

New Technology Batteries Guide: A Glossary of Battery Terms

8. A Glossary of Battery Terms

- **Ampere-Hour** -- One ampere-hour is equal to a current of one ampere flowing for one hour. A unit-quantity of electricity used as a measure of the amount of electrical charge that may be obtained from a storage battery before it requires recharging.
- **Ampere-Hour Capacity** -- The number of ampere-hours which can be delivered by a storage battery on a single discharge. The ampere-hour capacity of a battery on discharge is determined by a number of factors, of which the following are the most important: final limiting voltage; quantity of electrolyte; discharge rate; density of electrolyte; design of separators; temperature, age, and life history of the battery; and number, design, and dimensions of electrodes.
- **Anode** -- In a primary or secondary cell, the metal electrode that gives up electrons to the load circuit and dissolves into the electrolyte.
- **Aqueous Batteries** -- Batteries with water-based electrolytes.
- **Available Capacity** -- The total battery capacity, usually expressed in ampere-hours or milliampere-hours that are available to perform work. This depends on factors such as the endpoint voltage, quantity and density of electrolyte, temperature, discharge rate, age, and the life history of the battery.
- **Battery** -- A device that transforms chemical energy into electric energy. The term is usually applied to a group of two or more electric cells connected together electrically. In common usage, the term "battery" is also applied to a single cell, such as a household battery.
- **Battery Types** -- There are, in general, two type of batteries: primary batteries, and secondary storage or accumulator batteries. Primary types, although sometimes consisting of the same active materials as secondary types, are constructed so that only one continuous or intermittent discharge can be obtained. Secondary types are constructed so that they may be recharged, following a partial or complete discharge, by the flow of direct current through them in a direction opposite to the current flow on discharge. By recharging after discharge, a higher state of oxidation is created at the positive plate or electrode and a lower state at the negative plate, returning the plates to approximately their original charged condition.
- **Battery Capacity** -- The electric output of a cell or battery on a service test delivered before the

cell reaches a specified final electrical condition and may be expressed in ampere-hours, watt-hours, or similar units. The capacity in watt-hours is equal to the capacity in ampere-hours multiplied by the battery voltage.

- **Battery Charger** -- A device capable of supplying electrical energy to a battery.
- **Battery-Charging Rate** -- The current expressed in amperes at which a storage battery is charged.
- **Battery Voltage, final** -- The prescribed lower-limit voltage at which battery discharge is considered complete. The cutoff or final voltage is usually chosen so that the useful capacity of the battery is realized. The cutoff voltage varies with the type of battery, the rate of discharge, the temperature, and the kind of service in which the battery is used. The term "cutoff voltage" is applied more particularly to primary batteries, and "final voltage" to storage batteries. Synonym: **Voltage, cutoff**.
- **C_i** -- The rated capacity, in ampere-hours, for a specific, constant discharge current (where *i* is the number of hours the cell can deliver this current). For example, the C₅ capacity is the ampere-hours that can be delivered by a cell at constant current in 5 hours. As a cell's capacity is not the same at all rates, C₅ is usually less than C₂₀ for the same cell.
- **Capacity** -- The quantity of electricity delivered by a battery under specified conditions, usually expressed in ampere-hours.
- **Cathode** -- In a primary or secondary cell, the electrode that, in effect, oxidizes the anode or absorbs the electrons.
- **Cell** -- An electrochemical device, composed of positive and negative plates, separator, and electrolyte, which is capable of storing electrical energy. When encased in a container and fitted with terminals, it is the basic "building block" of a battery.
- **Charge** -- Applied to a storage battery, the conversion of electric energy into chemical energy within the cell or battery. This restoration of the active materials is accomplished by maintaining a unidirectional current in the cell or battery in the opposite direction to that during discharge; a cell or battery which is said to be charged is understood to be fully charged.
- **Charge Rate** -- The current applied to a secondary cell to restore its capacity. This rate is commonly expressed as a multiple of the rated capacity of the cell. For example, the C/10 charge rate of a 500 Ah cell is expressed as,

$$C/10 \text{ rate} = 500 \text{ Ah} / 10 \text{ h} = 50 \text{ A.}$$
- **Charge, state of** -- Condition of a cell in terms of the capacity remaining in the cell.
- **Charging** -- The process of supplying electrical energy for conversion to stored chemical energy.

- **Constant-Current Charge** -- A charging process in which the current of a storage battery is maintained at a constant value. For some types of lead-acid batteries this may involve two rates called the starting and finishing rates.
- **Constant-Voltage Charge** -- A charging process in which the voltage of a storage battery at the terminals of the battery is held at a constant value.
- **Cycle** -- One sequence of charge and discharge. Deep cycling requires that all the energy to an end voltage established for each system be drained from the cell or battery on each discharge. In shallow cycling, the energy is partially drained on each discharge; *i.e.*, the energy may be any value up to 50%.
- **Cycle Life** -- For secondary rechargeable cells or batteries, the total number of charge/discharge cycles the cell can sustain before it becomes inoperative. In practice, end of life is usually considered to be reached when the cell or battery delivers approximately 80% of rated ampere-hour capacity.
- **Depth of Discharge** -- The relative amount of energy withdrawn from a battery relative to how much could be withdrawn if the battery were discharged until exhausted.
- **Discharge** -- The conversion of the chemical energy of the battery into electric energy.
- **Discharge, deep** -- Withdrawal of all electrical energy to the end-point voltage before the cell or battery is recharged.
- **Discharge, high-rate** -- Withdrawal of large currents for short intervals of time, usually at a rate that would completely discharge a cell or battery in less than one hour.
- **Discharge, low-rate** -- Withdrawal of small currents for long periods of time, usually longer than one hour.
- **Drain** -- Withdrawal of current from a cell.
- **Dry Cell** -- A primary cell in which the electrolyte is absorbed in a porous medium, or is otherwise restrained from flowing. Common practice limits the term "dry cell" to the Leclanché cell, which is the common commercial type.
- **Electrochemical Couple** -- The system of active materials within a cell that provides electrical energy storage through an electrochemical reaction.
- **Electrode** -- An electrical conductor through which an electric current enters or leaves a conducting medium, whether it be an electrolytic solution, solid, molten mass, gas, or vacuum. For electrolytic solutions, many solids, and molten masses, an electrode is an electrical conductor at the surface of which a change occurs from conduction by electrons to conduction by ions. For

gases and vacuum, the electrodes merely serve to conduct electricity to and from the medium.

- **Electrolyte** -- A chemical compound which, when fused or dissolved in certain solvents, usually water, will conduct an electric current. All electrolytes in the fused state or in solution give rise to ions which conduct the electric current.
- **Electropositivity** -- The degree to which an element in a galvanic cell will function as the positive element of the cell. An element with a large electropositivity will oxidize faster than an element with a smaller electropositivity.
- **End-of-Discharge Voltage** -- The voltage of the battery at termination of a discharge.
- **Energy** -- Output capability; expressed as capacity times voltage, or watt-hours.
- **Energy Density** -- Ratio of cell energy to weight or volume (watt-hours per pound, or watt-hours per cubic inch).
- **Float Charging** -- Method of recharging in which a secondary cell is continuously connected to a constant-voltage supply that maintains the cell in fully charged condition.
- **Galvanic Cell** -- A combination of electrodes, separated by electrolyte, that is capable of producing electrical energy by electrochemical action.
- **Gassing** -- The evolution of gas from one or both of the electrodes in a cell. Gassing commonly results from self-discharge or from the electrolysis of water in the electrolyte during charging.
- **Internal Resistance** -- The resistance to the flow of an electric current within the cell or battery.
- **Memory Effect** -- A phenomenon in which a cell, operated in successive cycles to the same, but less than full, depth of discharge, temporarily loses the remainder of its capacity at normal voltage levels (usually applies only to Ni-Cd cells).
- **Negative Terminal** -- The terminal of a battery from which electrons flow in the external circuit when the cell discharges.
- **Nonaqueous Batteries** -- Cells that do not contain water, such as those with molten salts or organic electrolytes.
- **Ohm's Law** -- The formula that describes the amount of current flowing through a circuit.
Voltage = Current \times Resistance.
- **Open Circuit** -- Condition of a battery which is neither on charge nor on discharge (*i.e.*, disconnected from a circuit).
- **Open-Circuit Voltage** -- The difference in potential between the terminals of a cell when the circuit is open (*i.e.*, a no-load condition).

- **Oxidation** -- A chemical reaction that results in the release of electrons by an electrode's active material.
- **Parallel Connection** -- The arrangement of cells in a battery made by connecting all positive terminals together and all negative terminals together, the voltage of the group being only that of one cell and the current drain through the battery being divided among the several cells. See **Series Connection**.
- **Polarity** -- Refers to the charges residing at the terminals of a battery.
- **Positive Terminal** -- The terminal of a battery toward which electrons flow through the external circuit when the cell discharges.
- **Primary Battery** -- A battery made up of primary cells. See **Primary Cell**.
- **Primary Cell** -- A cell designed to produce electric current through an electrochemical reaction that is not efficiently reversible. Hence the cell, when discharged, cannot be efficiently recharged by an electric current. Note: When the available energy drops to zero, the cell is usually discarded. Primary cells may be further classified by the types of electrolyte used.
- **Rated Capacity** -- The number of ampere-hours a cell can deliver under specific conditions (rate of discharge, end voltage, temperature); usually the manufacturer's rating.
- **Rechargeable** -- Capable of being recharged; refers to secondary cells or batteries.
- **Recombination** -- State in which the gasses normally formed within the battery cell during its operation, are recombined to form water.
- **Reduction** -- A chemical process that results in the acceptance of electrons by an electrode's active material.
- **Seal** -- The structural part of a galvanic cell that restricts the escape of solvent or electrolyte from the cell and limits the ingress of air into the cell (the air may dry out the electrolyte or interfere with the chemical reactions).
- **Secondary Battery** -- A battery made up of secondary cells. See **Storage Battery**; **Storage Cell**.
- **Self Discharge** -- Discharge that takes place while the battery is in an open-circuit condition.
- **Separator** -- The permeable membrane that allows the passage of ions, but prevents electrical contact between the anode and the cathode.
- **Series Connection** -- The arrangement of cells in a battery configured by connecting the positive terminal of each successive cell to the negative terminal of the next adjacent cell so that their voltages are cumulative. See **Parallel Connection**.

- **Shelf Life** -- For a dry cell, the period of time (measured from date of manufacture), at a storage temperature of 21°C (69°F), after which the cell retains a specified percentage (usually 90%) of its original energy content.
- **Short-Circuit Current** -- That current delivered when a cell is short-circuited (*i.e.*, the positive and negative terminals are directly connected with a low-resistance conductor).
- **Starting-Lighting-Ignition (SLI) Battery** -- A battery designed to start internal combustion engines and to power the electrical systems in automobiles when the engine is not running. SLI batteries can be used in emergency lighting situations.
- **Stationary Battery** -- A secondary battery designed for use in a fixed location.
- **Storage Battery** -- An assembly of identical cells in which the electrochemical action is reversible so that the battery may be recharged by passing a current through the cells in the opposite direction to that of discharge. While many non-storage batteries have a reversible process, only those that are economically rechargeable are classified as storage batteries. Synonym: **Accumulator**; **Secondary Battery**. See **Secondary Cell**.
- **Storage Cell** -- An electrolytic cell for the generation of electric energy in which the cell after being discharged may be restored to a charged condition by an electric current flowing in a direction opposite the flow of current when the cell discharges. Synonym: **Secondary Cell**. See **Storage Battery**.
- **Taper Charge** -- A charge regime delivering moderately high-rate charging current when the battery is at a low state of charge and tapering the current to lower rates as the battery becomes more fully charged.
- **Terminals** -- The parts of a battery to which the external electric circuit is connected.
- **Thermal Runaway** -- A condition whereby a cell on charge or discharge will destroy itself through internal heat generation caused by high overcharge or high rate of discharge or other abusive conditions.
- **Trickle Charging** -- A method of recharging in which a secondary cell is either continuously or intermittently connected to a constant-current supply that maintains the cell in fully charged condition.
- **Vent** -- A normally sealed mechanism that allows for the controlled escape of gases from within a cell.
- **Voltage, cutoff** -- Voltage at the end of useful discharge. (See **Voltage, end-point**.)
- **Voltage, end-point** -- Cell voltage below which the connected equipment will not operate or

below which operation is not recommended.

- **Voltage, nominal** -- Voltage of a fully charged cell when delivering rated current.
- **Wet Cell** -- A cell, the electrolyte of which is in liquid form and free to flow and move.

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