Collins 30L-1 Linear Amplifier - Restoration & Repair

Collins **30L-1** Linear Amplifier has an input power rating of **1000 Watts** on **SSB** and **CW** on all amateur bands, and requires **70** to **100 Watts** of drive for full output. The 30L-1 is a grounded grid linear amplifier with four 811A triode tubes. The 811A's are instantly heated which requires non warm-up delay. The metering function monitors plate voltage and current and a tuning voltage which is used to quickly tune the amplifier. The amplifier is completely self-contained including power supply and designed for desk-top use. The amplifier has tuned input circuits to provide a good match to the exciter. I bought this 30L-1 at what I felt was a fair price. Considering I knew it was in need of work! It attracted me because it was a later Round Emblem (RE) unit which ment it should have had all the Collins Service Bulletin changes installed. The seller also provides an extra set of tubes.

The Obvious Needs
- Cabinet and Trim Ring were in bad shape and needed repainting or replacement.
- 120VAC power cord was in bad shape.

The Obvious Good Things
- It was a late production S/N 41188 MCN 4387
- All Service Bulletins should have been factory completed.
- It was only about half the price of other nice 30L-1 amplifiers.

About one year before I began the restoration I had found and purchased a almost new looking 30L-1 cabinet (no trim ring) so getting the old one repainted was thus no longer a priority. I had a repainted metal trim ring that was purchased a few years back for another project so I felt I had the outside cosmetics taken care of.

I proceeded to open things up and begin the evaluation.

Evaluation Results:

1. Previous owner had replaced the RF Output connector from an N type to a SO-239. This is not an uncommon change. Still I don't mind using N-Connectors on my coax runs and I actually find them easier to install than the more common PL-259's.
2. Previous owner has moved the RF input from the RCA jack on the rear left side to a newly installed SO-239 placed where the original grounding screw was located.
3. Noticed the 39 ohm 1/2W resistor for the antenna relay pull-down was burnt and open.
4. One of the 811A tube grid resistors measured 91 ohms. It should be 47 ohms. I could tell they have been replaced before as two of them were 10% tolerance and the other two were 20% tolerance rated.
5. Resistance measurement on power switch showed one of the poles had a closed resistance of about 1K ohm.
6. Things haven't been turned on in a long time! I would check and replace, if necessary, most of the original HV power supply diodes, electrolytic caps and resistors
7. Things were getting dirty.
8. I want to run the amp from 240VAC and not 120VAC as this one was wired.

AC Power Switch

Thankfully the AC Power switch resistance dropped down after an extensive workout of toggling and rocking the switch on/off and back-en-forth! After a few minutes both poles were measuring 1.3-1.5 ohms consistently. The resistance measurement is the switch in series with one of the 120VAC primary windings. Thus the value slightly over one ohm is normal. I just hope the resistance was a result of many years of non use. Replacing these switches can be a real pain!

Fix RF Connectors

I wanted to return the RF connections to the original Collins design. I needed to relocate the RF IN back to the RCA jack on the left back side of the transmitter. This ment removing the SO-239 now occupying the original ground connection and running a new piece of RG-58 coax to the original RCA. The SO-239 location was closer to the antenna relay so that piece of coax was to short to reuse. Getting a new piece of coax installed was a bit of work and required removing the relay retaining screws and a grounding strip near the relay. Both were then pulled away from the chassis to allow removing the old coax and installing the new.

IMPORTANT NOTE: In this later 30L-1 Collins got away from the nice string lacing of cable bundles. Instead now they were using simple plastic cable ties. I do love the look of the string lacing better than the cable ties, but it sure is a great deal easier to remove wires or reroute wires held in the cable bundles by plastic cable ties. Cables ties can easily be cut and replaced with new ones after the wires have been replaced and/or rerouted.

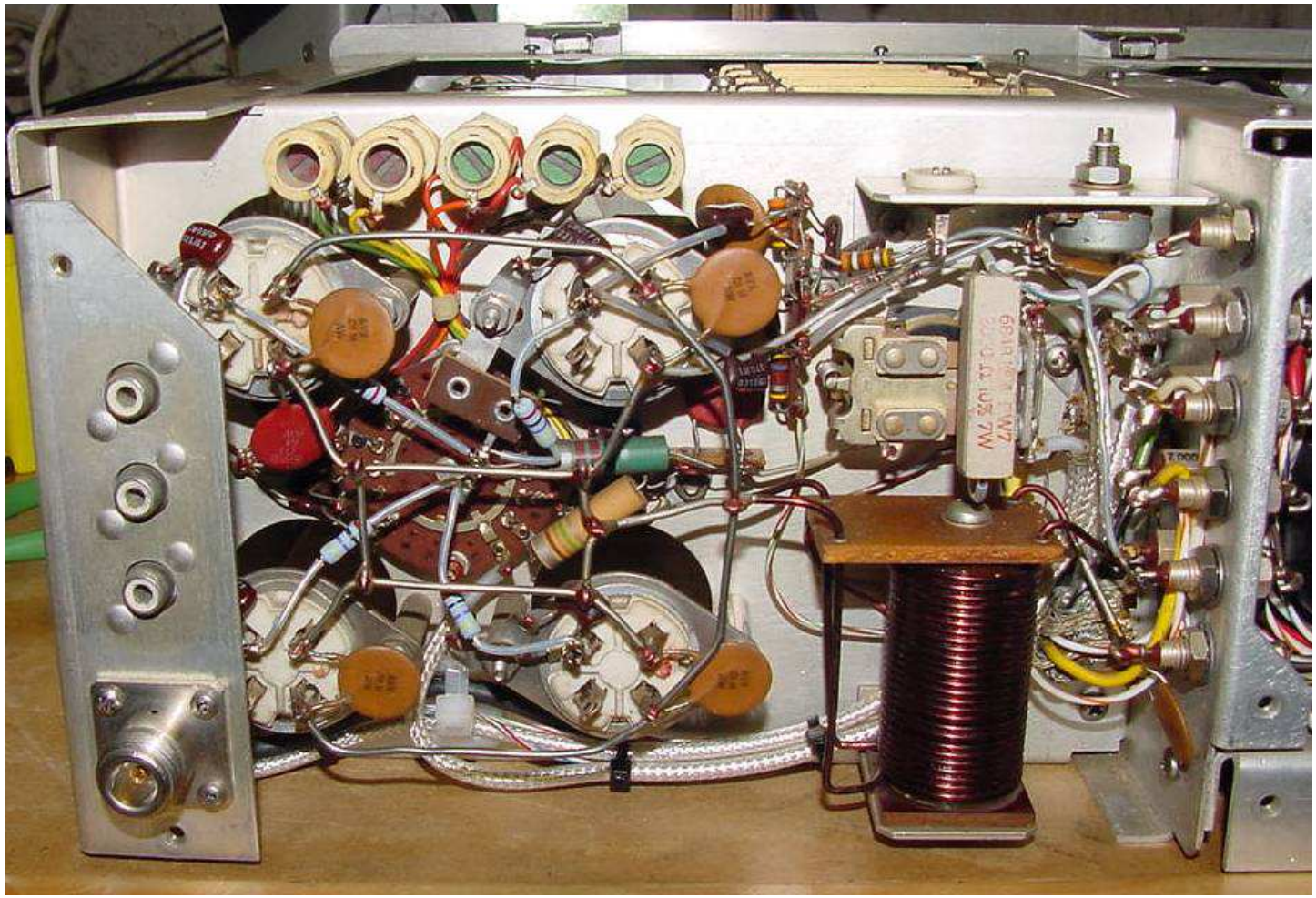
I wanted to return the original ground connection to the location of the replacement SO-239. So I made a small flange out of steel that was the same size as the flange on an SO-239. It is now mounted on the inside of the rear cover plate. A small hole was drilled for a grounding screw. To improve the look I added a thick aluminum washer (spacer) on the grounding post. This washer fills the hole from the old SO-239 connector. I countersunk the flange mounting holes and used flat head screws. I think it looks a little bit more professional.

Original Ground returned in place of the modified RF IN

Next was the much easier return of the N-Connector in place of the SO-239 used in the RF OUT. On the back of that bracket is also the 39 ohm antenna relay resistor. I replace the original 1/2W carbon comp resistor with a newer 1W NTE Flame Proof resistor. I like the NTE flame proof resistors as the 1W size is pretty much the same as the old 1/2W carbon comp resistors.

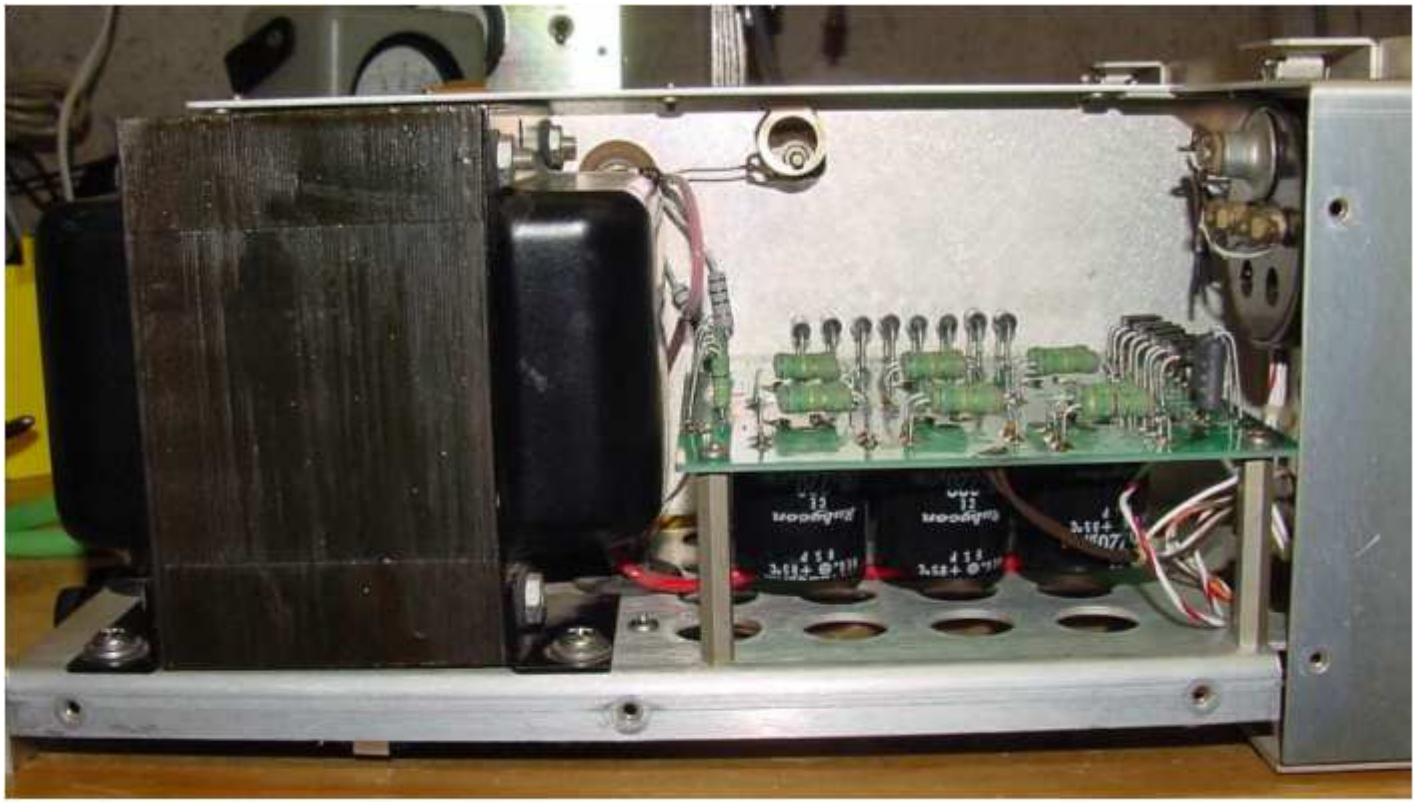
Grid Resistor Replacement

The 811A grid resistor that measured 91 ohms instead of 47 ohms physically looked fine. After being unsoldered it just snapped in half! So obviously outside appearance doesn't mean squat! Since I'm in replacing one resistor I decided to do them all. Again using NTE flame proof resistors. This time I stayed with the original 1W rating, even though the new ones are physically smaller than the originals. I added Teflon tubing to all the resistor leads.



New RF OUT N-Connector on left side and new grid resistors with common connection point near the center of the tube sockets

HV Work



*The **W6BN HV Board** offer a clean replacement solution*

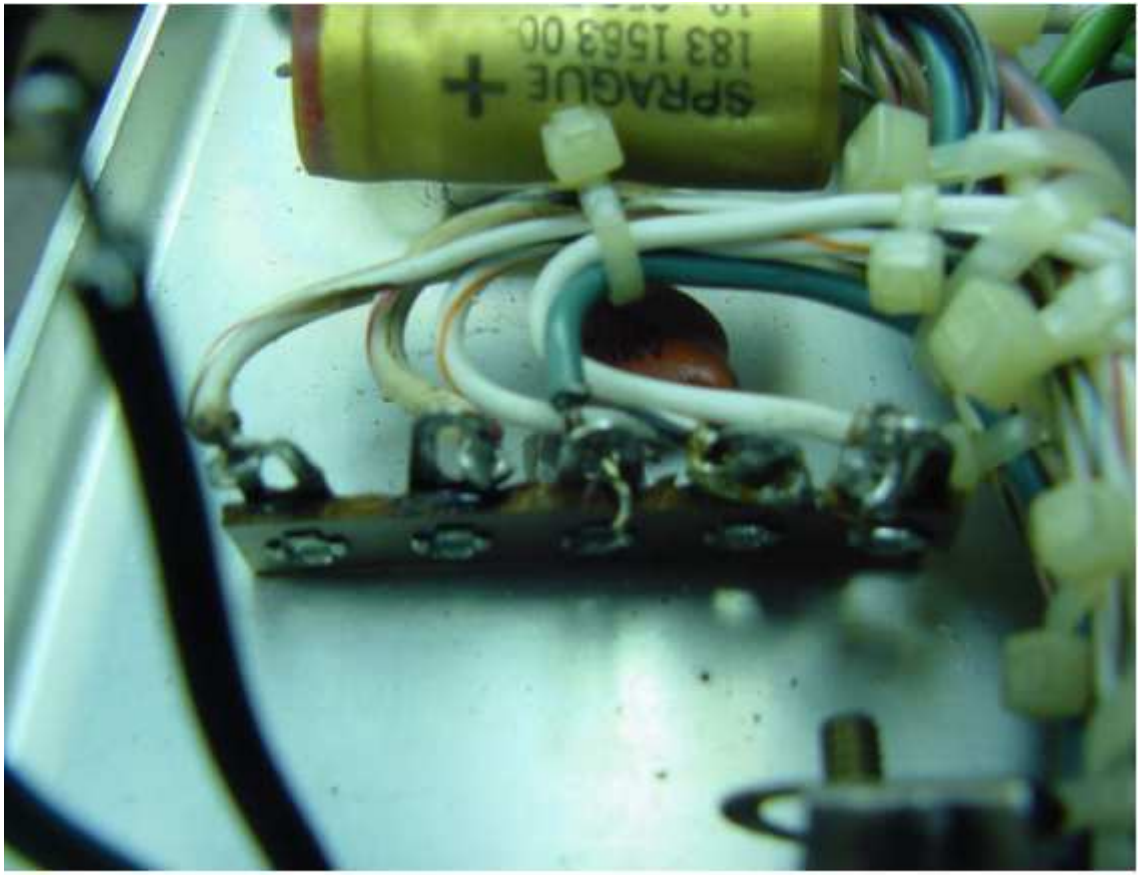
Instead of replacing all the HV board diodes and electrolytic capacitors, plus checking out all the equalizing, bleeder and dropping resistors I opted for one of the replacement boards. In my case it was the ***Bill Noonan, W6BN circuit board***.
The reason was simply it was a professional grade ***single*** board replacement.
The original Collins diode and cap/res boards are both replaced. In their place is one PCB mounted above the chassis. Installation is quick and painless. Taking my time it only took a little over an hour. Remember though I already had the amplifier opened up for my other work

Note: You can also use the ***PM-300 Replacement Power Supply Module*** for the Collins **30L-1** of ***Harbach Electronics*** for more information (*see where to buy pages*).

AC Input

I want to operate my 30L-1 from 240VAC which I have available in the shack. If there is one shortcoming to the 30L-1 amplifier it is that Collins did not make conversion from 120VAC to 240VAC and vice versa an easy affair. I guess I'm used to modern equipment that normally will have simple screw terminal jumper changes for such a voltage input change. Even though the schematic has a marked terminal block drawn with the numbers 1 through 5, in reality it is just s simple solder terminal strip. Such an arrangement is a call to disaster if the unit gets switched back-and-forth enough times. A look through my junk box and I found a neat screw terminal block replacement.

Interestingly it was actually engraved with the numbers 1 through 5 just like the Collins schematic. As you can see all the AC input wires from the line cord now connect via push-on terminals. Changing to 120VAC in the future will be a simple movement of the line cord terminals and the movement of one or two terminal-to-terminal jumpers. All original transformer primary winding connections, jumpers and bypass noise capacitors use simple eyelet terminals that now screw down for ease of removal and/or relocation.



Collins Original AC Input Terminal Strip (AC Line Cord already removed)

My Replacement AC Input Strip - The Way Collins should have done it! Just to the left of the new AC Input Strip above is the LV DC power supply circuit. There is a 10uF 250VDC electrolytic capacitor that should also get replaced here. Note this picture shows the new cap in place.

Also, notice the small wire (#30) that runs between the two lower terminals of that terminal strip at the far left. That is actually a fuse in the center tap to ground of the filament voltage secondary. If you have a 30L-1 that is experiencing hum in the output signal this little fuse wire may be blown. The tube filament will still glow when this wire is blown! Beware...

Check Out

Before buttoning it all back up I did go through and check all remaining components, except those on the new HV power supply board. Everything else checked out. I originally applied 24VAC to the line cord to verify that all the HV and LV DC voltages came in at 1/10th the expected value once 240VAC was finally applied. It's much safer working with a HV of 200VDC than 2000VDC! You will need to slide a little bit of insulation tubing over the three interlock switch shorting posts to prevent shorting out the DC voltage. The HV and LV voltages checked out fine at 1/10th their normal operating values. ***Do not forget to remove the tubing before you button up the internal covers!*** Installed the four 811A tubes and screwed all internal cabinet covers back in place.

Tuning

With the amplifier connected to the 32S3A I retuned all the input circuits per the procedure in the Collins manual. I did not perform the Tune Meter or ALC Threshold adjustments. I figured if I noticed that there was a problem relating to these areas in use I could always come back and perform those adjustments. On my 30L-1 there are adjustment holes in the top of the RF cage to access those adjustment points. So it would not require case removal in the future if such adjustment is needed.

Trim Rings

I knew that the Collins KWM-2A used a slightly different trim ring from the others as it has additional holes under the cover edge for locking type screws. I had a very nice repainted metal trim ring for use when I finished this 30L-1. However, when I tried attaching it I ran into a problem. Collins would add additional metal to the rear side of trim ring to add strength. On the 30L-1 just like the 75S3 or 32S3 units they have flat head screws located about 3.75" each side of front center just under the top cover lid. The ring I had did have these holes, but underneath this particular trim ring some of that reinforcement came to close to those holes. If you go back to the picture of the HV section and look at the top right side you can see the L-brackets on the 30L-1 with mounted retaining nuts attached. Well those L-brackets would not clear the reinforcement metal added to my trim ring! The original trim ring I had on this 30L-1 was plastic and it was cracked in half. However, I did have a couple of others that are in need of getting sand blasted and repainted. So for now I am using one of those metal trim rings. I don't think they were from a 30L-1. So I'm not to sure why the differences.

For now I'll use the scratched up trim ring until I can visit a local powder coating business and see about getting a small collection of cabinets and trim rings I currently have repainted. I must say out of all my S-line equipment the 30L-1 trim ring was the hardest to install. Since the 30L-1 is essentially a full cabinet within a cabinet many of the inner cabinet mounting screws will easily hit the trim ring while it is slid on. When I do get a nicely painted trim ring I will be extra careful and SLOW installing it to avoid nicks!

I put on the scratched up metal trim ring and the like new cabinet. Moved it into the shack for the trial run. I have made a few one hour plus QSO with the 30L-1 driven by my 32S-3A transmitter. It has performed flawlessly! I get about 600 watts output on the 312B4 meter on 75 meter phone.

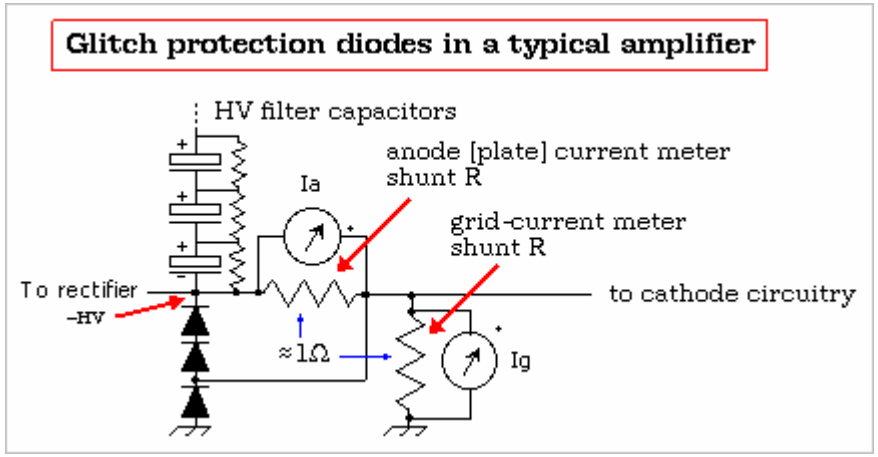
Fan Balancing

After I had everything back together I did notice the fan was making a little vibration noise. The Collins manual does indicate the fan should be lubed every six months. Yeah right! I did lube it while I had everything open and I knew the fan turned smoothly by hand. Bad bearings were not suspect. Since my fan blades were kinda dirty I did clean them up during the refurbishment. I noticed how easy it was to bend them as they are a light aluminum. Perhaps it was wobbling due to one of the blades being off as a result of cleaning them... Opening the final cage cover and slowly rotating the blades by hand, I could use the air openings along the bottom of the cage as a reference point to watch the edge of each blade as it turned. They weren't off by much, but I did do a little streaking so that visually they all lined up against my reference point. Buttoned it all back up and applied power. No more noise!

Before I forget. I did mention the amplifier came with a ***extra set*** of tubes. I had always figured they were new or good replacements. The installed tubes were all **RCA JAN** versions. The backup set was four **Cetron** versions. After looking over the Cetrons I came to the conclusion that I bet they were previous pulls from this amplifier. One of the tubes had a slight caving in of the plate near the top of the tube. So much for an extra set. Lesson learned - "Extra Set" does NOT mean new or even working set! I do think a couple of them may be fine, but I'll need to make a test fixture to verify that.

The completed 30L-1 RE. If you look closely you can see the scratches in the trim ring

GLITCH PROTECTION

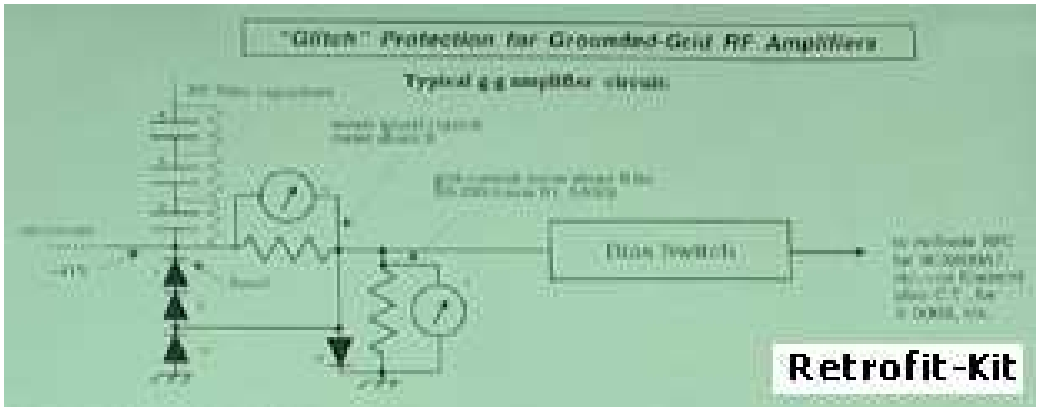


During a «**glitch** » such as a +HV to ground arc, or an intermittent VHF parasitic oscillation, the –HV circuitry in an amplifier may spike to **several kilovolts negative** with respect to chassis ground. This much voltage can damage components, or amplifier tubes. For example, such an event can cause a cathode-to-filament or cathode-to-grid arc inside an indirectly-heated cathode (IHC) amplifier tube. Such an arc can burn out the filament or damage the cathode surface, This an other expensive problems can be avoided if protection diodes are added as shown in the circuit diagram above. During a glitch, the 3 diodes limit the –HV spike to about -4.5v maximum. The 3 glitch diodes also protect the anode and grid current meters as well as their shunt resistors from current spikes. **

** Glitch diodes may short when there is a severe problem.

Although directly-heated cathode amplifier-tubes, such as the **3-500Z, do not suffer from filament burnout during a glitch, protection diodes are beneficial since they protect the metering circuits and the insulation in the filament transformer from the typical multi-kilovolt negative pulse during a glitch.

GENERAL INSTRUCTIONS



Connect **3 diodes** in series. Connect the banded end (cathode) of the upper diode to the negative terminal of the lower HV filter capacitor(s). Connect the unbanded end of the lower diode to the ground. From the cathode of the lower diode, connect a wire to the junction of the shunt resistors for the anode current meter and the grid current meter. Thus, 2 seriesed diodes are in parallel with the anode **I meter shunt R** and 1 diode is in parallel with the **Grid I meter shunt**. If the anode current meter shunt resistor **is less** than **0.5Ω,** and the anode current is **1A maximum**, only **one** glitch diode across the resistor is needed.

NOTE: if either the grid or anode meter current shunt resistor has more than about **1 Ω** of R, additional diodes in series may be needed to avoid changing the accuracy of the meters at high readings. The maximum V per diode should not exceed 0.5V (Note that glitch diodes are operated with forward polarity voltage).

For more information see retrofit kit pages, and: **http://www.somis.org/Price-Info.html**