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White Paper

How to Select Lead Acid Battery for your Usage

Electricity has played an important role in the development of any country, from securing financial institutions to factory automation. The most common problem with electrical energy is that it can hardly be stored for future use. Batteries were introduced to overcome this problem of electricity and ensured power supply whenever needed.

Lead acid batteries have been the most common type of battery, widely used today worldwide, but what kind of battery will be an ideal choice in different circumstances, still creates confusion among users. In this whitepaper we will try to describe the problems, usage and various applications so that you can choose the best battery type according to your requirement.

> It's important to use the right kind of battery for the defined purpose so that the end user gets the maximum benefit from the batteries.
>
> If the product is not used for the intended application then it's performance may degrade over time. In this Whitepaper we will help users select the right type of battery as per their usage.

Types of Batteries covered in this Whitepaper

- **Flooded Tubular Battery**
- **Absorbed Glass Mat Battery**
- **Gel Battery**

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Flooded Tubular battery

For many years, flooded lead-acid batteries have been the norm in the domestic and solar industry. As the name suggests, this kind of battery is designed in tube form, and that is why we call this as tubular battery. It is a flooded type battery, consisting of liquid electrolyte which acts as a medium for ionic transfer. This type of battery is basically used in inverter application. They are the most cost-effective and lasts longer than any other lead-acid batteries. Flooded lead-acid batteries have an electrolyte that is free to rotate in battery encasement. Electricity is stored when the battery acid and lead plates reacts. These batteries are meant to be mounted upright in order to avoid electrolyte from leaking out of the cap at the top. Since sealed batteries are well sealed, you can mount them in any orientation without fear of leaking. While this is the most economical battery on the market, it will reach its potential lifespan only when maintained correctly. Checking the levels quarterly and topping it up with distilled water will ensure the longest lifespan. Eastman's batteries are specially designed, and undergoes various tests in order to ensure that these batteries remain spill proof. This is an unique ability of our batteries to avoid spills.

Absorbed Glass Mat Battery (AGM)

Absorbent glass mat batteries are the most popular kind of VRLA batteries, because it can work in wide range of conditions. The battery working ethic is that hydrogen and oxygen are recombined within the battery, then being

Different Batteries Type

Tall Tubular Conventional Battery

Tall Tubular Maintenance Free Battery

Short Tubular Maintenance Free Battery

T-Gel Battery

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vented. A vent valve is placed in the battery to remove excess gases in condition of over charge. The electrolyte is suspended in a thin fiberglass mat that lies between the lead plates and the sponge form of glass mat, which also helps in supporting the plates.

This makes the battery resistant to vibration. It can also be mounted in any orientation, commonly seen mounted on their sides for convenient placement and wiring. They also can charge and discharge at high rates and do perform well at low temperatures. It becomes necessary to take care that the AGM batteries not to over charge.

Drying out the battery can be a very serious issue because of overcharge, as such batteries are more expensive and don't last as long as flooded lead acid batteries. But you get an added benefit with added cost, such batteries don't require as much maintenance and doesn't release much gas during charging. Such batteries are ideal for mobile applications or where leaked acid would be problematic, harsh weather conditions and where regular maintenance is not possible.

Gel Battery

The basic construction of this battery is the same as the flooded tubular type battery. But in actual it works on the principle of VRLA battery. We can also say that it is combo of both flooded or VRLA battery. Because it works like a VRLA battery and construct like a flooded tubular battery, but uses different lead alloys and separators. The electrolyte is immobilized in a silica-based gel, which offers capability to withstand higher temperature and doesn't release the hydrogen during normal operation. Gel batteries are costly then VRLA batteries, but excellent for projects that need a very slow deep discharge rate. Gel Batteries lasts a bit longer in tougher temperatures, so you might pick them if you are concerned about high or low ambient temperatures in the space where the batteries are enclosed. Eastman Tubular Gel batteries have a higher lifecycle as compared with AGM VRLA batteries and can operate in wide temperature range. Gel Batteries provides excellent performance on cyclic application then AGM VRLA batteries.

What is included in a battery and what are its features:

In this section we will try to decode - what are the different elements in batteries and how are they useful, which will in turn help you understand it's overall structure.

- **Tubular Plates**

As the name suggests the positive plate is designed in Tube form whereas the Negative plate in Grid pasted design, to allow accumulation of more active material compared to other plate technologies. It is a flooded type battery in which we have a liquid electrolyte which acts as a medium for iconic transfers. Series of woven fiber tubes are fitted over the spines, these are then filled with a mixture of lead oxide and red lead powder by vibration.

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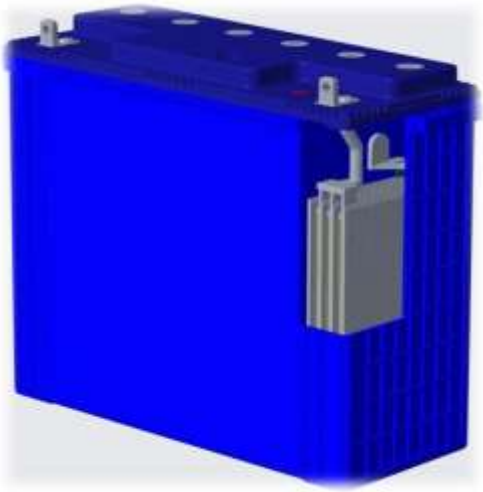
After it's done, the tubes are then sealed by plastic fittings onto the ends followed by "pickled" process in which it's soaked in dilute sulphuric acid to convert lead oxides into lead sulfates.

The final product we get is tubes filled with lead sulfate and a center core of lead to carry the current.

Construction of the Battery



- **Electrolyte**

The electrolyte is a crucial component of the cell. Often it's the only medium for electrode reactions and ionic conductivity and doesn't appear within the cell reactions but sometimes as in lead-acid batteries, it's also a component of the cell reaction. A interaction, however, between the electrolyte and the active material usually can't be prevented and sometimes influences aging of the battery.

- **Water Loss**

In Flooded lead acid batteries water is lost during normal working as a result of evaporation and electrolysis into hydrogen and oxygen.

- **Self-Discharge**

Batteries have a typical phenomenon during which the inside chemical reactions reduce the stored charge of the battery without having any connection between the electrodes or any external circuit. Self-discharge is additionally thought to be reduced, as a passivation layer develops on the electrodes over time. How quickly a battery self-discharge? It always depends on temperature, battery gets self-discharged much quicker during summers. This will be a crucial constraint if batteries needs to be stored for long periods of time.

- **Water Top**

Flooded batteries require regular water replacement to still perform effectively. If we maintain the system of regular top up of battery, it can achieve the battery life by twice of its specified life. If regular maintenance cycles to add water are impractical, such as in remote, unstaffed installations, then one of the Gel batteries & VRLA batteries are more desirable. *Note- even that these batteries don't require watering, periodic cleaning and re-torqueing of connections is still required*.

- **Plastic Material (PPCP)**

The polypropylene-polyethylene copolymer has the ideal properties that make it the best material for battery cover and container. Polypropylene containers are molded with thin partitions and thin walls. Due to the addition of available acid volume it makes possible for getting higher capacities for given sizes or new compact battery designs.

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BATTERY TECHNOLOGY

Conventional

This is the traditional style battery. The liquid electrolyte is liberal to move within the cell compartment. The user has access to the individual cells and may add water because the battery dries out. It is basically used for power backup, UPS, inverter & float applications

VRLA

This stands for Valve Regulated Lead Acid battery. This is also a sealed battery. The valve regulating mechanism allows for a secure escape of hydrogen and oxygen gasses during charging.

Gel

It is also a type of VRLA battery. Eastman manufacture Tubular gel battery which is combination of Flooded and VRLA technology. Manufacturing of this battery is same as of flooded battery but it works on the principle of VRLA technology.

1. Discharge Current

We claim that our batteries discharge at 2mV/day. OCV decay allows battery to hold charge for longer duration of time and quick charge with charger.

2. Charging Setting

Flooded lead acid batteries need a higher amount of overcharge than VRLA types to avoid a harmful effect known as stratification, so this can extend FLA charge times. However, charge time is more dependent upon the depth of discharge and the size (power) of the charger being used.

3. Operating Temperature

The Flooded lead acid batteries can be used for a wide range of temperature. "-20 Degrees to +55 Degrees"

4. Spillage

We claim that our batteries are spill proof. No spillage of Acid under 90 degree tilt for at least 45 Minute.

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Summary

As this paper has described, a wide variety of factors that can influence the selection of the proper lead-acid battery technology. In some instances, one factor may dominate the decision, while in others a mix of performance attributes may determine which technology will be the best.

Consider the Table Below - Comparison

	TTC-Regular	AGM VRLA	T-Gel Platinum
Plate Technology	Tall Tubular Plate	Flat Pasted Plate	Tall Tubular Plate
Electrolyte	Free Flow Electrolyte	Electrolyte in-between AGM	Electrolyte in- Between Gel
Water Loss	Low	Negligible	Negligible
Self-Discharge	Very Low < 2.0%	Very Low < 2.0%	Very Low < 2.0%
Life Cycle w.r.t DOD @27° C @ 80% DoD	900 Cycle	450 Cycle	2000 Cycle
water Top Up	Low water top up	No water top up throughout Life	No water top up throughout Life
Plastic Material	PPCP	PPCP & ABS	PPCP
Battery Technology	Conventional	Valve regulated Technology	Valve regulated Technology
Separator	Polyethylene(PE)	AGM	PVC
Life w.r.t application	Excellent performance on cyclic application	Not good for deep cycle application.	Excellent performance on cyclic application
Acid startification	Low	No	No
Discharge current	Low	wide	Low
Charging setting	Generic set point for chargers	Required special set point for chargers.	Required special set point chargers.
Operating Temperature	wide temperature operating range	temperature operating range is limited	wide temperature operating range
Spillage	Low spill proof	Spill proof	Spill proof

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