicates a move away from the chassis. A ‘−’ indicates a move towards the chassis. "Here" means into the chassis. "Here" means out of the chassis. A completely assembled dynacore is a completely assembled chassis. "In this" means into the chassis. "In this" means out of the chassis.

C-1) Mount the power slide switch SW-1 and the fuse holder in their original holes.

C-2) Mount the two short shafted potentiometers (R93 and R94) in the two holes in front of the power transformer using the panel washers and nuts. Position the tube in tube face the power transformer hole.

C-3) Mount two four-terminal strips (T-1-12) to the left of the power transformer two indicated, using for each a 61/2 x 1/4" phillips screw, #6 flat washer, star washer, and nut.
B-15) Mount the four-lug terminal strip (TS-3) to the right of the power transformer hole as indicated. Fasten to TS-1.

B-16) Mount the two-lug terminal strip (CT-3) in the hole to the right of the transformer, position as indicated. (Fasten as before.)

B-17) Mount the two output terminal blocks using 6/42 x 3/4" phillips screws, star washers, and nuts. The resulting four-two-lug terminal strip (TS-5-6) should be mounted under the out of service nuts near the chassis corners.

B-18) Mount the four new socket sockets (see Dalton's 4/04 x 1/4" screw, star washers, and nuts) in all areas face toward the nearest side edge as indicated. All socket housing, head down, show the metal ground lug toward the chassis, as they are not used.

B-19) Mount C16 (1200/570V tap) in its hole as indicated and twist the mounting wires 180°. Aligning a 100mm indicating dot on the lower left mounting terminal to the side chassis. Slight pressure on both chassis may be necessary for a good solder joint. In alternating direct to chassis soldering is to run a piece of wire from the same #8/10 to the center hole of the ground mounted tap of TS-4. Solder both ends well.

B-20) Mount the pneumatic capacitor mounting plate above the chassis for C16. Position on the rear panel so both output faces to the rear of the chassis (6/42 x 3/4" phillips, star washers, and nuts)

B-21) Mount C10, the dual 6.8/47K can capacitance on the pneumatic mounting plate. Twist the three mounting lugs to secure it.

B-22) Insert jack assembly. See Fig. 2.

B-23) Assemble the input jack parts onto the new jack panel in the following sequence: --onto each jack, slip a large ground lug, star washer, and fiber washer. --Insert the nuts from the hole from the rear of the chassis.

B-24) Mount the 21K grid resistor washers (shower side toward component). --Align the jack grounds so that they point toward the transformer. (Rear jack is inserted slightly (2") upward). The opening on the center terminal washers should face toward the input jack.

B-25) Mount the front panel over the front chassis edge using four 6/42 x 1/4" phillips screws, star washers, and nuts. Fasten the rear flanges of the jack plate on the inside, with all washers under the pillar. Note: Although this plate is not finished, it is desirably close. Mount with the four large holes toward the rear.

B-26) Plug all tubes into the G-socket and temporarily position it on the plate to check that the perforated cover plate has been installed up to the level of the holes, the plate is in place down.

Special note: Take a look at the schematic page 8 of this manual, note R-4 and C-4. You may, according to those, use one of two methods to choose for correct bias level on the output tubes: In Method A you use a voltmeter, attaching its leads across 885 and then 486, adjusting 885 (for the right channel) at 2-42 volts. In Method B you read the lead from 817 (right channel) to the B-27 (ground) of the output transformer (optional). If you prefer Method C, you may want to install a permanent biased circuit jack in the chassis at locations indicated on Fig. 8. The tip and ring of clip plug are wired so that when clip plug is inserted, the plug is inserted into the clip plug, and ring are connected to your milliammeter to measure current through one side of the line, which should be 16ma. See Fig. 8 for suggested location of the two jacks.

SECTION C POWER TRANSMISSION WIRING

Wiring notes: The size of additional electronic typeAudio P.h.s will sometimes facilitate soldering to the output transformer wiring. (DO NOT USE ordinary acid core solder or acid flux which damages electronic gear.)

Wiring plan: Note in the wiring drawings how most wiring is routed as a 'T' channel from the center of the chassis to the sides and around to the tubes and/or output terminals (see Fig. 5 and 6) and mounting a piece of wire, try to follow the plan:

1. Turn to Fig. 3.

C-1) Mount the power transformer in its position using the original star washers and nuts.

C-2) From the right hole, find and insert the following wires into the side terminal of Fuse holder 1 (Solder). (Solder).

C-3) From the left hole, find and insert the following wires into the side terminal of Fuse holder 1 (Solder).

C-4) Route and connect the length black wire to the right jack (Fig. 1) of the on-off switch (Solder). (Solder).

C-5) Twist the green pair together and route to VB. Connect one wire to pin 2 and the other to pin 7. Do not solder.

C-6) The left hand leads remain unconnected at this time. Take them out of the way somewhere.

SECTION D OUTPUT TRANSFORMER WIRING

D-1) Mount the two output transformers in their original positions using 10/12 x 3/8" screws, flat washers, star washers, and nuts. The four short leads should exit the rear holes. The transformer with the长期 red lead should be mounted in the left side of the chassis (over TS-2). (Solder)

D-2) Route and insert the short red/3rd wire into the lower left hole of 2 of TS-4. (Solder)

D-3) Route and connect the short red/3rd wire into the lower left (previously soldered) ground lug of the 3302C (Solder).

D-4) Twist the two long brown wires together and route to VB connect one to pin 2 and the other to pin 7. Do not solder.

D-5) Route and insert the two long green/brown wire together and route to VB connect one to pin 2 and the other to pin 7. Do not solder.

D-6) Select the left output transformer. Connect the four short output transformer wires into the output terminal in the following sequence: from left to right, PB, B, G, C, G, B, PB. The output terminals of the transformers may be determined as follows: the long green/brown wire should be soldered as near to the center as possible, while the long black wire should be as near to the outside as possible.

D-7) From the left hole, find and identify the long green/brown wire as shown and insert the long green/brown wire into the VS-1. (Solder)

D-8) Select the right output transformer. Connect the four short output transformer wires into the output terminal in the following sequence: from left to right, PB, B, G, C, G, B, PB. The output terminals of the transformers may be determined as follows: the long green/brown wire should be soldered as near to the center as possible, while the long black wire should be as near to the outside as possible.

D-9) From the left output transformer, connect the two black and green wires together. Route to VS-1 and connect the blue wire to pin 2. Take the capped green wire out of the way.

D-10) From the right output transformer, connect the two black and green wires together. Route to VS-1 and connect the blue wire to pin 2.

D-11) From the left channel output transformer, connect the two green and red wires together, but route the blue and green pair to VS-1.

SECTION E COMPONENT MOUNTING

Turn to Fig. 4.
**SECTION F. MAIN CHASSIS WIRING**

**Wiring Notes:** All lengths include 4" stripped ends. Much of the following lengths are specified, the lengths refer to total length from bearing to bearing. The lengths of unstriped wire are given at each stop (in parentheses) that will twist together to near the required length. See Fig F-3 for an example.

**Fig. 5:**

- **P-1:** Cut a 7" square and a 9" square of b/w wire. Solder (S-1) the 7" square to pin 2 (VIII). Twist together four to five times and attach one wire to pin 7 (Y9) and the other to pin 2 (V8).
- **P-2:** Make up a twisted brown pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.
- **P-3:** The twisted green wire pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.

**Fig. 6:**

- **P-1:** Solder (S-1) a 5" b/w wire to pin 7 (Y9). Twist together four to five times and attach one wire to pin 7 (Y9) and the other to pin 2 (V8).
- **P-2:** Make up a twisted green pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.

**Fig. 7:**

- **P-1:** Solder (S-1) a 5" b/w wire to pin 7 (Y9). Twist together four to five times and attach one wire to pin 7 (Y9) and the other to pin 2 (V8).
- **P-2:** Make up a twisted brown pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.

**Fig. 8:**

- **P-1:** Solder (S-1) a 5" b/w wire to pin 7 (Y9). Twist together four to five times and attach one wire to pin 7 (Y9) and the other to pin 2 (V8).
- **P-2:** Make up a twisted brown pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.

**Fig. 9:**

- **P-1:** Solder (S-1) a 5" b/w wire to pin 7 (Y9). Twist together four to five times and attach one wire to pin 7 (Y9) and the other to pin 2 (V8).
- **P-2:** Make up a twisted brown pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.

**Fig. 10:**

- **P-1:** Solder (S-1) a 5" b/w wire to pin 7 (Y9). Twist together four to five times and attach one wire to pin 7 (Y9) and the other to pin 2 (V8).
- **P-2:** Make up a twisted brown pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.

**Fig. 11:**

- **P-1:** Solder (S-1) a 5" b/w wire to pin 7 (Y9). Twist together four to five times and attach one wire to pin 7 (Y9) and the other to pin 2 (V8).
- **P-2:** Make up a twisted brown pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.

**Fig. 12:**

- **P-1:** Solder (S-1) a 5" b/w wire to pin 7 (Y9). Twist together four to five times and attach one wire to pin 7 (Y9) and the other to pin 2 (V8).
- **P-2:** Make up a twisted brown pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.

**Fig. 13:**

- **P-1:** Solder (S-1) a 5" b/w wire to pin 7 (Y9). Twist together four to five times and attach one wire to pin 7 (Y9) and the other to pin 2 (V8).
- **P-2:** Make up a twisted brown pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.

**Fig. 14:**

- **P-1:** Solder (S-1) a 5" b/w wire to pin 7 (Y9). Twist together four to five times and attach one wire to pin 7 (Y9) and the other to pin 2 (V8).
- **P-2:** Make up a twisted brown pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.

**Fig. 15:**

- **P-1:** Solder (S-1) a 5" b/w wire to pin 7 (Y9). Twist together four to five times and attach one wire to pin 7 (Y9) and the other to pin 2 (V8).
- **P-2:** Make up a twisted brown pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.

**Fig. 16:**

- **P-1:** Solder (S-1) a 5" b/w wire to pin 7 (Y9). Twist together four to five times and attach one wire to pin 7 (Y9) and the other to pin 2 (V8).
- **P-2:** Make up a twisted brown pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.

**Fig. 17:**

- **P-1:** Solder (S-1) a 5" b/w wire to pin 7 (Y9). Twist together four to five times and attach one wire to pin 7 (Y9) and the other to pin 2 (V8).
- **P-2:** Make up a twisted brown pair that has a total length of 10" (about 10" initial length) for a moderately tight twist. At one end, solder (S-3) the one wire to pin 2 (V8) and the other to pin 7 (Y9). Stretch this twisted pair out of the way temporarily, as it will connect to the PC board which has not been mounted yet.
Turn to Fig. 5.

J-17 I Route the two remaining red leads from the power transformer to a 6, 7, and 8 on the PC board. Solder the longer wire to pin 30 (x-1). Solder a 2.5" or 3" extension of 14 AWG red wire to this point and insulate the connection with the last piece of heat-shrink tubing. Solder this wire to a 29 (x-1).

J-18 I Solder a 29 (x-2) to a 10" yellow wire to the upper of the 23. To route out the wire to the center of the PC board and solder to a 29 (x-1). (See Fig. 6.)

Turn to Fig. 6.

J-9 I Solder a 5 (x-1) to the center terminal #2 of H3, route up the center of the PC board and solder 5 (x-1) to #10.

J-10 I Solder a 5 (x-1) to the center terminal #2 of H4, route up the center of the PC board and solder 5 (x-1) to #11.

J-11 I Solder a 5 (x-1) to the center terminal #2 of C4, route up the center of the PC board and solder 5 (x-1) to #12.

J-12 I Solder a 5 (x-1) to the center terminal #2 of L16, route up the center of the PC board and solder 5 (x-1) to #13.

J-13 I Solder a 90°, red wire to the center terminal #3 of C15 (x-5), route and solder 5 (x-1) to the center terminal #1 of C16 (x-5).

J-14 I Solder the long green twisted pair that is attached to #11 up the center of the PC board and solder one wire to a PC board terminal #3 (x-2) and the other to PC board terminal #2 (x-2).

J-15 I Insert the power cord through the grommet or strain relief mounting (depending on what your kit uses) between the power switch and the fuse. If a plug grommet is used tie a knot in the cord inside the chassis, leaving about 9" length free. If a strain relief, mount it on the cord about 9" from the end. Strip 9" of insulation. Attach the wire to terminal #2 (x-1) and #3 (x-1).

J-17 I Use the nylon ties supplied to handle most of the wires, as shown in Fig. 8. Does not handle wires going to electrolytic capacitors L2 (x-2), L5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17.

J-18 I Insert tubes in their sockets as shown in Fig. 8. Note that the output tubes are paired in pairs and should be inserted in pairs H8/V10 and H9/V11 output socket sets as shown.

J-19 I Be sure that the output tubes are properly adjusted (see output tubes procedure, Section 6, above) before making the AC balance adjustment.

K-1 I Plug the amplifier into a 110VAC power source.

K-2 I Adjust the output stage bias control(s) and/or or for 110VAC nominal quiescent current. Output tube current is monitored according to Notes 8 and C on the schematic.

K-3 I Make the output stage bias controls have been properly adjusted (see AC bias procedure, Section 6, above) before making the AC balance adjustment.

K-4 I Connect the 110VAC "clamp" lead to the amplifier output of the channel under test.

K-5 I Plug the amplifier into a 110VAC power source.

K-6 I Allow the amplifier to warm up for 30 minutes.

K-7 I Connect the AC balance control H3 or H4.

L-1 I With a low distortion amplifier (+0.0% residual THD) inject a 1kHz input signal. Adjust input level for full rated output—50 Watts RMS.

L-2 I Connect (float) a harmonic distortion analyzer (+0.0% residual) across the 100 output.

L-3 I Adjust the AC balance control for maximum output.

L-4 I Adjust the AC balance control for minimum distortion.

L-5 I Adjust the AC balance control for maximum output.

L-6 I Adjust the AC balance control for minimum distortion.

L-7 I Connect (float) a harmonic distortion analyzer (+0.0% residual) across the 100 output.

L-8 I Adjust the AC balance control for maximum output.

L-9 I Adjust the AC balance control for minimum distortion.

L-10 I Adjust the AC balance control for maximum output.

L-11 I Adjust the AC balance control for minimum distortion.

L-12 I Connect (float) a harmonic distortion analyzer (+0.0% residual) across the 100 output.

L-13 I Adjust the AC balance control for maximum output.

L-14 I Adjust the AC balance control for minimum distortion.

L-15 I Adjust the AC balance control for maximum output.

L-16 I Adjust the AC balance control for minimum distortion.

L-17 I Connect (float) a harmonic distortion analyzer (+0.0% residual) across the 100 output.

L-18 I Adjust the AC balance control for maximum output.

L-19 I Adjust the AC balance control for minimum distortion.

L-20 I Adjust the AC balance control for maximum output.

L-21 I Adjust the AC balance control for minimum distortion.

L-22 I Connect (float) a harmonic distortion analyzer (+0.0% residual) across the 100 output.

L-23 I Adjust the AC balance control for maximum output.

L-24 I Adjust the AC balance control for minimum distortion.

L-25 I Adjust the AC balance control for maximum output.

L-26 I Adjust the AC balance control for minimum distortion.

L-27 I Connect (float) a harmonic distortion analyzer (+0.0% residual) across the 100 output.

L-28 I Adjust the AC balance control for maximum output.

L-29 I Adjust the AC balance control for minimum distortion.

L-30 I Adjust the AC balance control for maximum output.

L-31 I Adjust the AC balance control for minimum distortion.

L-32 I Connect (float) a harmonic distortion analyzer (+0.0% residual) across the 100 output.

L-33 I Adjust the AC balance control for maximum output.

L-34 I Adjust the AC balance control for minimum distortion.

L-35 I Adjust the AC balance control for maximum output.

L-36 I Adjust the AC balance control for minimum distortion.

L-37 I Connect (float) a harmonic distortion analyzer (+0.0% residual) across the 100 output.

L-38 I Adjust the AC balance control for maximum output.

L-39 I Adjust the AC balance control for minimum distortion.

L-40 I Adjust the AC balance control for maximum output.

L-41 I Adjust the AC balance control for minimum distortion.

L-42 I Connect (float) a harmonic distortion analyzer (+0.0% residual) across the 100 output.

L-43 I Adjust the AC balance control for maximum output.

L-44 I Adjust the AC balance control for minimum distortion.

L-45 I Adjust the AC balance control for maximum output.

L-46 I Adjust the AC balance control for minimum distortion.

L-47 I Connect (float) a harmonic distortion analyzer (+0.0% residual) across the 100 output.
**Troubleshooting Table**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead, both channels</td>
<td>- Blown fuse (F1)</td>
</tr>
<tr>
<td></td>
<td>- No power at plug</td>
</tr>
<tr>
<td></td>
<td>- Defective DC filament supply</td>
</tr>
<tr>
<td></td>
<td>- Defective ZD1 (open)</td>
</tr>
<tr>
<td></td>
<td>- Defective transformer (F1)</td>
</tr>
<tr>
<td>Dead, one channel</td>
<td>- Defective tube(s) V1 through V10</td>
</tr>
<tr>
<td></td>
<td>- Defective output tubes V5, 10 or 3, 11</td>
</tr>
<tr>
<td></td>
<td>- Defective plate or cathode resistor (open) associated with V1 through V10</td>
</tr>
<tr>
<td>Blown Fuses</td>
<td>- Wrong size and/or type fuse</td>
</tr>
<tr>
<td></td>
<td>- Defective diode(s) in high voltage bridge rectifier (D1-H)</td>
</tr>
<tr>
<td></td>
<td>- Defective V5 through V11</td>
</tr>
<tr>
<td></td>
<td>- Defective zener diode(s) in series regulator circuit. Note: if one or more are shorted, replace all zener diodes</td>
</tr>
<tr>
<td>Blown fuse at moderate to high signal levels only</td>
<td>- Wrong size and/or type fuse</td>
</tr>
<tr>
<td></td>
<td>- Defective diode in high voltage bridge rectifier</td>
</tr>
<tr>
<td></td>
<td>- Defective output tube(s) V8 through V11 (internal arcing)</td>
</tr>
<tr>
<td>Low power output</td>
<td>- Low ZD or voltage supply</td>
</tr>
<tr>
<td></td>
<td>- Low regulated screen voltage</td>
</tr>
<tr>
<td>Poor sound, one or both channels</td>
<td>- Output tubes(s) incorrectly biased</td>
</tr>
<tr>
<td></td>
<td>- Output balance incorrectly adjusted</td>
</tr>
<tr>
<td></td>
<td>- One or more output tubes defective. Note: If any are defective, replace battery matched pairs for lowest distortion</td>
</tr>
<tr>
<td></td>
<td>- Defective tube(s) V1 through V11</td>
</tr>
<tr>
<td></td>
<td>- Defective coupling capacitor C8 or C9</td>
</tr>
<tr>
<td></td>
<td>- Defective output transformer T2 or T1</td>
</tr>
<tr>
<td>Hum</td>
<td>- Defective C5 or C7</td>
</tr>
<tr>
<td></td>
<td>- Defective input filter capacitor(s) 15 through 16</td>
</tr>
<tr>
<td></td>
<td>- Defective tube(s) V1 through V11</td>
</tr>
<tr>
<td></td>
<td>- Open diode(s) in high voltage bridge rectifier</td>
</tr>
<tr>
<td></td>
<td>- Open diode(s) in filament voltage rectifier</td>
</tr>
<tr>
<td>Noise</td>
<td>- Defective tube V1 through V6 or associated plate or cathode load resistor</td>
</tr>
</tbody>
</table>

**Limited Warranty**

The circuit board and kit of parts in the ST-70-C5 modification kit are warranted for 90 days from purchase date to be free from defects in materials and manufacturing. If a defective component is located in the circuit board or in the kit of parts supplied, return that part, prepaid, well packed, to Old Colony Sound Lab, P.O. Box 243, Peterborough, NH 03458 and it will be replaced free of charge.

If you cannot locate the difficulty, return the unit prepaid to Old Colony via UPS or Bus Parcel service. Old Colony's UPS shipping address is 8J, 202 at Old Jaffrey Road, Peterborough, NH 03458. DO NOT SHIP VIA PARCEL POST. ALL WARRANTIES ARE VOIDED IF THE UNIT IS SHIPPED VIA U.S. POSTAL SERVICE. Defective parts discovered within said ninety-day period will be placed at no charge but units will be subject to a service charge for labor to diagnose the unit's problem. Units will be returned G.O.D. via UPS, including the cost of return shipment. Do not return circuit boards or service. They will be returned G.O.D. This warranty is voided if it is evident that the components have been mishandled or abused or that other than rotatable solder has been used in assembly. Old Colony will not be responsible for uninsured shipments or units which have, in its manager's opinion, been inadequately packed.

Pack the unit securely, preferably in double boxes. Include: your name and address (a street address please, P.O. boxes are NOT acceptable); the serial number of your unit (see the new front panel of the unit); a list of symptoms, any tests you may have performed with their results, and whether the problem is steady or intermittent. Please include your dated bill of sale for the kit.

Old Colony technical services are available by mail (please enclose a stamped, self-addressed envelope) or by telephone (603) 924-6526, Monday-Thursday, 9 a.m. to 4 p.m. R.S.T. ONLY. When you write or call please provide the serial number, exact nature of the problem and what you have done to test the unit's condition.

Old Colony will maintain a stock of repair or replacement parts for builders of the ST-70-C5 unit, including matched pairs of power output tubes. Please write for a current price list on those items, or watch the Old Colony ads for announcements.

**THE WARRANTY HEREBIN CONTAINED IS LIMITED TO THE ORIGINAL PURCHASER OF THE MODIFICATION KIT AND IS NOT Assignable or Transferable To ANY OTHER PERSON.**

**THERE ARE NO WARRANTIES, INCLUDING ANY WARRANTY OF MERCHANTABILITY Which EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.**

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P.O. BOX 243  Peterborough NH 03458