APPLICATION NOTES FOR USE WITH SPELLMAN HIGH VOLTAGE POWER SUPPLIES

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"No, *you* touch it". HVPS output fall and discharge times explained.

When working with high voltage power supplies knowing about output fall and discharge times can be helpful. Consider this information as only providing additional details on power supply functionality. This application note by itself is not adequate "safety training" for the proper setup and use of a HVPS. Please refer to the complete safety information provided with our products.

Typically, high voltage is created by controlling an inverter that feeds a step up transformer which is connected to a voltage multiplier circuit. This multiplier circuit (an arrangement of capacitors and diodes) uses the principle of charging and discharging capacitors on alternate half cycles of the AC voltage, where the output is the sum of these capacitor voltages in series. By definition, the voltage multiplier circuit is capacitive in nature and has the ability to store and hold charge.

For the sake of efficiency, any internal current paths to ground are minimized. Typically the only resistive path connecting the output of the supply to ground is the high impedance voltage feedback divider string. This feedback divider generates the low level, ground referenced, voltage feedback signal used to control and regulate the supply.

Due to the orientation of the diodes in the multiplier assembly, a positive polarity supply can only source current; it has no ability to sink current. So the feedback divider string becomes the only discharge path for the output during a "no-load" condition. Let's look at a typical unit's value of multiplier capacitance and feedback divider resistance to see what kind of no load RC discharge time constants we're talking about.

SL60P300 0-60kV, 0- 5mA, 300 watts
C multiplier = 2285pF R feedback = 1400MΩ
RC = (2285pF) (1400MΩ) = 3.199 seconds
5 RC time constants required to approach zero (≈1.2%)
(5) (3.199 seconds) = 15.995 seconds

The above example illustrates how under a no load condition it can take considerable time for the output to discharge. If an external load is left connected to the supply's output, the discharge time constant can be shortened considerably. For this reason HVPS fall times are termed to be "load dependant". Keep this in mind when working with your next HVPS.