HUX ELECTRONICS

PO Box 6160, Mitchelton, Qld, 4053

Phone/Fax 07 33557555, Email admin@hux.com.au

VA Ratings For Generators

How to convert VA to usable watts

The VA rating of a generator represents its ability to power a purely resistive load such as an incandescent light bulb or an electric stove as these loads have a perfect power factor, this being a power factor of 1. The power factor refers to the fact that the load draws its current evenly (proportionally) over the entire waveform and therefore the transfer of energy from the generator to the load is efficient.

Power factors of less than 1 occur whenever the load draws current in a non proportional way. Standard fluro light fittings do this and so need a power correction capacitor to be fitted.

Nearly all standard power supplies in mixing consoles, power amplifiers, computers and clock radios etc have a power factor of less than 1 and have no power factor correction applied.

Once the initial turn-on surge has passed "normal" power supplies only really draw current when the on-board DC filter capacitors need topping up and so most of the current draw occurs when the AC waveform is approaching or at its peak. Almost zero current is drawn when the waveform is below its peak. This causes the load to the generator be non linear (non resistive) in its behaviour. The generator is still feeling the full effect of the load current but only for a short period of time in each half cycle of the AC waveform.

The generator cannot supply more than its stated current and as the load is only drawing this current for a short period of time in each half cycle we have to do one of two things. (1) add power correction circuitry to the load device (rarely done), or (2) de-rate the maximum load of the generator by the power factor amount. This de-rating is normally a 0.7 or 70% rule.

If we are operating a very large PA system with power amplifiers that do not have power factor correction (normal amplifiers) then the maximum power in watts that we can draw from a generator will be 70% of the maximum VA available. If the generator is 100KVA generator then the maximum power in watts that we can draw will be 70KW.

It must be stated that some modern power amplifiers and mixing console power supplies have built in power factor correction and would be immune from this rule. However power factor correction in these products is expensive, complicated and adds another level of potential for equipment failure and is therefore not fitted as the "norm".

Conventional incandescent stage lighting can approach a power factor of 1 when run at 100% but it is almost never used in this way. Modern smart lights and LED lights nearly all have a power factor of less than 1 and so the total lighting power draw (in watts) from a generator still needs to be de-rated to about 70% of the VA rating.

Apart from power factor issues there is one other very important reason why the total load in watts is de-rated to about 70% of the total available VA. If we draw the maximum amount of power from a generator with a dynamic load (such as a very large audio system or large stage lighting system) then the load may cause the generator output voltage to be modulated by the dynamic current peaks. This potential for generator supply voltage variation could be catastrophic for any of the more sensitive equipment that is powered by the generator.

The bottom line no matter how you approach it is that the load in watts should never be more than 70% of the rating of the generator in VA.

The simplest way to work out the available current per phase from a three phase generator is to divide the total VA by 240 and then divide the result by 3. This gives the maximum available current per phase at 240 volts and assumes a purely resistive load, then de-rate this to 70% (multiply by 0.7) and you have the maximum available current per phase for practical use.

A side note or two :

A three phase 415 volt system will provide 240 volts if the current is drawn between any one of the active wires and the neutral wire.

A three phase 415 volt system is only 415 volts when the voltage is measured between any two of the three active wires. A three phase load (such as a three phase motor) generally only draws its power from the three active wires, it does not need the neutral wire.

A standard three phase cable can therefore supply three different 240 volt circuits with power when each circuit is drawn between one of the active wires and neutral, or it can supply one 415 volt circuit when neutral is not used (it becomes optional) and the power is drawn purely from all three actives.

The integrity of the neutral is critical when distributing three phase power for 240 volt use.

Consideration should also be given to balancing the total load across all three phases as a matter of good practice.