



APPLICATION NOTES FOR USE WITH SPELLMAN HIGH VOLTAGE POWER SUPPLIES

Application Note Number: AN-12

Revision: 11/15/13

The Benefit of Using a Current Source to Power X-Ray Tube Filament Circuits

Virtually all the filament power supplies Spellman uses in their X-Ray generators and Monoblock® X-Ray sources are current sources...not voltage sources. That is, the filament power supply controls and regulates the current through the filament of the X-Ray tube. This is done to protect the filament and obtain the longest usage and lifetime of the X-Ray tube possible.

If a voltage source is used to power a filament then the current through the filament is dependent upon the impedance of the circuit. Cold filaments have a low impedance, as they heat up the impedance rises. So if you drive a filament with a voltage source you typically get a large spike of current at turn on...this is why most household incandescent light bulbs usually fail (blow out) at initial turn on.

With a current source filament power supply the current through the filament is always regulated, regardless of the impedance of the load. In fact, even if a short circuit was placed on the output, the current would still be regulated and limited to a safe level.

In this current regulated scenario “voltage” is not a critical factor. The voltage is nothing more than the compliance of the circuit. Whatever the impedance of the circuit is (filament resistance, cable and connector resistance, etc.), this times the current flowing through the circuit will yield a voltage. As long as the current source filament power supply has more compliance voltage capability than the total circuit needs, all is fine.

The only time the “voltage limit circuit” could ever come into effect is if there is an open filament fault. In this case it’s basically a moot point, the filament is open...you can’t make X-Rays and the X-Ray tube requires replacement. Does it really matter if the open filament cable has 6 volts across it or 12 volts across it? No it doesn’t, the filament is open, and the X-Ray tube can’t function because you have an open filament circuit.

For this reason we don’t fuss much with voltage limit settings on filament power supplies. As long as there is enough compliance voltage to drive the effective filament load...all is fine. If the filament fails, the maximum open circuit sourcing voltage will be limited to a safe and predictable level. With a current source filament power supply playing with the setting of the voltage limit circuit provides no real additional protection or benefit for the X-Ray tube.