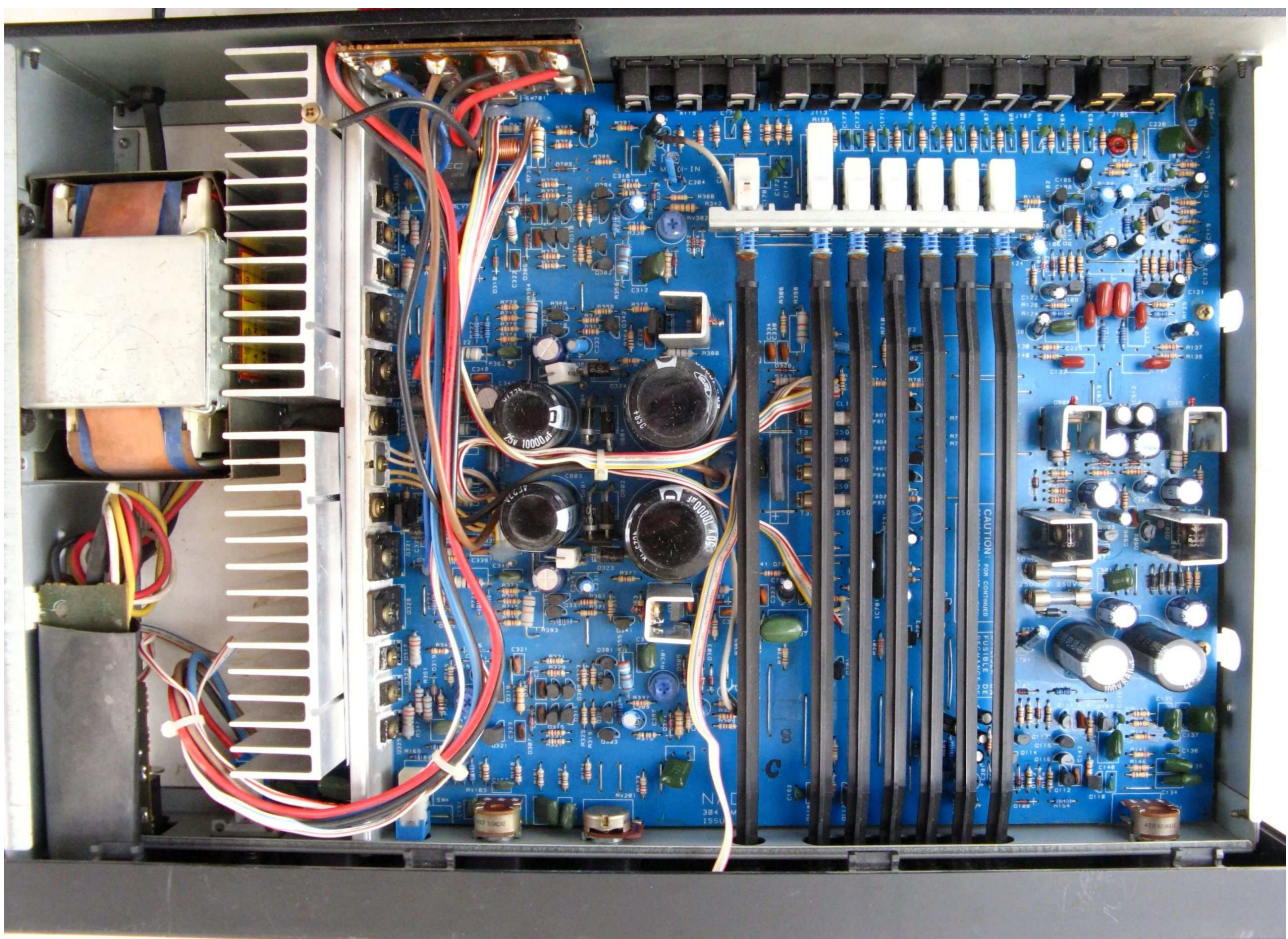


Audio Restoration Upgrade Project: Repair NAD 304 Stereo Integrated Amplifier

This is one of the real classics, and excellent in its own right, sought after by collectors, but not without its share of problems. As with most of the high-quality vintage units, the problems are well-known, and relatively easy (for a good tech) to take care of, but this customer gave me a clear instruction – "Make this 304 into the best one in the world"!

This one had the standard range of problems – out-of-spec (due to overheat) resistors causing channel failure, oxidized relay contacts causing scratchy and intermittent sound, and general old-age.

Removing the cover, it has the desirable blue PCB, well organized with the PreAmp at the right, and the Power Amp at the left. The RIAA is at the rear right. It's a superb platform for upgrading.



After close examination, I decided that the upgrade would take apply to 4 major areas:

1. Capacitor Upgrade
2. Resistor Upgrade
3. Cleaning the Potentiometers
4. Relay Replacement

1. Capacitor Upgrade

Of the original ~40 capacitors, only 4 were still within their ESR limits, so it was an easy decision to replace the whole consignment.

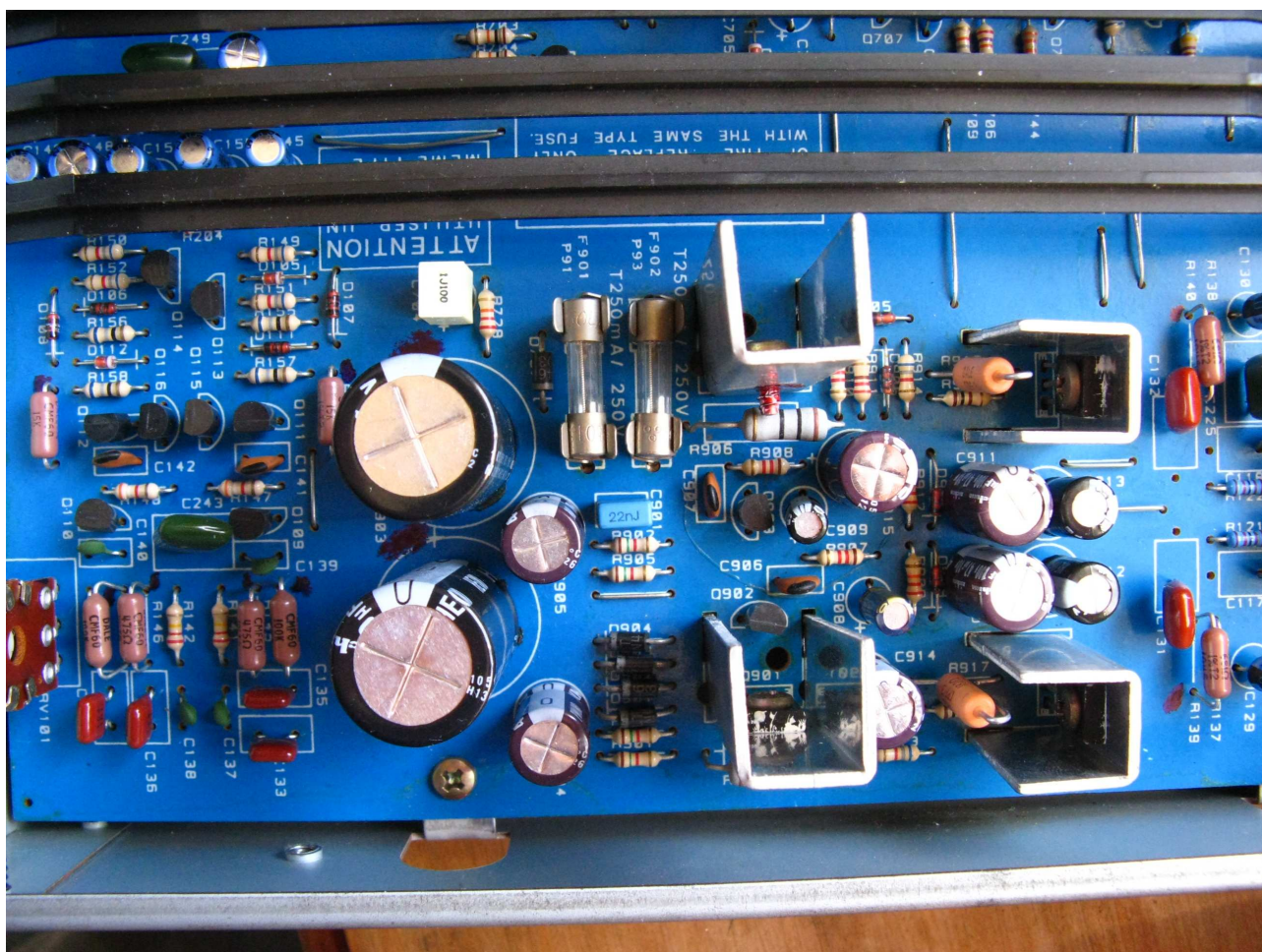
I spent a few minutes examining the schematics, to determine which capacitors are Power, and which are Audio-signal path

The Audio path capacitors would be upgraded to top-grade Nichicon KT and KA, and Elna Silmic II.

The Power capacitors would be upgraded to Nichicon HE, PW, and Panasonic FC.

The 2 big blue Power capacitors are CDE 381LX, upgraded from 10,000uF 50V to 12,000uF 50V.

And of course, Wima MKS2 and MKP4 film capacitors, where they can really make a difference!



2. Resistor Upgrade

I noticed that all the signal path resistors were a mix of cheap Carbon Film and Metal Oxide resistors. Both of these types are acoustically very noisy, and completely undesirable if your objective is purity of sound.

In any amplifier circuit such as this, the ONLY resistors which need to be Metal Oxide, are the final-stage output resistors, which have typical values of 2.2 or 3.3 Ohms in most amplifiers. That's all.

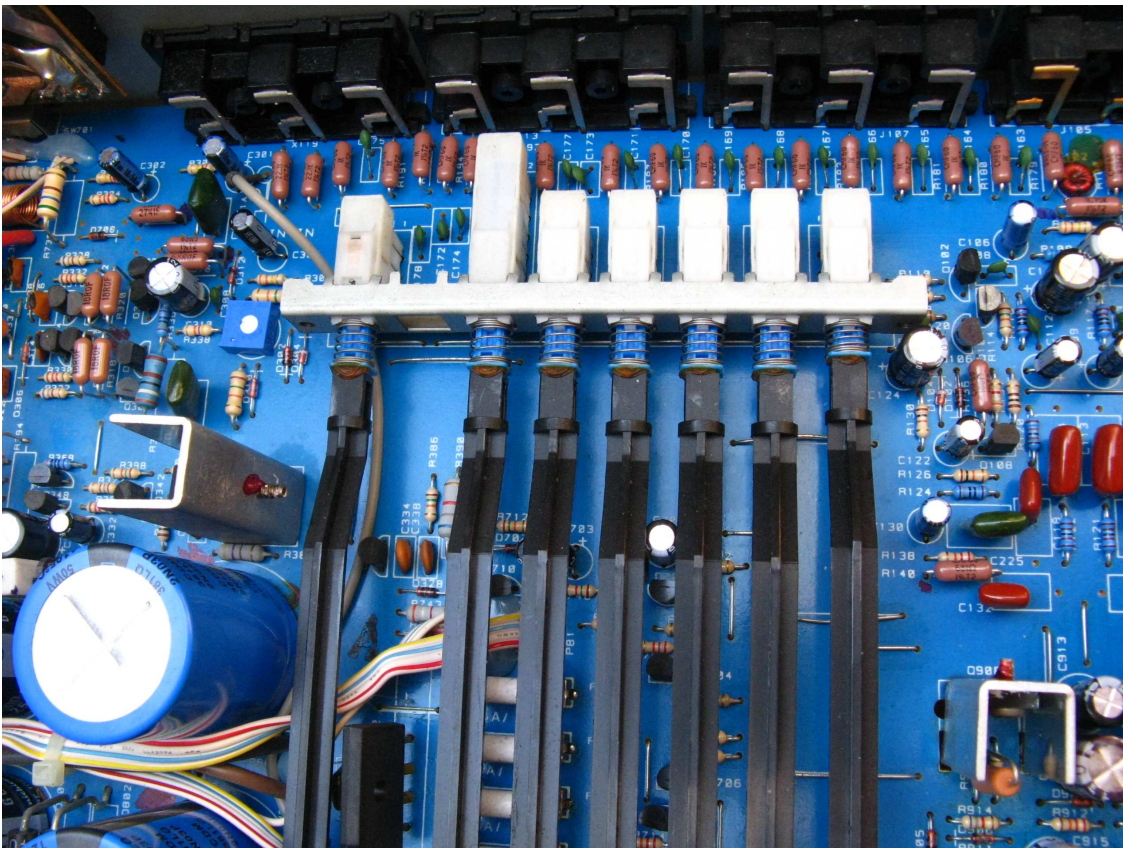
ALL the other resistors should be Metal Film resistors, taking into account that in the PowerAmp section, they need to be up-rated to at least 2 watts or higher, because of the lesser ability of Metal Film to dissipate heat.

My favorite choice, as always, is Vishay Dale's CMF, RN, or RL series, which has a phenomenally low noise figure of -40dB. For the higher wattage requirements, I chose Vishay's CPF series, including the trouble-prone 47Kohm R333 and R334, and 180ohm R917 and R918.

Placing the Vishay CMF resistors in the signal path has a long-term technical benefit beyond the superb sound improvement – their plain tan format makes them easily identifiable, so any tech who may need to troubleshoot in the future, needs to just touch his scope's probes at the tan resistors for an immediate signal-path waveform – no time-consuming searching is required to find the signal path among the hundreds of components.

The trimmer potentiometers are notorious for burning out, so those were replaced with Bourns Cermet 3386 units.

There were a few solder-joints which were cracked; this is usually the most-common problem with modern amplifiers using unleaded solder. So, I resoldered all the solder joints on all the PCB's with old-fashioned fully-leaded solder. The new unleaded solder just doesn't have the ability to last without cracking, through years and years of constant cold-hot cycling on any PCB.



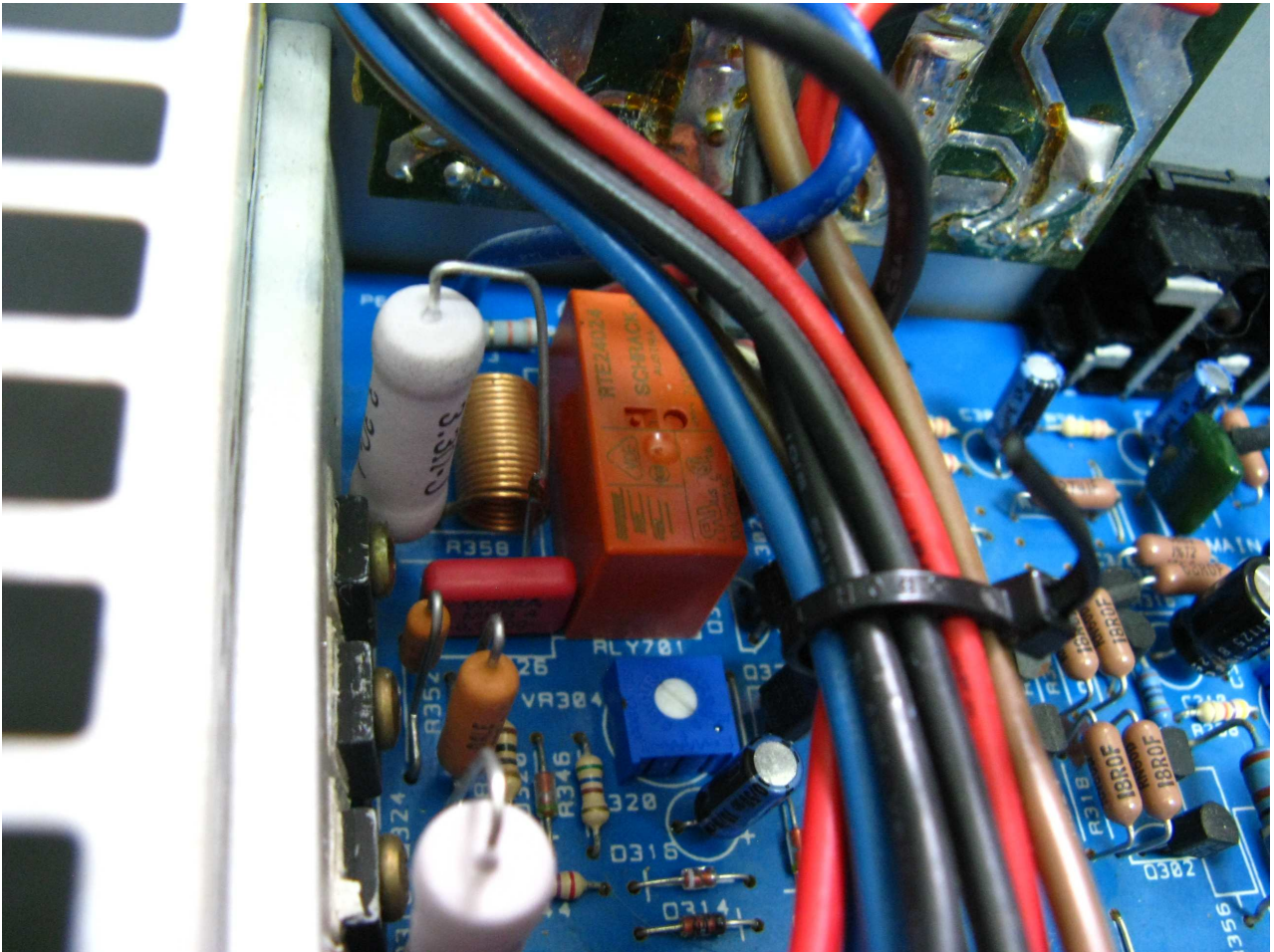
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3. Cleaning the Potentiometers

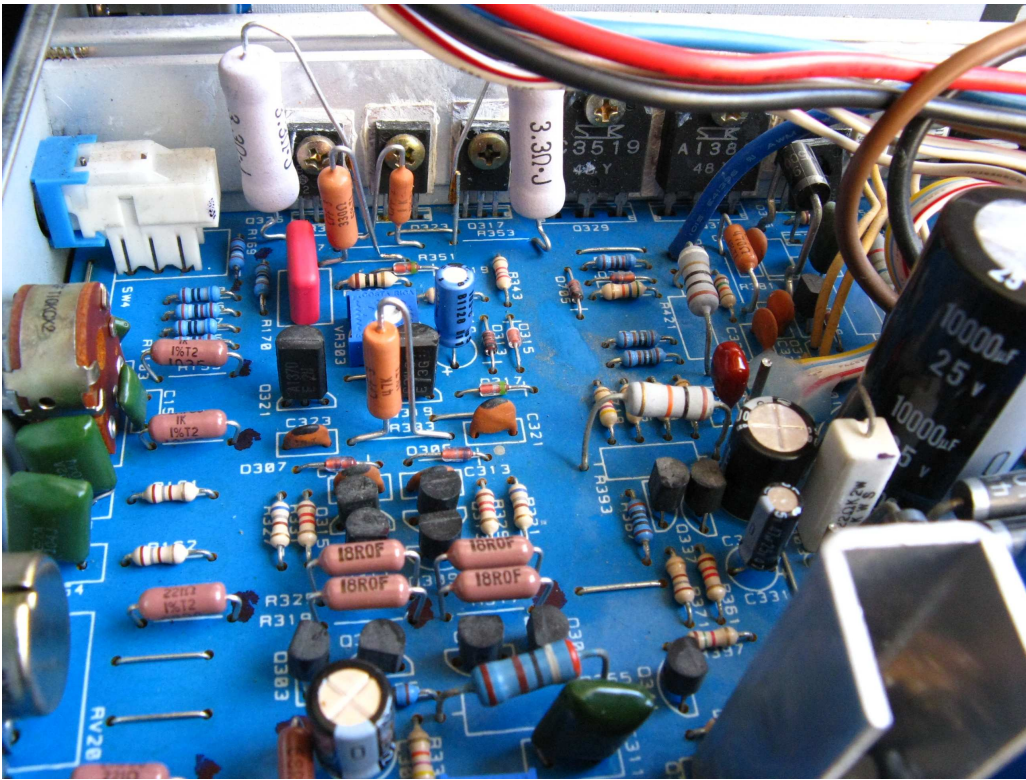
It is normal for these to become scratchy after 20+ years, and all that is needed to restore clear operation again, is to spray DeOxit Fader Lube liberally inside the Volume, Treble, Bass, and Balance potentiometers.

4. Relay Replacement

The original relay is way past its useful service life, and I did consider disassembling and cleaning the contacts, but that is generally a short-term fix, so I replaced it with a high-quality robust Austrian Schrack 24VDC 8Amp (instead of the original lower rated 5Amp relay).

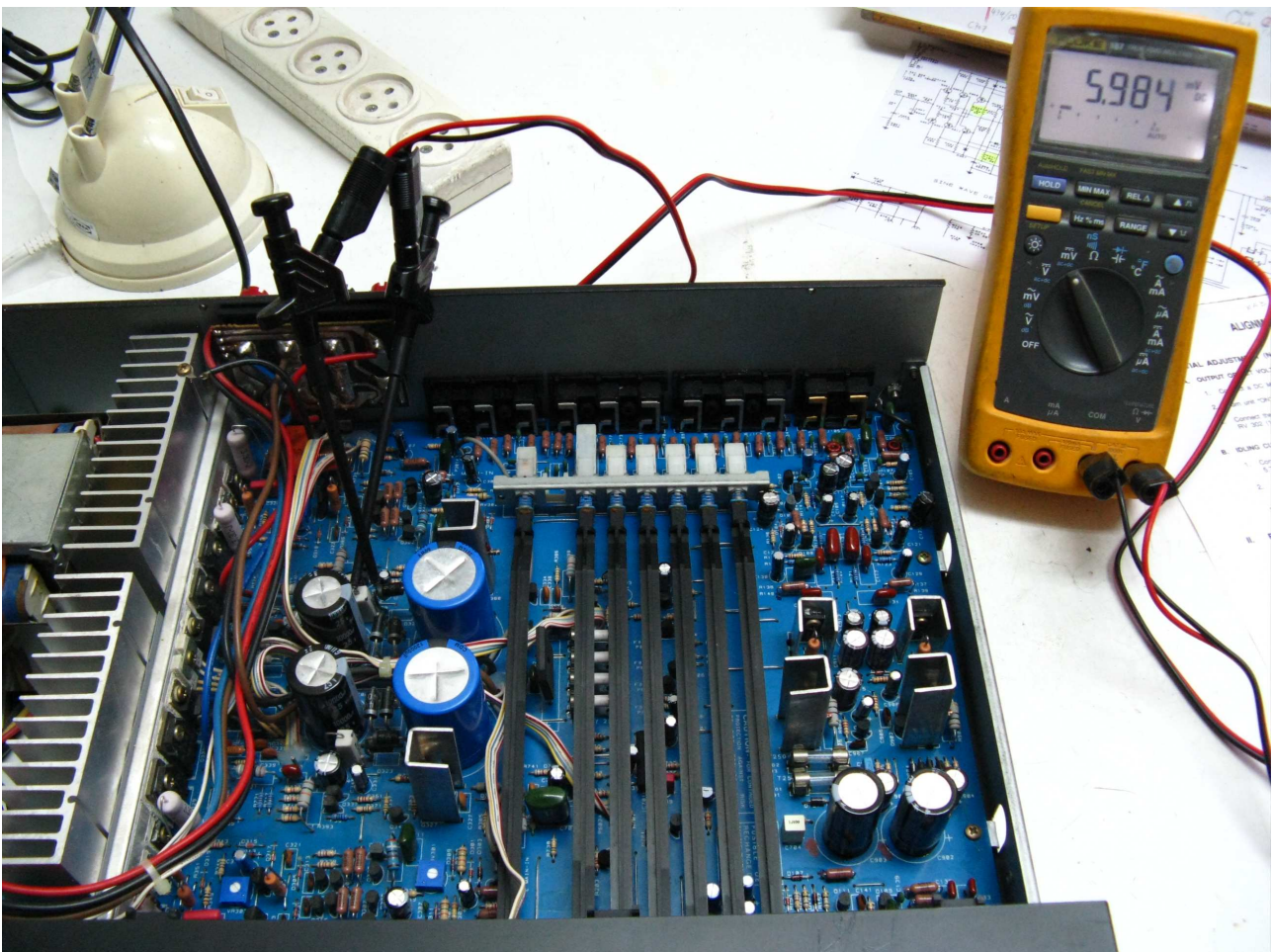


Here, also clearly visible at the Power Amp circuits, are the upgraded 3.3 ohm Metal-oxide power resistors, the orange Vishay CPF Metal-film low-noise power resistors, the Blue Bourns Cermet trimmer, and the tan Vishay CMF Metal-film resistors, which replaced ALL the original noisy carbon resistors in the audio-signal path.



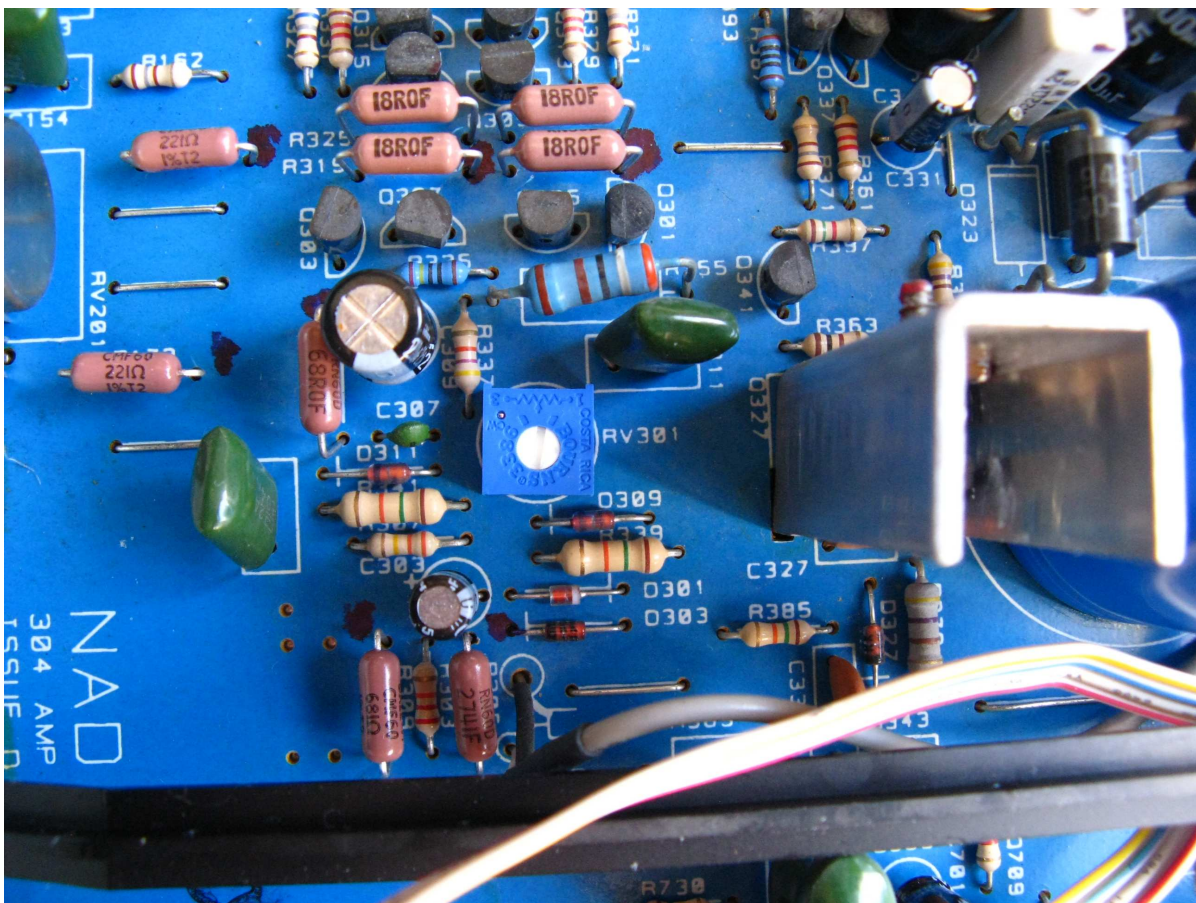
5. Calibration of the Bias Current

After replacing the original low-quality trimmer 1K and 10K potentiometers with Bourns 3386 Cermet units, I re-calibrated the Bias Current to factory specifications. This ensures that the machine runs cool, and that the semiconductors last a LONG time.



6. Calibration of the DC Offset

Likewise for this adjustment to set the DC level at the speaker outputs to 0.0 mV +/- 10.0mV.



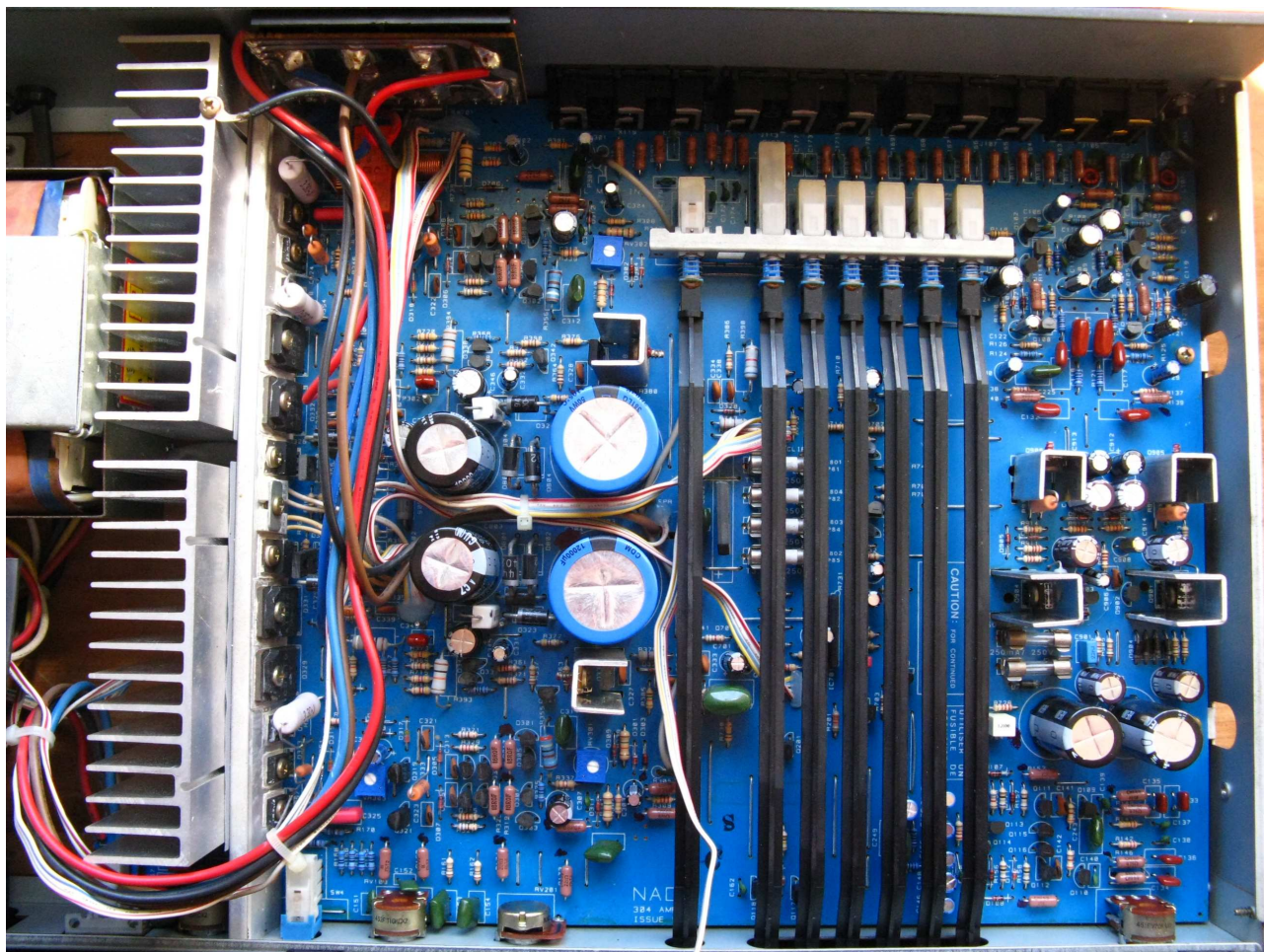
7. ReAssembly and Burn-In

All repairs or upgrades endure a full 48-hour Burn-In before being returned to the customer, to ensure that everything is operating EXACTLY as it should. Not only that, but that's the time I get to enjoy the results of my work.

The sound improvement is stunning, exactly as I expected it to be.

Bass response is much more exact, and mid and treble frequencies open the sound-stage much more than previously.

All in all, a much more pleasurable listening experience, and this upgrade would easily give any of NAD's modern BEE-specced units a serious run for its money.



Parts for this restoration

Parts and advice are available for owners who wish to tackle this project by themselves.

<http://www.condoraudio.com>

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