# APPLICATION NOTES FOR USE WITH SPELLMAN HIGH VOLTAGE POWER SUPPLIES

**Application Note Number: AN-19**
**Revision: 01/08/16**

**Keep it short if you can. High voltage cable lengths discussed.**

Most of Spellman's high voltage power supplies use some type of cable to connect the output of the high voltage power supply to the customers "load". Many of these cables are coaxial in nature. The coaxial cable has inherent safety protection due to its grounded shield, in addition to noise suppression and a good ground path from source to load.

But coaxial cable adds capacitance to the output. Depending upon the specific type of coaxial cable used the capacitance could be 30pF or more of capacitance per foot of high voltage cable length. At the extreme high voltages Spellman's power supplies operate at, even a nominal amount of capacitance can have a significant amount of stored energy. Energy stored in a capacitor is calculated as:

Stored Energy (Joules) = ½ $CV^2$, where C is the capacitance and V is the applied voltage.

It is easy to see how even a small amount of capacitance can have a large amount of stored energy at high voltage, as the voltage term is squared. There are instances where the high voltage cable can have more stored energy than the output capacitance of the power supply.

This cable capacitance is seen as external capacitance to the power supply. The power supply must charge and drive this capacitance, and under certain cases this can present problems. But the real issue is what happens when arcing occurs. Due to the location of this cable capacitance there is no resistor in series with this energy source dissipating the stored energy. The power supply has arc limiting resistors built into its output to limit the power supplies arc current discharge magnitude to safe and predictable levels. Cable capacitance has no such limiting so during arcing the discharge currents can be huge and the energy can cause voltage cycling; "ringing" which can be very damaging to the cable and the power supply. Eventually the energy will be dissipated by the arc impedance and other dissipative elements, but only after very high voltage ringing has occurred. This can also be detrimental to delicate customer loads and wreak havoc with improperly grounded equipment.

For these reasons it's considered good engineering practice to try to keep the length of the high voltage cables as short as possible. Does this mean you can't have a power supply with a long cable? No. But with all things being equal a setup with a short high voltage cable is likely to be less problematic than the same setup with a very long high voltage cable.