EXTENDING THE LIFE OF A TRAVELING WAVE TUBE

The Traveling Wave Tube (TWT) is the heart of your TWT amplifier (TWTA), as well as its most expensive component. And while MCL prides itself on providing state-of-the-art amplifiers designed to extend tube life in a variety of ways, the owner/operator of a TWTA should be aware of the following list of suggested precautions that will help maximize their TWT investment by contributing to the tube’s performance and life.

Handling of Replacement TWTs

When you take delivery of a new TWT, careful handling during installation is advisable. Special attention should be given to ensure that the exposed high-voltage connections, ceramic seals and RF connectors are protected from damage which may occur during the process of unpacking the TWT.

Installation

Only trained personnel should participate in the removal or installation of a TWT. This person must proceed with caution so that no strain is put on the RF connectors. On TWTs with SMA connectors, precautions should be exercised as to the amount of torque applied to the connectors - 8 inch-pounds is the recommended torque. The waveguide mating flanges should be clean, smooth and flat so that a good mechanical, as well as RF connection can be made. Any o-rings must be clean and aligned in the groove to avoid pinching. Ensure proper connections are made pertaining to the individual elements of the TWT.

Storage

If at all possible, the original shipping container should be retained and used for storing the TWT and for any future handling or moving which may be required. In addition, the specific storage temperature limits must not be exceeded. Specific storage temperatures can be found with the tube data in your documentation.

Protective Measures

Steps must be taken to provide protective measures so that the TWT is not exposed to abnormal extremes, such as AC line surges, temperatures, and load mismatches. All MCL TWTAs are supplied with operating instructions and test performance data. Owners/operators should take the time to read and refer to these manuals on a regular basis. Special attention should be given to the recommended precautions and operating instructions.
Preventative Maintenance

Develop a regular maintenance plan for the inspection and cleaning of air filters. Air filters should be maintained at least once a month. If the filters are found to be very dirty, the frequency of the maintenance period should be increased. The frequency may also need to be increased during dry periods or when there is construction nearby. In highly corrosive environments (i.e. salt air) the filter should be replaced at regular intervals.

Proper Cooling

A key factor in extending the life of any TWT is controlling the temperature of the tube at all times. Most systems produced by MCL are designed with cooling systems to ensure reliability and long life at temperatures up to 50 deg C at sea level and derated at 1.9 deg C per 1000 ft. at altitudes up to 10,000 ft. Do not operate systems for extended periods of time or at high ambient temperature conditions with the HPA covers off or doors open. In many cases these doors are an integral part of the cooling design. Air will not flow correctly and some items will not be cooled adequately. Air filtering will also be compromised.

TWT Operation

By adhering to the following general operational principles, TWT life can be extended:

*Longest Life (Steady State)* - Beam and RF on continuously (Unit in Transmit position)

Beam on, RF off during downtime (Unit in Transmit position)

HPA (Beam and Heater/Filament) off during long downtime (Unit Off)

*Shorter Life (Transients)* - Heater/Filament Voltage full on, Beam off (Unit in Standby position)

Protection During Faults

Although all MCL amplifiers are designed to provide maximum operational efficiency, it is possible that during the life of your amplifier a fault may occur. If a fault does occur, resetting the fault is a normal procedure. Should the fault fail to clear after three attempts, MCL recommends that you log all operational parameters (i.e. meters and voltages) and contact us immediately. If further attempts to reset the fault are made to the system, damage to the TWT may result.

In general, all major tube manufacturers agree that a cooler running cathode (TWT) provides the best long life performance. By following the suggestions in this article, you can get the maximum return on your HPA investment by significantly extending the life of the TWT.

For more information, please contact us.