Explaining Watts and Volt Amps
or "What the Heck is a KVA?"

By John Savageau

Have you ever wondered why some power ratings are expressed in WATTS, some in AMPS, some in VOLTS, and some in KVA? For many in the hosting business this can be a very confusing topic. Face it, professionals in the content business are probably not electrical engineers, and most electrical engineers know nothing about the creation and delivery of content.

This article will explain in simple terms the difference between the major power ratings, and describe when each should be used in your network architecture planning.

According to APC, the main difference between watts and volt amps is the watt rating determines the actual draw of power from a power source and the heat generated from equipment. The VA rating is used for sizing equipment such as circuit breakers, wiring, and UPS. The VA rating is normally equal to or higher than the watt rating, as it includes the “power factor” in its calculation.

Power Factors

The Power Factor is a calculation used to account for the difference in power supplies used to convert AC power into DC for use in electrical appliances and computer equipment. There are two types of power supplies – the capacitor input supply and the power factor corrected supply.

Power factor corrected supplies are used in most high end computing and switching equipment, and have a ratio of 1VA:1W – allowing a very simple calculation for scaling electrical equipment and UPS. Thus, in theory, if your power factor is 1:1, and your UPS is an 80KVA UPS, then you would be able to load the UPS to 100% of its rating.

Older electrical equipment, as well as most lower end computers and video equipment use capacitor input power supplies and have a power factor anywhere from .55 to .75 times the VA rating.

Typically when scaling a UPS for use in a data center you will use a 60% load factor on the UPS. If you overload a UPS it is almost certain to fail during a power outage, as the draw on the batteries will exceed the capacity of the UPS. Most new UPSs will automatically go into battery bypass when an overload condition occurs. The 60% load factor accounts for the high probability that most of the equipment drawing power through the UPS will be of a category that has a power factor of between .55 and .75.

Example 1

You have a 10KVA UPS. Your data center has racks of low end self-assembled computers with a total estimated rating of 9000 watts. Your UPS will most like fail, as the power factor is probably around .70. You would need at least 12.85KVA to adequately backup the data center.

Example 2

You have a 10KVA UPS. Your data center has racks of low end self-assembled computers with a total estimated rating of 6000 watts. Your UPS will be able to handle the load, as the power factor corrected rating will require approximately 8.5KVA of UPS.

Some modern UPSs will actually tell you the average power factor and real time load capacity of the UPS.

Some Useful Conversion Factors

Refrigeration

- 1 watt =.86 kcal/h
- 1 watt = 3.412 Btu/h
- 1 watt = 2.843 x 10-4 tons
- 1 ton = 200 Btu/min
- 1 ton = 12,000 Btu/h
- 1 ton = 3,517.2 W

kVA Conversions

Three phase
1000 √3 ⁄ ·A ·kVA = V

Single phase
kVA = V 1000 A ⁄ ·

Formulas

kVA = Voltage x Current (amps)
Watts = VA x PF
BTU = Watts x 3.41