

Repair of the 70E-8 PTO used in my Collins 32V3

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The Collins 32V3 (on right)

With the high interest in AM operation on the ham radio bands, one of the best AM transmitters available today is the Collins 32V series transmitter. Most are very reliable even though many are over 50 years old because they were manufactured with the best components and design available in the 1950's. They don't seem to require the extensive modification of many other AM transmitters for good audio quality. However, the test of time has pointed out two weaknesses. The first is the failure of the 5 Volt HV rectifier filament windings in the LV power transformer requiring an expensive replacement. The second is PTO tracking problems. In my 32V3 the PTO tracking problem was that I could not correct a 3 kc dial error over the 80 meter band. Below I'll describe how I corrected the tracking error along with the method I used for removing the PTO from my 32V3 without affecting the transmitter's alignment.

If you suspect you have an error in your 32V PTO dial reading first follow the procedure on page 5-4 of your owners manual, which I won't describe here. However, I modified this

procedure to use my HF380 transceiver digital readout to accurately listen for a signal from my 32V3 at 3500 kc with my 32V3 the CAL mode. I then tuned my HF380 to 4000 kc and tuned my 32V3 dial to where I could hear the CAL signal in the HF380. With mine it took a 32V3 dial setting at 4006 kc to zero beat the receiver at 4000 kc. After following the adjustment procedure in the manual I could only get the error down to 3 kc, then I ran out of adjustment on the PTO trimmer capacitor.

After some looking at the 32V3 schematic and bugging my friend John Bess, WA5VVT, I decided to open the PTO and see if I could get more adjustment out of the trimmer capacitor. Changing some of the PTO's fixed capacitor values looked promising. Also I didn't want to pull the front panel of the 32V3 so I decided to try removing the PTO from behind and underneath which turned out to be much easier than pulling the 32V3 panel.

After disconnecting the AC power I removed the 32V3 from its cabinet and the RF shielding from the chassis. I then removed its rear panel and tipped the rear panel down on my workbench. This panel holds the transmitter's connector strips and fuses, it's secured to the rear chassis by six #6 screws. With the panel open I carefully removed the two #6 screws and lock washers securing the bracket holding two large capacitors, C101 and C102, to the rear chassis. Be careful not to drop the screws by using a captive head screwdriver because it's almost impossible to fish them out if you drop them. Having this bracket loose will allow you swing it clear when you remove the PTO. Next I removed the connector assembly, P101, located on top of the PTO just in front of the PTO desiccant container. It has the two cables running out of the cover to the exciter chassis. I loosened the two long #6 Phillips head screws to allow lifting the connector up and free of the PTO. Be careful to not lose the two hollow standoffs under the connector brackets. I left the screws in the connector brackets for ease of assembly later.

Then I tipped the rig on its side and turned the dial to the 4000 kc end of its range. I then turned the tuning knob to be able to reach and loosen one of the screws. "Don't remove the screws securing the PTO shaft to the U joint."

You can gain access to the screws by looking from the bottom of the rig and next to the bracket securing the PTO to the front panel assembly. Use a long screwdriver to loosen one of the screws. I then moved the tuning knob to expose and loosen the second screw securing the PTO shaft. After loosening these screws do not move the dial knob or PTO shaft. Confirm the U joint is completely loose on the shaft by pushing it with your screwdriver and observing it to move freely on the PTO shaft.

Next I removed the four #6 Phillips head screws securing the PTO bracket to the front panel assembly. Two are on the bottom near where I just loosened the U joint and two are on the top forward of the PTO connector pins. I then pulled the PTO very carefully toward the back of the rig while holding the now loose capacitors located behind the PTO up and out of the way. I confirmed that the PTO shaft came completely out of the U joint and then removed the PTO from the underside of the rig. I removed the PTO mounting bracket and shield by removing the three #6 screws from the inside of the mounting bracket. (Be sure to remember the orientation of these parts for re-assembly later.)

Now the hard part begins. These PTO's were sealed using a yellow Gliptol to exclude dust and humidity, which makes it very hard to disassemble the PTO. I found the heat from a large soldering iron handy to break screws loose from the Gliptol. I removed the four #2 screws securing the cover over the PTO tube, V001. I had to heat the heads of the screws to loosen the Gliptol and not damage the screw heads. I then removed the cover and tube. I carefully removed the desiccant container using a large pair of channel lock pliers. I then removed the trimmer cap cover by removing the three #2 screws securing it. Next I removed the connector from the top of the PTO by removing the two #2 screws holding the connector retainers. I again had to use heat to break the #2 screws loose. I was very careful not to break the connector insulator when prying it loose from the PTO using my pocketknife. It could lift up and unplug it from the PTO after the Gliptol seal was broken loose. The last and hardest job was to remove

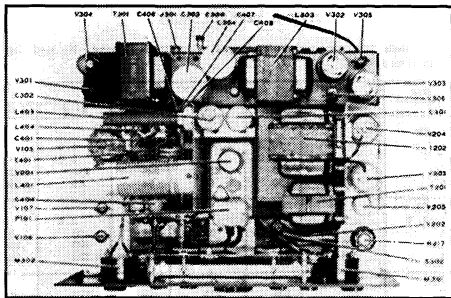
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Inside the Collins 32V3 transmitter

the two #6 flat head screws from the shaft side of the PTO in line with the heads of the barrel nuts that can be seen on each side of the PTO. Only remove these flat head screws to disassemble the PTO from its case. On mine Gliptol had run into the barrel nut threads and under the screw heads. For me the best way to remove these screws was to heat the head of each barrel nut and then the screw heads to melt the Gliptol.

I then slid the PTO chassis carefully out of its aluminum enclosure. I then removed a #2 flat head screw securing a shield to the PTO and then removed the shield by heating each of the four finger stock shield corners soldered to the PTO chassis. I found the best method was using a pocketknife blade to hold the finger stock off the chassis as the solder melted and then re-hardened. Then I slid the shield off the chassis to gain access to the PTO circuit.

In my PTO I found the desiccant to be good, the PTO chassis very clean and the lubricant was in good shape so I decided not to mess with cleaning or re-lubrication. I thought that any attempt to re-lubricate might mess it up more than help. I also found that C005, as shown as 20 pf on my schematic, was really two 10pf caps of different negative temperature coefficients in parallel. Thus making them very critical to the PTO's temperature stability. I decided not to change them. There is a stack of disks across the bottom of the PTO with two arms from the PTO slug riding on them. They are set by the factory during assembly to correct tracking errors of the PTO over small parts of the PTO range. Never mess with them unless you really know what you are doing. In most cases they don't need adjustment.

Looking at my PTO I found the trimmer capacitor C003 was in its completely opened position. Therefore I needed less capacitance to correct my tracking error. Evidently the components in the PTO age with time and humidity resulting in an increase of the LC ratio in the original PTO components. On my PTO I found a small 10pf NPO capacitor, C002, in parallel with the large 710pf capacitor and the 0 to 25pf trimmer capacitor. This is labeled (select in test) on my schematic and was

probably selected during calibration to gain a midway setting of the trimmer capacitor when the PTO is calibrated. However it may be of a different value on your PTO. I decided to try removing it from the circuit but physically leave it in the PTO for possible future use by cutting only its lead to the top of the tank circuit. I then reassembled the PTO, First installing the shield and then re-melting the solder at the shield corners. On both barrel nuts the Gliptol re-hardened in the threads so I had to chase them using a 6-32 tap. Also I resealed the PTO, to exclude dirt and moisture, by using GE RTV sealant. It will provide an excellent seal and be easy to remove if any future work is done inside the PTO. However, RTV is conductive so don't get any on the PTO connector around the connector pins or any electronic components. I also put some under the flat head screw and barrel nut heads.

Installation of the PTO is in the reverse order of the method I used to remove it. Be careful not to drop screws and washers into the transmitter. That's why the captive head screwdrivers are a real help. Be very careful when sliding the PTO shaft into the dial drive U joint not to damage it, and leave the two screws loose on the PTO shaft U joint. If you didn't move the PTO shaft or 32V3 tuning knob while the PTO was removed, your transmitter will still be in alignment with the exception for a small dial error. Also be sure to install the two hollow standoffs under the connector bracket. My PTO also had a tendency to drift about 75 cycles when the 32V3 was keyed to transmit. It was noticeable working SSB stations. I replaced my PTO's 6SJ7 tube, which completely solved this problem.

After the PTO was installed, I turned on the transmitter, held my breath, and placed it in the "CAL" mode. I had lots of grid drive and then relaxed. I then used my HF380 to find the signal from my transmitter. Set the dial of the 32V3 to the zero beat frequency on the receiver and then tightened the screws securing the U joint to the PTO shaft with the PTO signal zero beat with my HF380. I then repeated the calibration of the PTO using the method of page 5-4 of the manual but with my HF380 as described above. I was able to get my dial to track within 100 cycles over 500 kc of the 80Meter band after this procedure.

This repair worked well for my 32V3 but may not work as well for you if your C002 test select capacitor is too small to correct the error. If the scale factor had been too large (with the trimmer running out of adjustment with the trimmer completely closed) it's easy to find good quality NPO caps to add in parallel with the air variable to achieve more adjustment of the variable. Unfortunately, most 70E-8 PTO's

seem to age such that capacitance or inductance has to be removed from the circuit. Also I was fortunate that the sealing of my PTO was so good that both the desiccant and lubrication were in excellent condition. However, if anyone has had experience with re-lubrication or more extensive work on this PTO, I would like to hear from you. Also it would be interesting to hear if anyone has removed windings from the inductor or changed other capacitors in the PTO to solve larger tracking errors.

Dayton Hamvention Cometh

For many of us, there's nothing like the Dayton flea market and indoor displays to revive the amateur radio spirit for yet another year. If you've come before then come again. If you've never been to Dayton now's your chance.

Dayton is a special place for the Collins gang. There's no better place to seek out and probably find that special Collins Radio you've been looking for. The CCA will once again be holding it's annual Dayton Banquet on Friday, May 17th at our new location, the Dayton Fairborn Holiday Inn. Hospitality hour starts at 7PM, with the Dinner at 8PM sharp. Bob Heil, K9EID will once again be at the Hammond organ and after Dinner the annual Awards will be presented followed by Door Prizes and our featured speakers. Speakers and presentations include an FCC Update from Riley Hollingsworth, K4ZDH and a special presentation from Ted Craven on the Collins Radio Company Dallas operations in the 1960's. The Raffle drawing will wrap things up and this year Tony, W9JXN, has rounded up a truly amazing treasure trove of Collins and other goodies to be handed out to the lucky winners. Prizes this year include a Collins Aviation Atomic Clock, a 'Fly Collins' jacket, a new Vintage mic from Heil Sound, two MM-1 mics, an Ultimeter 800 WX station from Peet Brothers, a 516F-2 Solid State Conversion kit from Peter Dahl and much, much more! Banquet Tickets are still available but going fast. Hospitality Suites will be up and running at the Fairborn Holiday Inn on Thursday night through Saturday night. This is where you get to meet and greet your fellow CCA members, renew old friendships and put a face to some of the voices you've heard on-air.

Of special note is Hap's 'Dance Card'. Each year Hap, WA4UPV, compiles a list of all flea market spaces held by CCA members and prints them up on a handy pocket-size card. Pick yours up at the CCA Hospitality Suite on Thursday night. We look forward to seeing as many of you who can make it to Dayton this year. It promises to be another great CCA gathering. '73 Peter, VE3KWM