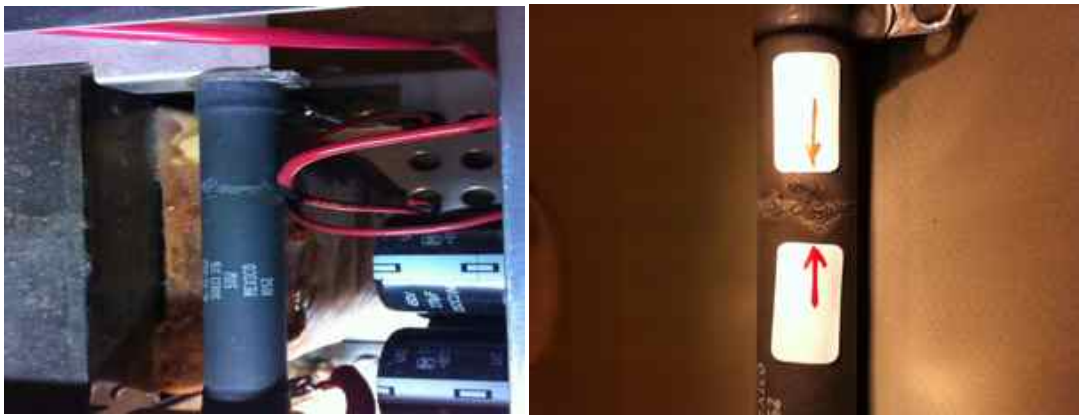
KL0S Shack Note #27
Drake L-4B HF RF Amplifier High Voltage Transformer Replacement

In Shack Note #25 I described my repair of a Drake L-4B/L7 HF amplifier power supply for my good friend Gray W4NGR. Little did I know that I would be soon be repairing my own L-4BPS by having a custom made transformer manufactured to replace the one in the original power supply.

The story begins one evening when I happened to glance down toward the amplifier's separate power supply on the floor and noticed that it had developed it's own "internal inspection lamp" – in other words there was a bright electrical arc where there shouldn't have been one and along with the light came a noxious odor. I immediately switched the amplifier off and drug the power supply to the workbench for an autopsy. The fault was immediately obvious, one of the two high voltage 50KΩ/50W bleeder resistors had failed catastrophically and somehow one of the transformer's high voltage secondary wires was involved as you can see below:



High Voltage Bleeder Resistor Failure

I replaced the bleeder from spares I had on hand and repaired the high voltage wire with a little dab of liquid electrical tape as I had done previously with W4NGR's transformer case. But I noticed something unusual about the transformer, a definite "oozing" emanating from the coil windings. As I didn't really remember that ooze when doing the power supply rebuild a couple of years ago I had a terrible feeling that the transformer might have developed an internal problem involving the coil windings (I would find later that the resistance measurements of those windings were in fact much higher than they should have been). Although

the high voltage still indicated correctly on the plate voltage meter something just wasn't right (you know, that nagging thought in the back of your mind you get when troubleshooting a problem).

Unusual "ooze" from the transformer's interior

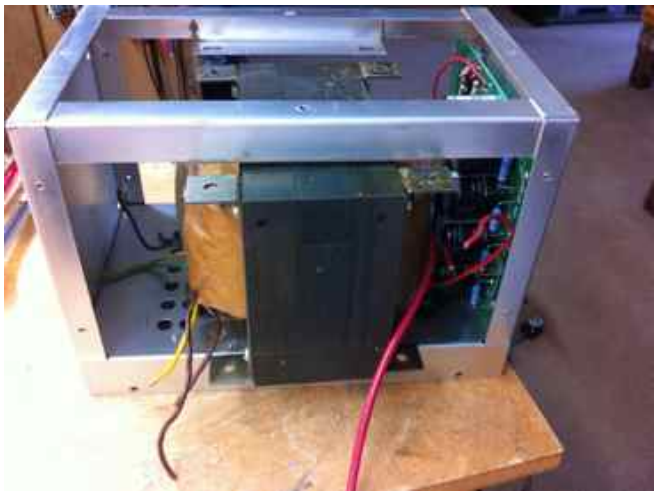
As the RF deck of the amplifier was in good shape I tabled the thought of buying a new amplifier (don't those "Alphas" look good in their ads?), after all, this unit had served me well for almost 36 years! But with a new DXpedition coming up shortly that I wanted to work I needed the amplifier available and fortunately Gray, who has two Drake amplifiers, came to my rescue by loaning me one of his power supplies.

But what was I to do about my failed power supply? Finding one for sale by itself is rare these days so, long story short, I ended up buying another complete L-4B with power supply for a very attractive price at a local hamfest. Having a backup amplifier will likely keep me on the air until my key goes silent but I still needed to replace the transformer in the supply that would probably fail catastrophically at some point in the future.

R.L. Drake has been out of business for many years now so obtaining a new transformer was problematic. But Hammond Manufacturing, a Canadian company who is probably most famous for their great electronics enclosures (www.hammondmfg.com), had recently taken up the mantle of building new replacement transformers for boatanchor rigs. Fortunately they had acquired the specifications for the "Peter Dahl" line of Drake replacement transformers and working with one of their sales engineers I ordered a new transformer that provided a higher output voltage than the original (read that as making more power output from the amplifier).

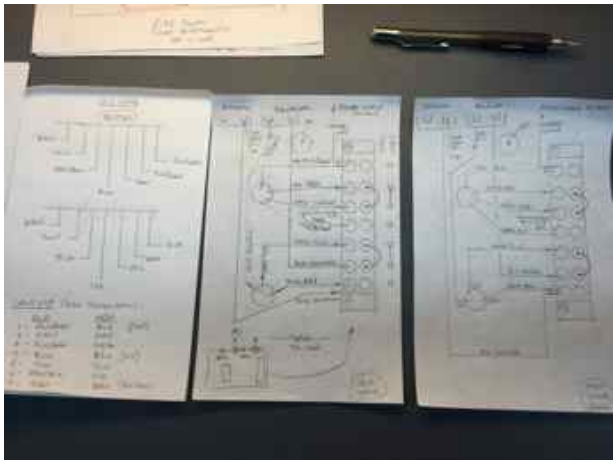
The new transformer cost $390 plus a surprisingly small charge for shipping and it took about eight weeks to produce (they're doing these custom builds as "one-offs" and have to fit them into their production cycle).

While waiting for the new transformer to arrive I removed the old one from the power supply chassis and made some physical measurements to compare with the diagram Hammond was using to build the new unit; everything seemed to check out ok (famous last words).



The old transformer being removed

I also made several diagrams to document the interconnections since all the voltages floating around inside the power supply chassis probably wouldn't like being connected to the wrong place!



Interconnection diagrams – can't live without 'em!

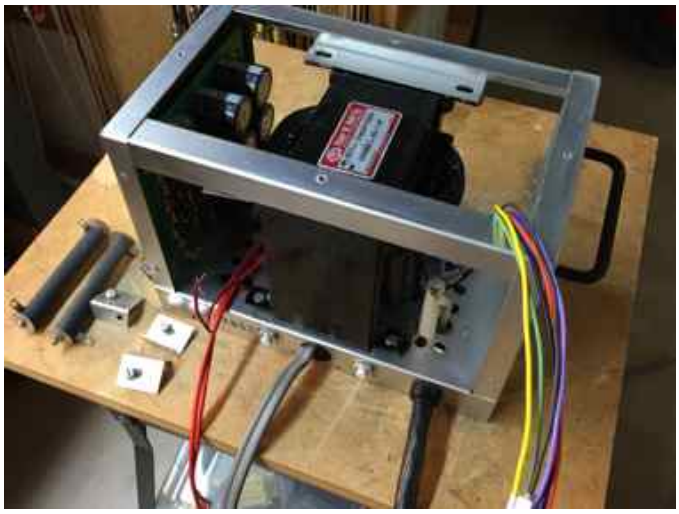
I also took the opportunity with the chassis temporarily stripped to install a pair of handles on the outside as the power supply weighs in at a hefty 38 pounds (I knew I'd find a use for those handles someday!). This makes it much easier to manhandle the box underneath the operating desk or move it to the workbench for troubleshooting and repairs.

Here are the two transformers side by side being compared prior to installing the new unit.

New transformer (left) and the original

Once the new transformer arrived I tried shoehorning it into the chassis; that's when I found out that, although Hammond's measurements were correct on their diagrams, the vertical mounting brackets were placed slightly off center. Those brackets could not be adjusted since they were an integral part of the case. The chassis fit was snug with the OEM transformer to begin with – the fit with the Hammond, well lets just say it didn't fit because of the bracket placement. So I applied a small amount of *"percussive persuasion"* to both the mounting brackets and the transformer

and they moved slowly into place (I'd hate to be the guy to have to remove the transformer some day if it ever failed!).



New transformer after being "persuaded" into place!

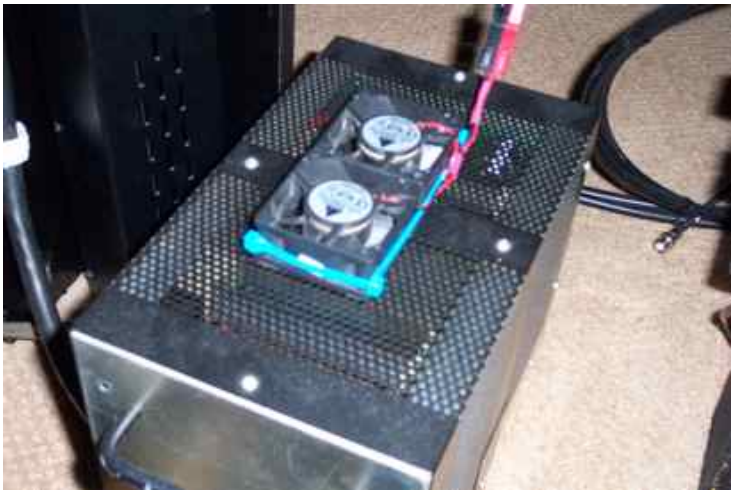
After the handles, transformer and power supply PCB were installed and the interconnections remade the next step was the "smoke test." Hammond provides a list of the resistance values you should find for each winding and my measurements had matched these very closely so I was pretty sure the supply would fire up correctly and it did. This replacement Peter Dahl style transformer has a higher AC secondary output voltage than the original and was the preferred replacement by those who either repaired their supplies or wanted a higher RF output. The higher secondary AC voltage resulted in an increased DC voltage applied to the plates of the two 3-500Z tubes in the amplifier:

Original Supply Voltages	New Supply Voltages
CW – 1900 VDC	CW – 2450 VDC
SSB – 2600 VDC	SSB – 3280 VDC

The amplifier's RF output power was correspondingly higher and I found that the unit will now output a true legal limit signal as measured under current output power rules (you old timers will remember that back in the day the rules governed input power). The "new" amplifier set now sits quietly in the corner waiting to be called into the game if required.

As an aside the bleeder resistors in the high voltage circuit create quite a bit of heat; they're rated at 50W each but get pretty hot. So I also took

the opportunity to add a small pair of fans that simply rest on top of the power supply cabinet to move the heat away from those resistors. I chose two 12VDC fans that were in the junk box but decided to run them at a lower voltage to reduce the noise they made. It was a simple matter to determine the lowest voltage at which the fans would reliably start, about 7.5VDC (fans wired in parallel). The junk box also produced an old "wall-wart" supply that was rated at 6VDC but, as it was a simple unregulated unit, the output voltage was around 9VDC and sagged downwards towards 7.5VDC under load. But who wants to have to plug in a wall-wart every time you want to turn on the amplifier? Not me – back to the junk box where I found a RF controlled AC switch that would do the trick, the type that folks use to turn Christmas light strings on and off remotely.



Fan pair in place above the bleeder resistors

Remote fan on/off switch in place ready for use

I mounted the remote switch next to the amplifier so I would remember to switch the fans on when firing up the L-4B. At the reduced operating voltage the fans are quiet and, although they spin more slowly than they would if operated at 12VDC, they still move air efficiently; the area on the top of the power supply case above the two bleeder resistors used to get almost too hot to touch but with the fans in place the spot remains remarkably cool.

I'd like to thank Mark Mercer at Hammond Manufacturing and Steven Dahl (no relation to the transformer designer) at Digi-Key, the U.S. representative for Hammond, for their assistance and recommend Hammond to you if you're in need of a replacement "boatanchor" transformer (www.hammfg.com/electronics/transformers/classic).

It's always gratifying to be able to repair a piece of your equipment that over many years has become a good friend – look out DX, here I come!

73 – Dino KL0S (kl0s@cox.net)