Tech Talk from HVI: Circuit & Feature Explanations

Subject: AC Hipot Inductive Input Compensation

When high voltage testing with AC voltage, nearly all loads are capacitive since the high voltage is being applied to two conductive surfaces with a dielectric, or insulative, material between them. The PFT Series of AC high voltage test sets are made with a **gapped primary within the high voltage transformer** to increase the circuit inductance to minimize the input primary current draw when testing a capacitive load. The **added inductance to the circuit nulls out much of the capacitance** of the load. This is why a hipot rated for 3 kVA, which would draw 25 amps at 120 volts, only draws 14 – 15 amps. This way, it can be plugged into a regular 120 volt outlet without the current draw exceeding the maximum allowable 16 amps on a conventional 20 amp circuit.

The **added inductive impedance is designed to reduce the input current draw of the hipot by ~ 50%** when the load capacitance is matched to the circuit rating, meaning a load that draws full hipot rated current at full voltage. As this load condition is rarely achieved, the output current from the hipot will be significantly less than the nameplate rating.

Example: The PFT-503CM is rated for 0 - 50 kVac @ 3 kVA. Ideally, one could draw 60 mA of output current. However, this rating can only be achieved at the full output voltage of 50 kVac and only if the load capacitance is rated such that it would draw 60 mA at 50 kV. As this is never the case, the user can realistically expect to be able to draw 40 – 45 mAac maximum. Other models are available without this feature, permitting higher output currents to be achieved. However, they are not portable like the PFT Series.

The overload on the PFT series is based on the input primary current, with the overload set to 15 amps on 120 volt units, and 7.5 amps on 230 volt units. To calculate the maximum load current achievable at any given output voltage, the following formula should be used:

(Test Voltage/Full voltage x 50% mA rating) + 50% mA rating = approximate Overload Current

For example, for a model PFT-503CM rated for 50 kVac @ 60 mAac, a 27 kV test voltage would provide: (27/50 x 30) + 30 = 46 mA maximum current on the meter before overload current is reached.

This number is assuming a purely capacitive load. If there is resistive current involved, the total current indicated on the meter will be less. (Vector analysis of the R and I current phasors is needed in this case.)

Summary: Due to built-in **inductive compensation to counter the capacitive nature of the load**, done to minimize the input current, means that nameplate full current ratings will not be achieved before the hipot trips off due to primary current overload. **A user can expect 70% - 75% of maximum rated current**. Below is how the effects of this circuit are described in the PFT Series Portable AC Hipots brochure.

	PFT Model Specifications				
	PFT-301CM	PFT-103CM	PFT-303CM	PFT-503CM	PFT-1003CM
Input	120V, 60 Hz, 10A or 230V, 50/60 Hz, 5A	120 V, 60 Hz, 15A, or 230 V, 50/60 Hz, 8A			
HV Output	0-30 kVac, 1kVA resistive load 33 mA current	0-10 kVac, 1kVA resistive load 3 kVA capacitive load Up to 300 mA current	0-30 kVac, 1kVA resistive load 3 kVA capacitive load Up to 100 mA current	0-50 kVac, 1kVA resistive load 3 kVA capacitive load Up to 60 mA current	0-100 kVac, 1 kVA resistive load 3 kVA capacitive load Up to 30 mA current
Ground Current: at full output voltage in ground mode but not guard mode	2.5 mA	1.0 mA	14 mA	20 mA	2 mA
	*3 kVA output power is only available with a capacitive load sized to draw 3 kVA at full rated output. Available output current decreases with other loads.				

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