

eHam

eHam Forums => Amplifiers => Topic started by: K2LGO on April 08, 2009, 08:12:49 AM

Title: **HEATHKIT SB-200 LOADING...**

Post by: **K2LGO** on **April 08, 2009, 08:12:49 AM**

I WAS UNDER THE IMPRESSION THAT I SHOULD GET THE HIGHEST OUTPUT FROM THE SB-200 ON THE 80 METER BAND, AND THE OUTPUT SHOULD DECREASE AS I GO HIGHER UP...ON MY WATERS LOAD/WATTMETER I GET 400 OUT ON 80..500 ON 40, AND THEN IT GRADUALLY DECREASES AS I GO HIGHER UP...BUT ON 80 IT APPEARS THAT THE LOAD CONTROL IS FULLY COUNTER CLOCKWISE TO GET THE HIGHEST OUTPUT, AND IT APPEARS THAT IT WANTS MORE C TO GET ANY MORE POWER OUT ON 80..I CHECKED THE CAPS THAT ARE SWITCHED IN ON 80, AND ALL SEEMS WELL...THE TUNED INPUT ON 80 WITH A SWR BRIDGE BETWEEN THE EXCITER AND AMP, SHOWS LOW SWR, BUT I GET VERY LITTLE CHANGE USING THE 80 METER TUNED INPUT COIL..AND YES I CHECKED THE 470 MICA ON THE 80 METER TUNED INPUT COIL..WHY ON 80 (AND TO A SMALLER EXTENT ON 40) DO I REQUIRE MAX C ON THE LOAD CONTROL TO GET MAX OUTPUT...

Title: **HEATHKIT SB-200 LOADING...**

Post by: **WB2WIK** on **April 08, 2009, 09:10:55 AM**

Sounds like the loading padder cap(s) may not be doing well, regardless of how they "look."

I've had these open up in the past, and they look fine but have very little capacitance.

Could also be a bad bandswitch contact (caps are fine, but not being connected)...

Title: **HEATHKIT SB-200 LOADING...**

Post by: **K2LGO** on **April 08, 2009, 09:42:18 AM**

STEVE..THANKS FOR THE QUICK REPLY...ALTHOUGH I MENTIONED THE CAPS THAT YOU REFER TO AS THE "LOADING PAPPER" CAPS, THEY APPEAR TO BE MORE PADDERS FOR THE TUNING CAP, AND NOT THE LOADING CAP..100 & 500 uuf RESPECTIVELY...I DID MEASURE THE CAPACITANCE OF BOTH OF THOSE AND THEY WE'RE FINE...ACTUALLY I REPLACED THEM ABOUT SIX MONTHS AGO IN THIS ONGOING BATTLE TO SOLVE THIS PROBLEM...REPLACED THEM WITH HEFTIER 5KW UNITS...BOB

Title: **HEATHKIT SB-200 LOADING...**

Post by: **WB2WIK** on **April 08, 2009, 10:19:20 AM**

I don't have the SB-200 schematic here and I don't believe it's on line (big issue with Heath stuff and copyright preservation)...there aren't any switched-in padders on 80m for the LOAD cap? That's unusual.

It's been years since I've looked at an SB-200...

Title: **HEATHKIT SB-200 LOADING...**

Post by: **KB1LKR** on **April 08, 2009, 10:35:04 AM**

Bob: switch off your Cap Lock, it'll make the posting easier to read!

Title: **HEATHKIT SB-200 LOADING...**

Post by: **WB2WIK** on **April 08, 2009, 10:55:47 AM**

Bob, I received the schematic you sent me, thanks.

The 500pF padder cap IS in the LOAD circuit, not in the plate TUNE circuit. The 100pF padder C26 is in the TUNE circuit; but the 500pF padder C27 is definitely in the LOAD circuit (I thought there should be one there, there always is!).

Based on your symptoms:

-Either the bandswitch wafer contact to C27 is not making properly, so the capacitor really isn't switching in on 80 meters, or...

-The 500pF padder, even if "new," may be bad. Remember capacitors ALL have a voltage coefficient; that is, they reduce in capacitance when voltage is applied. So a cap measuring 500pF using a "capacitance meter" which tests it at 1 kHz (or maybe 100 kHz) at 1 Volt really doesn't mean anything...you're using it at 3.5 MHz and several hundred Volts. I've seen lots of caps "measure" just fine and then actually not work in the application.

(There are some exceptions to this, like NPO caps which have a very low voltage coefficient.)

In any case, I'd be suspicious of the capacitor or the switch contacts...

WB2WIK/6

Title: **HEATHKIT SB-200 LOADING...**

Post by: **AD4U** on **April 08, 2009, 11:21:55 AM**

I often use an SB-200 in my vintage Heathkit station. As long as the antenna is fairly resonant (SWR < 1.5), I never have to turn the loading control past 4 or around the 11 o'clock position in order to get 500-600 watts output.

If all the suggestions so far do not isolate the problem, I assume you are using a dummy load or an antenna with a good SWR.

Dick AD4U

Title: **HEATHKIT SB-200 LOADING...**

Post by: **K2LGO** on **April 09, 2009, 03:57:59 AM**

Well I thank all of you for your suggestions, but the problem persists...Steve of course you we're right and the 500 uuf cap is in the load circuit, but I have changed that and tried two other caps, and nothing changes. I have even tried soldering in the 500uuf cap direct bypassing the switch, but nothing changes, still have to use max C on 80 to achieve anything near 400W, where on 40 I can get in excess of 500W, without needing max C. Once again its only on 80 meters...More suggestions appreciated....I hate to put the amp back in the cabinet, until I can get to the bottom of this..

THANKS TO ALL

Title: **HEATHKIT SB-200 LOADING...**

Post by: **VR2AX** on **April 09, 2009, 06:01:48 AM**

An amp may not give the highest output on the lowest frequency. Ageing tubes tend to drop output as you go high in frequency but it is often only noticeable on the higher

bands. Maybe the amp is just more efficient on 40 than on 80, the decreasing output above 40 could be due to tubes? Just an idea. Hope you get to the bottom of it.

Title: **HEATHKIT SB-200 LOADING...**

Post by: **AD4U** on **April 09, 2009, 06:25:47 AM**

Obviously what you have is not normal. Right now I am just grabbing at straws to try to help. I own and use a SB-200 that I built in 1970, so I am quite familiar with that amp. The SB-200 is not a complicated unit.

Just to help us out a little more:

Did you just get this amp (ebay special)?
Did it ever load properly?
Did it work OK for a while and then quit?

Since you have replaced the padder cap in the loading circuit, we can assume that is not the problem.

IF IT NEVER LOADED PROPERLY SINCE YOU OWNED IT, I would do this in this order:

Clean the band switch contacts with DeOxit.

Carefully inspect the band switch wafers and contacts for damage. Make sure every "finger" contact on the band switch is making contact and that none are arc damaged.

Retrace every construction step in the manual in and around the tank circuit for wiring errors.

Check each solder joint in and around the tank circuit.

IF THE AMP LOADED PROPERLY FOR A WHILE AND THEN QUIT, I would suspect a failed component in the tank circuit.

Good Luck Dick AD4U

Title: **HEATHKIT SB-200 LOADING...**

Post by: **K2LGO** on **April 09, 2009, 06:26:34 AM**

Thank you VR2AX for your input...What you say about the amp possibly being more efficient on 40 might be true, but this seems to extreme for that to be an explanation of needing max C with the load control on 80. As for the tubes, I even switched the tubes with another set I had, and the results we're identical. Something here is eluding me, and I can't seem to put my finger on it.

Title: **HEATHKIT SB-200 LOADING...**

Post by: **K2LGO** on **April 09, 2009, 06:36:08 AM**

Lest I forget I did indeed take KB1LKR advise, and am using lower case to make reading easier...AD4U thank you for the suggestions...I have tried almost exactly what you have suggested, and I even tried tack soldering the padder cap (500uuf) in the circuit to go around the switch that switches it in, and out on 80M...I did not build this amp, but only recently started to use it on 80, so I just recently noticed the problem...I notice that the tuned input coil on 80 has very little influence on the SWR between the driver, and amp when I try to make an adjustment on 80...Could I possibly not have enough drive on 80 ???

Title: **HEATHKIT SB-200 LOADING...**

Post by: **WB2WIK** on **April 09, 2009, 07:54:31 AM**

Bob, how much grid current do you get on 80 meters?

Max Ig for a pair of 572Bs is about 100mA, and normal operation is probably at 70-80mA. Also, grid current should "peak" when the plate TUNING causes a plate current "dip." The grid current peak and plate current dip should occur at the same tune point.

If you can't get at least 70mA or so of grid current, then you probably do not have sufficient drive. What transmitter/transceiver are you using?

73

Steve WB2WIK/6

Title: **HEATHKIT SB-200 LOADING...**

Post by: **K2LGO** on **April 09, 2009, 07:56:30 AM**

Whoops....I thought it was only on 80 meters, but now that I have taken the time to try 40, its the same on 40 (20 is fine) so obviously those padder capacitors have nothing to do with it...On 40 I can get 600 out (WATERS 334 WATTMETER-DUMMY LOAD) but its with load C at max(fully counter clockwise)...back to the drawing board...BOB

Title: **HEATHKIT SB-200 LOADING...**

Post by: **AD4U** on **April 09, 2009, 08:11:26 AM**

I do not think lack of drive on 80 would make the loading do what you are experiencing. Once again, my SB-200 does not act like yours and neither have any of the many SB-200's I have been associated with. What you are seeing is not normal. Also I do not remember that adjusting the input matching network made much difference, but that should not have any bearing on loading.

Most all SB-200's were bought in kit form. A few were factory built. The quality of the finished product often reflects the builder's ability. When they are properly constructed, the SB-200 (IMO) is a very fine amp, as evidenced by the vast number sold and still in use after 40 years.

Like any amp that you do not know its history, it could have been modified, poorly constructed, improperly soldered, wired with errors, or gosh knows what else by previous owners.

Assuming you are testing into a dummy load or an antenna with reasonable SWR, typical loading should be around 3-4.

Make sure all sections of the variable loading cap are connected together. Not sure but I think they had to be bridged together by the builder. But then if that were the case, you would probably have this problem on more than 80 meters.

As you can see, I am running out of ideas. If you are tuning up into a dummy load, I definitely think you will find one of the issues I mentioned in my earlier post.

I do not know your trouble shooting background, so please do not take offense. Maybe a fresh set of eyes looking at your amp would help. Sometimes I overlook the same (obvious) problem over and over. When you find the problem, please let all of us know what it was.

Dick AD4U

Title: **HEATHKIT SB-200 LOADING...**

Post by: **K2LGO** on **April 09, 2009, 09:31:50 AM**

PROBLEM SOLVED...For what ever reason the 500uuf padder cap in the 80m loading configuration, was not large enough...replaced with a 1000uuf, and everything fell into place...WHY...I'm not sure...I went over everything three times as per AD4U suggestions, but all was wired correctly, so I gave the 1000uuf cap a shot, and it solved the problem on 80 & 40, and the other bands are fine...if something is going on with the dual 437uuf loading variable, I damn sure can't find a problem..So hopefully alls well that ends well.

Thanks for all the knowledgeable fellows who took a shot at it...no place like EHAM....BOB

Title: **HEATHKIT SB-200 LOADING...**

Post by: **AD4U** on **April 09, 2009, 09:54:58 AM**

Great news Bob. I have built a number of home brew amps, and I have always used a 2000 uuf variable cap for loading.

I am at work and cannot look at the SB-200 diagram. Did Heath use a 500 uuf padding cap in parallel with the loading cap or did they use 1000 uuf? Just wondering. What ever they used is still in my SB-200 and it works fine.

Any way, glad you solved the problem.

Dick AD4U

Title: **HEATHKIT SB-200 LOADING...**

Post by: **K2LGO** on **April 09, 2009, 10:07:28 AM**

Dick...They used a 500uuf padder, and I'm sure it has worked in the other 50,000 (give or take 10,000) SB-200-s, but for some reason it was a problem with my amp...I too would love to know if others have experienced this same problem, or if it is unique to my amp, because of some other component deficiency that I cannot uncover...BOB

Title: **HEATHKIT SB-200 LOADING...**

Post by: **WB2WIK** on **April 09, 2009, 02:57:19 PM**

Bob, you never answered the question about grid current.

It is true if an amp is "under driven," it will require "under loading" along with that: Meaning you'll need way more loading capacitance than if operated at full power.

As you increase drive and also plate current, the amp should require more loading (meaning, less LOAD capacitance).

So, what's the grid current on 80m?

WB2WIK/6

Title: **HEATHKIT SB-200 LOADING...**

Post by: **K2LGO** on **April 09, 2009, 04:15:27 PM**

Steve...grid current is about 100ma and does occur at plate current dip...you can see from one of my blurps that a 1000uuf in place of the 500 padder as per the scan I sent you solved the problem, still not sure why. The exciter is a 746(non pro) and it appears

that the drive on 80 is about the same as on other bands, as indicated on the PO indicator on the 746. Thanks for the tutorial on the relationship of drive to the need for more C when under driving occurs. Always something to be learned..

Title: **HEATHKIT SB-200 LOADING...**

Post by: **WD8PHW** on **April 09, 2009, 05:35:07 PM**

"I too would love to know if others have experienced this same problem"

Well...since you mention it...mine has almost the same problem, and I couldn't believe my eyes, when I saw this post.

The problem here only exists on 80...just like your original post. None the less, that cap will be the first order of business.

Title: **HEATHKIT SB-200 LOADING...**

Post by: **WB2WIK** on **April 09, 2009, 05:58:01 PM**

Bob, if you have 100mA Ig that should be enough and is about all a pair of 572Bs can handle safely.

Glad to hear the 1000pF worked!

I built an SB-200 from a kit about 40 years ago and never had this problem: No idea why yours does, but you found a fix, might as well stick with it!

Good job!

73

Steve WB2WIK/6

Title: **HEATHKIT SB-200 LOADING...**

Post by: **K2LGO** on **April 09, 2009, 06:30:32 PM**

WD8PHW...Please let me know if that does cure the problem...maybe its a design flaw, and most are satisfied to operate with the load control fully CCW.

BOB

Title: **HEATHKIT SB-200 LOADING...**

Post by: **WD8PHW** on **April 10, 2009, 06:21:56 AM**

OK Bob, I'll keep you posted, but don't hold your breath! :)

I won't get the replacement, until I place another Mouser order. I don't think RS sells these, but I'll take a look. Where did you get your replacement?

Title: **HEATHKIT SB-200 LOADING...**

Post by: **W5CPT** on **April 12, 2009, 05:22:11 AM**

My SB-200 has always loaded with the LOAD fully counter-clockwise on 40 & 80M. I get 600 watts on those bands into a dummy load on 115V. On 20M it will also get 600W but the load ia about 4 to 4.5 as is all other bands with the output dropping to 500 on 10M.

Clint - W5CPT

Title: **HEATHKIT SB-200 LOADING...**

Post by: **WD8PHW** on **April 13, 2009, 09:18:57 AM**

Bump....Does anyone know where I can get some 1000pF/2kV silver mica caps? Mouser doesn't have them.

Title: **HEATHKIT SB-200 LOADING...**

Post by: **K2LGO** on **April 13, 2009, 12:17:47 PM**

Greg....This is K2LGO...I started this thread...email me at robco@optonline.net and I'll tell you what I have that you can have that should work..BOB

Title: **HEATHKIT SB-200 LOADING...**

Post by: **KA3DNR** on **July 23, 2009, 10:52:55 PM**

Hello!

Thank you so much for bringing up this issue!

I have the same exact problem...On 80 and 40 meter, the LOAD is fully counterclockwise, and I can't "peak" those bands. I now see the padder up by the front wafer, and have ordered some HV caps. I hope it fixes my 40 and 80 meters issue, like it has yours...

I read here that the "padder" is only switched in for 80 meters; then why does it also work for 40 meters? It must be that that statement is incorrect; the padder does work for 40 and 80 m, correct?

I anxiously await my HV caps from eBay...

Regards,

Marc

Title: **HEATHKIT SB-200 LOADING...**

Post by: **KA3DNR** on **July 23, 2009, 11:01:30 PM**

Hello!

You don't need silver micas...You can use high voltage ceramic caps. Go to eBay.

Regards,

Marc

Title: **HEATHKIT SB-200 LOADING...**

Post by: **WOOPW** on **July 24, 2009, 06:27:29 AM**

I just bought some 560 pF, 2.5 kV ceramic caps(N3300?) at All Electronics for 10/\$1. Will these work ok?

Title: **HEATHKIT SB-200 LOADING...**

Post by: **KA3DNR** on **July 24, 2009, 08:17:09 AM**

Hello!

That's a darn good price! I ordered my 470 pF 6KV ceramics through eBay, but they are costing me \$7 to get to my door.

The padder in your SB200 is probably like mine, a 500 pF, 2KV cap. You now have 560 pF, 2.5KV caps. I would think they will work fine.

Marc

Title: **HEATHKIT SB-200 LOADING...**

Post by: **KA3DNR** on **July 24, 2009, 08:45:44 AM**

Perhaps I shouldn't say "sure it will be fine"...One thing to consider is RF currents.

Perhaps an RF HV experts can answer this question.

Marc

Title: **HEATHKIT SB-200 LOADING...**

Post by: **AE5EP** on **August 02, 2009, 04:09:31 PM**

With the possible exception of electrolytic capacitors, which are not under discussion here, capacitors do not exhibit a significant voltage coefficient of capacitance.

The problem cited with modern capacitance meters is that the measuring technique used misinterprets capacitor leakage as additional capacitance, and is not a function of applied voltage.

NPO refers to the temperature coefficient of capacitance.

Title: **HEATHKIT SB-200 LOADING...**

Post by: **K2LGO** on **August 11, 2009, 04:35:04 PM**

Hello to all...Well I started this thread about four months ago, and I have found the solution...I finally located a set of CETRON 572B-s (I WOULDN'T HAVE THAT CHINESE JUNK) As soon as the new set of tubes was installed, the problem of not enough range in the loading control all disappeared...Obviously the reason for the problem was that in order to try and get the power I desired from the old tubes that we're not capable of putting it out, I was trying to load the amp more and more until the load control was at its CCW stop. Now I have removed that extra capacitance that I had advocated adding in the 80 meter position, and replaced the original 500mmf cap, and all is well.. I have a feeling that this might be the problem with many who are experiencing the same problem...COMMENTS???

Title: **HEATHKIT SB-200 LOADING...**

Post by: **WD8PHW** on **August 11, 2009, 06:56:52 PM**

Thanks for the update...Bob.

Title: **RE: HEATHKIT SB-200 LOADING...**

Post by: **K2CUB** on **August 13, 2010, 07:05:47 PM**

I have the same exact issue. I may try to replace the 500 puff cap first. will post the results.

Title: **RE: HEATHKIT SB-200 LOADING...**

Post by: **W8JI on August 15, 2010, 02:05:01 AM**

Quote from: K2LGO on April 09, 2009, 09:31:50 AM

PROBLEM SOLVED...For what ever reason the 500uuf padder cap in the 80m loading configuration, was not large enough...replaced with a 1000uuf, and everything fell into place...WHY...I'm not sure...I went over everything three times as per AD4U suggestions, but all was wired correctly, so I gave the 1000uuf cap a shot, and it solved the problem on 80 & 40, and the other bands are fine...if something is going on with the dual 437uuf loading variable, I damn sure can't find a problem..So hopefully alls well that ends well.
Thanks for all the knowledgeable fellows who took a shot at it...no place like EHAM....BOB

Problem wasn't solved. :-)

I'm surprised more people don't know this right away or no one mentioned it, but when power is low the loading control goes more meshed. This is just how amplifiers behave!!

A low drive problem can cause the loading cap to peak fully meshed. Anyone who has tuned a pi-net should know that.

If you add padding cap to "fix" the problem, and eventually drive the amp properly, you can uncouple the amp and cause even bigger problems like arcing.

Things that can cause the loading control to be fully meshed at maximum output (other than bad original design):

- 1.) Low output power. If the amp is designed to run 600 watts output and is being run at 300 watts, it takes about 50-75% more loading capacitance to re-peak the output.
- 2.) A shorted turn in the tank, but this normally overheats the shorted turn.
- 3.) A bad padding cap, although this is a very unlikely failure.

I would focus on number 1.

If the exciter is shutting down or not able to fully drive the amp, the loading control will be too far meshed. ALWAYS. Weak tubes will also cause this problem.

You might want to read this link before hacking up an amplifier:
http://www.w8ji.com/loading_amplifier.htm

I would first find the real reason the loading cap is meshed, and that will be whatever is causing power to be low. That would most likely either be bad tubes or low drive from the exciter. Low drive from the exciter is normally caused by ALC connections or high amplifier input SWR.

Also NPO (negative positive zero) means the capacitor is temperature stable. The single padding cap should at least be less than a N750 to be reasonably stable, and should have reasonable Q to minimize heating. I would use a CDE snubber mica capacitor of about 1000 to 1500 volt rating for the SB200. Mouser sells them. Disc ceramics are far too unpredictable. Some handle good current, some do not. Few are NPO or a low temperature coefficient.

73 Tom

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