

Battery Industry Terms & Definitions

Ambient Temperature

The average temperature of the surroundings.

Ampere-Hour Capacity (Ah)

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 Management System (BMS)

Electronic circuit that maintains specific parameters during charge and discharge of high level battery packs.

Battery Pack (Battery Assembly)

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.

Button Cell

A cell that has a height smaller than its diameter, normally used in low drain applications.

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The total number of ampere-hours or watt-hours that can be withdrawn from a fully charged cell or battery under specified conditions of discharge.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

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

Capacity Retention (or Charge Retention)

The fraction of the full capacity available from a battery under specified conditions of discharge after it has been stored for a period of time.

Cathode

The electrode in an electrochemical cell where reduction takes place. During discharge, the positive electrode of the cell is the cathode. During charge in a rechargeable battery, the negative electrode is the cathode.

Cell

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

Cell Imbalance

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 Acceptance

The cell or battery pack's ability to store energy. It can be affected by temperature, charge rate and state of charge.

Charge Control

Technique for effectively terminating the charging of a rechargeable battery.

Charge Efficiency

The ratio of charge current over time and the available capacity.

Charge Rate

Current applied to a cell or battery pack to restore its capacity.

Charge Retention

Remaining capacity after a period of storage of a fully charged battery or battery pack.

Conditioning

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

Constant Current Load

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

Constant Power Load

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

Constant Resistive Load

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

Constant Current Charge

Charge method by which the charge current is constant and the voltage is allowed to rise.

Constant Voltage Charge

Charge regime that limits voltage to a pre-set value allowing variable current.

Coulomb Counting

Allows for accurate measuring of charge and discharge of smart battery packs.

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).

Cutoff Voltage

The battery voltage at which the discharge is terminated. The cutoff voltage is specified by the battery manufacturer and is generally a function of discharge rate.

Cycle

A sequence where a charged battery is discharged and recharged.

Cycle Life

The number of cycles under specified conditions that are available from a secondary battery before it fails to meet specified criteria as to performance. (Usually <80%)

Cylindrical Cell

The positive and negative plates are rolled up and placed into a cylindrical container (as opposed to stacking the plates in a prismatic cell design).

Delta V (- ΔV)

The change in voltage that is used to determine charge state of nickel based chemistries.

Depth of Discharge (DOD)

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

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.

Dumb Battery (Electronically Challenged)

A battery pack assembly without internal circuitry that enables communication between the battery and the host device.

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.

Electric Current

The movement of electrons along a conductor.

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 or battery.

Electron

Negatively charged particle that orbits the nucleus of an atom.

End Discharge Voltage (EDV)

The prescribed voltage at which the discharge of a battery may be considered complete. The EDV is cell specific and is defined by manufacturer.

Energy

The output capability of a cell or battery, usually expressed in watt-hours.

Energy Density

The ratio of the energy available from a battery to its volume (Wh/L) or weight (Wh/kg).

Fast Charge

The ability to charge a cell or battery pack at the highest possible rate. Some cells allow for higher rates than others.

Float Charge (Maintenance Charge)

Similar to trickle charge. Compensates for the self-discharge on an SLA battery.

Forced Discharge

The discharging of a cell in a battery by the other cells or an external power source.

Fuse

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

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.

Hard Pack

A Battery Pack enclosed in hard plastic case, assembled using fasteners or ultrasonic welding.

Hertz (Hz)

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

High Rate Discharge

The maximum discharge rate of a cell or battery pack within the design limits of the manufacturer.

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.

Internal Impedance

The opposition exhibited by a circuit element (cell or battery) to the flow of an alternating current (AC) 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 (DC). In a cell, the internal resistance is the sum of the ionic and electronic resistances of the cell components.

Internal Pressure

The pressure that is developed inside a sealed cell due to oxygen or hydrogen evolution.

Ion

An atom or molecule in which the total number of electrons is not equal to the total number of protons. An Ion is either positively or negatively charged.

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).

Current Limiting

The maximum current drain under which the particular battery will perform adequately under a continuous drain.

Load Current

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

Low Voltage Disconnect (LVD)

Voltage sensing device that prevents over discharging of cells by disconnecting the load.

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.

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.

Nominal Voltage

The average operating voltage or rated voltage of a battery.

Ohm

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

Open-Circuit Voltage (OCV)

The difference in potential between the terminals of a cell when the circuit is open (no-load condition).

Operating Voltage

The voltage range at which the main device operates.

Overcharge

The forcing of current through a cell after all the active material has been converted to the charged state, that is, continued charging after reaching 100 percent state-of-charge.

Over discharge

The process of discharging a cell or battery beyond its cutoff voltage and possibly into voltage reversal.

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 unattached because of modified or altered surface conditions.

Peak Voltage Detection

Charge termination based on battery or cell being charged having reached peak voltage just as overcharge begins.

Polarity

In electricity, the condition of being positive or negative.

Positive

A terminal or electrode which has a shortage of electrons.

Positive Temperature Coefficient (PTC)

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

Power (Watts)

The unit of measure based on Voltage and 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.

Printed Circuit boards (PCB)

A substrate that supports and electrically connects electronic components using conductive tracks, pads and other features etched from copper sheets.

Printed Circuit Board Assemblies (PCBA)

Completed assemblies that contain all electrical components ready for installation.

Prismatic Cell

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

Protection Circuit Module (PCM)

Circuit used to protect lithium based battery packs from abnormal conditions.

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.

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 (Ni Based Chemistry)

One or more deep discharge cycles below 1.0 volt/cell at a very low, controlled current. Reconditioning helps to revert large crystals to small, desirable-sized crystals, 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 over discharge.

Safety Vent

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

Secondary Battery

A battery that can be recharged and reused many times.

Self-Discharge

The loss of useful capacity of a battery on storage due to internal chemical action.

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 needing to be replaced.

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-circuit Current

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

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 Pack

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

Soft Pack

Battery Pack which is enclosed in shrink tubing, such as PVC, PET, Polyolefin.

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.

State of Charge

The capacity remaining in a battery.

Sulfation

Growth of lead sulfate crystals in Lead-Acid batteries which inhibits current flow. Sulfation is caused by storage at low state of charge.

Tab (Nickel 200)

Cell interconnect material used to electrically connect multiple cells together to form a Battery Pack.

Temperature Cutoff Device

A protective or safety device (e.g., thermostat, PTC, etc.) which senses temperature in a battery and opens or cuts off the electrical circuit if the specified temperature is exceeded, thus preventing a further rise in temperature due to the charge or discharge of a battery.

Terminal

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

Thermal Fuse

A one-time, non-resettable temperature activated device that disconnects the source from the load.

Thermal Runaway

The temperature at which a cell will become exothermic and will continue to heat until disassembly or discharge occurs.

Thermistor (NTC)

A temperature sensitive resistor that decreases in value of resistance as temperatures rise.

Thermostat

A temperature activated switch.

Time Charge

A charging method in which a predetermined time is used as a determination of state of charge.

Top-Off Charge

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

Trickle 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

A drop in voltage below expected values during the discharge of a battery due to discharge rate and cell IR.

Voltage Regulator

A device that regulates the output voltage to a set value.

Voltage Reversal

The changing of the normal polarity of a cell, normally due to over discharge or cell imbalance.

Volumetric Energy Density

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

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.