EAGLE EYE
TECHNICAL NOTE

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EAGLE EYE POWER SOLUTIONS

Comparison of VRLA Battery Technologies.

Gel Cells versus AGM

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Introduction.

These type of batteries should never be referred to as “sealed” or “maintenance-free” batteries because they are neither.

- They are not sealed because they have a pressure-relief valve which will open if the battery’s internal pressure rises above a preset safe recombinant level.
- They are not maintenance-free. The IEEE requires them to have as much periodic maintenance as Vented Lead-Acid (VLA) flooded batteries.

Definitions.

The Absorbed Glass Mat (AGM) technology is also sometimes referred to as “Absorbed Electrolyte”, “Immobilized Electrolyte” or “Starved Electrolyte.” They derive the name from the methodology used to immobilize the liquid dilute sulfuric acid electrolyte. A micro porous (sponge-like) glass mat separator is used to absorb all of the electrolyte so that there is no free liquid electrolyte.

The Gel Cell is so-called because the liquid electrolyte is immobilized by adding a gelling agent, usually silica.

In both cases:

- They use an immobilized electrolyte design.
- The immobilized electrolyte design prevents acid spills due to damaged containers.

- The use a recombinant technology forces the oxygen and hydrogen gases produced during charging to recombine into water within the battery container.
- With some limitations, they can be used in any orientation.
- They can be transported by ground or air without special handling requirements.
- They are fully recyclable.

The gel cell battery is mainly used in outdoor and temperature sensitive locations where it is claimed they performed better than AGM. They were also considered to be a better deep cycling battery. However, recent advances in AGM designs have improved their deep cycling capabilities. See comments below.

Some hyperbole has been built up in the broadband industry around the Gel Cell, and with many operators considering it the only way to go, it has become the de facto battery of choice for broadband applications. Today, this is not necessarily the case. See comments below

Gel Cell Advantages and Benefits.

- Good at dissipating heat because gel has good contact with container walls.
- Can be better for deep discharge. There is usually more electrolyte available.
- Slightly lower float voltage.
- Less chance of electrolyte stratification.
- Less chance of electrolyte “seepage” from damaged container.
- Dry-out (loss of electrolyte through venting) is usually slower over time than AGM.
- Gelled electrolyte maintains a better ionic contact with the plates, maintaining performance.

- The potential of thermal runaway is lower.
- Possibly better at handling badly filtered chargers.

AGM Advantages and Benefits.

- Higher energy density. About 14% more Ah per square inch.
- Lighter per Ah. Approx. 13% less weight
- Lower cost per Ampere-hour than Gel. Approx. 25%
- More consistent operation. Gel can develop voids that adhere to the plates causing loss of performance.
- Better for short duration discharges.
- Reaches full capacity quicker than Gel.
- Higher charge efficiency than Gel. (Less power used.)
- Better high current battery.
- Will accept a higher charging voltage than Gel.
- Wider charge voltage window than Gel.
- Better life cycle performance. See below.
- Lower internal resistance than Gel.
- More accurate information with Ohmic measurements compared to Gel.

Comments by other sources.

“One big issue with Gel Batteries that must be addressed is the charge profile. Gel Cell 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 Cell Batteries.” Source: Batterystuff.com

“Basically, an AGM can do anything a Gel-cell can, only better. However, since they are also sealed, charging has to be controlled carefully or they too can be ruined in short order.” Source: Vonwentzel.net

“Gelled electrolyte battery designs are generally quite old and few engineering options are left to improve them. Gel electrolyte is highly viscous and during charge and discharge the gel can develop voids (pockets) or cracks when the amperage is increased. These pockets impede acid flow and result in the loss of battery capacity.”

Source: BD Batteries.

“Due to the physical properties of the gelled electrolyte, gel battery power declines faster than an AGM battery’s as the temperature drops below 0°C. AGM batteries excel for high current, high power applications and in extremely cold environments.”

Source: EMROL BVBA

“These AGM deep cycle batteries are more forgiving in overcharge conditions than their gel counterparts, and its ability to recombine the hydrogen and oxygen gases back into water is more efficient, recombination rates tested better than 99%.” Source: BD Battery.

“Concorde Battery Corporation has had years of experience manufacturing quality gelled electrolyte batteries trade named “Gel Power®” before developing the AGM battery technology for Lifeline & Sun Xtender® Series batteries. This puts them in the unique position of understanding gel’s inherent limitations.” Source: Concord Battery.

It is estimated by a recognized telecommunications industry professional that Gels can dissipate heat better than AGM but it is only a few degrees of difference. This person goes on to say that the real killer of AGM batteries in outdoor broadband cabinets is the high ripple current imposed on the battery by

poorly filtered chargers and back feed from the inverters. Gels used with well regulated and filtered chargers will last slightly longer in hot locations, but in normal environments their life is very similar to AGM.

Summary.

There have been some very good research papers written regarding the benefits of Gel versus AGM, in particular Tubular Gel and Hybrid Gel/AGM, but there does not seem to be any significant works on the benefits of the latest generation of AGM versus Gel. It is this author's opinion that the gap has closed between Gel and AGM technologies over the past 20 years so much so that it is questionable, given the higher cost and space requirements, if there is any immediate benefit of Gel over AGM. There has been a lot of development and advances with tubular Gel batteries, especially in Europe, and these seem to have some good advantages over AGM, but the price differential is wider than with flat plate Gel.

There are some hybrid Gel/AGM batteries being produced that combine the best features of each technology. These are basically the same volume as the traditional AGM, but the price is higher.