What is a battery?
A battery, can be any device that stores energy for later use. The word battery, is limited to an electrochemical device that converts chemical energy into electricity, by use of a galvanic cell. A galvanic cell is a fairly simple device consisting of two electrodes (an anode and a cathode) and an electrolyte solution. Batteries consist of one or more galvanic cells.

A battery is an electrical storage device. Batteries do not make electricity, they store it. As chemicals in the battery change, electrical energy is stored or released. In rechargeable batteries this process can be repeated many times. Batteries are not 100% efficient - some energy is lost as heat and chemical reactions when charging and discharging. If you use 1000 watts from a battery, it might take 1200 watts or more to fully recharge it. Slower charging and discharging rates are more efficient. A battery rated at 180 amp-hours over 6 hours might be rated at 220 AH at the 20-hour rate, and 260 AH at the 48-hour rate. Typical efficiency in a lead-acid battery is 85-95%, in alkaline and Ni-Cd battery it is about 65%.

What is sulfation of batteries?
Sulfation is 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. Common causes of battery sulfation are standing a long time in a discharged condition, operating at excessive temperatures, and prolonged under or over charging.

What are some of the major types of lead acid batteries?
Batteries are divided in two ways, by application (what they are used for) and construction (how they are built). The major applications are automotive, marine, and deep-cycle. Deep-cycle includes solar electric (PV), backup power, and RV and boat "house" batteries. The major construction types are flooded (wet), gelled, and AGM (Absorbed Glass Mat). AGM batteries are also sometimes called "starved electrolyte" or "dry", because the fiberglass mat is only 95% saturated with Sulfuric acid and there is no excess liquid. Flooded may be standard, with removable caps, or the so-called "maintenance free" (that means they are designed to die one week after the warranty runs out). All gelled are sealed and a few are "valve regulated", which means that a tiny valve keeps a slight positive pressure. Nearly all AGM batteries are sealed valve regulated (commonly referred to as "VRLA" - Valve Regulated Lead-Acid). Most valve regulated are under some pressure - 1 to 4 psi at sea level.**(Return to Top)**

How long will my battery last?
The life span of a battery will vary considerably with how it is used, how it is maintained and charged, temperature, and other factors.

How to connect a battery in Series?
The positive terminal of the first battery is connected to the negative terminal of the second battery, the positive terminal of the second is connected to the negative of the third, etc. The voltage of the assembled battery is the sum of the battery voltages of the individual batteries. So the batteries are connected: + to - to + to - to + to -, etc. The capacity of the battery is unchanged.

What is a Starting battery?
Starting batteries (sometimes called SLI, for starting, lighting, ignition) are commonly used to start and run engines. Engine starters need a very large starting current for a very short time. Starting batteries have a large number of thin plates for maximum surface area. The plates are composed of a Lead "sponge", similar in appearance to a very fine foam sponge. This gives a very large surface area, but if deep cycled, this sponge will quickly be consumed and fall to the bottom of the cells. Automotive batteries will generally fail after 30-150 deep cycles if deep cycled, while they may last for thousands of cycles in normal starting use (2-5% discharge).**(Return to Top)**

What is a Deep Cycle Battery?
Deep cycle batteries are designed to be discharged down as much as 80% time after time, and have much thicker plates that a standard automotive battery.

What is a marine battery?
Marine batteries are considered a "hybrid" battery which actually fall between the starting and deep-cycle batteries. Marine batteries are usually rated using "MCA" or Marine cranking amps which is rated 32 degrees F, while CCA is at zero degree F. (For more information on CCA, CA & MCA, please see below)

What is a Sealed Maintenance Free Battery?
Sealed batteries are known as maintenance free batteries. They are made with vents that (usually) cannot be removed. A standard auto or marine maintenance free battery is sealed, but not fully leak proof. Sealed batteries are not totally sealed since all batteries must allow gas to vent during charging. There are sealed lead acid (SLA) batteries that are non-spillable. Please information on our SLA batteries, see AGM and Gel batteries below.

What is a AGM or Absorbed Glass Mat Battery?
The newer type of sealed nonspillable maintenance free valve regulated battery uses "Absorbed Glass Mats", or AGM separators between the plates. This is a very fine fiber Boron-Silicate glass mat. These type of batteries have all the advantages of gelled, but can take much more abuse. These are also called "starved electrolyte." Just like the Gel batteries, the AGM Battery will not leak acid if broken.

What are the advantages of the AGM battery?
The advantages of AGM batteries are no maintenance, sealed against fumes, hydrogen, leakage, or non-spilling even if they are broken, and can survive most freezes. AGM batteries are "recombinant" - which means the Oxygen and Hydrogen recombine inside the battery. These use gas phase transfer of oxygen to the negative plates to recombine them back into water while charging and prevent the loss of water through electrolysis. The recombining is typically 99+% efficient, so almost no water is lost. Charging voltages for most AGM batteries are the same as for a standard type battery so there is no need for special charging adjustments or problems with incompatible chargers or charge controls. Since the internal resistance is extremely low, there is almost no heating of the battery even under heavy charge and discharge currents. AGM batteries have a very low self-discharge rate (from 1% to 3% per month). So they can sit in storage for much longer periods without charging. The plates in AGM's are tightly packed and rigidly mounted, and will withstand shock and vibration better than any standard battery.

What is a Gel Cell Battery?
A gel battery design is typically a modification of the standard lead acid automotive or marine battery. A gelling agent is added to the electrolyte to reduce movement inside the battery case. Many gel batteries also use one way valves in place of open vents, this helps the normal internal gasses to recombine back into water in the battery, reducing gassing. "Gel Cell" batteries are non-spillable even if they are broken. Gel cells must be charged at a lower voltage (C/20) than flooded or AGM to prevent excess gas from damaging the cells. Fast charging them on a conventional automotive charger may be permanently damage a Gel Battery.

What is the Reserve Capacity rating (RC)?
The reserve capacity of a battery is defined as the number of minutes that it can support a 25 ampere load at 80°F until its terminal voltage drops to 1.75 volts per cell or 10.50 volts for a 12V battery. Thus a 12V battery that has a reserve capacity rating of 100 signifies that it can be discharged at 25 amps for 100 minutes at 80°F before its voltage drops to 10.75 volts.

What is the CCA rating?
The cold cranking ampere (CCA) rating refers to the number of amperes a battery can support for 30 seconds at a temperature of 0°F until the battery voltage drops to 1.20 volts per cell, or 7.20 volts for a 12V battery. Thus, a 12V battery that carries a rating of 600 CCA tells us that the battery will provide 600 amperes for 30 seconds at 0°F before the voltage falls to 7.20V.

What is the marine cranking rating (MCA)?
The marine cranking ampere (MCA) rating refers to the number of amperes a battery can support for 30 seconds at a temperature of 32°F until the battery voltage drops to 1.20 volts per cell, or 7.20 volts for a 12V battery. Thus, a 12V battery that carries a MCA rating of 600 CCA tells us that the battery will provide 600 amperes for 30 seconds at 32°F before the voltage falls to 7.20V. Note that the MCA is sometimes referred to as the cranking amperes or CA.

What is the difference between MCA and CCA?
The marine cranking ampere (MCA) rating of a battery is very similar to the CCA rating; the only difference is that while the CCA is measured at a temperature of 0°F, the MCA is measured at 32°F. All other requirements are the same - the ampere draw is for 30 seconds and the end of discharge voltage in both cases is 1.20 volts per cell.

What is HCA rating?
The full form of HCA is hot cranking amperes. It is the same thing as the MCA or the CA or the CCA, except that the temperature at which the test is conducted is 80°F.

What is the pulse cranking amp rating (PCA)?
Unlike CCA and MCA the pulse cranking ampere (PCA) rating does not have an "official" definition; however, we believe that for true engine start purposes, a 30 second discharge is unrealistic. With that in mind, the PCA is a very short duration (typically about 3 seconds) high rate discharge. Because the discharge is for such a short time, it is more like a pulse.

What is the Amp Hour (Ah) rating?
An amp-hour is one amp for one hour, or 10 amps for 1/10 of an hour and so forth. It is amps X hours. If you have something that pulls 20 amps, and you use it for 20 minutes, then the amp-hours used would be 20 (amps) X .333 (hours), or 6.67 AH. The accepted AH rating time period for batteries used in solar electric and backup power systems (and for nearly all deep cycle batteries) is the "20 hour rate". This means that it is discharged down to 10.5 volts over a 20 hour period while the total actual amp-hours it supplies is measured. Sometimes ratings at the 6 hour rate and 100 hour rate are also given for comparison and for different applications. The 6-hour rate is often used for industrial batteries, as that is a typical daily duty cycle. Sometimes the 100 hour rate is given just to make the battery look better than it really is, but it is also useful for figuring battery capacity for long-term backup amp-hour requirements.

What is a MilliAmp Hour (MAH)?
MilliAmp Hour means how much current a battery will discharge over a period of one hour. Higher numbers here reflect a long battery runtime and or higher storage capacity. Higher MAH ratings do not necessarily reflect on speed but more on runtime. For example a 2000 mAh pack will sustain a 2000 milli amp (2 amp) draw for one hour before dropping to a voltage level that is considered discharged. A 1700 will sustain a 1700 mAh (1.7 amp) draw for one hour. 1000 mAH is equal to a 1 Amp Hour (AH) rating.

What is Electrolyte?
In a lead-acid battery, the electrolyte is sulfuric acid diluted with water. It is a conductor that supplies water and sulfate for the electrochemical reaction:

What is the proper electrolyte level?
Liquid levels should be 1/8 inch below the bottom of the vent well (the plastic tube that extends into the battery). The electrolyte level should not drop below the top of the plates.

Do you ever add acid to my battery?
Under normal operating conditions, you never need to add acid. For a standard auto or marine battery, only distilled, deionized or approved water should be added to achieve the recommended levels mentioned above. When a battery is shipped in a dry state or accidental spillage occurs, electrolyte should be added to the battery. Once filled, a battery should only need periodic water addition.

Can batteries freeze?
In a partially discharged state, the electrolyte in a lead acid battery may freeze. At a 40% state of charge, electrolyte will freeze if the temperature reaches approximately 16.0°F. The freezing temperature of the electrolyte in a fully charged battery is -92.0°F.

How can a standard automotive or marine battery's state of charge be accurately measured?
The state of charge of a lead acid battery is most accurately determined by measuring the specific gravity of the electrolyte. This is done with a hydrometer. Battery voltage also indicates the level of charge when measured in an open circuit condition. This should be done with a voltmeter. For an accurate voltage reading, the battery should also be allowed to rest for a period sufficient to let the voltage stabilize.

Do batteries self-discharge when not in use?
All batteries, regardless of their chemistry, self-discharge. The rate of self-discharge depends both on the type of battery and the storage temperature the batteries are exposed to. However, for a good estimate, Trojan batteries self-discharge approximately 4% per week at 80°F.

Is there a maximum temperature for charging lead acid batteries?
When charging lead acid batteries, the temperature should not exceed 120°F. At this point the battery should be taken off charge and allowed to cool before resuming the charge process.

Are lead acid batteries recyclable?
Lead acid batteries are 100% recyclable. Lead is the most recycled metal in the world today. The plastic containers and covers of old batteries are neutralized, reground and used in the manufacture of new battery cases. The electrolyte can be processed for recycled waste water uses. In some cases, the electrolyte is cleaned and reprocessed and sold as battery grade electrolyte. In other instances, the sulfate content is removed as Ammonia Sulfate and used in fertilizers. The separators are often used as a fuel source for the recycling process.

Where do I recycle my old batteries?
Old batteries may be returned to the battery retailer, automotive service station, a battery manufacturer or other .

How do I Jump Start my Battery using booster cables?
WARNING-BATTERIES PRODUCE EXPLOSIVE GASES. These instructions are designed to minimize the explosion hazard. Keep sparks, flames and cigarettes away from batteries at all times. Both batteries should be of the same voltage (6, 12, etc.).

SAFE BOOSTER CABLE OPERATION When jump starting, always wear proper eye protection and never lean over the battery. Do not jump start a damaged battery; inspect both batteries before connecting booster cables. Be sure vent caps are tight and level. Be sure that the vehicles are not touching and that both ignition switches are in the "OFF" position. Turn off all electrical equipment (radio, defroster, windshield wipers, lights, etc.)

The following steps should be followed exactly.

1. Connect positive (+) booster cable to positive (+) terminal of discharged battery.
2. Connect other end of positive (+) cable to positive (+) terminal of assisting battery.
3. Connect negative (-) cable to negative (-) terminal of assisting battery.
4. Make final connection of negative (-) cable to engine block of stalled vehicle, away from battery and carburetor.
5. Be sure that cables are clear of fan blades, belts and other moving parts of both engines.
6. Start vehicle and remove cables in REVERSE order of connections.