



Back-up power – 4 options

By J Palmer, PowerMan

As an electricity user in South Africa today, you should not be asking yourself if you will experience a power failure but rather - how often will power failures occur and for how long.

Eskom has made no secret of the fact that it is struggling to meet the country's power demands. Over-loading and maintenance requirements have resulted in power failures becoming more frequent and longer lasting. Previously when purchasing an uninterruptible power supply (UPS), clients would look for units that would merely give them enough time to shut down their computers, but as businesses have become more dependent on computers, this approach is no longer viable.

Businesses today are more dependent than ever on their information technology (IT) and find it difficult to operate without this valuable tool. Businesses need solutions that can keep them running and fully operational without interruption. The real decision facing consumers is not if they need power back-up, but rather how much of their business do they need to keep running, and for how long. As a rule of thumb, in the absence of other requirements, the runtime should be two to four hours. There are four options for back-up systems with extended runtimes:

- Inverter with large battery pack
- Generator
- UPS with extended battery packs
- UPS and generator combination

1 Inverter with large battery pack

An inverter is not a UPS. At best, it can be compared to an off-line UPS, provided it has been fitted with an auto-switch that transfers from mains power to inverter power when mains power fails. In most cases, the unit allows mains power to pass straight through and, when the power fails, switches to the inverter. Switching time is anything from 20 milliseconds upwards, but some inverters are designed to have a dead time and so there is a complete loss of power to the load before the inverter power is switched on. The battery pack will be sized according to the run time required. The advantages of this solu-

tion are that it is quiet, it emits no exhaust fumes and it requires minimal maintenance. However, while the batteries need replacing every three to five years, which is expensive, the solution is usually cost effective.

The disadvantages are that it offers little or no protection against mains fluctuations, spikes, or surges. Moreover, if the system has dead time before the inverter starts, computers will shut down and reboot.

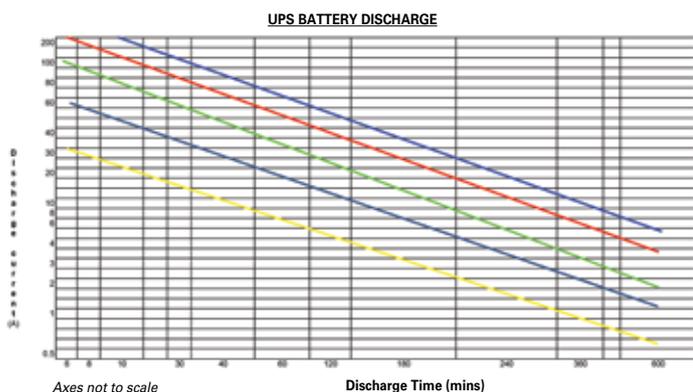
Once battery power is exhausted, eight to 12 hours are needed for recharging, during which time there will be only limited back-up available until the batteries are fully charged.

2 Generator

A generator creates a 220/ 230 V supply from either a diesel or petrol motor connected to an alternator. The key advantage is that runtime is unlimited. As long as the unit is refuelled, the generator will keep running. However, the user should check the manual, as some generators have a recommended usage period, after which they need to be cooled down.

A standalone generator has a number of disadvantages. Between the mains failure and generator start-up is down time. Even if an auto start is used, this down time will be anything from 20 to 60 seconds. If a manual start is used, the delay will be far longer. During this delay, all electronic equipment will go off. Computers will have to be re-started and there could be damage to data files. The same process applies when the mains returns. A further disadvantage is, as loads switch on and off, the generator's output may fluctuate before stabilising. Depending on the generator, the output wave may not be clean. Generators have the additional disadvantage of needing a suitable storage space, depending on the size. Noise and generator fumes can be a problem. Generators must be run regularly even when there are no power failures, to make

Red	12V100Ah
Blue	12V70Ah
Green	12V45Ah
Black	12V24Ah
Yellow	12V9Ah



sure they are working. Running costs are relatively high, considering fuel and servicing.

3 Online UPS with extended battery packs

To many this seems to be the ideal solution, combining the best features of an online UPS with the back-up time of an inverter. The unit offer a number of key advantages. It provides full protection against spikes, surges, dips, and power failures and, when the power does fail, output from the UPS is constant and uninterrupted. It can be designed to give the user anything from 15 minutes to eight hours. Computers are not switched off unexpectedly. When the power fails, no user intervention is needed, operation is silent, and no fumes are emitted. The batteries will probably need a fair amount of space, but the unit can be set up inside.

Like the inverter, the disadvantage is that once the batteries are flat the unit requires eight to 12 hours to recharge, and the batteries need to be replaced every three to five years, which can be expensive.

4 Generator and UPS combination

For areas that suffer from prolonged power outages, this is the best solution. The UPS will ensure that there is no break between failure of the mains supply and start-up of the generator. The power to the computers is clean, as the UPS corrects power problems from both the mains supply and from the generator. Run time is indefinite, as the generator can be refuelled.

The disadvantages of this solution are the need for a suitable storage space for the generator; noise; and exhaust fumes. The generator needs to be run regularly to make sure it is working. Running costs are relatively high, considering fuel and servicing.

Conclusion

There are a number of options for the user to consider, but certain things need to be taken into consideration.

The UPS or inverter must be sized to match the load that it is going to run. The user must never run the UPS at 100% load. Always calculate the load by looking at the specifications on the equipment. They will normally give a voltage and current rating or voltage and Watt. For the sake of sizing the UPS, take each piece of equipment and multiply the voltage by the current. If there are two voltages (for example, 110 V / 230 V, then use the lowest figure). This will give you

the VA rating. If there is no current rating then you can assume that Watts = VA for the purpose of sizing the UPS. For example:

Two servers @ 2,5 Amps (230 Vac)	1 150 VA
Five desktop PCs @ 1,5 Amps (230 Vac)	1 725 VA
Seven notebook computers @ 250 W each	1 750 VA
Total load	4 625 VA

Having established the load requirement, you should then choose the battery pack. Unfortunately, these calculations require you to have the discharge graph available for the batteries. You need to divide the total load by the nominal battery voltage and that will give you the current on the battery, armed with that information you can look at the battery graph and confirm the run time that the battery will give you.

There are a number of options for the user when deciding on back-up power, and certain specifics need to be taken into consideration. The best solutions are - a UPS with long runtime or the UPS-and-generator combination.

In the above example, the load was 4 625 VA, suggesting that a 6 kVA UPS would be required. It will be loaded to around 75%. The 6 kVA in question has 20 batteries connected in series, giving a battery voltage of 240 Vdc. The current drawn from the batteries will be $4\ 625 / 240 = 19,3\text{ A}$. The accompanying graph provides a rough guide for the runtime achieved for different batteries. Run times should be confirmed with the battery manufacturer or agent. The 6 kVA machine will back up the equipment described above for four hours with 100 Ah batteries, 2,5 hours with 70 Ah batteries, 70 minutes with 45 Ah batteries, and 40 minutes with 24 Ah batteries. The best solutions are a UPS with long runtime or the UPS-and-generator combination.



Jonathan Palmer was born in the UK and immigrated to South Africa in 1975. In 1984, he became a founding member of PowerMan, a manufacturer of UPSs. In 1997, Palmer bought out the shares held by other directors to become sole shareholder and managing director. Palmer has overseen a variety of process models at PowerMan, from on-house manufacturing, to local outsourcing, to international outsourcing on an OEM basis (the current model). The company is based in Honeydew, west of central Johannesburg. Enquiries: Email jonathan@powerman.co.za.