



EV Battery Glossary

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A

[Ampere](#)

AGM

[Absorbed Glass Mat](#)

Ah

[Amp-hour](#)

Absorbed (or absorptive) Glass Mat

A technique for sealed lead-acid batteries. The electrolyte is absorbed in a matrix of glass fibers, which holds the electrolyte next to the plate, and immobilizes it preventing spills. AGM batteries tend to have good power characteristics, low internal resistance, and good behavior during charging.

Amp, Ampere

Unit of electrical current. Abbreviated "A"

Amp-hour

Unit of electrical energy, one amp of current flowing for one hour. Abbreviated Ah

Anode

The negative [electrode](#) of a battery (or other device).

Automotive post

A battery terminal style found on starting batteries in internal-combustion vehicles. A round post made of lead. See [terminal styles](#) for comparison.

BCI

Battery council international. Promoters of battery standards, notably the "[Group sizes](#)" which specify the external dimensions of a battery. See also the [group size chart](#). They have a minimal [web page](#).

C20, C6, C1, etc

An expression describing rate of discharge. The number indicates the number of hours to completely discharge the battery at a constant current. So C/20 is the current draw at which the battery will last for 20 hours, C/1 is the current at which the battery will last 1 hour. The useful capacity of a battery changes depending on the discharge rate, so battery capacities are stated with respect to a particular rate. For instance, a particular model of [Hawker](#) battery is rated at 42 [amp-hours](#) at the C/10 rate of 4.2amps, but only 30 Ah at the C/1 rate of 30A. Also written as the [20-hour rate](#), 1-hour rate, etc.

CCA

[Cold Cranking Amps](#)

Cathode

The positive [electrode](#) of a battery (or other device).

Cold Cranking Amps

A performance rating for automobile starting batteries. It is defined as the current that the battery can deliver for 30 seconds and maintain a terminal voltage greater than or equal to 1.20 volts per cell, at 0degrees Fahrenheit (-18Celsius), when the battery is new and fully charged. Starting batteries may

also be rated for Cranking Amps, which is the same thing but at a temperature of 32F (0C).

Cycle Life

How many charge/discharge cycles the battery can endure before it loses its ability to hold a useful charge. Cycle life typically depends on the [depth of discharge](#). For example, if a hypothetical battery pack will propel your car for a maximum range of 100 miles, and you drive 50 miles between charges, (50% [DOD](#)) then you may get 600 trips before replacing the pack; but if you drove 80 miles between charges, you might only get 400 trips before the pack wears out. (All numbers were made up.)

DOD

[Depth of Discharge](#).

Depth of Discharge

The amount of energy that has been removed from a battery (or battery pack). Usually expressed as a percentage of the total capacity of the battery. For example, 50% depth of discharge means that half of the energy in the battery has been used. 80% DOD means that eighty percent of the energy has been discharged, so the battery now holds only 20% of its full charge.

ECD

[Energy Conversion Devices](#)

Electrode

A conductor by which electrical current enters or leaves a non-metallic medium, such as the electrolyte in a battery (as well as vacuum tubes and lots of other devices).

Electrolyte

An electrically conductive medium, in which current flow is due to the movement of ions. In a lead-acid battery, the electrolyte is a solution of sulfuric acid. In other batteries, the electrolyte may be very different.

ElectroSource

Makers of "[Horizon](#)" advanced lead-acid batteries. They have a [web site](#).

Energy Conversion Devices

Parent company of [Ovonics](#).

Energy Density

The amount of energy that can be contained in a specific quantity of the fuel source. Typically quoted in watt-hours per pound, wh/lb, or watt-hours per kilogram, wh/kg. For example, flooded lead-acid batteries generally have about 25 wh/kg, the latest advanced lead-acid designs claim about 50 wh/kg, and newer battery technologies such as NiMH and LiON are in the 80-135 wh/kg range.

Flooded cell

A design for lead-acid batteries. The [electrolyte](#) is an ordinary liquid solution of acid. Flooded cells are prone to making gas while being charged. Flooded cells must be periodically checked for fluid level and water added as necessary. Flooded cells are also typically less expensive than [AGM](#) or [gel](#) type lead-acid batteries.

Fuel Cell

A battery where reactants are supplied to the cell from an external source. The most commonly cited example is the hydrogen fuel cell, in which hydrogen and oxygen are combined, producing electric current and water.

GNB

GNB Industrial Battery company, maker of lead-acid batteries.

Gel Cell

A technique for sealed lead-acid batteries. The electrolyte solution is in a gel form, usually silica gel, instead of plain liquid.

Genesis

Brand of advanced lead-acid battery made by [Hawker Energy Products](#).

Group size

A set of standard sizes for the external dimensions of a battery, standardized by [BCI](#). All "group 27", etc, batteries are the same size, though they may differ in weight and capacity. We have a [chart](#) of the group sizes most likely to be found in a car.

Hp

[Horsepower](#)

Hawker

Manufacturer of "[Genesis](#)" advanced lead-acid batteries. They have a [web site](#).

Horizon

Brand of advanced lead-acid batteries made by [ElectroSource](#). (also apparently the name of a stationary power supply system made by Exide.) The plates in a Horizon battery are arranged horizontally, instead of the more common vertical arrangement, hence the name. Horizon batteries have very high energy density for lead-acid batteries, but are not general available at retail.

Horsepower

Unit of rate of doing work. Defined as 550 foot-pounds per second. One horsepower is about 746 [watts](#). (A horsepower has also been defined as the amount of power needed to drag a dead horse 500 feet in 1 second, but this was not accepted by the international standards community.)

Hydrometer

A tool for testing the specific-gravity of a fluid, such as the electrolyte in a flooded battery. Typically a squeeze-bulb is used to suck up a sample of the fluid, and a float indicates the specific gravity.

Hygrometer

A tool for measuring the humidity of the air. It is not unheard-of for people to say "hygrometer" when they mean "[hydrometer](#)".

Immobilized Electrolyte

A technique for lead-acid batteries. The electrolyte (the acid) is held in place against the plates instead of being a free-flowing liquid. The two most common techniques are [gel](#) and [glass mat](#).

Kilowatt

One thousand [watts](#). Equivalent to about 1.34 [horsepower](#).

L-Post

A style of battery terminal, shaped like an L, with a flat vertical part to which the cable is bolted. See [terminal styles](#) for comparison.

Lead-acid

A technique for rechargeable batteries. [Electrodes](#) of lead oxide and metallic lead are separated by an [electrolyte](#) of sulfuric acid.

LiON, LiIon

Lithium ion. A technique for rechargeable batteries. Instead of using metallic lithium as the anode, lithium ions are added to a carbon electrode.

Lithium

A light metal, atomic number 3. Used in advanced rechargeable batteries.

Lithium Polymer

A technique for rechargeable batteries. The lithium anode is separated from the cathode by a thin polymer electrolyte.

NiMH

[Nickel Metal Hydride](#)

Nicad

[Nickel Cadmium](#). (historical note, Nicad is/was a registered trademark, but has effectively passed into the public domain, like aspirin.)

Nickel Cadmium

"Old" rechargeable battery technology. For many years, rechargeable dry cell meant nickel-cadmium. Recently, newer technologies such as nickel-metal hydride have mostly replaced nicad, since they have better energy characteristics and don't contain toxic cadmium. The battery has a nickel-hydroxide [cathode](#), a cadmium [anode](#), and aqueous potassium hydroxide [electrolyte](#). [Saft](#) is a leading manufacturer of nickel-cadmium batteries for EV applications.

Nickel Metal Hydride

A technique for making rechargeable batteries. NiMH batteries are common in laptop computers and cellular phones. The battery is similar to nickel-cadmium but uses an [anode](#) of a metal hydride; a variety of metal alloys are used.

Optima

Manufacturer of sealed lead-acid batteries: the [Red Top](#) and [Yellow Top](#). They have a [web site](#).

Ovonics

Division of Energy Conversion Devices, makes [nickel metal-hydride](#) batteries. They have a [web site](#).

Peukert's equation

A formula that shows how the available capacity of a lead-acid battery changes according to the rate of discharge. The capacity of a battery is expressed in [Amp-Hours](#), but it turns out that the simple formula of current times hours doesn't accurately represent the situation. Peukert found that the equation:

$$C = I^n T$$

fits the observed behavior of batteries. "C" is the theoretical capacity of the battery, "I" is the current, "T" is time, and "n" is the [Peukert number](#), a constant for the given battery. The equation captures the fact that at higher currents, there is less available energy in the battery.

Peukert number

A value that indicates how well a lead-acid battery performs under heavy currents. The Peukert number is the exponent in [Peukert's equation](#). A value close to 1 indicates that the battery performs well; the higher the number, the more capacity is lost when the battery is discharged at high currents. The Peukert number of a battery is determined empirically. For Peukert numbers for typical EV batteries, see [Uve W. Rick's Battery Page](#).

Power-Sonic

Maker of lead-acid batteries.

Red Top

A sealed battery made by [Optima](#), so-called because of the color of its case, it is not the official product name. The red top is a starting battery, sometimes used in racing applications. It is not designed as a [traction battery](#)

Reserve Capacity

A performance rating for automobile starting batteries. It is the number of minutes at which the battery can be discharged at 25 Amps and maintain a terminal voltage higher than 1.75 volts per cell, on a new, fully charged battery at 80degrees Fahrenheit(27C).

SG

[Specific Gravity](#). A specific gravity of 1.300 is sometimes written as 1300SG, multiplying by 1000 to avoid the use of fractional parts.

SLI battery

Starting, Lighting, and Ignition battery, a battery designed for use in a conventional gasoline automobile. An SLI battery is designed to give a lot of current during starting, but then to be recharged

immediately by the car's alternator. Deeply discharging an SLI battery will greatly shorten its life. SLI batteries are sometimes used in electric vehicles, especially for racing, but are generally not considered suitable because of their short [cycle life](#).

SOC

[State of Charge](#)

Saft

Manufacturer of [Nickel-Cadmium](#), [Nickel-Metal Hydride](#), and [Lithium Ion](#) batteries. [Web Site](#)

See Also

Lead Industry Associates <http://www.leadinfo.com/USES/battery.html>

Delco's battery glossary: <http://www.apaa.org/delco/glossary.html>

Uve W. Rick's [battery page](#)

Mike Thompson's [battery information page](#)

[SAFT AG](#)

Specific Gravity

The density of a material, expressed as the ratio of the mass of a given volume of the material and the mass of the same volume of water; a specific gravity greater than 1 means heavier than water, less than 1 means lighter than water. The specific gravity of the [electrolyte](#) in a battery can be used to measure the state of charge of the battery.

Spiral-Wound

A particular design for the electrodes in a lead-acid battery. Instead of having the electrodes as flat plates, the electrodes are rolled up in a spiral, like a cinnamon roll. The [Optima](#) is an example of a spiral-wound battery.

State of Charge

The amount of electrical charge in the battery, expressed as a percentage of the difference between the fully-charged and fully-discharged states.

Starved Electrolyte

A technique for "maintenance free" lead-acid batteries. These batteries are less prone to gassing, so they don't require frequent checking and addition of water. "Starved" because the battery contains just enough electrolyte to provide the necessary chemical reaction, as opposed to the older "flooded" arrangement which contains considerably more electrolyte than needed to make the rated amp-hour capacity.

Terminal styles

Lead-acid batteries are made with several different styles for the posts that connect to the cables. The most common styles are



"Automotive" -- the round post familiar on starting batteries in gas-powered cars. The cable lug fits around the terminal.



"Universal" -- Like an automotive post, with an extra stud in the center of the post. The cable lug fits over the stud and a nut holds them together



"L" -- A flat tang with a hole through it. A bolt through the hole connects the terminal to the cable lug.

There is considerable difference of opinion as to which style is "best".

Traction Battery

A battery designed to be used to provide the power to move a vehicle, e.g. to be used in an electric car.

Trojan

Manufacturer of flooded cell traction batteries. Popular and (relatively) inexpensive, Trojans seem to be the default choice for converters.

Universal post

A style of battery terminal, with a round post similar to the automotive post, but with a threaded stud in the center of the post. See [terminal styles](#) for comparison.

VRLA

[Valve-Regulated](#) Lead Acid

Valve Regulated

A technique for making lead-acid batteries. Instead of simple vent caps on the cells to let gas escape, VRLA have pressure valves that open only under extreme conditions. Valve-regulated batteries also need an electrolyte design that reduces gassing, usually involving a catalyst that causes the hydrogen and oxygen to recombine into water.

W

[Watt](#)

Wh

[Watt-hour](#)

wh/kg

[Watt-hours](#) per kilogram, unit of [energy density](#).

wh/lb

[Watt-hours](#) per pound, unit of [energy density](#).

Watt

Unit of electricity, the rate at which work is done. The equation is Watts = Volts x Amps. One watt is equivalent to about 0.00134 [horsepower](#).

Watt-hour

Unit of electrical energy, or work. 1 watt expended continuously for 1 hour equals 1 watt-hour

Yellow Top

A sealed battery manufactured by [Optima](#), so-called because of the color of the case, it is not the official product name. The Yellow Top is designed to be a [traction battery](#). A relative newcomer to the market, the yellow top is popular in some circles because it can deliver high currents, providing good acceleration.

X-hour rate

The discharge rate of a battery is usually quoted in the number of hours that the battery will last at that current. So at the 6-hour rate, the battery can produce current for 6 hours. Same as [C6](#).

Model designations

T105

A 6-volt flooded lead-acid battery from Trojan.

T125

A 6-volt flooded lead-acid battery from Trojan

T145

A 6-volt flooded lead-acid battery from Trojan

SCS225

A 12-volt flooded lead-acid battery from Trojan

5SHP

A 12-volt flooded lead-acid battery from Trojan

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■ Last Modified: October 17, 1999; maintained by [Jon Mauney](#), Send comments, corrections, additions to teaa@rtpnet.org

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