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TB-200: Filament Power Supply  
Recommendation

*An Employee-Owned Company*

## TECHNICAL BULLETIN

# HEATER POWER SUPPLY RECOMMENDATIONS

## A.C. or D.C?

### Background

The preferred power supply for heaters in alumina potting is A.C. Furthermore it is preferred that one end of the heater be grounded to the heater body. Other configurations will have reduced heater life, often by only a few percent, but in worst cases to only a few hours. A lightly run cathode or other potted filament can have a filament life of tens to hundreds of thousands of hours with the proper connections.

If the heater wire is positive with respect to the heater body, tungsten ions will react with the alumina potting and form aluminum tungstate. The aluminum tungstate degrades the insulating qualities of the alumina and a partial short forms. This partial short can quickly become a catastrophic failure of the heater.<sup>1</sup>

The reaction between the heater wire and the alumina **will not** occur if the heater wire is negative with respect to the heater body. However, the same reaction will occur on the surface of the heater body forming aluminum molybdate (if the body is molybdenum). The reaction between the body and the alumina is less harmful than the above reaction because the heater body will be 100°C to 300°C cooler than the heater wire.

This reaction does not occur if the heater is running on A.C. power and one end of the heater is grounded to the heater body. If the heater cannot be grounded to the body it is critical that the potential between the heater and the body be minimized and the heater be negative with respect to the body.

The above statements are somewhat simplified and there is much more going on in the potting. However, following the guidelines below will maximize heater life.

### The Ideal Heater

1. The heater should be grounded to the body (internally or externally).
2. The heater should run on A.C. power.
3. If D.C. power is a requirement, the wire must be negative with respect to the body.
4. If the heater is ungrounded (A.C. or D.C.) its bias must be negative with respect to the body and as low as possible.
5. Maximize the heater wire surface area to minimize the wire temperature.

<sup>1</sup> References:

Allentown Laboratory, Bell Telephone, Inc. 1959

Philips Technical Review, 1950

Studies at Eitel-McCullough, Inc (Eimac), 1965

Unpublished studies at Spectra-Mat, Inc. 2002/2003