Subject: Replacing Selenium
Posted by AstroSonic on Sun, 15 Mar 2009 20:44:10 GMT
View Forum Message <> Reply to Message

Hi,I am restoring a Zenith AM-FM table radio that uses a selenium stack as a half-wave rectifier it has no power transformer). I would like to replace the selenium diode with a modern silicon diode. My question is - what was the voltage drop across the selenium diode (when it was new). I figure I'll need to add a dropping resistor in series with the (replacement) silicon diode in order to get the design voltages to the tubes. Otherwise, the tubes will see higher (possibly excessive/damaging) voltages. A search (selenium) of this forum did not turn up anything. Surely others have run into this same problem, as these devices were used extensively in the 40s and 50s. TIA,Bob

Subject: Re: Replacing Selenium
Posted by Wayne Parham on Mon, 16 Mar 2009 18:37:31 GMT
View Forum Message <> Reply to Message

The forward voltage drop across a selenium rectifier plate is approximately 0.5v - 1.0v, so you could count the plates to estimate the drop produced by the stack.I have selenium stack in my TransOceanic radios. I'll power one of them up and measure across it. As I recall, the voltage drop was not huge - like a few volts, maybe 10. It would be similar to a series string of germanium or silicon diodes, each having 0.3v to 0.7v across it, each adding to the total voltage drop.You could mimic this behavior with a series string of more modern semiconductor rectifiers or a diode and resistor. If the circuit is low voltage, like a filament circuit, I might be inclined to do that. But if it's the B+ supply, I think that the DC voltage desired is probably high enough that a few volts loss isn't required for proper operation. In that case, I think you probably could replace it with a single diode having less than a volt drop across it.

Subject: Re: Replacing Selenium
Posted by AstroSonic on Mon, 16 Mar 2009 20:58:49 GMT
View Forum Message <> Reply to Message

Wayne,I have a Naval electronics training manual that describes Selenium rectifiers as being 65-85% efficient. Not sure, but I thought it might mean that 15-35% of the applied voltage is dropped across them. It would be an easy fix if there were only about a one volt drop per plate: it has five 1x1 inch plates. I could then replace with a modern silicon diode as you suggested.Do let me know what you measure across the stack in the TransOceanic. Thanks,Bob

Subject: Re: Replacing Selenium
Posted by Wayne Parham on Tue, 17 Mar 2009 01:15:19 GMT
View Forum Message <> Reply to Message

I've seen that 60-80% efficiency spec listed too, as well as the tube rectifier spec being quoted as around 50%. But remember that efficiency doesn't have much to do with forward voltage drop. Efficiency would have more to do with resistance at current levels above what is required to bias the junction on. Once there is enough potential to forward bias the junction, current flows relatively freely.The biggest drawback of selenium rectifiers is the relatively low breakdown voltage when reverse biased, not the forward bias drop or efficiency. They also produce a toxic gas when they blow.

Subject: 15v
Posted by Wayne Parham on Wed, 25 Mar 2009 02:07:13 GMT
View Forum Message <> Reply to Message

I just measured the voltage drop across the selenium stack in one of my TransOceanics. Sorry I couldn't get to it sooner, but I have a 2-year-old running around these days so hobby projects go much slower.The stack in my radio has six plates. Input voltage measured 122vrms and the output was 107v. Not a real scientific test, since I didn't measure current and didn't take into account the fact that half-wave rectification cuts one-half cycle. But it does give you an idea of the scale.

Subject: Re: 15v
Posted by AstroSonic on Fri, 27 Mar 2009 18:15:34 GMT
View Forum Message <> Reply to Message

Thanks, thats very helpful. I am thinking that after replacement with a silicon diode, the extra 14.3 volts will not seriously challenge (stress) the tubes and caps.Bob

Subject: Re: 15v
Posted by Wayne Parham on Fri, 27 Mar 2009 20:30:07 GMT
View Forum Message <> Reply to Message

Yes, I agree.Let us know how it turns out!

Subject: Re: 15v
Posted by AstroSonic on Sun, 05 Apr 2009 23:32:47 GMT
View Forum Message <> Reply to Message

Wayne,It worked great. There is a little hum that was not audible before. I think it may be due to the detector/voltage amp tube I replaced. The old one was running on fumes (an original Zenith). There is a lot more gain now. Or the hum might be due to the difference in waveform between the Selenium rectifier and silicon rectifier. Could need a little more filtering. With music or voices at low to reasonable volumes, it is inaudible.The radio sounds remarkably good with its wood cabinet, alnico 4x6 full range speaker and an electrostatic tweeter (actually works!).Thanks for the help.Bob

Subject: Re: 15v
Posted by Wayne Parham on Mon, 06 Apr 2009 04:43:10 GMT
View Forum Message <> Reply to Message

That's great! Congratulations!Feels good to have it running again, doesn't it?