Gettering Power Grid Tubes

By Charles T. Rauch, Jr. W8JI

Gettering is very important, since even miniscule amounts of gas will cause a low-resistance arc from anode to grid or cathode. The normal results of such arcs are blown grid chokes, collapsed anode chokes, damaged meter shunts, and other problems cause by high fault currents. While a few people blame high fault currents on Parasitics, it is actually impossible for a parasitic to create such arcs. All the anode and grid can do is deplete the electron cloud from the area of the cathode, and the available current even with a parasitic is limited by the available emission. Uncontrolled arcs are always the result of gas or element alignment in the tube, rather than excessive current from oscillations.

Anode systems should have series-resistance to limit peak current in the event of a tube arc or failure. That series resistance should always be in the anode lead between the filter capacitors and RF choke. A diode clamp should be installed to protect meters, especially the grid meter since the grid is in the normal path of any internal tube arc.

Ceramic tubes, because of low anode operating temperatures, have the Gettering agent applied to the cathode or filament assembly. This is the only area inside the tube that heats enough to activate most common Gettering materials. **Ceramic tubes without internal flaws or broken seals can generally be gettered by running the filament at rated voltage for an extended period of time before application of any high voltage. The normal time for Gettering is between one hour and one full day. If the tube does not getter within a day it is most likely never going to be restored to an operational relatively pure vacuum.**

Glass internal anode tubes generally have the Gettering material coated on anodes, which must be operated high temperatures to activate the getter. Glass tubes have a propensity for seal leakage and element out-gassing, both of which lead to a short self-life for large tubes. It isn't the glass that leaks gas, but rather a Kovar alloy used to bond the glass to the metal protruding through the envelope.

Kovar is also subject to rusting. As odd as it seems, glass-transmitting tubes should be stored in a dry location. Glass tubes should be operated at full temperature every few months.

U**nder some conditions a glass tube can be restored to operation by running low anode voltages and positive bias on the grid. This will sometimes allow full operating anode temperatures to be reached, and the tube can be "cooked" for several hours. I've had about a 50% success rate restoring old 3-500Z's that have sat for years without use. Even though they initially arced severely at full voltage, by cooking them at low voltage and positive grid bias to show anode color vacuum was restored.**

Most important, an arc by itself will break down and getter gas inside the tube. This is why an amplifier with a gassy tube will sometimes operate without problem after a sudden tube arc.

Intentional arcing and overheating, while pumping down a tube, are often a normal part of tube manufacturing processes.