
Subject: Fisher 500C-how hot is too hot?

Posted by [hurdy_gurdyman](#) on Sun, 04 Sep 2005 12:22:40 GMT

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Can anyone give me an idea of just how hot the output transformers should be on a Fisher 500C after running all day? Mine are hot enough that I can only leave my hand on them for about 8 seconds or so. I've heard that these receivers run hot, but want to make sure that these aren't too hot. I can't just check bias voltage and such by comparing to schematic. The receiver was long ago converted from 7591 to EL34. Bias was adjusted by lowering screen voltage. The tubes don't have any sign of strain even after running all day, no orange glow at all on the plates. There is about 440 VDC at the plates, about 320 VDC (was 375) at the screens, and -20 VDC at the grids. Dave

Subject: Re: Fisher 500C-how hot is too hot?

Posted by [Damir](#) on Sun, 04 Sep 2005 22:59:52 GMT

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With OP - $U_a=440V$, $U_{g2}=320V$, $U_{g1}=-20V$, you can expect more than 100mA I_{a+g2} current through each EL34. Much more than P_a max for EL34. For "reasonable" bias of about $I_a\sim 50mA$ (and $I_{g2}\sim 5mA$) you should change the "bias voltage" U_{g1} to about -26V. If you don't have adjustable "bias" pot, you can change the values of voltage divider resistors in "bias" supply to "enlarge" U_{g1} .

Subject: Re: Fisher 500C-how hot is too hot?

Posted by [hurdy_gurdyman](#) on Mon, 05 Sep 2005 02:52:04 GMT

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Thanks for the help. I've never been any good at math formulas. I changed the resistor on the bias bridge rectifier-to-ground from 15 ohms to 2 ohms and got the voltage to -24 VDC. This also, unfortunately, raised the filament voltage on four 12AX7's higher than what is good for them, so I added a 16 ohm resistor in series with them and have them right where they should be. I'm a bit worried about reducing the bias resistor anymore. Not sure if the transformer tap and rectifiers are up to a lower resistance than this or not (not sure if it's up to the value I have on it now.) Is -24 V close enough, or should I try an even lower resistor? Dave

Subject: Re: Fisher 500C-how hot is too hot?

Posted by [Damir](#) on Mon, 05 Sep 2005 10:43:48 GMT

I found the schematic, actually the voltage across two series connected 12AX7 heaters wired for 12,6V operation must be 25,2V. I'd leave 15 Ohms resistor in place, but I'd change the series connected 5k6 resistor to about 2k2-2k7. This resistor with 15k resistor forms voltage divider, and "set" the bias voltage. I think that -24V is still on the "hot" side, you can measure the current through EL34s by installing 1 Ohm (or 10 Ohms) "sense" resistor between the cathode and ground on each EL34 (pin 8). By measuring the voltage drop you can calculate the current by Ohms Law (say, 60mV through 1-Ohm resistor is $I_{a+I_g2}=60mA$, and that's about max. you can use with respect for max. Pa data).

Subject: that's power iron hot...

Posted by [Thrint](#) on Mon, 05 Sep 2005 13:47:24 GMT

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a 7591 running at +400 is going to pull less than 70 mA before developing plate glow. So, what is creating the heat? I^2R in the primary winding? What is primary DCR? Do the calculation, and measure idle current. Is there any other source of heat? you mentioned the rectifier a bit ago. Have you actually measured temp? 8 seconds is a long time when holding your paws to heat. There is a diff between hot and inducing damage, and hot and able to burn fingers. 85-C is not going to allow 8 seconds of good finger contact, I can assure you...Still, none of my OPTx's run hotter than I can stand, so I would urge you to discover the heat source. There is *NO* magic involved, so examine it thoroughly. cheers, Douglas

Subject: Re: that's power iron hot...

Posted by [hurdy_gurdyman](#) on Mon, 05 Sep 2005 14:38:28 GMT

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Aser the conversation with Damir below, I'm zeroing in on the problem. It all started because I converted it to EL34 several years ago when there were none being made that would fit it. Hasn't been used in a few years, now I'm getting it going again and working out the bugs. Dave

Subject: Re: Fisher 500C-how hot is too hot?

Posted by [hurdy_gurdyman](#) on Mon, 05 Sep 2005 14:45:56 GMT

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The series resistor for the bias voltage has been completely by-passed a long time ago. There just

isn't enough voltage there to reach 26 volts without changing the 15 ohm resistor to ground. The way it is currently hooked up with the 2 ohm resistor replacing the 15 ohm, I am getting: Plate= 440 VDC Screen= 300 VDC Grid= -24 VDC Also, some time ago I replaced the 1.2 ohm resistor between first and second stage in the high voltage supply with a 7.2 ohm. This is what lowered the screen voltage. It gets complicated, but it does seem to play well and sounds wonderful. The things I'll do to save money. EL34's are still cheaper than 7591's. Besides, I love the sound of EL34's. Dave

Subject: Re: Fisher 500C-how hot is too hot?
Posted by [Damir](#) on Mon, 05 Sep 2005 16:32:51 GMT
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With lower Ug2=300V and Ug1= -24V, current through the tube(s) is now in the "safe area", lower than Pa+g2 max. Enjoy...:-)

Subject: Re: Fisher 500C-how hot is too hot?
Posted by [metasonix](#) on Mon, 05 Sep 2005 18:07:20 GMT
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I have repaired and upgraded SCORES of Fisher receivers. Please let me offer some advice. Yes, your output tubes are running too hot, plate current must be decreased. -26v is not negative enough. Also, the heaters of the EL34s draw a LOT more current than 7591 heaters. This is dangerous. The original power transformer is barely adequate to run the original load. If I had to put EL34s in a 500C, I'd either use an external power transformer or remove/bypass some preamp tubes (or maybe even the tuner) to decrease the load. >) you should change the "bias voltage" Ug1 to about -26V. >If you don't have adjustable "bias" pot, you can change >the values of voltage divider resistors in "bias" supply >to "enlarge" Ug1. That's good advice. If this were my receiver, I would assume even worse, and modify the output stage to insert a cathode standoff resistor on the cathode of all 4 tubes, to further decrease plate current. I suggest a big 100 ohm wirewound resistor bypassed with a 1000 uF, 25v capacitor. Another advantage to this scheme: the cathode resistor helps limit inrush current at turn-on. Another thing I always do to old tube receivers is to put a large resistor in series with the AC mains input. 5-10 ohms at 10 watts also limits inrush, to help prevent power transformer death. Remember, AC line voltages have crept up over the last 40 years. If modern EL34s conformed to the old data sheets, -26 would be adequate, but modern EL34s NEVER conform. They always seem to need more negative grid bias.

Subject: Re: Fisher 500C-how hot is too hot?
Posted by [hurdy_gurdyman](#) on Mon, 05 Sep 2005 20:32:13 GMT

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When I first did the EL34 conversion I mounted a couple of Radio shack transformers on the back of the chassis to handle voltage for the power tube heaters, so thats not a problem. Will it hurt the power transformer to change the bridge rectifier-to-ground resistor to an even lower value than the 2 ohms I'm presently using (original value was 15 ohms)? I've looked at schematics of amps from other companies and see that many times the bridge rectifier is hooked directly to ground without any resistors. I was wondering earlier about using cathode resistors but didn't know how to adjust the values. I think I'll try this soon. Dave

Subject: Re: Fisher 500C-how hot is too hot?
Posted by [hurdy_gurdyman](#) on Wed, 07 Sep 2005 02:03:42 GMT
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>That's good advice. If this were my receiver, I would assume even worse, and modify the output stage to insert a cathode standoff resistor on the cathode of all 4 tubes, to further decrease plate current. I suggest a big 100 ohm wirewound resistor bypassed with a 1000 uF, 25v capacitor.

Subject: oops
Posted by [hurdy_gurdyman](#) on Wed, 07 Sep 2005 03:01:41 GMT
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I wrote the wrong cathode and grid voltages above. My tired eyes was reading the scale wrong. It should have read: Plate= 450 V Screen= 350 V Grid= -24 V Cathode= 3 V I'm not using my old faithful Eico VTVM I've used for many years because the 1 meg precision resistor in the probe has finally drifted to much. I'm using an old archer with different values for each scale. I have it straightened out now. I also experimented with a resistor in the AC line. All I had on hand was a pair of 50 ohm, 10 watt, so I wired them together for 25 ohms. Here's what I got. Plate= 420 V Screen = 330 V Grid = -22 V Cathode = 2.6 V Looks like I'm just not going to get enough negative bias. I'm almost ready to rewire this back to original and just buy a set of 7591's. Darn. I prefer EL34's, and dang if this thing doesn't sound sweet. Dave

Subject: Re: oops
Posted by [Russellc](#) on Wed, 07 Sep 2005 16:23:05 GMT
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Not to worry, the 7591 also sounds excellent as well! Good luck with the 500C, Russellc

Subject: New day, more tinkering, new results

Posted by [hurdy_gurdyman](#) on Wed, 07 Sep 2005 17:47:23 GMT

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Not tired anymore (much) and started playing with cathode resistors. I have a single 5000 ohm wirewound resistor hooking all the cathodes together, bypassed by a 1000 uF cap, and get these results: Plate= 440 Screen= 340 Grid= -25.5 Cathode= 15 What voltage should I be shooting for on the cathode resistor seeing as I've reached the maximum the bias power supply can put out? Dave

Subject: Re: New day, more tinkering, new results

Posted by [Damir](#) on Wed, 07 Sep 2005 18:23:20 GMT

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With too large common cathode resistor (5k), you've "biased" your EL34s to about $I = 15/5000 = 3\text{mA}$ total, or just 0,75mA per tube! The original thought was one 100-Ohms resistor between each cathode and ground - that way (with "combination" bias) you'd get probably less than 40mA per tube, OK. If you want one common resistor for all four tubes, then you can use 25 Ohms. But, better to "separate" two channels and use 50 Ohms for L (2xEL34), and 50 Ohms for R ch (2xEL34 again). Two capacitors, of course.

Subject: Re: New day, more tinkering, new results

Posted by [hurdy_gurdyman](#) on Wed, 07 Sep 2005 19:42:45 GMT

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OK, somehow I got things backward in my head. I have an old artical on converting 7591 to 5881, and it calls for a 390 ohm resistor on each cathode. Oh well, I corrected it. All I have on hand is a 20 ohm resistor, so I tried it. here's the results: Plate = 400 Screen = 270 Grid = -23 Cathode = 1.1 I can get a pair of 50 ohms the first of the week. I'm leaving for a music festival tomorrow and won't be back till Sunday evening. Thanks for the patience. Dave

Subject: Hmm...

Posted by [Damir](#) on Thu, 08 Sep 2005 04:46:02 GMT

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Are you sure that your resistors values are correct, and your measurements, too? In this last case, (20 Ohms for 4 tubes), you have large drop of U_{g2} and U_a , and your $I_{a+g2} = 1,1/20 = 55\text{mA}$, or 13,75mA per tube- something isn't quite right. I suppose that you doing it right - disconnect all the

cathodes (pin 8), solder them together and ground it through 20 Ohms resistor. Pin 1 (g3) of each EL34 is connected to pin 8, right?

Subject: Re: Hmm...

Posted by [hurdy_gurdyman](#) on Thu, 08 Sep 2005 12:20:57 GMT

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Looking at the pin wiring, pin 1 is grounded on each tube. Pin 8 was grounded as well, but I lifted this and hooked all four pin 8's together and grounded them through the 20 ohm resistor. Should I un-ground pin 1 and wire it to pin 8?Dave

Subject: actually...

Posted by [hurdy_gurdyman](#) on Thu, 08 Sep 2005 12:38:10 GMT

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Pin 8 was hooked to pin 1, but with all the experimenting going on, it was un-hooked when the cathode resistors were installed.

Subject: Re: actually...

Posted by [hurdy_gurdyman](#) on Thu, 08 Sep 2005 14:14:34 GMT

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I disconnected the ground from pin 1 and tied it to pin 8. the results didn't change much. Plate = 400 VDC
Screen = 275 VDC
Grid = -24 VDC
Cathode = 1.1 VDC
Dave
