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Useful information regarding 12v Batteries including AGM, GEL and Charging

AGM battery technology continuous to develop and offers a number of benefits over other sealed battery technologies. AGM technology has become the latest phase in advancement of the new start stop generation of vehicles. It makes a great deep cycle sealed battery for both starting and house applications for marine use, recreational vehicles and renewable. This new generation technology delivers increased safety, performance, and service life over all other existing sealed battery types, including gel technology.

In AGM sealed batteries, the electrolyte is absorbed between the plates and suspended by a very fine fiberglass mat containing only enough liquid to keep the fine fiberglass mat wet with the electrolyte. Because the glass mat absorbs and immobilises the electrolyte, keeping the electrolyte available to the plates it allows a faster reaction between the electrolyte and plate material. Another advantage is if the battery should get broken no free liquid is available to leak out.

The AGM battery has an extremely low internal electrical resistance. This, combined with faster acid migration, allows the AGM batteries to deliver and absorb higher rates of amperage than other sealed batteries during discharging and charging. In addition, AGM technology batteries can be charged at normal lead-acid regulated charging voltages, therefore, it is not necessary to recalibrate charging systems or purchase special chargers.

Sometimes AGM Batteries are incorrectly identified as GEL Batteries, the reason for this is both batteries have similar traits; such as being non spill and deep cycle, they may be mounted in any position (but not upside down) they both offer low self-discharge and are safe for use in limited ventilation areas, and may be transported via Air or Ground safely without special handling.

AGM is preferred when a high burst of amps is required (such as the latest start stop technology). The life expectancy measured as cycle life or years remains excellent in most AGM batteries if the batteries are not discharged more than 60% between recharge.

Gel batteries are usually a bit more costly, they contain a silica type gel that the battery electrolyte is suspended in, this thick paste like material allows electrons to flow between plates and will not leak from the battery if broken. Works well in slow discharge rates and slightly higher ambient operating temperatures. GEL Batteries must be recharged correctly or the battery will suffer premature failure. The battery charger being used to recharge the battery(s) must be designed or adjustable for GEL Batteries. If you are using an alternator to recharge a true Gel Battery a special regulator must be installed.

Decide what type of battery or batteries you will be charging, MF Sealed (Maintenance Free), Wet Cell (flooded), AGM (absorbed glass mat), Gel Cell or VRLA (valve regulated lead acid). In most cases one charger will work for all types except for Gel Cell.

Selecting the correct charger?

What size is your battery? How many Amp hours does your battery store? As an example, a typical full size auto battery is about 100 amp hours, and it would take a 20 amp charger approximately 6 hours to recharge it if the battery was totally flat. Another example, a Marine Deep Cycle Battery may be rated at 100 amp hours, so it would take a 10 amp charger about 11 hours to recharge a flat battery to near 100% full charge, from a completely discharged condition.

To calculate your total charge time, a good rule of thumb is to take the amp hour rating of the battery and divide by the charger rating (amps) and then add about 10% for the extra time to totally top off the battery.

Some people need to size the charger for quick recharge, therefore requiring more amps. Others are not in a hurry and may select a smaller charger. The most important thing here is to make sure you have enough charger power to do the job you require in the time you allocate.

Know your preferred outcome. Some people require a charger to keep the motorcycle, classic car, charged during the off season, in this a case a simple low current charger will work fine. Others require a fast and powerful charger to quickly restore a battery or battery set.

There are certainly other factors in selecting a battery charger, and it would be difficult to cover them all, but here a few. Input voltage, Exposure to elements, Automatic, i.e. would you benefit from a waterproof charger? Perhaps you will need a charger that doubles as a power supply for a RV or some other application. Often people will need to charge multiple batteries simultaneously, so multiple bank chargers may be needed.

Charging is intended to regenerate the active materials sulphuric acid (H_2SO_4), lead (Pb) and lead oxide (PbO_2) from the lead sulphate ($PbSO_4$) formed during discharging. That's right – lead sulphate is the same material that causes the problem known as sulphating. Thus, lead sulphate is necessary in the entire process. It is when lead sulphate crystals grow large that problems arise.

A charging curve or a charging algorithm to be more exact describes how the battery obtains its energy during the entire charging procedure. DIN standard 41773 provides guidelines for how this type of algorithm must be structured. But, most critical is knowledge of how a battery must be treated to ensure the best condition possible, aiming for the longest service life and highest capacity. There is no universal method that solves all problems optimally. The battery itself can be manufactured a number of different ways. It is also necessary to consider the battery and the way it is used together. Because of this, the number of algorithms is huge. There is a huge difference between a modern, multistage primary switched battery charger and a linear transformer charger, which is the type found at car accessory companies and discount markets.

A couple of interesting details from the curve:

Even though the battery charger is marked with a high Ampere rating, this is usually measured with a battery that is down at 5-6V. A more realistic figure is 75% of the marked current strength. But, this drops quickly when the battery voltage rises.

The primary switch mode battery charger may lag behind at first when it comes to how much energy it provides to the battery, but it quickly catches up.

The linear battery charger has trouble filling the battery, even though it is at high voltage. At that point, the battery charger provides a lot more heat than current and not much more charging in the battery.

A battery charger that cannot provide constant voltage cannot charge the battery completely. It instead comes up to the range when the battery gases and loses fluid. A rule of thumb is that 80% of charging is obtained during the first phase. All simple, regulated battery chargers go down to a lower voltage after reaching 14.4V, but it can then take weeks to obtain the final 20% of charging.

The most important property of a battery charger is that it reaches the exact voltage during the charging cycle. If voltage is too high, the battery boils.

The battery becomes unusable due to dried-out cells and crevice corrosion, which occur due to high acid concentration and overheating during charging. If voltage is too low, you end up with an incompletely charged battery that will lose more and more capacity until it gradually becomes unusable.

Flooded Vented:

This is the traditional engine start, tractor and deep cycle style battery. The liquid electrolyte is free to move in the cell compartment. The user has access to the individual cells and can add distilled water as the battery dries out. Popular uses are engine starting and deep cycle designs.

Typical absorption charge voltage range 14.4 to 14.8 volts, typical float voltage range 13.2 to 13.8 volts, typical equalization voltage range 15.5 volts.

Flooded Sealed:

This term can refer to a number of different constructions, including only a slight modification to the flooded vented style. In that case, even though the user does not have access to the cell compartments, the internal structure is still basically the same as a flooded vented battery. The only difference is that the manufacturer has ensured that a sufficient amount of electrolyte is in the battery to sustain the chemical reaction under normal use throughout the battery warranty period. Other types of lead acid batteries are also sealed, as explained below. Very popular uses are engine start and limited starting/deep cycle applications.

Typical absorption voltage range 14.2 to 14.7 volts, typical float voltage range 13.2 to 13.8 volts.

AGM:

The Absorbed Glass Matt construction allows the electrolyte to be suspended in close proximity with the plates active material. In theory, this enhances both the discharge and recharge efficiency. Actually, the AGM batteries are a variant of Sealed VRLA batteries, just a more advanced design. Popular usage includes high performance engine starting, power sports, deep cycle, solar and storage battery.

Typical absorption voltage range 14.4 to 14.7 volts, typical float voltage range 13.2 to 13.8 volts.

GEL:

The electrolyte in a GEL cell has a silica additive that causes it to set up or stiffen. The recharge voltages on this type of cell are lower than the other styles of lead acid battery. This is probably the most sensitive cell in terms of adverse reactions to over-voltage charging. Gel Batteries are best used in VERY DEEP cycle application and may last a bit longer in hot weather applications. If the incorrect battery charger is used on a Gel Cell battery poor performance and premature failure is certain. Battery chargers with gel profile will have information either on the unit, or in the manual, about gel compatibility.

Typical absorption voltage range 14.1 to 14.4 volts, typical float voltage range 13.4 to 13.8 volts.

All above recommendation are a guide and should be confirmed with battery manufacturers' specifications.