Collins 32V-2 Transmitter Low-Voltage Power Transformer Woes

By Ben Booth, W4CT
PO Box 545
Mentone, AL 35984-0545

It's interesting how "tuned in" (forgive the pun) I became to 32V-series, low-voltage transformer maladies once my 32V-2 gave up the ghost because of a shorted B+ secondary. I had heard about this problem from other 32V-series owners. This is a story of how I chose to meet the problem. It is not the only way – others being adding an outboard chassis or having the old one rewound. It is hard to find someone to do the rewind job. Fitting an off-the-shelf, old-or-new transformer in the original space (if possible) is difficult because the external dimensions are the critical criteria. I had several that were close, but "close" won't work here.

First off, how would I prevent some of these transformer failures? I have Bill Decker (W4VMY), among others, in the Southeastern AM Radio Club (see ER "Vintage Nets"), to thank for this suggestion. Bill says to simply remove the 5Z4 and replace it with a 5Y3. Why, you may ask? Because the 5Z4 rectifier has an indirectly-heated cathode with the attendant very-close spacing between its cathode and plate. Just look at a 6X5 or 6X4 and you will see the problem. These rectifiers work fine until age, heat, fatigue, and who knows what else causes the cathode and/or the plate to warp, and because of the very close internal spacing, a short soon develops, causing lots of current to flow through that half of the secondary winding. Unfortunately, it is generally not enough current to cause the 3-amp B+ fuse to blow, and also, unfortunately, the rig will continue to work, after a fashion, at least long enough to destroy the transformer. My transformer got so hot you couldn't touch it. Also, mine was the potted variety (Collins used both potted and open frame). The wax (or whatever it is) melted and the odor and smoke literally ran me out of the ham shack. My wife Susan (W4YL) is used to odd smells coming from that part of the house, but this got her attention, to say the least.

Before I proceed to the fix, one more anecdote. The fact is, I had replaced the 5Z4 with a 5Y3/GT! But, a test of my 5Y3 showed a dead short. How could this have happened? Over the years I have used, plugged in, and pulled out a hundred 5Y3s (maybe a slight exaggeration) since first licensed in 1951, so I know what a 5Y3 is supposed to look like internally. If you're unfamiliar with this tube, look at a 5Y3 or a 5U4 – it's a big sister. Their filaments are like a ribbon, without an indirect-heated cathode structure, and the filament and plates are at respectable distances from one another, unlike the 6X4 or 6X5.

I did look at the 5Y3 that I used, but sadly, not very carefully. After all, it was plainly marked "5Y3/GT," right? In addition, it was a JAN-type 5Y3.

In my defense, the glass envelope had been almost entirely "silvered" from the getter "burn" at time of manufacture. So, I didn't scrutinize the tube structure, the label 5Y3 being enough, or so I thought! After the smoke cleared, I looked carefully with these 73-year-old eyes at the 5Y3 and guess what? In fact, it had an indirectly-heated cathode structure. It was constructed just like a 6X4. I couldn't believe my eyes – what is that saying about judging a book by its cover?

Now to the repair. It is not easy, but I managed to do the whole job right at the operating position on the desk where the 32V-2 sits next to the 75A-1 receiver. I never actually had to lift the beast completely off the desk. I even removed the cabinet by myself. By judicious use of towels, lots of patience and careful labeling of wires and parts, I got the job done without scratching the desk or mashing my fingers. The use of graphics and drawings will save a lot of grief when it comes time to reverse the process– especially drawings and notes about the wire colors (they are faded now, so be careful), where the wires go, pin numbers, wire lengths, etc.

I guess I'd better say something about the replacement parts. The original transformer is small and just barely fits in the space provided for it. Did the Collins engineers get caught up short? Because, when you look at what is asked of this piece of iron and copper, one can see why the transformer may also fail just from use. These transformers have done well for 60 years, and this is certainly testimony to the Collins team. However, it is called upon to provide B+ for all the exciter stages as well as the speech amplifier. It also provides 6.3 volts at 9 amps – that's right – 9 amps, for all the filaments, including the 4D32 (3.75A). In addition, it provides two 5-volt windings, one for the 5Z4(2A) and one for the two 5R4Ys(4A). That's a lot of KVAs to expect from that little box.

Fortunately, there are at lest two suppliers that I know of – Radio Daze, an ER advertiser, 877-653-8823, and Antique Electronics. They have a near-perfect replacement for the original. It has exactly the correct external dimensions (extremely important) and almost the correct electrical specs. It is Radio Daze part #HX-274BX, made by Hammond Manufacturing in Canada. It is not, however, a potted transformer, but rather an open-frame transformer. However, my Collins manual actually shows an open-frame transformer in that spot. Collins used both. The only problem is that the Hammond transformer supplies only one 5-volt winding and only 6 amps for the 6.3-volt filaments rather than 9 amps, which is required.

Here is how I dealt with these shortcomings. I did away with the 5-volt rectifiers altogether and built solid-state rectifiers. 2.5-amp, 1000-volt diodes are cheap and plentiful and an octal base from an old tube is all you need to build these two rectifier replacements. Be sure and use lots of diodes in series. Also, you will only need one unit to replace the two 5R4s. I did add a ¼-amp fuse in the output of the solid-state rectifier in the 5Z4 position and a ½-amp fuse in the 5R4 position.

That takes care of the 5-volt shortage. Now for the 6.3-volt current problem. It turns out that (at least in my 32V-2) Collins engineers brought two green, filament-supply leads to the transformer (terminal #10). One is from the speech amplifier and modulator, which requires 3 amps, and the other is from the 4D32 and exciter tubes, which requires a total of 5.75 amps. There is room under the chassis for a small filament transformer. The one I chose was Radio Daze part #HX-166N6 (6.3V @ 4A). It is a tight fit, but it will fit under the chassis, somewhat kitty corner, below the new power transformer. I had to drill no new holes for either transformer or for this repair. I used existing screw holes for the filament transformer, although I ended up with only one screw holding it in, but hey, I don't plan to take this beast into combat! The mounting flanges on the new power transformer do not quite fit the existing chassis holes, but a little filing with a chain-saw file on the transformer-flange holes makes all the difference. You could, of course, file the holes larger in the 32V. But why do that, especially when filings can get into all those tight places under this part of the chassis.

I did use a judicious number of terminal strips, again using existing screw holes. Use plastic-tie wraps to keep bundled wires away from the relay contacts, etc. (note the excellent cabling done by Collins). You may be able to make these changes without loosening the cable-tie strings, but I had to cut some of the strings in order to route wires where I needed them.

This project is not for the timid. Be sure and check resistance from the filter capacitors to ground and do other circuit checks to make sure that something besides the 5Z4 is not at fault. I seem to remember the resistance in the neighborhood of 5000 ohms or so. I know that seems too low, but it is due to the bias circuit. Also, I no longer feel comfortable using the 700-volt switch tap on the 4D32-plate supply because the solid-state diodes don't provide the voltage drop that the 5R4s did (actually I rarely use the 700-volt position). Running it on the 600-volt tap works just fine and provides from 630-650 volts on the plate of the 4D32 and 807s. The low-voltage B+, using this particular transformer, with the solid-state rectifier, provides almost the exact voltage needed.

Be careful when wiring the two green filament-supply leads. The replacement 4-amp filament transformer must be connected to the modulator and speech amp and the 6-amp winding from the low-voltage power transformer connected to the RF section.

I know this fix may not appeal to the real purists among us, and there is some of that in me – but it comes close – closer than most alternatives I could come up with. I did have a chance to acquire a used 32V-LV transformer, but because this iron is 60-years old I decided to go the new-transformer route. The total cost is in the neighborhood of $100, but almost any replacement or rewind (I explored that also) will be that, or more.

I used PVC pipe, 1" I think, to make covers for the solid-state rectifiers and covered the 5Z4-replacement PVC with copper foil and grounded the foil. It is in a fairly high-density RF field from the 4D32. Was that why Collins chose the metal-shielded 5Z4? I don't know that it is necessary, as tests without the shield seemed to present no problems. Indeed, the 5Y3 is not shielded! By the way, I hooked the 5-volt, 3-amp winding from the new transformer to the 5Z4 socket so that a 5Z4, 5Y3 or even a small-envelope 5U4 could be used. Unfortunately, it will not be prudent to use this winding for the 5R4 sockets, as their total-filament drain is 4 amps.

You will need a schematic (32V owner's manual) and a good understanding of power-supply circuitry. The terminal numbers on my original 32V-2 transformer were as follows:

- Pin 1 – 110VA Pri
- Pin 2 – 110V (2 wires Pri)
- Pin 3–HV Sec
- Pin 4 – HV Sec CT
- Pin 5 – HV Sec
- Pin 6 – 5Z4 Fil
- Pin 7 – 5Z4 Fil (2 wires)
- Pin 8 – 5R4 Fil
- Pin 9 – 5R 4 Fil
- Pin 10 – 6.3 V Fil (2 green wires)
- Pin 11 – 6.3 v Fil (3 yellow wires – all of which go to ground.)

The Hammond transformers both come with color-coded leads.

Wouldn't it be nice if "someone" would manufacture an exact replacement for the Collins bunch, or pray tell, they have and I missed it! Good luck, and remember to short all B+ to ground 3 times before poking around inside the cabinet or under the chassis.

ER