

# GLOSSARY OF BATTERY TERMS

This glossary of technical terms is designed to help you understand the frequently used terms within the battery industry.

## ACTIVE MATERIAL

The active electro-chemical materials used in the manufacture of positive and negative electrodes.

## ABSORBANT GLASS MAT (AGM)

Absorbent Glass Mat (AGM) is a type of lead acid battery that uses a glass mat to promote the recombination of gases produced by the charging process.

## AMBIENT TEMPERATURE

The prevailing surface temperature to which a battery is exposed.

## AMPERE

Unit of measurement for electric current.

## AMPERE-HOUR

The product of current (amperes) multiplied by time (hours). Used to indicate the capacity of a battery. Also referred to as Amp. Hr. or A.H.

## ANODE

Electrode that releases electrons on discharge. When applying power to a device, the anode is positive, when taking power away on discharge the anode turns negative.

## BATTERY

Two or more cells connected together in series or parallel. See guide on how to connect in series/parallel.

## BESS

Battery energy storage system, sometimes referred to as ESS.

## BMS

Battery Management System used inside or outside a battery to manage charge, discharge and provide SoC, SoH data. Used to protect the battery and maximize service life.

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## BLUETOOTH

Low-power radio communications up to 10 meters (30 feet). Power Sonic Lithium Bluetooth batteries utilize Bluetooth in combination with a BMS to give instant access to the status of the battery from a smart device.

## C

Used to signify a charge or discharge rate equal to the capacity of a battery divided by one hour. Thus C for a 2000 mAh battery would be 2.0 A. C/5 for the same battery would be 400 mA and C/10 would be 200 mA. More information can be

## CAPACITY

The electrical energy available from a cell or battery expressed in ampere-hours.

-**Available capacity:** ampere-hours that can be discharged from a battery based on its state of charge, rate of discharge, ambient temperature, and specified cut-off voltage.

-**Rated capacity ("C"):** the discharge capacity the manufacturer states may be obtained at a given discharge rate and temperature.

-**Capacity fade:** the loss of capacity due to inadequate recharging.

-**Capacity offset:** the correction of capacity when discharging a battery at a higher C-rate than specified.

## CATHODE

Electrode in a cell in which reduction takes place by absorbing electrons. During discharge, the cathode is positive, during charge it is reversed and becomes negative.

## CELL

The basic building block of a battery. The nominal voltage of a lead acid cell is 2 volts and a LiFePO<sub>4</sub> cell is 3.2 volts.

-**Secondary cell:** the process is reversible so that charging and discharging may be repeated over and over.

-**Cell reversal:** the act of driving a cell into reverse polarity by excessive discharge.

-**Cell mismatch:** cells in a battery pack that have unequal capacities, voltages or internal resistance values.

-**Primary cell:** cell or battery that can be discharged only once, can not be recharged for further use. Examples include alkaline manganese-Zinc.

-**Secondary cell:** the process is reversible so that charging and discharging may be repeated over and over. Examples include lead acid.

-**Cylindrical cell:** positive and negative plates are rolled up and placed into a cylindrical container. Examples include AA and 18650 cells.

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- Prismatic cell:** a battery that the positive and negative plates are stacked as opposed to rolled.
- Pouch cell:** packaged into a flexible, heat-sealable foiled pouch.
- Power cell:** cell designed for maximum current delivery, high rate of discharge.
- Energy cell:** cell designed for maximum capacity. Longer cycle life.

### CHARGE

The conversion of electrical energy to chemical energy; the process which restores electrical energy to a cell or battery. Guides available on charging a lead acid battery and charging a lithium battery.

- Charge Retention:** a battery's ability to hold a charge. It diminishes during storage.
- Charge Acceptance:** quantifies the amount of electric charge that accumulates in a battery.
- Float Charge:** maintains the capacity of a cell or battery by applying a constant voltage
- Trickle Charge:** maintains the capacity of a cell or battery by applying a small constant current.
- Charge Equalization:** brings all of the cells in a battery or string to the same state of charge.

### CLOSED CIRCUIT VOLTAGE TEST

A test method in which the battery is briefly discharged at a constant current while the voltage is measured.

### COULOMB

Unit of electric charge. One coulomb (1C) equals one ampere-second (1As).

### CUT-OFF VOLTAGE

The final voltage of a cell or battery at the end of charge or discharge.

### CYCLE

The final voltage of a cell or battery at the end of charge or discharge.

- Cycle life:** total number of cycles a battery can deliver until it reaches the end of life.

### DEEP CYCLE

A cycle in which the discharge continues until the battery reaches its cut-off voltage, usually 80% of discharge for a lead-acid battery.

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### DIRECT CURRENT (DC)

The type of electrical current that a battery can supply. One terminal is always positive and the other always negative

### DISCHARGE

The process of drawing current from a battery.

- Deep discharge:** the discharge of a cell or battery to between 80% and 100% of rated capacity.
- Depth of discharge:** (DoD): the amount of capacity, typically expressed as a percentage, removed during discharge.
- Self discharge:** the loss of capacity while stored or while battery is not in use.
- Self discharge rate:** the percentage of capacity lost on open circuit over a set period of time

### DRAIN

The withdrawal of current from a battery.

- Parasitic drain:** when power continues to be drained from a battery after the vehicle engine is off.

### ELECTRODE

Positive or negative plate containing materials capable of reacting with electrolyte to produce or accept current.

### ELECTROLYTE

Conducts ions in a cell. Lead acid batteries use a sulfuric acid solution

### END OF CHARGE VOLTAGE

The voltage reached by the cell or battery at the end of charge, while the charger is still attached.

### ENERGY DENSITY

Ratio of battery energy to volume or weight expressed in watt-hours per cubic inch/mm or pound/kilogram.

### GAS RECOMBINATION

The process by which oxygen gas generated from the positive plate during the final stage of charge is absorbed into the negative plate, preventing loss of water.

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## HIGH RATE DISCHARGE

A very rapid discharge of the battery. Normally in multiples of C (the rating of the battery expressed in amperes).

## HYDROMETER

Device used to measure the specific gravity of a fluid, reads state-of-charge of flooded lead acid batteries.

## IMPEDANCE

The resistive value of a battery to an AC current expressed in ohms ( $\Omega$ ). Generally measured at 1000 Hz at full charge.

## INTERNAL RESISTANCE

The resistance inside a battery which creates a voltage drop in proportion to the current draw.

## LITHIUM ION BATTERY

Rechargeable battery with cobalt, manganese, iron and/or other metals as cathode and graphite anode.

## NEGATIVE ANODE

The terminal of a battery from which electrons flow in the external circuit when a battery discharges.

## NOMINAL CAPACITY

The nominal value of rated capacity.

## NOMINAL VOLTAGE

The nominal value of rated voltage.

## OPEN CIRCUIT VOLTAGE

The voltage of a battery or cell when measured in a no load condition.

## OVERCHARGE

The continuous charging of a cell after it achieves 100% of capacity. Battery life is reduced by prolonged overcharging.

## PARALLEL CONNECTION

Connecting a group of batteries or cells by linking all terminals of the same polarity. This increases the capacity of the battery group.

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### **POLARITY**

The charges residing at the terminals of the battery.

### **POSITIVE TERMINAL**

The terminal of a battery toward which electrons flow through the external circuit when the cell discharges.

### **RATED CAPACITY**

The capacity of the cell expressed in amperes. Commonly, a constant current for a designated number of hours to a specified depth of discharge at room temperature.

### **RECOMBINATION**

The state in which the gasses normally formed within the battery cell during its operation are recombined to form water.

### **SERIES CONNECTION**

The connection of a group of cells or batteries by linking terminals of opposite polarity. This increases the voltage of the battery group.

### **SELF DISCHARGE**

The loss of capacity of a battery while in stored or unused condition without external drain.

### **SEPERATOR**

Material isolating positive from negative plates. In sealed lead acid batteries it normally is absorbent glass fiber to hold the electrolyte in suspension.

### **SLA BATTERY**

Sealed lead-acid battery, generally having the following characteristics: Maintenance-free and leak-proof. Batteries of this type have a safety vent to release gas in case of excessive internal pressure build-up. Hence also the term: Valve regulated battery or VRLA. Gel batteries are SLA batteries whose dilute sulfuric acid electrolyte is immobilized by way of additives which turn the electrolyte into a gel.

### **SERVICE LIFE**

The expected life of a battery expressed in the number of total cycles or years of standby service to a designated remaining percentage of original capacity.

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### SHELF LIFE

The maximum period of time a battery can be stored without top up charging.

### STANDBY SERVICE

An application in which the battery is maintained in a fully charged condition by trickle or float charging.

### STATE OF CHARGE (SOC)

The available capacity of a battery at a given time expressed as a percentage of rated capacity.

-**Absolute state of charge (ASoC)**: ability to take specified charge when the battery is new.

### STATE OF HEALTH (SOH)

Reflects battery performance that verifies capacity, current delivery, voltage and self-discharge; measured as a percentage.

### SULFATION

The formation or deposit of lead sulfate on the surface and in the pores of the active material of the batteries' lead plates. If the sulfation becomes excessive and forms large crystals on the plates the battery will not operate efficiently and may not work at all.

### VALVE REGULATED LEAD ACID (VRLA) BATTERY

See 'SLA Battery'

### WATT

Unit of power; ampere (A) times volt (V) equals watts (W).

### WATT-HOUR

Unit of electrical energy equivalent to a power consumption of one watt for one hour. Multiplying a battery voltage (V) by the rated capacity (Ah) gives the battery energy in Wh.

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