A primer on ATV batteries

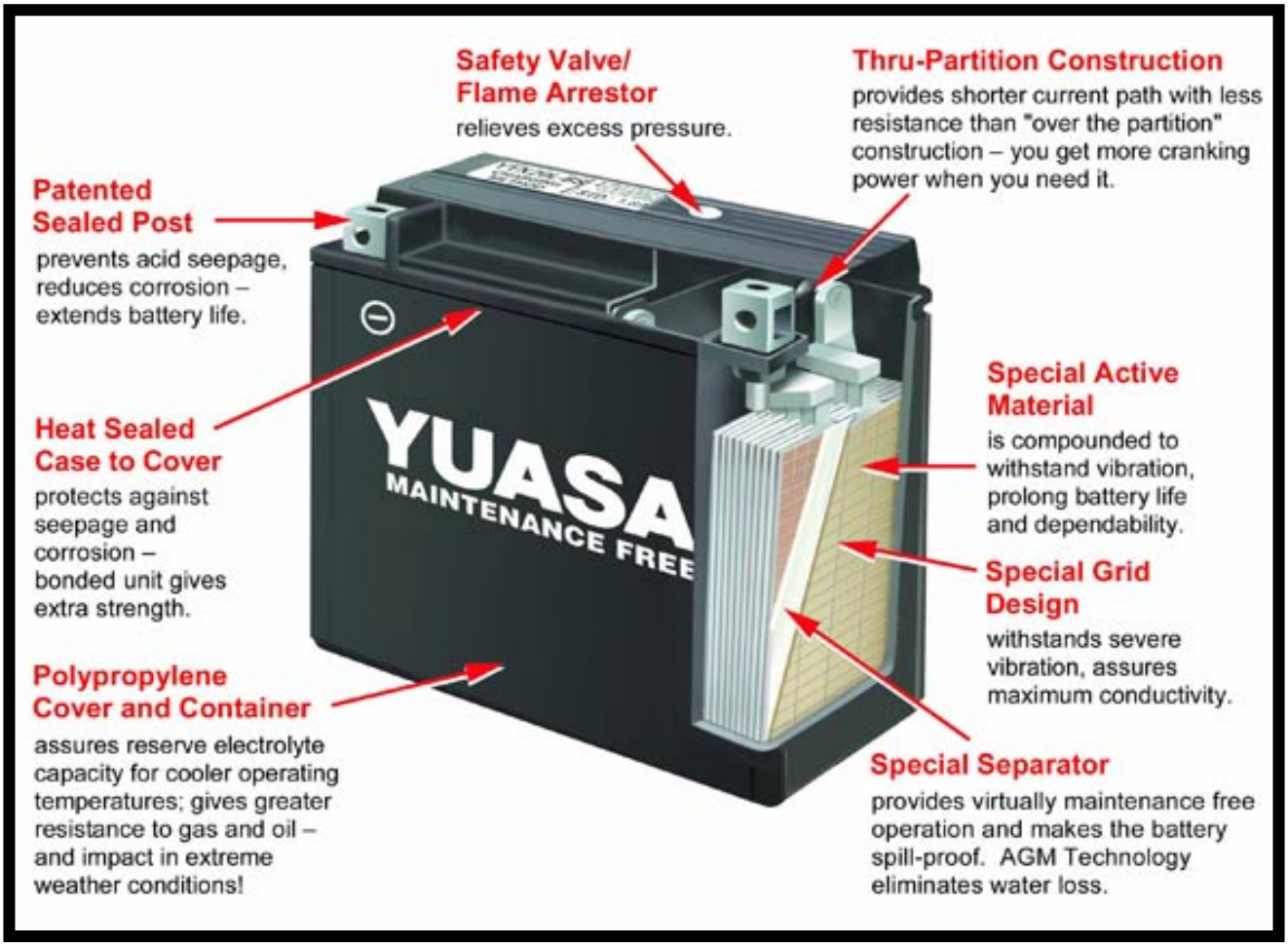
Date 2008/12/19 9:14:09 | **Topic:** General Tips

Relationship between the Charging System and the Battery

As with many electrical technologies, the relationship between the battery and charging system are a little fuzzy in the minds of many consumers. And if the truth be told, even service technicians sometimes have a hard time separating the two. The battery and charging system are directly related, but actually each has it's own purpose. The charging system on an ATV needs to support all of the high duty-cycle (frequent, long-term) electrical loads AND keep the battery charged as well. Examples of high duty-cycle loads are: Cooling fans, headlights, and accessories such as sprayers that draw a lot of power and are on for long periods. The battery alone cannot support high duty-cycle loads because in most cases an ATV battery's energy storage capacity (measured in Amp-Hours) is actually pretty low. Batteries with low amp-hour capacities are used on ATVs to reduce weight, for easier packaging, and to reduce cost. The "so what" of this is if the loads on the electrical system exceed the charging system capacity, even a large battery will go dead, sooner or later. The battery is meant to handle low duty-cycle, high current electrical demands like starting the engine and winching. In other words, the battery on most ATVs is built to deliver a lot of "juice" for a short time. Batteries also stabilize the voltage on the DC power bus, helping all components to operate without malfunctioning.

A battery is most properly viewed as being an energy storage tank that needs to be topped off on a daily basis. In most cases the ATV charging system will perform this operation, but in some cases the operator must take responsibility for charging the battery. As will be explained shortly, when in doubt, use a battery maintainer or tender when you park your quad, and leave it on until the battery is re-charged.**There are really only 2 Battery types on ATVs**

The terms “Gel Cell”, “Sealed”, “Maintenance-free”, etc. are often used when comparing battery types. The fact is there are two basic types of battery technology in use on ATVs today—conventional (also known as flooded) and AGM—short for Absorbed Glass Mat. All other terminology are simply different ways to describe these battery types. Conventional battery technology is just that. It has been around for many, many years. AGM batteries are a little newer. They were pioneered on Honda powersports vehicles in the early 1980s (with an expensive learning curve) but have since become by far the prevailing battery technology on motorcycles, ATVs, snowmobiles, and personal watercraft. The innovative “spiral” cell batteries from Hawker and now Johnson Controls are just a different way to implement an AGM battery. Here is a brief comparison between the 2 battery types (See Fig A and B):



AGM Battery Design Courtesy Yuasa Corp.

Characteristic	Conventional	AGM
Other common names:	Flooded	Sealed, Gel Cell*, VRLA, Maintenance-Free, Recombinant
Specific Gravity of Electrolyte (at 77F)	1.265	1.310
At-rest fully-charged voltage (no loads)**	12.6-12.8	12.8-13.1
Filler cap type	Removable	Permanently installed

Typical Housing Colors	Natural, White	Black, Grey
Needs distilled water refills?	Yes	No
Use bulk acid to activate?	Yes	No. Use pre-measured electrolyte container.
Can be installed at an angle or on it's side?	Never	Sometimes (if activated properly)
Has a vent hose?	Yes (On ATVs, not autos)	No
*There is a separate Gel-cell design, but it is not used on any ATVs **After 24 hours at rest to allow "surface charge" to dissipate.		

Almost 100% of the time, when people talk about sealed, Gel-Cell or maintenance-free batteries from any manufacturer on a powersports vehicle, they are actually talking about AGM technology. Absorbed Glass Mat refers to the battery's design in which all of the electrolyte (acid) is absorbed into fiberglass-pads that are pressed between the positive and negative plates. There is no loose acid in a properly-activated AGM battery. Conventional batteries must have extra acid above all of the negative and positive plates. Dry plate surfaces become damaged and that is one reason why conventional batteries must be topped off with distilled water as needed. AGM batteries are not vented to atmosphere so they do not dry out with normal use. One thing that should be noted is that while the basic technology is the same regardless of manufacturer, there are varying levels of quality from manufacturer to manufacturer. The familiar names in lead-acid batteries do have a longer track record of quality than many of the newcomers do.

AGM batteries have several advantages over Conventional batteries. They will have much higher cranking capacity for the same weight than a Conventional battery will. They do not need to have distilled water added, ever. They can be installed at an angle—but ONLY, ONLY if they have been perfectly activated. They generally have a higher amp-hour rating for the same weight than a Conventional battery will. Lastly, they do not have a vent hose to deal with because vapors are contained and re-combined into the electrolyte as part of the design.

The disadvantages of an AGM battery are that they are very sensitive to how well they are initially activated, they cost more, and the misnomer "maintenance-free" often misleads people to think they do not need to be concerned with charging them. An AGM battery needs to be kept properly charged every bit as much as a flooded battery does, and they require more complex equipment to both activate and charge them than a Conventional battery does.

Initial Activation of New Batteries is Critical

Here's a tip for the next time you buy an ATV. Tell the dealer that before you take ownership of the ATV you want the new battery to be trickle charged for at least 8-10 hours at between 1 and 3 amps (depending on battery size) on a charger designed specifically for powersports vehicle batteries—not a car battery charger. If the dealer makes comments like "The quad can charge the battery. Just take it out for a drive when you get it home" or "The battery is charged when you pour new acid into it" or "We use a rapid-charger, it'll only take an hour and the battery will be ready" tell the dealer you are not satisfied with his answer and insist on a proper trickle charge on a "smart" charger before the battery is ever put into service.

Tests indicate that a battery can lose *substantial* capacity, permanently, if it is not properly activated. You will miss that capacity if you ever have to start your ATV on a cold day to plow snow or when you are winching your way across a long swamp. Time must be allowed for the electrolyte to soak into the fiberglass matting thoroughly before a charging voltage is applied. In addition, both proper voltage and current must be administered for the battery to be properly activated. That is why a "smart" or programmable charger designed for AGM batteries must be utilized for the initial charge. Models I recommend include the Christie chargers that have been mandated to Honda's dealers and Tecmate models that are mandated

at some Yamaha dealerships. These chargers have all been developed specifically for AGM battery technologies. They will charge the battery at the right current and voltage if they are utilized correctly by the technician who is doing the set-up. Low-current battery tenders, typically in the 900 mA range, are not adequate for the initial activation of the battery. They are fine for maintaining the battery once it is in service.

The best dealerships constantly anticipate which batteries are going to be installed in their ATVs and keep a supply of batteries charging at all times. AGM batteries that are put on a smart trickle charger can be charged for months, as needed, with no damage to them. An advantage of the Christie and Tecmate chargers is that they have a de-sulfating feature that really works. A battery that has discharged and sulfated can usually be brought back to at least 90% of its original capacity after it has been put on a de-sulfating charge cycle.

What is sulfation and de-sulfation?

Without getting too technical, sulfation is a permanent, hard coating of lead sulfate on the battery plates. Areas of the plates that are covered with hard sulfate become useless. It is similar to cholesterol slowly clogging the arteries near one's heart—you often don't know there's a problem until it's too late. As sulfation builds up, the batteries capacity shrinks. It is like a gas tank getting smaller and smaller. When enough of the lead plates are covered with sulfate, the battery will no longer be able to store, and therefore, release enough current to turn over the engine.

Complex battery chargers are available that can apply a de-sulfating voltage cycle to the battery. These chargers are expensive and usually only purchased by dealerships. It takes a higher than normal voltage to break down the sulfate and re-combine the sulfur ions back into the electrolyte as acid. When the process begins to work, as evidenced by increased current flow, the charger gradually backs the voltage down to a normal level. Chargers are purpose-built to perform the de-sulfating process and they work very well. No amateur should attempt any homemade process to de-sulfate a battery because of the risk of explosion. Battery acid will permanently damage eyes and breathing passages.

Most Common Mistakes With Batteries

Many people have come to assume that their quad, or snowmobile, or motorcycle will need a new battery every year or 2. However, any modern power sports battery should last a minimum of 4 seasons and possibly as many as 7 with some basic care. One fact to be aware of is that in most cases battery damage accumulates and almost never corrects itself. Here are some of the most common mistakes made with batteries:

#1 Parking the ATV without being sure the battery is charged.

Once again—permanent, measurable damage (called sulfation) can occur in as little as 1 week if the battery is left uncharged. Sulfation accumulates and never reverses unless a de-sulfating charge is applied to the battery. If the battery is damaged enough times—presto! One morning you will not be able to start your ATV! Battery damage varying from minor to total failure can occur if the ATV has been operated in the following ways:

1. The lights (including brake and tail) were on for a length of time without the engine running.
2. Plowing snow.
3. Using a sprayer attachment on the ATV.
4. Doing lots of winch work, whether getting across a swamp or for utility purposes such as building hunting stands.
5. Parking the ATV with key-power on.

#2 Storing the ATV with the battery installed

It is best to disconnect the battery on any powersports vehicle if it is going to be stored or parked for longer than a month. Nearly every modern ATV has something called **quiescent current draw** that puts a continual, low-current draw on the electrical system. This draw will kill a battery in a matter of months, or even weeks in some cases. Sometimes on an older ATV the wiring insulation may break down enough to accelerate this process. The negative battery cable should always be the one disconnected so that you cannot short-circuit to your wrench to the frame of the ATV. If the ATV is going to be parked for more than a month, take your fully-charged battery off of the ATV completely and store it in a cool, dark place.

#3 Using tap water to fill conventional batteries

It really is true that you shouldn't use tap water to "top off" a conventional battery. This is because of minerals in the tap water. Ever heard of e-coating? It uses electrical current to deposit molecules of paint. A similar process occurs in a battery if there are minerals present in the electrolyte. As current flows through the battery the iron molecules from your tap water get built up into a little formation that looks like a stalagmite in a cave. When this spike is long enough to short a positive and negative plate together, your battery life will be finished. In addition, minerals can build up in the bottom of the battery like scale in the bottom of a toilet tank. When the mineral scale in the bottom of the battery shorts a positive and negative plate together, the battery will never work properly again. Unless you like buying a new battery every year, use distilled water to top off the battery electrolyte.

#4 Using a car battery charger to charge an AGM battery

The weight and size of the battery are not an issue on cars like it is on an ATV, so AGM technology is not very common in the automotive world. Therefore chargers made for car batteries are not designed for the AGM battery on your quad. You should use a charger and/or maintainer specifically made for AGM technology if your ATV is equipped with this type of battery. AGM batteries have a higher specific-gravity acid, and need a higher voltage to charge them than car batteries do. Also—some car battery chargers will not taper or "trickle" down the current as the battery charges. This will cause the battery to lose electrolyte by evaporating it through the safety valve. Since you do not and should not add water to an AGM battery, the electrolyte that the car charger cooks off is gone forever, with a resulting loss in battery capacity. Battery tenders made for AGM batteries have come down in price. Buy and use a 900 milliamp battery tender and you should save your self the cost of it several times over by prolonging your battery life. Good brands for this type of tender are—Yuasa, Midtronics and Battery Tender.

#5 Thinking that "Sealed" means "Maintenance Free"

A car battery called "maintenance-free" can be treated as such. No battery on an ATV should ever be considered maintenance-free. Because of the fact that ATVs have weaker charging systems than cars, and are left parked for months at a time (unlike most cars) a sealed battery will usually require some maintenance charging. The same is true for the other power toys in your garage from boats to motorcycles.

The Future Of Batteries

In many other industries, the future of batteries is already here. New vehicle powerplants have created a need for new types of energy storage. For example Nickel-Metal Hydride and Lithium-ion batteries are in use on hybrid electric automobiles. Hybrids use an ICE (internal combustion engine) plus

electric motors. Either one is utilized to move the vehicle depending on which one is most efficient for the operating conditions. The electric motors require enormous power to move the vehicle or perform any other "by-wire" functions. More energy can be stored in a battery at a high voltage than a low one, so new batteries were developed that meet this need.

Fuel cell vehicles do not utilize a traditional gasoline ICE. They also require energy storage beyond traditional lead-acid designs. In the automotive world consumers are willing to pay more for the so-called "green" technology these advanced platforms are based upon. The same is not true in the powersports world. It will probably be some time before new battery technologies migrate to ATVs because of their exorbitant cost. ATVs still use gasoline ICEs and operate on traditional 12-volt systems where advanced energy storage is not mandated. Advanced powerplants haven't yet made it into the powersports world—but people are dreaming of it as evidenced by the Peugeot Quark concept:

This incredibly cool quad has a hydrogen fuel cell (at least in theory), but could cost more than a new pickup truck! In truth, the Quark is meant more as a homologated (street-legal) "quad-bike" than a mud conqueror. It will not be easy for the ATV industry to migrate to fuel cells or hybrid drivetrains. Potentially every single electrical component on the quad would need to be re-developed to operate at higher voltages to truly eliminate the need for a 12 volt, lead-acid battery. For example, nearly all headlight bulbs developed to date were made to work at 12 volts. Bulbs operating at higher voltages would require different materials, and there is not yet enough sales volume to bring the costs down. It's not as easy to get rid of 12-volt systems (and lead-acid batteries) as you might think, even in the automotive world. That is why the automotive transition to 42-volt systems has been so slow.

Another component that will be replacing some lead-acid batteries on powersports vehicles in the near future is the ultracapacitor. Ultracapacitors are very lightweight and can deliver enormous amounts of power for a short time. Ultracaps can be used to start internal combustion engines. Ultracaps do not have enough energy, however, for winching or other extended, high current-draw operations. They are also exorbitantly expensive. Thus ultracaps will probably not be capable of completely replacing lead-acid batteries.

Conclusion

The lead-acid battery is an optimized, mature design that has filled a need on ATVs very well. To paraphrase Winston Churchill—It's the worst form of energy storage there is, except for all the others. Lead-acid batteries have their strengths and weaknesses, but will probably be a necessity on ATVs as a source of electrical system stability and electric-start power for some time to come.

Submitted by Gary Gustafson http://www.atvnation.com The URL for this article is:
http://www.atvnation.com/modules/AMS/article.php?storyid=435