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TECH TIP – VA vs. Watts

Since watts is Volts X Amps, what is VA?

VA (or volt-amps) is also Volts X Amps, the concept however has been extended to AC power.

For DC current:

VA = Watts (DC current).

In AC if the volts and amps are in phase (for example a resistive load) then the equation is also:

VA = Watts (resistive load) where **V** is the RMS voltage and **A** the RMS amperage.

In AC, the volts and amps are not always in phase (meaning that the peak of the voltage curve is does not happen at the peak of the current curve). Think of pushing a swing. The greatest force is applied when the swing stops at the peak, but the greatest velocity is at the bottom of the arc. When you have reactive circuit elements the current can't keep up with the voltage, but lags behind. So in AC, if the volts and amps are not precisely in phase you have to calculate the watts by multiplying the volts times the amps at each moment in time and take the average over time.

The ratio between the VA (i.e., Volts X Amps) and Watts is called the power factor PF.

VA•PF = Watts (any load, including inductive loads)

In other words, volt-amps x power factor = watts. When you want to know how much the electricity is costing you, you use watts. When you are specifying equipment loads, fuses, and wiring sizes you use the VA, or the voltage times the amperage. This is because VA considers the peak of both current and voltage, without taking into account if they happen at the same time or not. When sizing UPS's it is important to understand the relationship between watts and VA's.

UPS's have both maximum Watt ratings and maximum VA ratings. Neither the Watt nor the VA rating of a UPS may be exceeded. It is typical in the industry that the Watt rating is approximately 60% of the VA rating for small UPS systems, this being the typical power factor of common personal computer loads. In some cases, UPS manufacturers only publish the VA rating of the UPS. For small UPS designed for computer loads, which have only a VA rating, it is appropriate to assume that the Watt rating of the UPS is 60% of the published VA rating. For larger UPS systems, it is becoming common to focus on the Watt rating of the UPS, and to have equal Watt and VA ratings for the UPS, because the Watt and VA ratings of the typical loads are equal.