

## Battery Glossary

### **ABS**

A metal alloy (e.g., LaNi<sub>5</sub>) capable of undergoing a reversible hydrogen absorption/desorption reaction as the battery is charged and discharged, respectively. This is the most popular electrode used in nickel metal hydride batteries.

### **Absorption**

The taking up or retention of one material by another by chemical or molecular action.

### **Alkaline**

A primary battery (non-rechargeable) often used in electronics applications requiring heavy currents for long periods of time (i.e.: cd players, radios, etc.). Alkaline batteries can deliver 50-100% more total energy than conventional Carbon/Zinc batteries of the same size, hence their popularity in consumer applications.

### **Alloy**

A mixture of several other metals or a metal and a non-metal.

### **Alternator**

A type of generator used in automobiles to produce electric current.

### **Ambient Humidity**

The average humidity of the surroundings.

### **Ambient Temperature**

The average temperature of the surroundings.

### **Ampere-Hour Capacity**

The quantity of electricity measured in ampere-hours (Ah) that may be delivered by a cell or battery under specified conditions.

### **Anode**

The electrode in an electrochemical cell where oxidation takes place. During discharge, the negative electrode of the cell is the anode. During charge, the positive electrode is the anode.

### **Battery or Pack**

Two or more electrochemical cells electrically interconnected in an appropriate series/parallel arrangement to provide the required operating voltage and current levels. Under common usage, the term "battery" is often also applied to a single cell.

### **Bobbin**

A cylindrical cell design utilizing an internal cylindrical electrode and an external electrode arranged as a sleeve inside the cell container.

### **C-Rate (also see Hourly Rate)**

Discharge or charge current, in amperes, expressed in multiples of the rated capacity. For example, C/10 discharge current for a battery rated at 1.5 Ah is:  $1.5 \text{ AH} / 10 = 150 \text{ mA}$  (A cell's capacity is not the same at all discharge rates and usually increases with decreasing rate.)

### **Capacity**

The total number of ampere-hours or watt-hours that can be withdrawn from a fully charged cell or battery under specified conditions of discharge.

### **Capacity Offset**

A correction factor applied to the rating of a battery if discharged under different C-rates from the one rated.

### **Cell**

The basic electrochemical unit used to generate or store electrical energy.

### **Cell Mismatch**

Cells within a battery pack that contain different capacity and voltage levels.

### **Cell Reversal**

The stronger cells of a battery (several cells connected in series) impose a voltage of reverse polarity across a weaker cell during a deep discharge.

### **Charge**

The conversion of electrical energy, provided in the form of electrical current from an external source, to restore the chemical energy in a cell or battery.

### **Charge Control**

Technique for effectively terminating the charging of a rechargeable battery.

### **Closed-circuit Voltage(CCV)**

The potential or voltage of a battery when it is discharging or charging.

### **Condition**

A process that utilizes a series of heavy discharges and recharges on a battery to assure optimum performance.

### **Constant Current**

A battery discharge regime whereby the current drawn during the discharge Discharge remains constant.

### **Constant Power**

A battery discharge regime whereby the current during the discharge increases as the battery voltage decreases.

### **Constant Resistance**

A battery discharge regime whereby the resistance of the equipment load remains constant throughout discharge.

### **Continuous Test**

A test in which a battery is discharged to a prescribed end point voltage without interruption.

### **Coulomb**

The amount of electricity transported by a current of one ampere flowing for one second.

### **Current Collector**

An inert structure of high electrical conductivity used to conduct current from or to an electrode during discharge or charge.

### **Current Density**

The current per unit active area of the surface of an electrode.

### **Current Drain**

The current withdrawn from a battery during discharge.

**Current Limiting Chargers**

A charger that keeps the charge current constant during the charge process but allows the voltage to fluctuate (typically used on NiCd and NiMh chargers).

**Depth of Discharge (DOD)**

The ratio of the quantity of electricity (usually in ampere-hours) removed from a battery to its rated capacity.

**Desorption**

The opposite of absorption, whereby the material retained by a medium or another material is released.

**Direct Current**

Electrical current that flows in one direction only. Batteries produce direct current as the current flows from a negative to a positive source.

**Discharge**

The conversion of the chemical energy of a battery into electrical energy, and the withdrawal of the electrical energy into a load.

**Discharge Rate**

The rate, usually expressed in amperes, at which electrical current is taken from the battery.

**Drain**

The current withdrawn from a battery during discharge.

**Dry Cell**

A cell with immobilized electrolyte. The term "dry cell" is often used to describe the Leclanche cell.

**Dumb Battery**

Straight battery pack without internal circuits enabling communication between the battery and the user.

**Duty Cycle**

The operating regime of a battery including factors such as charge and discharge rates, depth of discharge, cycle duration, and length of time in the standby mode.

**E-Rate**

Discharge or charge power, in watts, expressed as a multiple of the rated capacity of a cell or battery that is expressed in watt-hours. For example, the E/10 rate for a cell or battery rated at 17.3 watt-hours is 1.73 watts. (This is similar to the method for calculating C-Rate.)

**Electric Current**

The movement of electrons along a conductor.

**Electrochemical Equivalent**

Weight of a substance that is deposited at an electrode when the quantity of electricity which is passed is one coulomb

**Electrode**

The site, area or location at which electrochemical processes take place.

**Electrolyte**

The medium which provides the ion transport mechanism between the positive and negative electrodes of a cell.

**Electron**

Negatively charged particle that orbits the nucleus of an atom.

**End Voltage Cutoff**

The prescribed voltage at which the discharge (or charge, if end-of-charge voltage) of a battery may be considered complete.

**Float Charge**

Similar to trickle charge. Compensates for the self-discharge on a Lead Acid Battery battery

**Forced Discharge**

Discharging a cell in a battery, by the other cells or an external power source, below zero volts into voltage reversal.

**Fuse**

Device used for cutting off an electrical current in the event of an abusive condition.

**Gassing**

The evolution of gas from one or more of the electrodes in a cell. Gassing commonly results from local action (self-discharge) or from the electrolysis of water in the electrolyte during charging.

**Generator**

A device that produces an electric current through magnetism.

**Gravimetric Energy**

The ratio of the energy output of a cell or battery to its weight (Wh/kg). This term is used interchangeably with specific energy.

**Ground**

To connect to the earth or some conductor which takes the place of the earth.

**Hazardous Waste**

Waste which is classified as "hazardous" (i.e.. potentially harmful to the environment) by the government.

**Hertz (Hz)**

The standard unit of frequency. A frequency of one complete cycle per second is a frequency of one hertz.

**Hourly Rate**

A discharge rate, in amperes, of a battery which will deliver the specified hours of service to a given cutoff voltage.

**Hydrometer**

A device used to measure the specific gravity of the electrolyte in a cell.

**Impedance Intermittent Test**

Used in terms of the battery's internal resistance a test during which a battery is subjected to alternate periods of discharge and rest according to a specified discharge regime.

**Internal Impedance**

The opposition exhibited by a circuit element (cell or battery) to the flow of an alternating current (a/c.) of a particular frequency as a result of resistance, induction and capacitance.

**Internal Resistance (IR)**

The opposition exhibited by a circuit element to the flow of direct current (D.C.). In a cell, the internal resistance is the sum of the ionic and electronic resistances of the cell components.

**IR Drop**

A voltage drop associated with the electrical resistance (R) of a battery or current flow (I). The voltage drop is the product of the current (in amperes) and the resistance (in ohms).

### **Limiting Current**

The maximum current drain under which the particular battery will perform adequately under a continuous drain. The rate is based on whatever drain rate reduces the running voltage to 1.1 volts.

### **Lithium**

A primary battery (non-rechargeable) that is quickly entering mainstream electronic designs, particularly in consumer, portable equipment and non-volatile memory back up applications where small size, long life and low cost are the primary requirements. Lithium batteries have superior cold temperature performance and a shelf life of 5-10 years.

### **Lithium Ion (Li Ion)**

One of the newer rechargeable battery technologies, Li Ion batteries can deliver 40% more capacity than comparably sized NiCd batteries and are one of the lightest rechargeable batteries available today. Li Ion batteries are the batteries of choice in notebook computer, wireless telephones and many camcorder models. They are also one of the more expensive rechargeable technologies.

### **Load Current**

The discharge current provided by a battery, or drawn by a battery powered device.

### **Manganese Dioxide**

A primary battery (non-rechargeable) similar to that of the alkaline battery though not as strong in total energy. Available in the same size as Alkaline and Carbon/Zinc ("AA", "AAA", "C", "D", 9volt) the Manganese Dioxide chemistry is noted for its ability to retain its charge while being stored at high temperatures and operates well at temperatures as low as -40°C with little loss of capacity.

### **Memory Effect**

A phenomenon in which a cell or battery operated in successive cycles to the same, but less than full, depth of discharge temporarily loses the rest of its capacity at normal voltage levels.

### **Metal Hydride**

An intermetallic compound or alloy in which hydrogen has been absorbed-, also, the negative electrode in a nickel-metal hydride battery.

### **Midpoint Voltage**

The voltage of a battery midway in the discharge between the start of the discharge and the end voltage.

### **Milliamps**

Refers to battery capacity. A 1/1000th of an amp, e.g.: 1.0Ah = 1000mAh.

### **Negative**

A terminal or electrode which has an excess of electrons.

### **Nickel Cadmium**

One of the most proven and historically most widely used rechargeable batteries. Very dependable and "robust" but contain cadmium and have relatively low capacity when compared to other rechargeable systems. Very good high rate discharge capabilities make them very popular in high drain applications such as power tools.

### **Nickel Metal Hydride (NiMh)**

Interchangeable with most NiCd batteries, nickel metal hydride (NiMh) batteries generally deliver 10-25% greater capacity than NiCds and are environmentally more friendly than NiCds since they do not contain cadmium. Used in many wireless phone and camcorders.

### **Nominal Voltage**

The characteristic operating voltage or rated voltage of a battery.

**Ohm**

A measure of resistance that causes one volt to produce a current of one ampere.

**Parallel**

Term used to describe the interconnection of cells or batteries in which all the like terminals are connected together. Results in increased capacity.

**Passivation**

The phenomenon by which a metal, although in conditions of thermodynamic instability, remains indefinitely unattacked because of modified or altered surface conditions.

**Polarity**

In electricity, the condition of being positive or negative.

**Polarization**

The lowering of the potential of a cell or electrode from its equilibrium value caused by the passage of an electric current.

**Positive**

A terminal or electrode which has a shortage of electrons.

**Positive Temperature**

A thermally reactive device which becomes highly resistive at a specific Coefficient (PTC) temperature or current.

**Primary Battery**

A battery which is not intended to be recharged and is discarded when the battery has delivered all of its electrical energy.

**Prismatic Cell**

The positive and negative plates are stacked rather than rolled as done in a cylindrical cell.

**Pulse Current**

A periodic current drain of higher than normal drain rates.

**Rapid Charge**

A charge time that is between slow charge and fast charge (typically 3 to 6 hours for a NiCd).

**Rated Capacity**

The number of ampere-hours a battery can deliver under specific conditions (e.g., rate of discharge, end voltage, temperature); usually specified by the battery manufacturer.

**Rechargeable Battery**

A galvanic battery which, after discharge, may be restored to the fully charged state by the passage of an electrical current through the cell in the opposite direction to that of discharge.

**Recondition**

One or more deep discharge cycles below 1.0 volt/cell at a very low, controlled current. Recondition helps to revert large crystals to small desirable sized, often restoring the battery to its full capacity.

**Resistance**

The degree to which the flow of electrons is opposed by the material the electrons must pass through. Resistance is expressed in OHMS.

**Reversal**

The changing of the normal polarity of a battery due to Overdischarge.

**Safety Vent**

A venting mechanism designed into a cell which activates under specific conditions of abuse to relieve internal pressure.

**Separator**

An ionic permeable electronically non-conductive spacer or material which prevents electronic contact between electrodes of opposite polarity in the same cell.

**Series**

The interconnection of cells in such a manner that the positive terminal of the first is connected to the negative terminal of the second, and so on, resulting in increased voltage.

**Service Life**

The period of useful life of a battery before a predetermined end-point voltage is reached.

**Shelf Life**

The duration of storage under specified conditions at the end of which the battery still retains the ability to give a specified performance.

**Short Circuit**

An unwanted electrical connection between a negative and positive source. Short circuits can damage the battery and equipment and can cause sparks or fire.

**Short-circuit Current**

The initial value of the current obtained from a battery in a circuit of negligible resistance.

**Silver/Oxide**

A primary battery (non-rechargeable) it is a major contribution to miniature power sources, and is well suited for hearing aids, instruments, photoelectric exposure devices and electronic watches. These cells are primarily made in the smaller "button" sizes.

**Slow Charge**

Typically an over-night charge lasting about 14 hours at a charge current of 0.1C. Battery does not require instant removal when fully charged.

**Smart Battery**

Battery with internal circuit enabling some communication between the battery and the user. Some batteries feature a capacity indicator only, others offer an external bus to interface with the equipment the battery power and the intelligent charger.

**Soft Cell**

A cell whose voltage rises above its defined boundaries during charging. This voltage rise may be caused by high cell impedance as a result of prolonged battery storage, very cold battery temperature or lack of electrolyte.

**Specific Energy**

The ratio of the energy output of a cell or battery to its weight (Wh/kg). This term is used interchangeably with gravimetric energy density.

**Specific Gravity**

The weight of the sulfuric acid electrolyte compared to water.

**Spiral Wound**

An electrode structure of high surface area created by winding the electrodes and separator into a spiral-wound jelly-roll configuration.

**Standby**

The use of batteries in which they are charged by an application to be ready for use if the primary power to the application fails. Also called float or backup.

**Terminal**

A device at the end of a cell or wire for making a connection to an adjoining cell or wire.

**Thermistor**

A temperature sensitive resistor usually made from specially processed oxides that are used to sense end of charge temperature rises and terminates high rate charging.

**Thermostat**

A temperature sensitive switch.

**Top-Up Charge**

A low rate charge following the main charge, designed to ensure maximum capacity.

**Trickle Charge (Float Charge)**

A charge at a low rate, balancing losses through local action and/or periodic discharge, to maintain a cell or battery in a fully charged condition.

**Voltage**

A unit of measuring electrical pressure, all batteries are rated in volts DC (Direct Current).

**Voltage Depression**

An abnormal drop in voltage below expected values during the discharge of a battery.

**Voltage Delay**

Time delay for a battery to deliver the required operating voltage after it is placed under load.

**Voltage-Keyed**

A system that incorporates a mechanical identifier on batteries and devices to ensure only batteries of the correct voltage are connected to the device.

**Voltage Regulator**

A device that regulates the output of a generator or alternator by controlling the current and voltage.

**Voltage Reversal**

The changing of the normal polarity of a battery due to overdischarge.

**Volumetric Energy Density**

The ratio of the energy output of a cell or battery to its volume (Wh/L).

**Wall-less Design**

A battery design where the structural support for the cells is formed by an open plastic framework.

**Watts**

A measurement of energy, arrived at by multiplying the voltage by the amperage.

**Watt Hours**

A common measurement of energy produced in a given amount of time, arrived at by multiplying the voltage by the amp hours.

**Zinc/Air**

A primary battery (non-rechargeable) that was commonly used for applications such as watches and hearing aids. In relation to their physical size, Zinc/Air batteries store more energy per unit of weight (in terms of 220 W h/kg) than any other primary type.