

## Your Reliable Guide for Power Solutions

To fulfill our commitment to be the leading supplier in the power generation industry, the GenPower Products, Inc. team ensures they are always up-to-date with the current power industry standards as well as industry trends. As a service our **Information Sheets** are circulated on a regular basis to existing and potential power customers to maintain their awareness of changes and developments in standards, codes and technology within the power industry.

### UPS Systems - What They Are and Where Required

Uninterrupted Power Supplies (UPS) are what their name implies. If there is an interruption or switching of power to an electrical circuit an UPS system will provide uninterrupted power to the circuit for the period of time taken for the back-up power to come on line or the primary power system to be restored.

**This information sheet discusses the type of UPS systems, how they operate, electrical loads that require UPS devices and the inter-face with traditional standby power systems.**

The designer of a generator system has to take into account the consequences of any interruption in power and if the load connected to the electrical circuit is so critical no power interruption can be tolerated. The traditional engine driven generator standby power system can take at least 10 seconds to come on line and as long as a minute before full load can be taken. In many cases this length of power outage is an irritating factor, but in some cases it can be life critical or economically serious.

**A system designer has to consider the following factors before they can select the appropriate UPS system:**

- Duration:** As stated the traditional engine driven system takes 10 seconds to start and up to a minute to carry full load. This assumes that the load is being switched through an automatic transfer switch (ATS) with a sensing system that automatically starts the standby system in the event of a power outage.  
If the backup power is not automatically transferred by an ATS the UPS System to cover a longer manual start period of the backup power could cost more than an automatic standby and smaller UPS System.
- Power:** The power required to bridge the gap between loss of main power and switching to back-up power can have a major influence on the UPS system selected. While a purely electrical UPS system may be the solution to some loads an electro-mechanical system may be required for much larger loads.
- Load:** Not all parts of a circuit's electrical load will be of a critical nature that requires a UPS system. The system designer may choose to isolate the critical areas of a circuit and only fit an UPS system to sectors of the circuit critical loads are connected to.

#### **Key principals of operation and types of UPS systems:**

As soon as a power outage occurs the UPS device has, to without interruption, provide power to the critical load. This requires the UPS device to always be connected to the circuit and have a sufficient reserve of independent power to supply the load when power is switched between the mains power and the primary back-up system.

- Power reserve:** The most commonly used form of stored electrical energy is the battery. As the utility system is AC power and batteries are DC power an UPS device using batteries has to convert DC to AC.  
Another source of energy is kinetic mechanical energy stored in a rotating flywheel. Some large UPS devices utilize the stored mechanical energy in a flywheel that continues to turn a generator while the power is interrupted.

- Connection:** A mechanical UPS system can be connected directly to the electrical circuit as another AC power source.  
An electrical UPS system using batteries for the back-up power has to be connected to the electrical circuit via an Inverter. An Inverter is a device that converts, by electronics such as thyristors, DC power to AC Power.  
Whether a mechanical or electric power system the UPS device at all times is an integral part of the protected circuit with no switching through any contacts taking place, such as with an ATS system on a standby generator set.

#### **Battery and mechanical UPS systems:**

The selection of an UPS device is a factor of economics, size and reliability. With the advancement in electronics the costs of inverters have come down considerably. Now-a-days the most common UPS devices use batteries to provide uninterrupted power when switching between primary and back-up power systems.

Mechanical systems have also taken advantage of technical advancements. While they tend to provide smaller periods of UPS power mechanical systems require less maintenance and are more environmentally friendly than battery systems.

#### **Battery/Inverter System: (see diagram one)**

In this system a bank of batteries sized to give sufficient UPS power are maintained in a fully float charged condition by a rectifier connected to the AC input. The battery's DC power is then converted by an Inverter into the required AC power of the load connected to the UPS protected part of the circuit. Below 120kW battery systems are commonly used but the costs of batteries for higher kW loads favor the selection of mechanical systems.

#### **Flywheel/Motor System: (see diagram two)**

Prior to the advances in electronics and battery technology this system was more common but is now used mainly on larger systems. A mechanical UPS system uses an electric motor driven from the AC power supply to turn a flywheel. The flywheel size is determined by the amount of kinetic energy necessary to turn the AC generator that feeds power to the UPS protected part of the electrical circuit.

**Typical applications of UPS systems:**

In the electronic world we live in relying on UPS devices has become very common place from a simple plug-in systems for your PC to the back up power needed for main frame computer systems. Examples of the application of UPS devices/systems are;

- Communications:** Phone and internet providers have installed UPS systems so that there is zero interruption between communications.
- Life support systems:** Advances in medical technology have made us more reliant on critical life support systems that have zero tolerance for power interruptions.
- Aviation support:** Critical systems for air traffic control must be assured a constant uninterrupted power supply.
- Security systems:** Constant surveillance without periods of black out.
- Data systems:** Uninterrupted power while key data is recorded, backed up and restored.

**UPS maintenance issues:**

As system is constantly connected power should be shut off in a controlled environment to ensure the UPS is operative. Batteries are a key item and should be constantly maintained as instructed by the manufacturer.

