BATTERY CHARGING SERVICE

As a supplier of rechargeable batteries and custom battery packs, **SunBest International** also offers an in-house charging service for our customers. We have standard charging equipment and can create custom programs to meet all of charging requirements.

This gives **SunBest International** the unique ability to deliver rechargeable batteries, and packs to our customers that are fully charged to their specs and can be immediately inserted into an end product.

BASIC BATTERY CHARGING METHODS

CONSTANT VOLTAGE

A constant voltage charger is basically a DC power supply which in its simplest form may consist of a step down transformer from the mains with a rectifier to provide the DC voltage to charge the battery. Such simple designs are often found in cheap car battery chargers. The lead-acid cells used for cars and backup power systems typically use constant voltage chargers. In addition, lithium-ion cells often use constant voltage systems, although these usually are more complex with added circuitry to protect both the batteries and the user safety.

CONSTANT CURRENT

Constant current chargers vary the voltage they apply to the battery to maintain a constant current flow, switching off when the voltage reaches the level of a full charge. This design is usually used for nickel-cadmium and nickel-metal hydride cells or batteries.

TAPER CURRENT

This is charging from a crude unregulated constant voltage source. It is not a controlled charge as in V Taper above. The current diminishes as the cell voltage (back emf) builds up. There is a serious danger of damaging the cells through overcharging. To avoid this the charging rate and duration should be limited. Suitable for SLA batteries only.

PULSED CHARGE

Pulsed chargers feed the charge current to the battery in pulses. The charging rate (based on the average current) can be precisely controlled by varying the width of the pulses, typically about one second. During the charging process, short rest periods of 20 to 30 milliseconds, between pulses allow the chemical actions in the battery to stabilize by equalizing

the reaction throughout the bulk of the electrode before recommencing the charge. This enables the chemical reaction to keep pace with the rate of inputting the electrical energy. It is also claimed that this method can reduce unwanted chemical reactions at the electrode surface such as gas formation, crystal growth and passivation. If required, it is also possible to sample the open circuit voltage of the battery during the rest period.

BURP CHARGING

Also called **Reflex** or **Negative Pulse Charging** Used in conjunction with pulse charging, it applies a very short discharge pulse, typically 2 to 3 times the charging current for 5 milliseconds, during the charging rest period to depolarize the cell. These pulses dislodge any gas bubbles which have built up on the electrodes during fast charging, speeding up the stabilization process and hence the overall charging process. The release and diffusion of the gas bubbles is known as "burping". Controversial claims have been made for the improvements in both the charge rate and the battery lifetime as well as for the removal of dendrites made possible by this technique. The least that can be said is that "it does not damage the battery".

IUI CHARGING

This is a recently developed charging profile used for fast charging standard flooded lead acid batteries from particular manufacturers. It is not suitable for all lead acid batteries. Initially the battery is charged at a constant (I) rate until the cell voltage reaches a preset value - normally a voltage near to that at which gassing occurs. This first part of the charging cycle is known as the bulk charge phase. When the preset voltage has been reached, the charger switches into the constant voltage (U) phase and the current drawn by the battery will gradually drop until it reaches another preset level. This second part of the cycle completes the normal charging of the battery at a slowly diminishing rate. Finally the charger switches again into the constant current mode (I) and the voltage continues to rise up to a new higher preset limit when the charger is switched off. This last phase is used to equalize the charge on the individual cells in the battery to maximize battery life.

TRICKLE CHARGE

Trickle charging is designed to compensate for the self discharge of the battery. Continuous charge. Long term constant current charging for standby use. The charge rate varies according to the frequency of discharge. Not suitable for some battery chemistries, e.g. NiMH and Lithium, which are susceptible to damage from overcharging. In some

applications the charger is designed to switch to trickle charging when the battery is fully charged.

FLOAT CHARGE

The battery and the load are permanently connected in parallel across the DC charging source and held at a constant voltage below the battery's upper voltage limit. Used for emergency power back up systems. Mainly used with lead acid batteries.

RANDOM CHARGING

All of the above applications involve controlled charge of the battery, however there are many applications where the energy to charge the battery is only available, or is delivered, in some random, uncontrolled way. This applies to automotive applications where the energy depends on the engine speed which is continuously changing. The problem is more acute in EV and HEV applications which use regenerative braking since this generates large power spikes during braking which the battery must absorb. More benign applications are in solar panel installations which can only be charged when the sun is shining. These all require special techniques to limit the charging current or voltage to levels which the battery can tolerate.