How To Preserve A Vacuum Tube's Lifespan

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Today RF Power tubes can cost hundreds of dollars, so be sure to keep tube usage at a minimum and squeeze every possible ounce of energy out of it. **Here is a list of helpful hints developed over the years from field engineers and their input.**

Use undamaged tubes

Always check a tube as soon as possible after receipt. There are two critical reasons for this: if the tube was damaged in shipment and you have sudden need for it, you may be off the air, or, if you wait too long to file a claim with the carrier, they may reject the claim on the basis that damage could have happened in hands other than carrier. If the carrier mishandled the package and you fail to notify promptly, then you will lose your right to file claim. Time is of the essence here. If there is any noticeable damage to the carton on delivery, be sure to note this on the delivery receipt before signing. As soon as practical thereafter, check for shorts with an ohmmeter. If shorted, file a claim immediately. If not, test it in your transmitter as soon as you can because the ohmmeter does not always tell the whole story. It would be very desirable if you could check the filament current at rated voltage because most tubes have multi-strand filaments, and one or two strands could be open without a piece breaking off and shorting. The tube could even operate with a strand or two open. Because of fragility, a filament can be broken without evidence of damage to the carton.
Handle a tube with care

Always pick up a tube from the envelope rather than the plate cap and clean the envelope before use to remove any fingerprints. Handle them with care and do not bump any tube. Filaments are almost as brittle as a burned matchstick. Grids are not much stronger.
Good pins are a must

Bad connections can cause trouble. Keep contact pins clean and tight against tubes. Wobbling tubes in and out of the sockets can bend and loosen the pins. If pins have lost springiness from overheating, replace them promptly. Look for discoloration.
Tube appearance

When removing an old tube, examine it carefully. Burned spots, or scorching are immediate signs of tube socket wear. Replace any bad socket and clean it of debris. Insert the new tube firmly in place, carefully take out and look at the scratches on the new tube rings. They should be shaped evenly around the rings.

Date coding

Although it is a good idea to keep a chronological record of the tube, **never write on the ceramic portion of a tube or place tape on it. The lead from the pencil could cause arcing and the tape could start a small fire from the heat**. It is suggested to keep a "The Tube History Service Report" attached to your transmitter log and that way both can be recorded easily.

Glass tube envelopes

Today's reliable ceramic has replaced most glass stems. However, if your transmitter or amplifier requires glass envelope tubes, **it is suggested to keep the tube in an airtight plastic bag to avoid rusting of the Kovar alloy that seals the tube. Rusting of the Kovar could compromise the internal vacuum and the tube could go to air rendering it useless.**

Keep it cool

The cooler tubes operate, the better. Be sure your air system is in good condition. Keep filters clean. Keep circuit efficiency high. It is a good idea to occasionally take the tube out and inspect the cooling fins for trash and insects. Several blocked fins could cause enough concentrated heat to crack a ceramic seal. Watch for discoloration of anodes and fins due to high temperatures

Effects of Altitude on Tube Life

It is not your attitude, but your altitude that determines tube life sometimes. In the high elevations, thin air gives less cooling for the same volume at sea level. Keep a thermometer near your transmitter or external RF Power Amplifier to check room temperatures according to designer's specifications. Lower air dielectric values at altitude could possibly result in external arcing.

Tuning at installation

Re-adjust the transmitter when installing a tube. Keep in mind that each tube is an individual, just like you! Each tube requires its own tuning at installation. If the new tube exactly matches the previous tube, you are fortunate. Since all tubes are not created equal, transmitter manufacturers provide for adjustments. **Remember good life depends on good operating conditions. Keep plate and grid dissipation to a minimum (efficiency high). Keep tubes properly loaded to avoid high RF voltages, which may cause arcing, and sometimes cracking of the ceramic.** Be sure you are not trying to tune the final to some harmonic and that there are no parasitic oscillations (neutralizing). During certain weather conditions, tube loading can change due to ice, etc. on the antenna or transmission line. Lowering power may be in order to keep R.F. voltages in the tube plate circuit down.

Adjusting filament voltage

Tubes commonly do not need to run at transmitter manufacturer's rated voltage. They can run at reduced voltage and still produce maximum output. When installing your tube, gradually bring the filament voltage up to the manufacturer's rated voltage. Allow the tube to season in at this voltage for a few hundred hours. After the tube has been successfully installed and seasoned, gradually bring the voltage down to a level where 100% output remains. Over time as the output begins to fall, you can steadily raise the voltage a few 10th of a volt to maintain output requirements.

Insufficient output

If, with normal or high plate current, output is low (efficiency low, plate dissipation high), there is usually not enough swing of the plate RF voltage. This could be due to the plate circuit not being at resonance, or antenna coupling too tight; also with certain combinations of grid excitation, grid bias, and screen voltage, together with antenna coupling. Among variations between tubes is the amount of grid and screen emissions. Grid and screen emissions are usually negative to the grid and screen current readings usually tend to make the grid and screen voltages too positive. Resistance in the circuit of either should be relatively low to prevent run-away. There is not a tolerance limit on the low side, but there is a tolerance limit on the high side. Since all tubes will have some screen and grid emission, and the average probably is toward the high tolerance, some transmitter manufacturers may design for this. It should usually be possible for the engineer to trade off antenna loading excitation, grid voltage and screen voltage (keeping plate circuit at resonance) and arrive at a good operating condition.