IS YOUR AMPLIFIER RUNNING HOT?
By Foy W. Byrd N1FOY
June 30, 2009

With the summer season upon us and some of our HF Amplifiers still a little 'toasty' from Field Days; have you ever wondered, "Is my Amp running too hot? Is my Amp receiving enough air? Should I move that Amp over just a bit to allow more air to circulate in and out? Should I not have stacked all those Amps into one pile? How hot is too hot? How hot is that thing actually getting anyway?"

Well, this quick project can be accomplished very easily; but must be done safely to be of any benefit. Now a word about that safety. Yes, I know, you have been working around HV for decades and owned, worked on, or built more Amplifiers than most of us will ever have the privilege to operate. But I would be remiss not mention that if you are new to the hobby or new to HV and HF, there are certain safety procedures that should go without saying. However, I will mention them here. Besides, it never hurts to hear it again no matter the experience level.

First, plan your project well. Have all the tools and materials required before even approaching your Amplifier. Try not to work on your equipment when you are in a hurry and distracted, had too much coffee, or when you are tired. Have your Amplifier's owners manual handy. I will make the assumption that you have read it thoroughly. Hasn't everyone?

Second, never remove the Amp cover without first turning off all front panel power switches and completely unplugging the unit from the power source; i.e. pull the cord from the Amp to the shack outlet. Then disconnect all cables, control wires, etc. at the Amp. I normally elect to leave a ground wire attached.

Third, most tube type HF Amplifier power supply circuits have very large capacitors that stay charged for some time. Therefore after step one and two, take a break while the caps discharge thru the bleeder resister system BEFORE removing the cover. Consult your

manufacturer's documentation BEFORE removing the cover. A good safety practice is to monitor the Amplifier's HV meter; if your Amp has one. If not, wait 2X longer than the recommended manufacturer's bleed down time for the power supply caps to discharge. No harm in waiting; possible harm if you don't.

Fourth, don't be afraid to ask for assistance or to have a more experienced operator present.

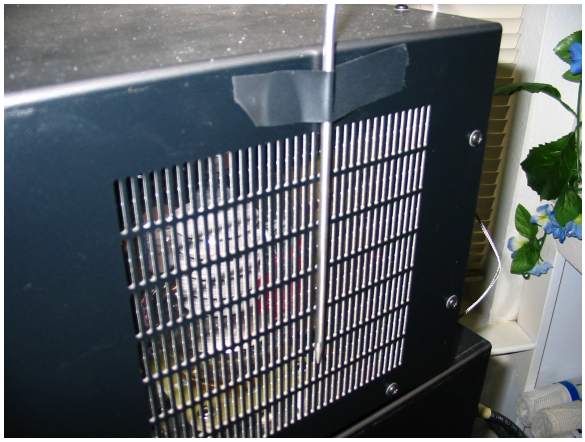
Fifth, if it does not feel safe, it probably isn't.

Now, back to the project at hand. This simple temperature monitor installation will give the operator a 'relative' indication of the air temperature exiting the Amplifier. The indicator is of a type used in many household kitchens for cooking that great Sunday dinner or that holiday feast. The particular temperature indicator in this article is powered by a single AAA battery and has a stainless steel probe connected by a stainless braided cover. The display unit has a digital readout in degrees F or C and has a handy feature that allows the operator to set a temperature value that will trigger an alarm.

Note the above term; 'relative'. It is just that; very subjective. Only an expensive calibrated laboratory grade digital thermometer will give absolute readings. However, for this exercise, to see the difference between 95 degrees and 150 degrees F is more than adequate. Most commercially manufactured tube type HF amplifiers have been meticulously engineered to provide as much air flow and heat dissipation as economically possible. Therefore any obstruction placed inside the Amp or any air flow disruption could alter or degrade the cooling effectiveness. So it was decided to mount the temperature probe on the outside rather than the inside of the amplifier cabinet, in the air stream that exits out through the grill, just inches away from the tube. Besides, any metallic object placed inside the RF compartment, could affect the operation, RF radiation, or safety advantages of the unit.

Now you have another question. The answer is no, there were no white smoke air flow velocity and pattern tests conducted to pinpoint the most exacting location for the probe within the exhaust air stream. And yes, technically the very thin probe could affect the exiting air. However, if this tiny probe does in fact account for any significant disruption, the case could be made that the Amp is being operated at the edge of its engineered envelope.

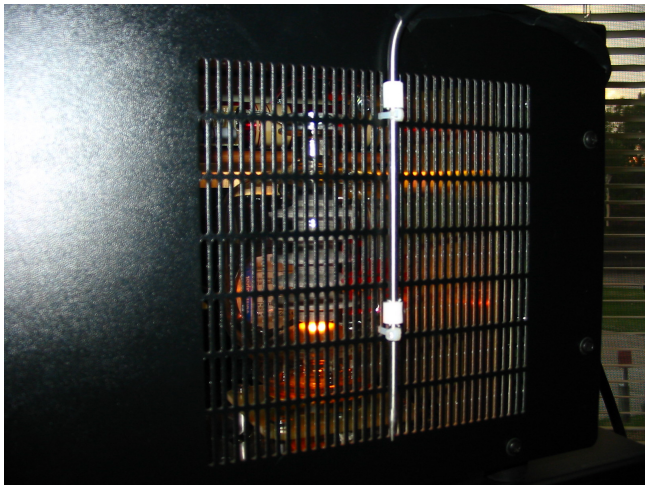
So, where to mount the probe? A very simple test was performed to determine that position. Using some black electrical tape as a temporary attachment, the probe was moved about in front of the grill while the Amp was operated at a steady pace in different modes at different power levels. The temperature was noted and the Amp placed in standby and allowed to cool back down to the idling temperature. Besides, how big can that grill be? It did not take long to make an educated guess as to a location. Remember the 'relative' thing?



Now a word about the probe sensor wire and RF. As stated, this particular thermometer was chosen on the basis of cost, features, and the fact it had a stainless braid protecting the probe wire. A short length of stranded copper antenna wire was wound around the stainless braid with enough turns to insure a good electrical connection. Soldering or crimping was ruled out due to possibly damaging the internal probe wire. Shrink tubing works well to affix the wound ground wire to the probe braid, being careful to keep that oxy-acetylene rig turned down when applying the heat. I normally use the YXL's hair dryer on heat shrink tubing. The other end of the stranded copper wire was connected to the rear Amp ground terminal. This ground wire was probably not required, but added as a just in case.

The main reason for all the safety fuss above is because in order to attach the probe to the outside of the cabinet, it is necessary to remove the cover. Oh sure, you could try and weave a little tiny wire tie through the grill, but most Amplifier cover grills are aluminum, the slotted spacing is very tight, and they bend rather easily. During the planning of this project it had been suggested, "Hey, why don't you just run one of them trash bag ties through there and just twist it tight?" The answer was, "So you want me to run a plastic coated metal wire into the RF compartment where the tube anode voltage is in the kilovolt range, not to mention the potential of creating an incidental radiator outside the 'Faraday' protection of the cover?" Nahhh.

There are numerous ways to mount the probe, but is was decided to keep it close to the cover, but not physically touching. You know all those little pieces of RG-8 you have stashed around? You know, the short pieces that you just can't part with, but know you will use one day? Cut off about1/2" of RG-8, remove the center insulation from around the center conductor, and slide it around the probe. Now you have a probe insulator that can be neatly wire tied to the grill utilizing those tiny computer wire ties. Remember to take care in the tightening of the ties. As discussed, most covers are aluminum and the grills slots bend easily.



The next step is to decide on a location for the digital display and how to explain to the YXL that you have commandeered her cooking thermometer. A good source for the thermometers is the house wares department at your local Mart type store. Ok, so now what? I have a probe installed on the outside of my Amp, strategically placed in the exhaust air slip stream, and the cover has now been reinstalled and the probe is connected to the digital display that is now powered on.

Again, the safety discussion is due. Check all your work to make sure no tools, materials, family pets, etc., have been left inside the Amp during the course of the project. Reconnect all cables, control wires, and only then plug the Amp back into the shack power. Again, check for any anomalies. Power on the Amp and watch the temperature during standby or idle. The temperature will peak at some value. “What should that be you ask?” Remember the ‘relative’ thing? Each Amplifier, ambient shack temperature, time of year, will cause this value to be slightly different. One would reasonably suspect that the standby temperature might be higher in the summer months than in the winter. However, it will not take long to get a ‘feel’ for what the idle reading will be. Again, you should expect a higher reading as duty cycle increases. Making notes of the duty cycle, mode, and temperature and output power will give a reasonable indication if something is

a miss. Set the Alarm temperature at or just a degree or two above what is noted during normal operation.

So, back to the original questions at the beginning. You should be able to reasonably set an alarm parameter based on your observations and ‘normal’ operating conditions. An Alarm Trigger may indicate a blocked air inlet from those little ‘dust bunnies’ that seem to always collect around equipment or a decrease in the RPM of your fan, or something in the exciter settings, grid and plate current, tuner, etc. Or it could be you are leaning too long on the PTT and the Amp just needs a rest; as well as the band.

73’s and keep cool.

ERROR: undefined
OFFENDING COMMAND:

STACK: