From: **Matthew Springer** (*mirage_indigo@yahoo.com*)
Date: 11/9/2001 12:36 AM
Subject: **Cathode Resistor vs. Bias point for 6V6**

Question for the grizzled verterns:
How does bias point (i.e. current draw) scale with bias resistor in cathode biased 6V6's? (linear, non-linear)

I've got the prototype for the Tweed-o-Verb design alive and well, but the tubes are biasing up much hotter than I intended. Like 50mA each for poor, defenseless 6v6's, glowing red plates too hot.

If I double the cathode resistor and hold the grids constant does current cut in half or is there a second order effect? I'd prefer to nail it on the first try as I don't particularly wnat to go around changing Al encloised chassis resistors too much.

On the plus side the amp sounds phenom. I think KG is right, no NFB with UL sound spretty groovy.

-Matthew

From: **Ray Ivers** (*RAGEray@aol.com*)
Date: 11/9/2001 2:08 AM
Subject: **Re: Cathode Resistor vs. Bias point for 6V6**

Matthew,

> *How does bias point (i.e. current draw) scale with bias resistor in cathode biased 6V6's? (linear, non-linear)*

IME it's a non-linear function, IMO due mostly to the variation of screen-to-cathode voltage with changes in bias current.

You *could* install a 500 ohm, 25 watt adjustable resistor (Mouser part # 588-D25K-500, $7.38), or the 750 ohm value, for your cathode resistor. After finding your ideal quiescent point, you could then replace it with the equivalent Al value or just leave the adjustable one in if it's working well and not overheating or drifting.

Ray 'Grizzly' Ivers ;)

From: **Wild Bill** (*wildbillcostello@sympatico.ca*)
Date: 11/9/2001 2:58 PM
Subject: **Re: Cathode Resistor vs. Bias point for 6V6**

Take a guess at the req'd bias voltage. Then just use Ohm's Law.

For example, if you want 35 volts at a cathode current of 35 ma, then R=E/I or 35/.035. You get 350 ohms.

Any good tube data site like Duncan's should give you a curve of current vs. bias voltage. I've always found this to get me close enough. You could then easily fudge the value up or down a little but I've never found it necessary.

---Wild Bill

From: **Bruce /Mission Amps** (*missionamp@aol.com*)

Date: 11/9/2001 4:58 PM

Subject: **Cathode Bias point for 6V6/ Wrong IMHO**

Although that method will keep you from blowing the power tubes up, it rarely works "well" (tone) for me in cathode biased amps especially using 6V6s.
And that 350 ohm figure is not right for what he is talking about either... OK for one 6V6 with low voltage but remember he said two 6V6s, which would meam twice that 35ma current across a singular cathode resistor.
If you were using the method Bill just mentioned, then it would be two tubes at 35ma each, or, 70ma at 35v ... 35v/.07a = 500 ohms.
IMHO, the trouble with that 500 ohm resistor in the amp doesn't really sound very good!
I don't know what your plate to cathode voltage or B+ is but I bet using the 350 ohm resistor acutally would sound better with two tubes then the 500 ohm.
270 ohms is even better still, if you keep that plate voltage down so the tubes are not underbiased.

When using overly large value cathode biasing resistors to control idle current points, even with a big bypass cap, it seems like there is too much weirdness with cathode voltage going all over the place when you are cranking the amp up. That really screws up the sweet cathode biased amp sound for me.
Again, IMHO, with cathode biased amps, I think the best tone thing to do is run the OT zed a couple thousand ohms higher then you think and try and biasing the tubes at around 75%-85% of their rating by using the smallest value cathode resistor you can and at the lowest B+ voltage that is reasonable to develop full power across the OT.
To my ears, in a non class A, small, rippin' guitar amp, a pair of cathode biased 6V6s sound great with an 8K OT, idling the plates around 12-13 watts each with the plate voltage around 350vdc- 370vdc and the screens about 20vdc-30vdc less.
That's usually well under 38ma each.
I don't care where that sits in a tube chart either.
Charts don't make music or any sounds and neither do O'scopes.

Bruce

From: **Matthew Springer** (*mirage_indigo@yahoo.com*)

Date: 11/9/2001 5:17 PM

Subject: **Re: Cathode Bias point for 6V6/ Wrong IMHO**

Thanks Everybody,

My B+ is currently sitting around 400, so I think I'm going to try and knock down the vlotage of the center tap OT feed some with a 30V zener (rather than the whole B+ PT trick in the secondary). I was hoping I could get away with 400v, but of well. Maybe I'll just put 6l6's in there and see how they sound.

It sounds like what I suspected, is true; the cathode voltage point changes with resistance at the same time as the idle current changes. I guess I should have been able to predict this given the 250 Ohm Tweed deluxe bias with a B+ of 360 or so. I'm 40 volts higher than that, so I guess I shold be slightly under (400/360) for cathode resistance. This makes the predicated value 111% of 250 which is 277.7 ohms, so Bruce, you're pretty much spot on.

-Matthew

From: **Wild Bill** (*wildbillcostello@sympatico.ca*)

Date: 11/10/2001 4:28 PM

Subject: **Re: Cathode Bias point for 6V6/ Wrong IMHO**

Hey Bruce, I'm not arguing! The end result in sound is the goal. It's easy to work out the theory after the fact.

Sorry if I wasn't more specific about my example. I plugged in those numbers just to show how the formula worked - the numbers of course change depending on B+, allowed plate dissipation, the bias/plate current curves of whatever tube you chose - the original post didn't contain enough info for anyone to give the exact resistor value for that specific situation.

I agree also that 35 ma for one 6V6, or even 70 ma for two might be wrong for the best tone. When I design for my own circuits I first look up the max plate dissipation and take 70 % of that as the idle point. Then you have to subtract the cathode resistor voltage drop from the plate voltage and work out the idle current to achieve that 70 % figure. Obviously you can run more idle current with 300 volts on a 6V6 than 400. And some brands of tubes can be run warmer than others if that's the tone you're looking for. I like to run at that 70 % figure - less sounds too "cold" to me.

I think Bruce that if you do the math for an actual case instance you'll find that indeed I'm using the same or similar value that you are.

As for the the cathode voltage "with such high values" "going all over the place when you are cranking" I quite agree - although please remember that I never suggested using 500 ohms for 2 6V6's as a real value! I find myself using values from 220 to 270 ohms in the real world, since B+ is usually in that ballpark.

Besides, even if things do get weird it's still all a matter of taste! In one of my amps I used fixed bias for a bank of six 6V6's, with unbypassed 47 ohm separate cathode resistors for each tube. The combination seems to have a bit of "thickening" as the amp is cranked that many players rave about. I have no idea how to calculate the dynamic changes aound the cathode resistors in this setup. All I knew was that with 47 ohms and the safe cathode current in each tube I'd get a bit over a volt or so of increased bias on large current peaks. I didn't bother with bypass caps 'cuz 47 ohms seemed too small to make much difference.

Anyhow Bruce, if you'll forgive me for any mistaken implication with the 35 ma and 350 ohm figures I used as examples I think we're really both arguing on the same side...

---Wild Bill

From: **Bruce /Mission Amps** (*missionamp@aol.com*)
Date: 11/10/2001 7:42 PM
Subject: **Re: Cathode Bias point for 6V6/ Wrong IMHO**

> *I think we're really both arguing on the same side...*

Yup, I think you're right.
I've tried many different cathode resistor values and the further I get from 250ohms to a max of 300 ohms, the least I like the overall tone and response.
So, over the last few years, when starting a new amp project using cathode biased 6V6s, I started thinking in terms of "within reason and without underbiasing the 6V6s (way too hot), what plate to cathode voltage do I need when using a 270ohm to resistor will get me in that idle current spot that I like the tone best."
So I guess it's all about my ears rather then what looks right on paper or on my scope!
I know that is not the typical way of doing it but I like the results.

Cheers oldboy!
Bruce
