Subject: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by polaris26 on Tue, 12 Dec 2017 15:06:25 GMT
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Hello everyone,

I am looking for input from people who have recapped boards in vintage Kustom amps, particularly the K200B series. I have a power amp board in a K200B-5 on which I want to replace the tantalum caps. I know in some circuits tantalum caps are required because of their unique electrical characteristics versus standard aluminum electrolytic caps.

My question is this: did Kustom use tantalum caps in any part of any circuit that cannot be subbed with modern good quality electrolytics, and if so, could you please point out any areas where you believe the caps should only be replaced with new tantalums? Has anyone had an aluminum replacement not work correctly in some areas? I have a stock of 'lytics (typically Nichicon 105C parts) I can use to recap this amp but will have to order the tantalums if it seems necessary, as I don't normally use them too often in my own projects.

Regards,
Dave

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by chicagobill on Tue, 12 Dec 2017 15:17:26 GMT
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Hey Dave, welcome to the place.

There are no places in these amps that require a tantalum that I know of, so replacement with a standard electrolytic will be fine.

Are you recapping for the sake of recapping or are you trying to fix a problem? I don't find that the tantalums have a high failure rate in these amps, if fact they seem to outlast most of the normal electrolytics in similar aged amps.

Just wondering.

Again welcome.

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by polaris26 on Tue, 12 Dec 2017 16:22:18 GMT
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Hello Chicagobill -

Thanks for the input. That's a great question RE: recapping. I find that if there are only a hand full

of caps to replace on a 45+ year old power amp, I would rather put in high quality new caps and feel good about the future of the circuit. As it stands, the amp came to me with no sign of catastrophic failure, but the speaker jacks have a large DC offset, in the neighborhood of +12V or more. Thankfully I did not have a speaker connected and was using my variac /dimbulb setup at the time. The offset rises smoothly with increased applied AC line voltage from the variac. There was no sign of smoke, overheating, blown fuses, etc.

I haven't dug too deeply into the amp yet to get at the root cause of the offset, and haven't pulled the board yet to work on it. I will check the silicon and the resistors as well but I admit the recap was more of a reflexive action on my part. I have a lot of good caps 'in stock' so I'd rather see them in an amp than laying bout in storage bins.

BTW I do have pretty decent output on the +/- 8V regulators (just under 8 v each if I recall correctly). I haven't messed with the pre-amp boards yet but it looks like there was some dodgy work done (transistors subbed in by clipping the old one out from behind and tacking the new sub onto the old leads, etc). Right now I am focusing on the PA and working back to the front end later.

Regards,
Dave

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by DeadKoby on Tue, 12 Dec 2017 23:46:13 GMT
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You can use an electrolytic in place of the Tantalum, but I don't see any need to.

Re-capping the Kustom was something I expected to have to do.... then I started testing all the caps on a pre-amp board, and found only one that was just a little off.

If you really want to buy tantalum caps, Electronicsurplus.com is a good source. You can get spragues that are similar to what you find in there.

Re-capping a tantalum equipped Kustom seems a bit of a waste. Go through and test a few, and see if any of them actually puked out.

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by polaris26 on Wed, 13 Dec 2017 05:19:12 GMT
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Hello DeadKoby -

Lately I've been on something of a cap-testing pilgrimage, watching a lot of YouTube videos on the subject. Apparently I've been doing it inadequately all this time. It seems there is no all-in-one tester that can tell everything you need to know about a cap for a given application. ESR, leakage

@ rated voltage, value, etc. I don't own the right equipment and it looks like you need hundreds of dollars of test gear to make it happen.

Just curious - how did you test your Kustom's tantalums? I've always heard they had a bad rep in certain applications. I've never used them in my own designs. The only place I recall them being specified was in data sheets for bypass caps on monolithic voltage regulator ICs. Also, aren't modern Aluminum 'lytics a lot better than they were in the late 60's? I assume Kustom's engineers spec'd the Tants for a reason, but maybe the performance gap has closed somewhat by now?

All I have is a cap meter to read value - I don't have an ESR or a leakage tester. A friend loaned me an old Heathkit IT-28 but it's a little rusty and could use a rebuilding.

I will be less lazy and track down the real cause of the DC offset, I promise!

Regards,
Dave

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by stevem on Wed, 13 Dec 2017 11:16:41 GMT
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That's a huge amount of D.C offset, so much so I question if the amp is even passing signal!
To me there is not a cap that could go bad in that amp , and I mean even the main power rail filters that could make for that much offset!
I would first unplug a output Transistor one at a time on each side of the power supply rail and see what might change with that offset to try to narrow things down.

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by chicagobill on Wed, 13 Dec 2017 16:31:16 GMT
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Before you start tearing apart the amp, please supply a little background information. Do you own this amp? Has it been used recently? What is the main problem with the amp that you are trying to fix? Are you using both a lamp limiter and a variac at the same time?

Without knowing more about your situation, it might be that what you are seeing is normal start up condition. I suggest that you plug the amp into your limiter (I assume a 60 or 100 watt bulb) and with no speaker connected to the amp turn it on. The lamp should flash slightly and then turn off. If this is true, then measure the dc voltage on the output jacks.

If the lamp lights up bright and stays lit, then you have a problem that needs to be addressed.

Until then, please refrain from fixing anything until you know what is broken.

As for the cap discussion, there are good reasons on both sides for shotgun replacement and for replace as needed approaches. Cap life is affected by many things, age, construction, how the amp was used, how the amp was stored, etc. I feel that Kustom chose to use tantalum caps because they were state of the art at the time and they wanted to design an amp that would last a "lifetime". How many other guitar amps used 1% metal film resistors to reduce noise back in the '60s? And remember that these parts cost two and three times the price of typical caps and resistors.

I've been repairing guitar amps for more than 40 years and in my personal experience, I have not seen a high failure rate for the tantalum caps in any of the K200-B series amps. When I repair these amps, I usually test and replace as needed.

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by polaris26 on Wed, 13 Dec 2017 16:31:53 GMT
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Hi stevem,

Just to be clear, I wasn't trying to associate the offset with the caps necessarily; I only mentioned the offset issue in this thread because chicagobill had asked if there was some issue with the amp, or was I recapping just for the sake of recapping. I almost never have 'bench time' on weekdays due to my day job, so hopefully this weekend I will get to the bottom of that issue either way.

As an aside (probably for another thread), I hope the transistors are ok, because they are just at that vintage where finding proper subs is a little challenging.
After some cursory research, I came up with 2N3019/2N4033 for the TO-39 w/ heat sink drivers, MJ15003 for the outputs, 2N3563/PN3563 for the PET1075 VAS, 2N4401/4403 for the protection circuit, and some nice quiet KSA992BFU for the 2N4249 PNP differential input stage. Recently, I used a pair of KSA992BFU that I sort-of "matched" with my Peak Atlas DCA75pro in a similar amp repair (EMC Sagittarius) that I did a few weeks ago. The EMC power amp section is very similar to the Kustom design, perhaps even a bit more primitive. The KSA992BFU worked well on the 'front end', and really brought the offset down to a few mV in that case. But, if I get more into the semiconductors I should probably start a new thread for that.

Thanks again everyone for your input RE: caps - always appreciated!

Regards,
Dave

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by polaris26 on Wed, 13 Dec 2017 17:14:58 GMT

Hello chicagobill,

A little history about this amp - Recently, I was approached by a friend of mine who has a co-worker who wanted someone to look at this amp to see if it could be put into working order. I was not entirely sure why he wanted it fixed or what he wanted it for. In fact, it was originally told to me that it was a guitar amp, but after I got it, it became clear that it was designed to be a PA head.

After having recently had success with a repair on a somewhat similar amp, I decided to take on the project. I always am careful to take plenty of pictures and notes as I examine something I am working on for someone else, both for my own convenience and to protect myself from potential liabilities. I document any visible/cosmetic issues as well as any electrical issues as I come upon them. The work goes in spurts because my free time is limited.

In this case I just got the chassis out of the wood case, got the reverb 'subframe' out (there was a spun nutsert/pemnut that I had to deal with), and started looking the innards over for signs of catastrophic failure or previous repair work. I have no idea about the usage history of the amp but it showed signs of storage in less-than-idea conditions, with dinge and corrosion here and there.

Having not seen any signs of obvious disaster, I brought the amp up from essentially 0 VAC with the variac. I believe the bulb was actually not part of the setup at this time, so I was actually running straight from the Variac while monitoring the voltages on the main caps. I don't know how long it's been since they've been at working voltage, so I bring them up very slowly. As I was doing this, there was a DC offset on the speaker jacks that grew larger in proportion to the main rails. I understand that with DC-feedback designs, you need to be at a minimum working voltage on the circuit for the voltage offsets to come into range due to some devices in the loop not being biased properly at very low voltages. In this case, the offset just kept getting bigger as I brought up the rails. The offset never hit the rail voltage, being always some fraction of it. I didn't leave the amp powered on in this condition very long but again there was no signs of smoke or drama.

I didn't put much more time into the diagnostic process at that point, because I had not gotten a firm commitment from the "customer" regarding what he wanted done, and how much he was willing to spend. I felt confident that I could resolve the issues with the power amp board for a certain cost and didn't want to put any more of my time into the amp until I got a more firm idea of what the owner expected from this repair, and what he was willing to spend. I set the project aside and began working on some other projects I have in the 'queue'.

In the mean time, I was taking a cursory look at the board and the schematics and noticed the use of the tantalum caps, which prompted me to pose the original question, since I didn't think it was necessary to use tantalum caps in such a design, but just wanted to check with the more Kustom-aware techs regarding thoughts on replacing them.

It seems the consensus is that there is little chance of the caps being bad and wholesale replacement is not necessary. I will take that into account while trying to separate the desire I have to see this thing leave with shiny new parts stuffed into it (probably my OCD) from the practical approach to just getting the thing fixed at a reasonable cost.

One thing I should note is that I am also desirous to replace the line cord with a three-pronger. I hope that's not too controversial, but I really don't see using two prong cords in the 21st century. But that's a topic for another thread...

Regards,
Dave

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by stevem on Wed, 13 Dec 2017 17:46:43 GMT
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When you bring these amps up slow on a Vriac they will put D.C on the output at a certain voltage level until the line voltage gets High enough!

If the amp came to you with its solder in 3 amp fuse still intact I would just plug it straight in and turn it on with only a volt meter hooked up across its output and then see what you see!

If your looking at voltages on Kustom schematics please note the they are taken with all the controls up full and no load hooked up to the output.

Another thing to confirm on these amps if they have seen some work is that the leads on the bias tracking diode on the output heat sink are intact on both sides and the the diode is in its clip , but not so far in its clip that the leads may short to it.

I have also found quite a few shorted Tantalum caps by just scanning them with a thermal gun as they do get much hotter then the surrounding circuit, of course if they are just getting leaky then a ESR meter is your best bet.

In regards to the output driver board in these amps they have so few caps that if I have the board off of the rear wall of the amp I just shot gun it and change them all.

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by DeadKoby on Fri, 15 Dec 2017 03:33:17 GMT
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For small value caps as you'd see in these solid state circuits, I use this type thing.

https://www.ebay.com/itm/12864-LCD-Transistor-Tester-Capacit
ance-SCR-ESR-Meter-Diode-Triode-MOS-NPN-US/131539364479?epid
=9004016466&hash=item1ea05b6a7f:g:0scAAOSw~OVWzsVH

These are good for stuff that's 25 volts or less. Many of the amp techs you find on Youtube will be working on tube amps with super high voltage caps... that's where a big super duty leakage tester will come in handy.

Here's my Youtube video where I was working on the 200B1 bass head. around the 15 minute mark, you'll see the tester in action... and get an idea of what I saw there. Most caps read AT or above capacitance, and had an ESR below 4 ohms... I fixed it in the next video, but this was my first time working on a Kustom anything... and I usually do "standard" repairs on tube amps.

https://www.youtube.com/watch?v=ZgDJ83VEL4o

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by stevem on Wed, 20 Dec 2017 11:02:13 GMT
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Polaris I did a test out for you on one of my K200 B heads.
When i fire it up slowly on a veriac it will start to output a positive D.C. Voltage on the speaker jack with about 20 volts of AC line input.
This D.C. Voltage maxed out at 5.36 volts with 33.8 volts of AC line input and quickly fell off as the line voltage was increased from there.
In light of your reading of 12 volts D.C. I would say that the amps output stage has a problem.

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by polaris26 on Sun, 24 Dec 2017 04:03:52 GMT
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Just a quick update as I had some time this evening to do a little work on the ol' Kustom -

I took the PA/voltage reg board (PC703) out of the amp and started checking some things in and out of circuit.
I found two 6.8uF 35V Tantalum caps were dead shorted (< 1 ohm). These are the ones tied to the output rail and running to opposite ends of the bias diode string. The rest of the caps tested ok, but I decided to replace most of the ones in the audio circuit anyway. I checked the transistors and diodes, and none appeared to be malfunctioning, so I am guessing the shorted caps were responsible for the high DC offset in this case.

Regards,
Dave

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by stevem on Sun, 24 Dec 2017 11:48:16 GMT
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Well that was your likely sourse of the D.C. Off set, but I am surprised that the 8 volts you had before hand checked out so good!
Just in case note this about this regulator circuit , that being that the negative voltage tracks the positive.

This means that if the positive side of the regulator has a issue you will never get the proper negative voltage out of it!

Anyway, it's good to hear that you likely got 'er back up and running, enjoy!

Subject: Re: Tantalum Capacitors sub w/ Aluminum Electrolytics?
Posted by DeadKoby on Mon, 25 Dec 2017 17:12:06 GMT
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Nothing beats a good fix. In the case of My K200B1, in generally worked ok... but the left channel was full of fizzy "Airplane noise"... so I didn't need to dig into the power amp/regulator boards at all.

Congrats on a successful fix.

"It's always the caps" is a mantra in our shop.... but when I started working on my K200, I realized in short order that it wasn't caps.. In your case, it was, and you got it. Cheers!
