

Audio Restoration Project: Fisher 500-C Tube Receiver with 7591A IBBA PCB – also applies to 500-B, 800-B and 800-C

This classic Tube Receiver with 4x 7591 original Output Tubes was problematic – the volume would be strong for a few minutes, and then die out completely. There was a volume imbalance between the Left and Right Channels, and FM reception was non-existent. I referred to AudioKarma for tips, and consulted with Dave Gillespie, for whose expertise I am very grateful.

This Project is suitable for all versions of the Fisher receivers which have the ECC83/12AX7 Driver and 7591 Output Tubes – as far as I have inspected the schematics – 500B 500C 800B 800C. There may be others.

The objective of this project is to present the absolute minimum restoration work required to ensure a properly functioning Fisher 500 or 800, which is reliable for decades to come. There are additional interesting enhancements which you can do (visit AudioKarma), but these are not in the scope of this primarily safety-oriented overhaul.

Parts Kits sold on the auction-sites, while reasonable quality, are horribly overpriced, and you would do well to ignore them, and simply buy from the major Electronics Distributors according to my BoM's below.

One of the glaring deficiencies of these Parts Kits, if you examine their circuit design critically, is that during the installation of their Potentiometers, it requires you to connect their Potentiometer Wiper (Pin 2) to the 7591 Grid (Pin 6). They do not disclose that not only is this poor circuit design technique, but that it is also highly dangerous, and may cause catastrophic failure of the tubes, should the Potentiometer Wiper disconnect. That many of these Kit vendors supply non-original Bourns lookalikes from the Far East, makes this reliability issue all the more relevant.

This project includes installing 2x IBBA PCB's (custom-designed by myself), which enables the EXACT Adjustment and Regulation of Bias Voltage and Current, ensuring the coolest and most-efficient operation of the new 4x EH 7591A Output Tubes. One PCB is for the Left Channel, and One PCB is for the Right Channel.



1. Clean all Switches and Potentiometers.

Clean with Deoxit 5, and rotate to spread the liquid inside the switches. On the Potentiometers, spray Deoxit FaderLube.

2. Remove and Discard Unnecessary Components.

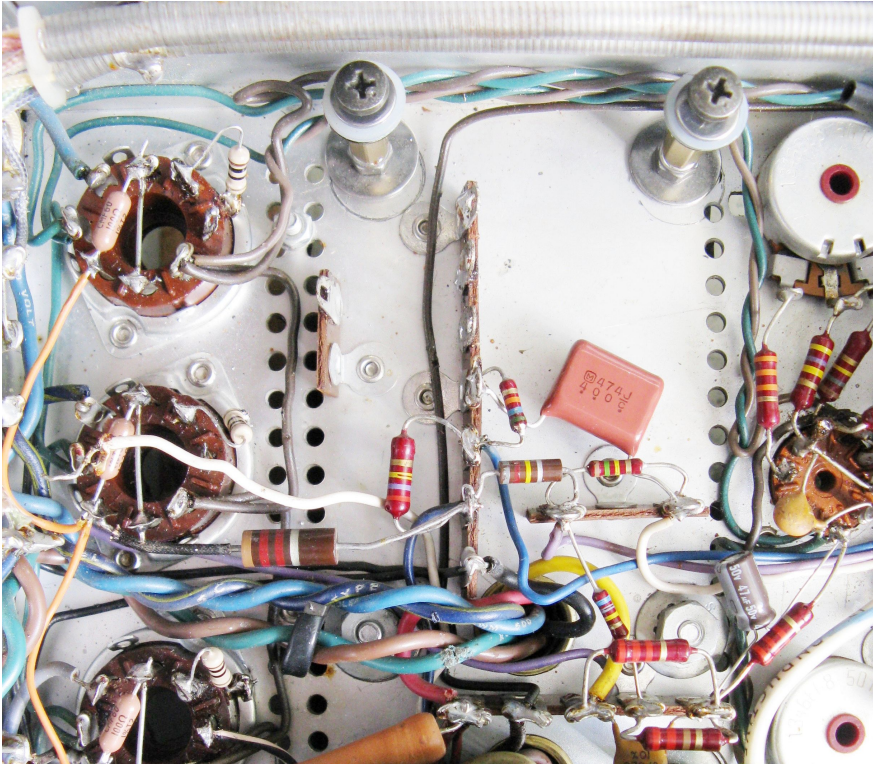
The **First group** of components to remove, are the links between the ECC83/12AX7 Driver section, and the Output Tubes. These will be upgraded by the 2 IBBA PCB's.

C77 C78 C79 C80 - 0.047uF - On PCB: Wima MKS2 or similar 0.10uF/630V (pitch 15mm).

R121 R122 R123 R124 - 330K- On PCB: Vishay RN60 220K.

R126 R127 R129 R130 - 1K - On PCB: Vishay RN60 1K.

C82 C84 - 10pF or 18pF - On PCB: Ceramic NP0 18pF (pitch 5mm).



The **Second group** of components to remove, are the Voltage Rails parts at the Bridge Rectifier, to enable the increased Voltage of -30V to the Bias Voltage circuit on the 2 IBBA PCB's - See Para 4 below.

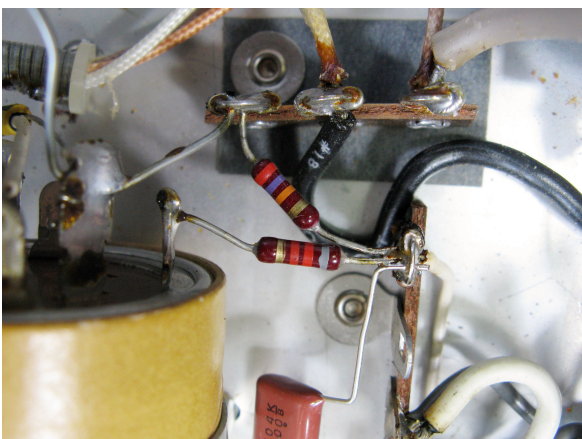
C97 2x 1000uF Big Capacitor - replace with discrete:

1000uF/35V (for the 25V Tube heater Rail), and

1000uF/50V (for the 30V Bias Voltage Rail), mounted in my custom 3D-printed holder.

R131 R132 C86 - at the big C97 capacitor.

CR6 - B30C-600 Selenium Rectifier - replace with KBPC810 Full-Wave Rectifier.



Optional and Recommended:

Remove the 3 Big Capacitors C91 C92 C98 on the Chassis Top side, and either restuff them or buy excellent replacements from Hayseed Hamfest. I made a 3D Replacement Standoff for the new Hayseed C98.

BoM:

Hayseed Hamfest - Fisher 500-C Recap Kit
Custom 3D Standoff

3. Install New Components.

Replace all these components as detailed below. These are direct replacements, and no circuit modifications are required. Listed according to Increasing Capacitance.

For Ceramic Capacitors, use Temperature-stable NP0/COG types.

For Film Capacitors, Mylar (Polyester) is suitable – Wima MKS2 or similar.

For Electrolytics, use 105°C long-life (more than 5000 hours) capacitors – Nichicon PW or HE.

BoM:

C216 C217 - 0.001uF/630V Ceramic

C214 - 0.0047uF/400V Film

C103 - 0.01uF/500VAC, Y1 or Y2 Ceramic Safety Capacitor

C102 - 0.01uF/630V Film

C107 - 0.01uF/630V or 0.10uF/630V Film – check YOUR version

C16 C17 - 0.022uF/400V Film

C52 C53 - 0.047uF/400V Film

C221 C222 - 0.047uF/630V Film

C59 C61 C72 - 0.1uF/250V Film

C57 - 0.47uF/400V Film

C210 - 1.0uF/350V Electrolytic

C51 - 2.2uF/100V Electrolytic – Move this capacitor away from the hot area of the tubes. It's connected to a Blue cable. At the other end of the blue cable, on the small vertical PCB adjacent to the FM Stereo Relay, solder the -ve lead to the Blue cable, and the +ve lead to a Ground lug.

C85 - 10uF/50V Electrolytic

C69 C70 - 47uF/50V Electrolytic

4. Install Bridge Rectifier CR6.

This enables the Bias Voltage to be increased to 30VDC.

In place of the Selenium Rectifier, bolt the new KBPC810 Full-Wave Rectifier to the chassis at the same location. As before, the Orange and Brown wires are the 25VAC inputs to the Bridge.

Solder the +ve Terminal directly to Chassis Ground.

Solder the -ve Terminal directly to the White Bias Voltage Wire at the Terminal block End lug in the area of the Fuse. This is where R131 and R132 were previously connected.

Now Solder two items to the White wire at the End lug:

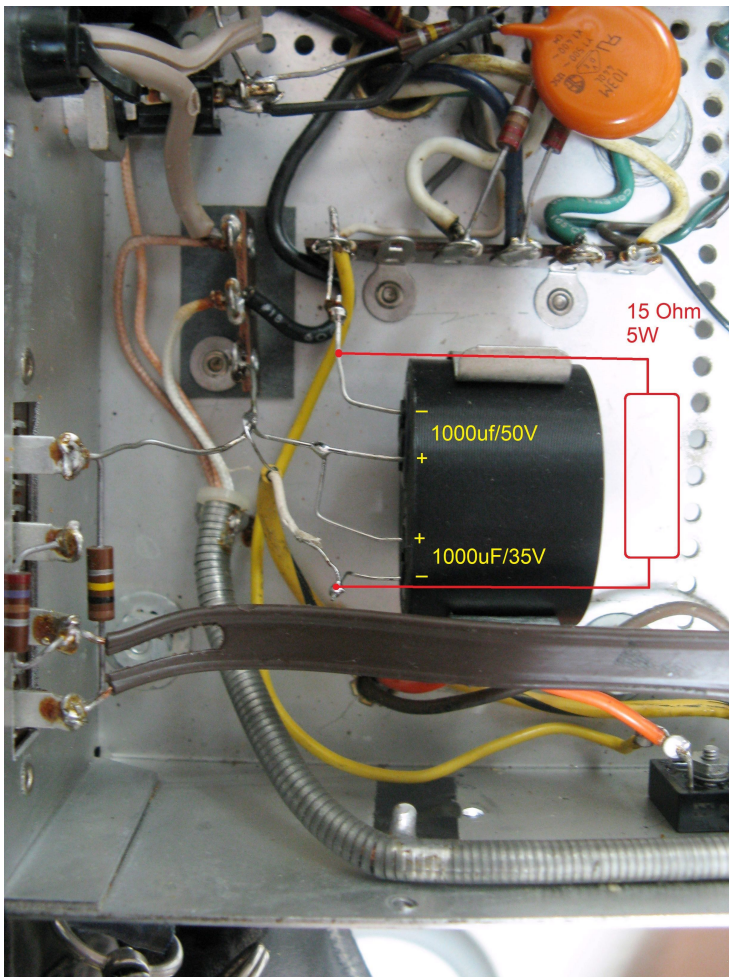
1. the -ve lead of the New 1000uF/50V capacitor
2. one lead of the 15 Ohm 5W resistor which you removed with the Selenium Rectifier.

Now Solder two items to the -ve lead of the New 100uf/35V capacitor:

1. the other lead of the 15 Ohm 5W resistor
2. the White internal power lead of the Yellow/Black Tube Heater cable

Now Solder three items to the Ground lug, directly adjacent to the above End lug:

1. The +ve lead of the 1000uF/35V capacitor
2. The +ve lead of the 1000uF/50V capacitor
3. The Bare internal screen lead of the Yellow/Black Tube Heater cable



BoM:

1000uF/35V Nichicon PW or HE - Diameter=12.5mm

1000uF/50V Nichicon PW or HE - Diameter=16mm

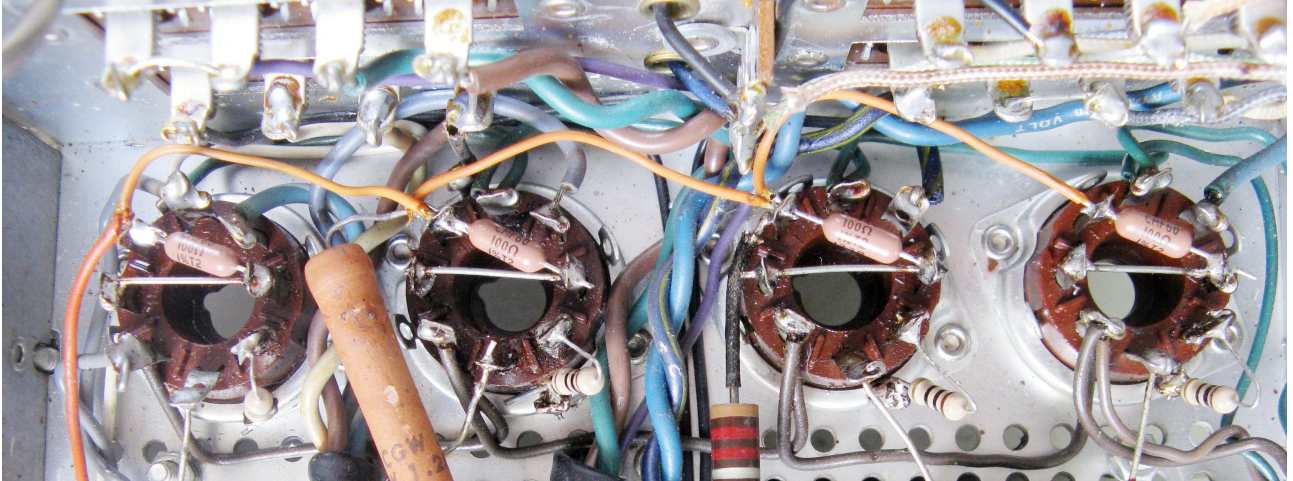
KBPC810 Bridge Rectifier 8A/1000V

Custom 3D Capacitor Holder

5. Modifying the Output Tube Sockets.

On the sockets for V8 V9 V10 V11:

1. Install 4x 10 Ohm Bias Current resistors, between Pin 5 and Ground – Pin 5 is currently shorted to Ground.
2. Install 4x 100 Ohm Screen protection resistors, between Pin 1 and Pin 4.
3. Continue the Orange cable to each of the 4 sockets at Pin 1.
4. Short Pin 4 to Pin 8 on each socket.

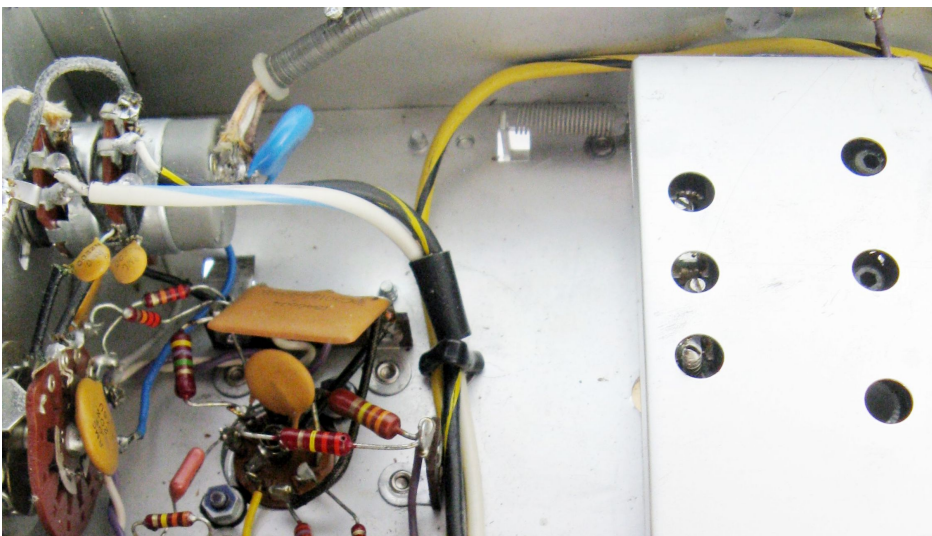


BoM:

4x Vishay RN55 10 Ohm
4x Vishay RN60 100 Ohm
Orange Cable

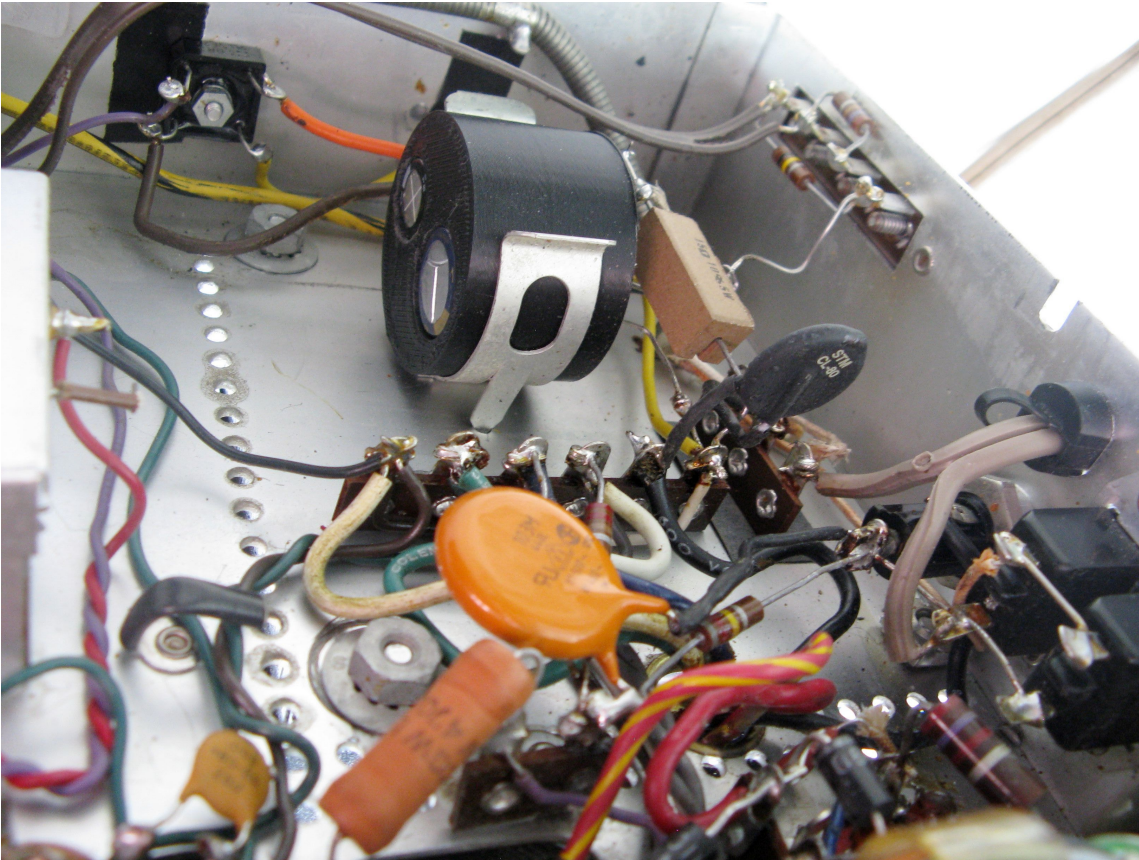
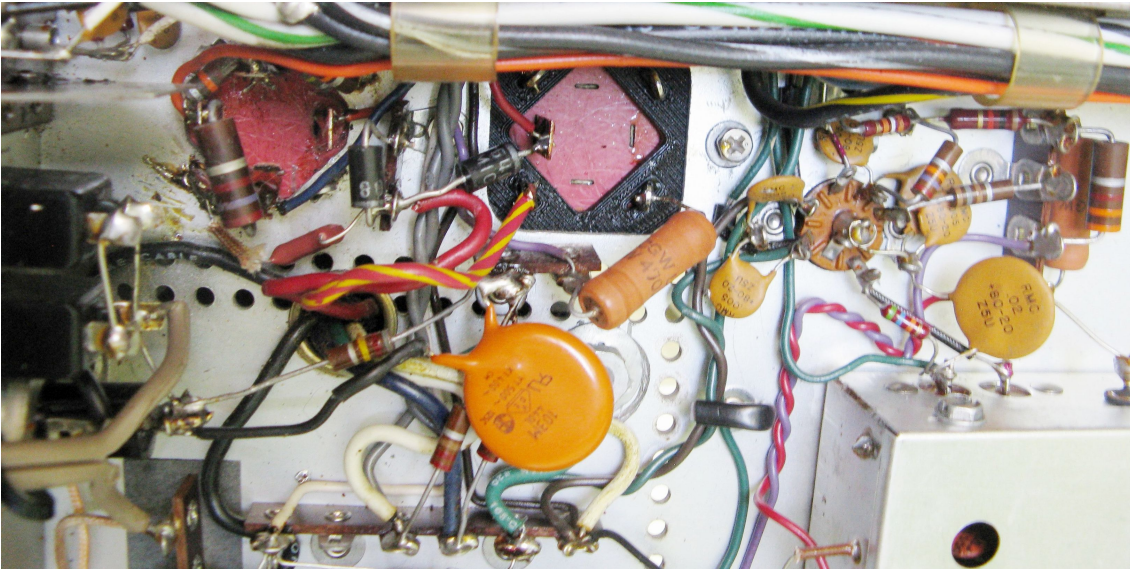
6. Install Additional Components.

1. Install 0.01uF/400V Snubber capacitor between the On/Off of Volume Control switch.



2. Replace CR5 CR7 with Vishay 1N5408 3A/1000V Diodes

3. CL80 Thermistor - enables gradual warmup of the tubes, without power spikes. Install in series with the Mains Transformer Primary Winding, AFTER the On/Off switch.



BoM:

- 1x 0.01uF/400V Film or Ceramic
- 2x Vishay 1N5408
- 1x CL80 Amphenol 3A/47 Ohm

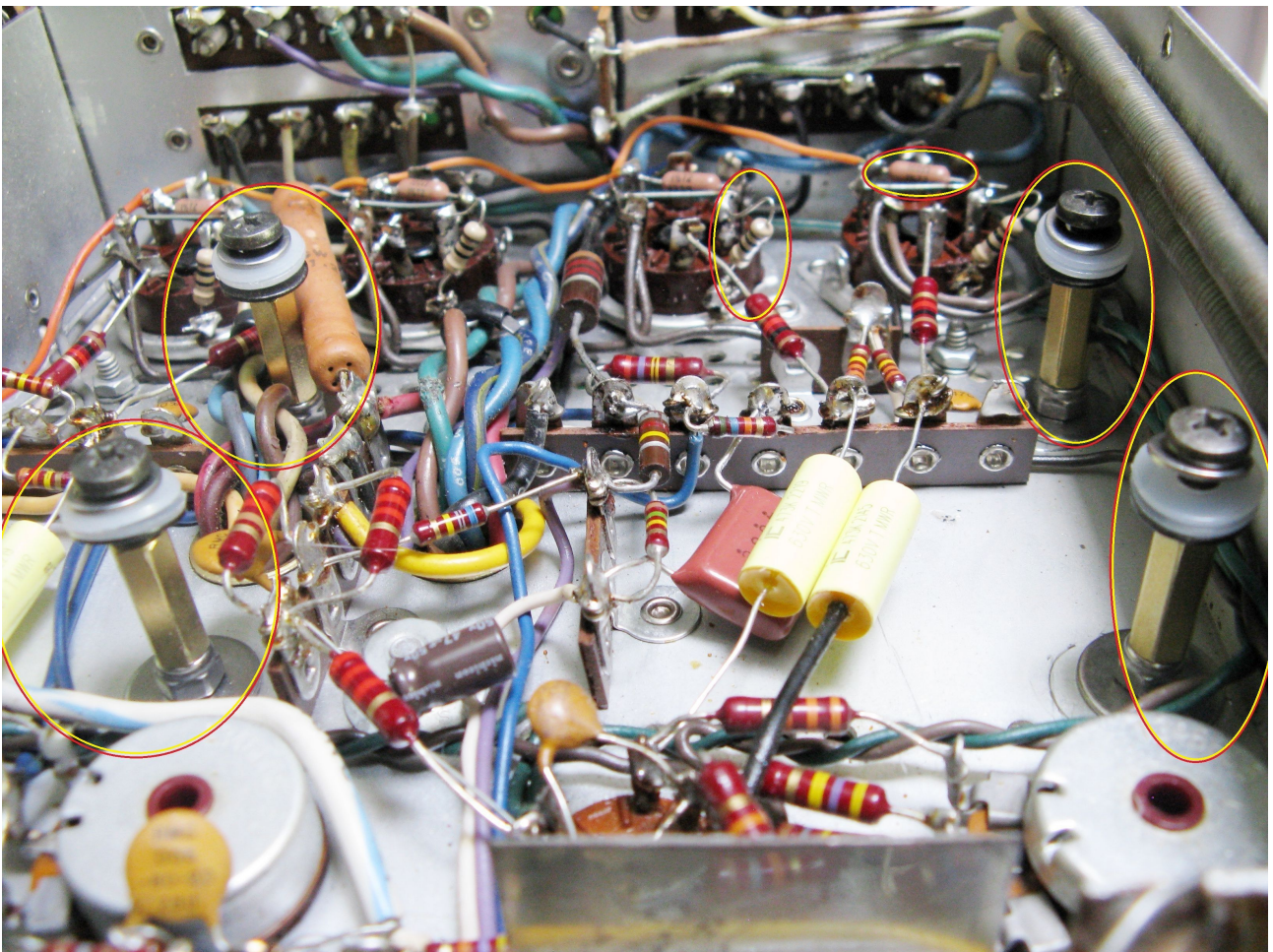
7. Assemble and Install 2 Custom IBBA PCB's - Mounting Hardware.

On each of the Speaker transformers, remove 2 of the original mounting bolts, and replace them with the following M4 components, according to the photos.

BoM: (Each PCB, therefore requires Double the listed quantity for 2 PCB's)

2x Washers M4x10mm Steel
2x Washers M4x12mm Steel
2x Washers M4x16mm Steel
4x Washers M4x12mm Nylon
2x Bolts M4x12mm Steel
2x Bolts M4x16mm Steel
2x Nuts M4 Locking Steel with Plastic Internal Friction liner
2x Standoff Hex M4x17mm Brass

In this photo, disregard the components which have already been removed, as per Para 2 above.



8. Assemble and Install 2 Custom IBBA PCB's - Electronic Components.

BoM: (Each PCB, therefore requires Double the listed quantity for 2 PCB's)

C1 C4 - 0.10uF/630V Film - Wima MKS2 (Pitch=15mm), or similar

C2 C3 - 22uF/50V - Nichicon HE or PW

C5 - 18pF/630V - Ceramic NP0 - Murata (Pitch=5mm)

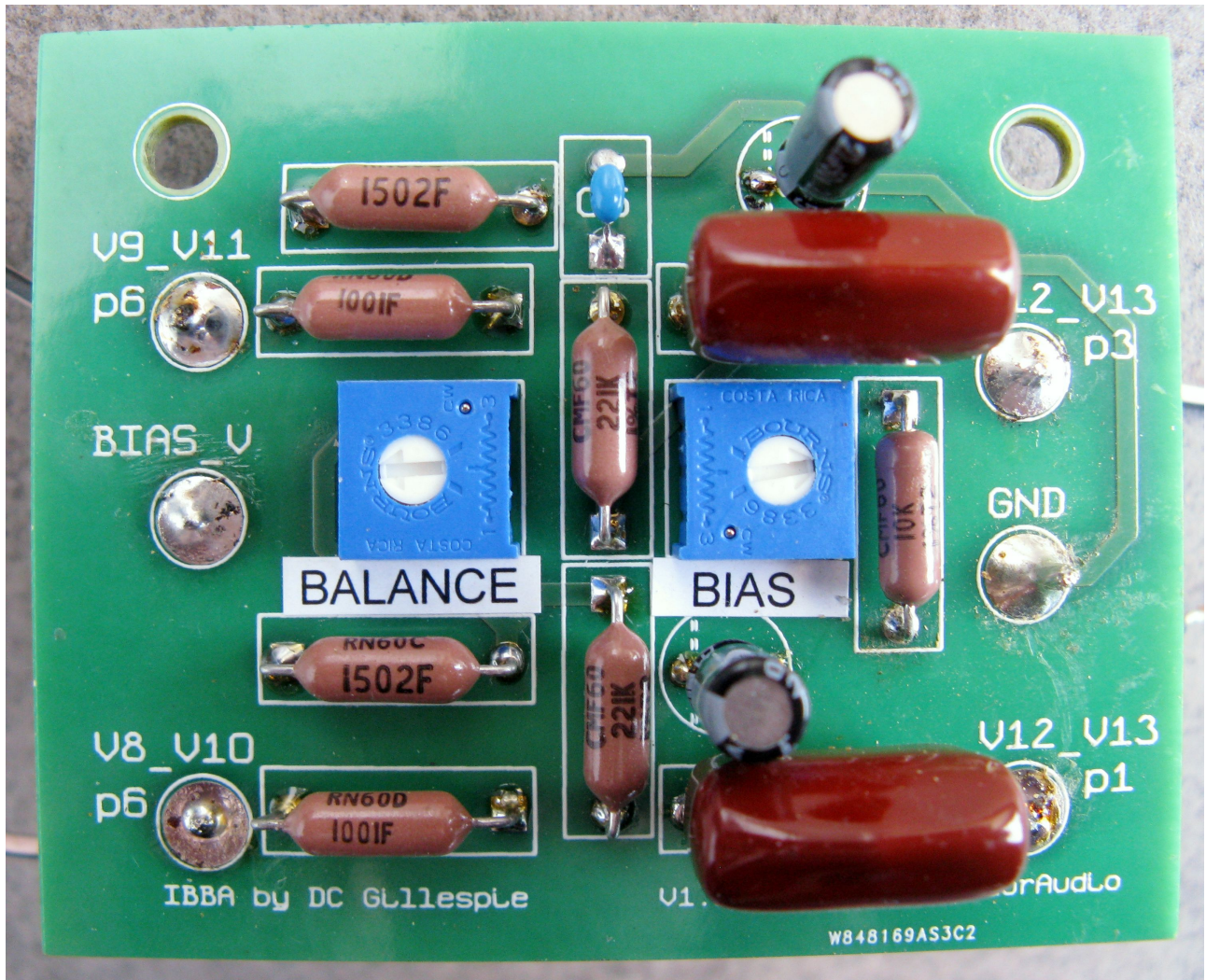
R1 R7 - 1K Ohm - Vishay RN60

R2 R6 - 220K Ohm - Vishay RN60

R3 R8 - 10K Ohm Potentiometer Bourns Cermet 3386F, 3386P or 3386Y

R4 R5 - 15K Ohm - Vishay RN60

R9 - 10K Ohm - Vishay RN60

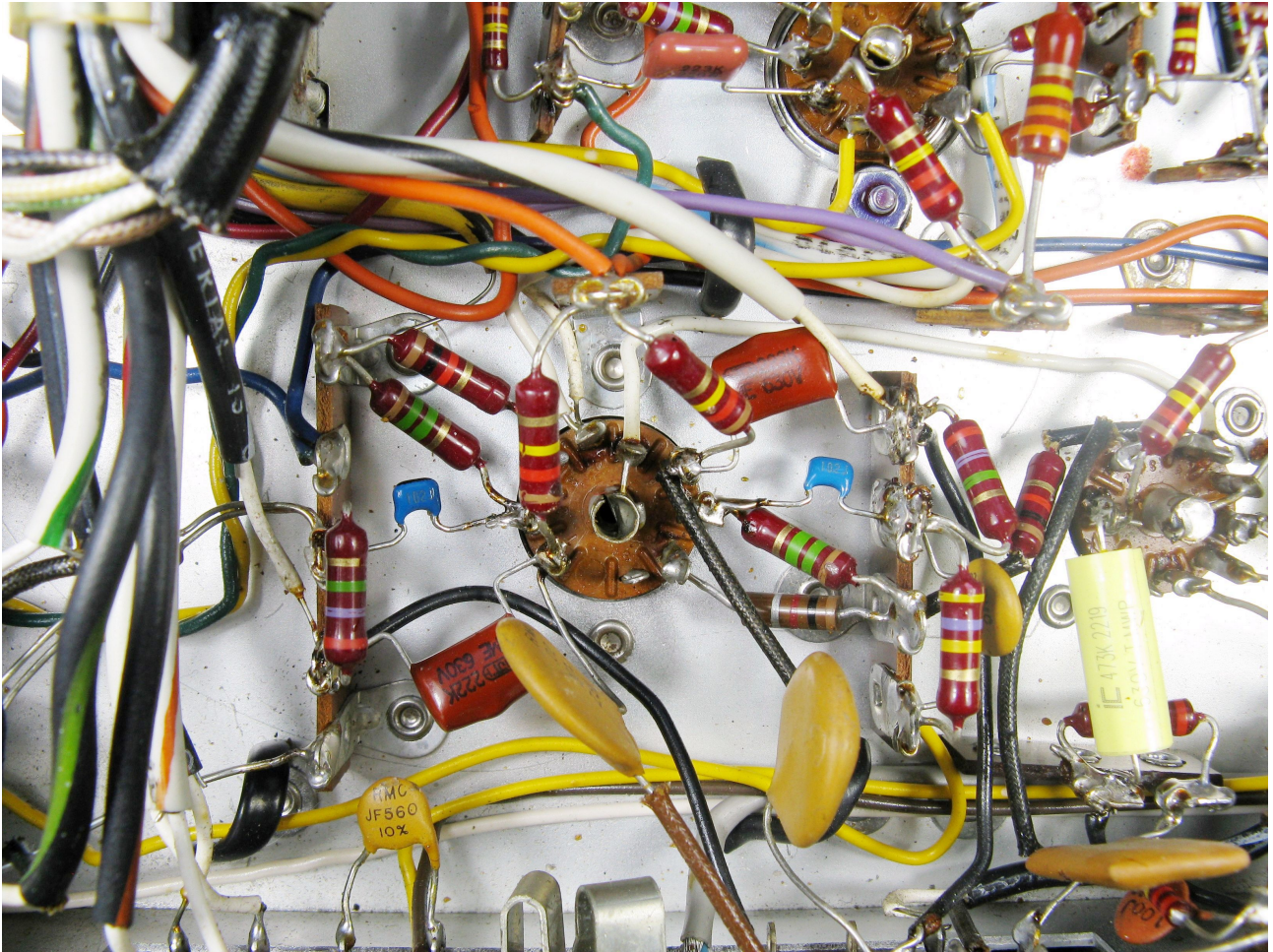


9. Repair the L-R channel imbalance.

With my Signal Generator, I fed a 1KHz 500mVpp Sine-wave into the L&R Aux RCA inputs, and scope-traced the signal path, looking for a discrepancy between the amplitudes of the Left and Right channels.

At V14 (V15 on the schematic!!), I detected the imbalance.

I replaced C35 C36 (0.001uF) at Pins 2 and 7, and C38 C40 (0.0022uF) at Pins 1 and 6. That solved the problem.



BoM:

2x 0.001uF/630V Ceramic NPO
2x 0.0022uF/630V Film Mylar

10. Calibration and Alignment of the IF / RF stages.

Because there was no reception at all, I treated this as a new off-the-production-line machine, for first-time alignment. A real back-to-basics alignment, and disregarding the Service Manual's alignment - it is misleading. Watch the below Video - it's the best I know of for Tube Tuner alignments.

Start with the IF chain, at the Final Coil in the chain. Via a 250pF capacitor, inject the Signal Generator's 10.7MHz signal (just strong enough to be able to detect it on the scope) into that Coil, and scope the Coil's output. Align that Coil for maximum amplitude and symmetry. Leave the Scope probe connected to the Final Coil's output. Move backward along the Coils of the IF Chain, while adjusting each Coil for similar results.

Once the IF Chain is complete, align the RF components (inside the sealed box - actually a Faraday Cage). In turn, inject three Signal Generator's Signals into the antenna input (87MHz, 98MHz and

106MHz). Adjust each appropriate Coil and Capacitor pair inside the Cage, to align the Tuning Indicator with the correct position on the dial panel.

<https://www.youtube.com/watch?v=FzWohAQ7PrA>

11. Expected Results - Electrical Measurements.

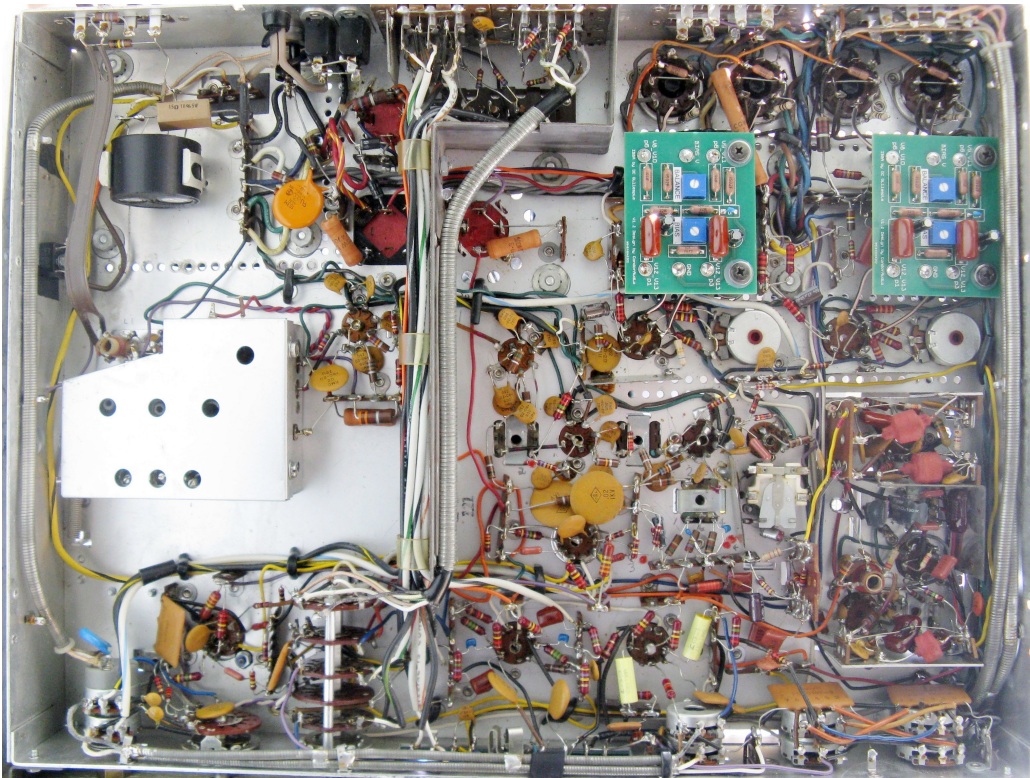
Similar measurements for both Left and Right Channels – Reference Chassis Ground.

For Original Fisher 7591's in good-condition:

Bias Voltage: -29.9VDC
V8 V9 Pin 5: 323mVDC (32.3mA)
V8 V9 Pin 6: -17.7VDC
V12 Pin 1: 322VDC
V12 Pin 3: 148VDC
Tube Heater: -25.2VDC
Mains AC Current Consumption: 1.48A

For New ElectroHarmonix 7591A's:

Bias Voltage: -29.4VDC
V8 V9 Pin 5: 317mVDC (31.7mA)
V8 V9 Pin 6: -19.4VDC
V12 Pin 1: 315VDC
V12 Pin 3: 142VDC
Tube Heater: -24.4VDC
Mains AC Current Consumption: 1.51A

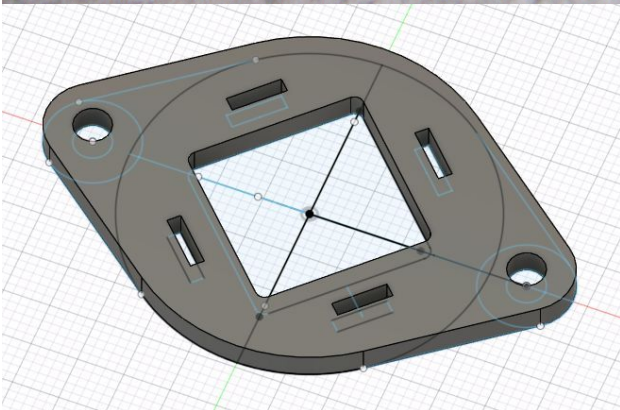
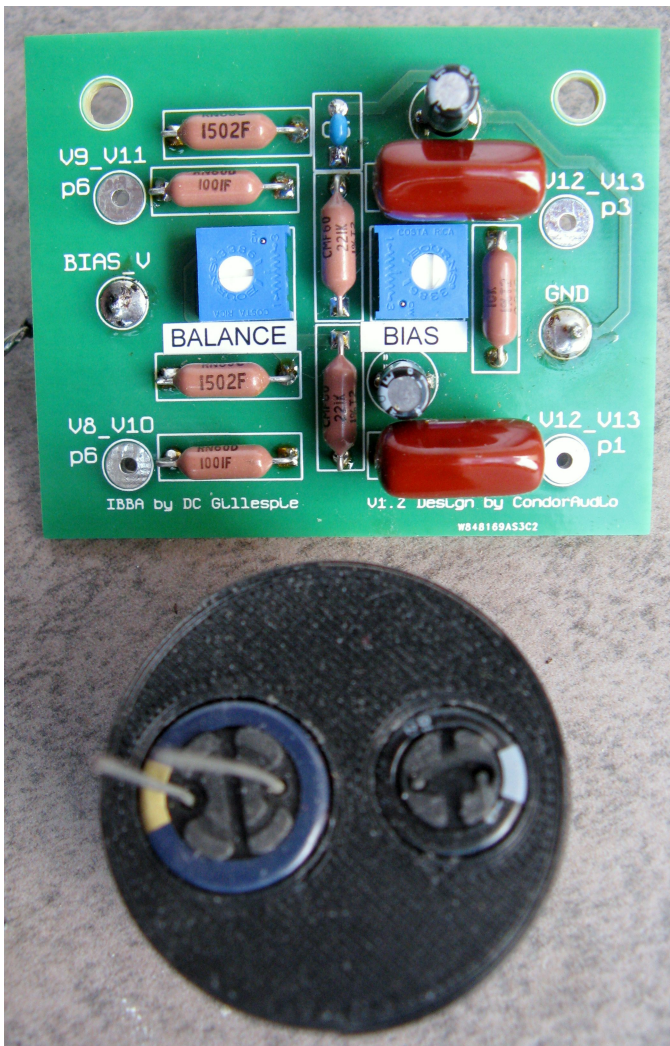


12. Custom Parts designed by myself, used in this project.

IBBA PCB

3D Capacitor Holder for 2x 1000uF

3D C98 Standoff



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