Subject: Re: Under-Biasing Output Tubes
Posted by Thermionic on Sun, 11 Mar 2012 07:31:41 GMT
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Hi AudioFred,

"I read somewhere that lowering the bias somewhat will extend tube life. The amp is rated at 50w/ch with KT88's, and I'm using efficient speakers that never require more than about five watts peak. What's the upside and downside of biasing the tubes to 0.43V instead of 0.45?"

Without actually seeing your amplifier's schematic, I'd venture to guess that what you're probably measuring here is not the actual bias voltage, but a reference voltage created by the tube's cathode current being drawn through a precision 10 ohm resistor. That tells you how much current the tube is actually conducting, which is really the only number to be concerned with. The actual negative bias voltage required to achieve the desired idle current doesn't matter, only that you achieve it.

A reading of .45V means you're drawing 45mA of current through the 10 ohm reference resistor. Going from .43V to .45V on your reading means you actually increased the bias voltage, which gave you a net decrease in cathode current of 2mA. To increase the current you decrease the bias, and to decrease the current you increase the bias. "Underbiased" means the tube is running too hot, likewise, "overbiased" means it's running too cold. A good way to remember this is that bias literally "biases against" the unwanted condition of the tube conducting wide open all the time.

FWIW, the bias voltage on a KT88 drawing 45mA in an amplifier that'll also run EL34s will probably be around -45 to -47 volts, depending on what your amplifier's exact power supply voltage is.

With a Class AB amplifier such as the Ella, you'll not see any difference in tube life with small changes in bias unless you normally play the amp at very high output levels, and since you don't do that it won't really increase the tube life for you. Here are the hows and whys of this:

As Wayne had noted, an amplifier running in Class A operation is typically biased to a point about halfway between cutoff and saturation. Whatever the zero-signal idle current is at that particular bias point will also be the average current at the amplifier's full, undistorted output power. For example, let's say you have a triode-configured EL34 running in Class A operation at 320 volts plate-to-cathode, with the bias set to an idle current of 82mA. When the tube is then driven to full power, the plate current will swing down to around 50mA on the negative half-cycle of the AC music signal, and probably a tad above 125mA on the positive half-cycle, but the *average* current will still be about 82mA.

However, with Class AB operation, both the average and peak currents increase much more sharply with output. In your particular amp, the peak current at the full, unclipped output will be maybe 4 times that of the idle current. The average current will be nearly double the idle current value. Needless to say, playing an AB amplifier at high output places a lot more stress on the tube's cathode than at low output, and uses up its emissive capabilities much faster.

But, you're only taking the Ella to just above its idle condition, so your power tubes will last far longer than if you kept 'er cranked, or if those same tubes were in a Class A amplifier. So in your particular case, biasing it slightly colder won't make any difference in tube life. But, it could very well affect the sound negatively.

Biasing colder will increase the high order harmonic distortion products, as well as increasing the overall THD. It also generally decreases the dynamic attack and punchiness in the bass regions, and takes the overall sound in a colder, more sterile direction. Biasing slightly hotter will generally make it sound warmer, juicier, and punchier, and will lower the high order distortion products and overall THD. Of course, you don't wanna get too wild with it, even though your particular situation means you'll never push it hard enough to overheat the tubes.

Also note that different brands of tubes will sound their best at different idle currents; 45mA is not a perfect generic setting for all KT88s, 40mA is not a perfect generic setting for all EL34s, etc. Let your ears be your guide, instead of a nominal idle current figure. With certain power tubes, sometimes just a small increase in current from a setting that sounded perfectly fine with a different brand can really unlock the magic.

Hope this helps.

Thermionic
