VRLA AGM AND GEL BATTERIES

Q: What are VRLA batteries?

A: Valve-Regulated Lead-Acid or VRLA, including Gel and AGM (Absorbed Glass Mat) battery designs, can be substituted in virtually any flooded lead-acid battery application (in conjunction with well-regulated charging). Their unique features and benefits deliver an ideal solution for many applications where traditional flooded batteries would not deliver the best results. For almost three decades, Koyama has been manufacturing valve-regulated batteries using tried and true technology backed by more than 20 years' experience. Koyama produces a complete line of Gel, AGM, and conventional flooded products for hundreds of applications. This diverse product offering enables Koyama to be objective as to the advantages of each type of battery. Koyama's VRLA (Gel and AGM) products have the reputation of being the highest quality VRLA batteries available.

Q: How do VRLA batteries work?

A: A VRLA battery utilizes a one-way, pressure-relief valve system to achieve a "recombinant" technology. This means that the oxygen normally produced on the positive plate is absorbed by the negative plate. This suppresses the production of hydrogen at the negative plate. Water (H2O) is produced instead, retaining the moisture within the battery. It never needs watering, and should never be opened as this would expose the battery to excess oxygen from the air. In addition to damaging the battery, opening it also voids the warranty.

Q: What is the difference between VRLA batteries and traditional flooded batteries?

A: Flooded electrolyte batteries do not have special one-way, pressure-relief valves, as they do not work on the recombination principle. Instead, flooded designs utilize a vent to allow gas to escape. They contain liquid electrolyte that can spill and cause corrosion if tipped or punctured. They should not be used near sensitive electronic equipment.
They can only be installed "upright." Flooded batteries lose capacity and become permanently damaged if:
Left in a discharged condition for any length of time (due to sulfation). This is especially true of designs that require water maintenance.
Continually over-discharged (due to active material shedding). This is especially true of automotive starting types.

Q: What are ideal applications for VRLA batteries?

A:

- Deep Cycle, Deep Discharge Applications
- Marine Trolling
- Electronics
- Sailboats
- Electric Vehicles
- Wheelchairs/Scooters

- Golf Cars
- Portable Power
- Floor Scrubbers
- Personnel Carriers
- Renewable Energy
- Village Power (Solar, Wind)
- Marine & RV House Power
- Commercial Deep Cycle Applications
- Standby and Emergency Backup Applications
- UPS (Uninterrupted Power Systems)
- Cable TV
- Emergency Lighting
- Computer Backup
- Renewable Energy
- Frequency Regulation (Solar, Wind)
- Telephone Switching

-Other Applications

- Race or High-Performance Cars
- On-Highway Trucking
- Off-Road Vehicles
- Wet Environments
- Marine & RV Starting
- Diesel Starting
- Cars and Light Trucks
- Vehicles with Accessories
- Start-Stop Systems

Q: What are Gel and AGM batteries?

A: VRLA technology encompasses both gelled electrolyte or gel batteries and absorbed glass mat or AGM batteries. Both types are regulated by special one-way, pressure-relief valves and have significant advantages over flooded lead-acid products.

AGM (Absorbed Glass Mat) batteries

The electrolyte in AGM batteries is completely absorbed in separators consisting of matted glass fibers. This causes them to be spillproof, meaning they don't leak acid like a flooded design if tipped on their side. The glass mats in AGM batteries are wrapped around the positive plate, which helps prevent damage from vibration and extend cycling. The battery's groups are packed tightly in the case partitions also protecting its power producing components. AGM battery designs can have over twice the cycle life of a conventional flooded product in the right application.

Gel or Gelled Electrolyte batteries

The electrolyte in a Gel battery is permanently locked in a highly viscous gelled state instead

of the traditional liquid form. Because there is no liquid-type electrolyte, it will not leak out of the battery if tipped on its side. The thick, gelled electrolyte and tightly packed groups also protect the battery's power producing components. Gel battery designs have a superior deep discharge resiliency and can deliver over two to three times the cycle life of an AGM product in the right applications.

Q: What are some similarities between Gel and AGM batteries?

A: Batteries utilize special one-way, pressure-relief valves and must never be opened.
Requires no electrolyte maintenance unlike deep cycle flooded batteries that require frequent checking and adjustment of electrolyte levels.
Uses a recombination reaction to prevent the escape of hydrogen and oxygen gases normally lost in a flooded lead-acid battery (particularly in deep cycle applications).
Spillproof design enables installation in virtually any position (upside-down installation is not recommended).
Has a higher tolerance against damage from deep discharge. These batteries have optimized amounts of electrolyte (which is also referred to as "acid-starved") so that they use the power in the acid before they use the power in the plates. This minimizes the destructive nature of ultra-deep discharges. Ultra-deep discharging is what causes plate shedding, which can destroy a battery.

Q: What are the Major differences between Gel and AGM battery performance?

A: A Gel battery is better suited for super-deep discharge applications, which means it can withstand deeper discharges without damaging the battery's performance. However, due to the physical properties of the gelled electrolyte, Gel battery power declines faster than an AGM battery as the temperature drops below 32ºF (0ºC). AGM batteries excel for high current, high power applications and in extremely cold environments. AGM batteries deliver a better dual-purpose solution for a combination of starting and accessory power.

Q: What do I need to know about VRLA battery charging?

A: All lead-acid batteries release hydrogen from the negative plate and oxygen from the positive plate during charging. VRLA batteries have one-way, pressure-relief valves. Without the ability to retain pressure within the cells, hydrogen and oxygen would be lost to the atmosphere, eventually drying out the electrolyte and separators.

Voltage is electrical pressure (energy per unit of charge). Charge (ampere-hours) is a quantity of electricity. Current (amperes) is electrical flow (charging speed). A battery can only store a certain quantity of electricity. The closer it gets to being fully charged, the slower it must be charged. Temperature also affects charging. If the right voltage is used for the temperature, a battery will accept charge at its ideal rate. If too much voltage is used, charge will be forced through the battery faster than it can be stored.

Reactions other than the charging reaction also occur to transport this current through the battery—mainly gassing. Hydrogen and oxygen may be given off faster than the recombination reaction. This raises the pressure until the one-way, pressure-relief valve

opens. The gas lost cannot be replaced. Any VRLA battery will dry out and fail prematurely if it experiences excessive overcharging.

Note: It is too much voltage that initiates this problem, not too much charge — a battery can be “over-charged” (damaged by too much voltage) even though it is not fully “charged.” Never install any lead-acid battery in a sealed container or enclosure. Hydrogen gas must be allowed to escape.

Q: Can continual undercharging harm a VRLA battery?

In many respects, undercharging is as harmful as overcharging. Keeping a battery in an undercharged condition allows the positive grids to corrode and the plates to shed, dramatically shortening life. Also, an undercharged battery must work harder than a fully charged battery, which contributes to short life as well.

An undercharged battery has a greatly reduced capacity. It may easily be inadvertently over-discharged and eventually damaged.

Q: Do VRLA batteries have a “memory” like Ni-Cad batteries?

A: One of the major disadvantages of nickel-cadmium (Ni-cad) batteries is that after shallow discharge cycles, the unused portions of the electrodes “remember” the previous cycles and are unable to sustain the required discharge voltage beyond the depth of the previous cycles. The capacity is lost and can only be restored by slowly discharging completely (generally outside the application), and properly recharging. VRLA lead-acid batteries do not exhibit this capacity robbing effect known as memory.

Q: What are the safety precautions for VRLA batteries?

A: Although all valve-regulated batteries have the electrolyte immobilized within the cell, the electrical hazard associated with batteries still exists. Work performed on these batteries should be done with the tools and the protective equipment listed below. Valve-regulated battery installations should be supervised by personnel familiar with batteries and battery safety precautions.

Protective Equipment

To assure safe battery handling, installation and maintenance, the following protection equipment should be used:

Safety glasses or face shield (Consult application specific requirements)

Acid-resistant gloves

Protective aprons and safety shoes

Proper lifting devices

Properly insulated tools

Procedures

Consult user manual of specific application for safety & operating requirements. The following safety procedures should be followed during installation: (Always wear safety glasses or face shield.)

These batteries are sealed and contain no free-flowing electrolyte. Under normal operating conditions, they do not present any acid danger. However, if the battery jar, case, or cover is damaged, acid could be present. Sulfuric acid is harmful to the skin and eyes. Flush affected area with water immediately and consult a physician if splashed in the eyes. Consult MSDS for additional precautions and first aid measures.
Prohibit smoking and open flames, and avoid arcing in the immediate vicinity of the battery.
Do not wear metallic objects, such as jewelry, while working on batteries. Do not store un-insulated tools in pockets or tool belt while working in vicinity of battery.
Keep the top of the battery dry and clear of all tools and other foreign objects.
Provide adequate ventilation as regulated by Federal, State and Local codes and follow recommended charging voltages.
Extinguishing media: Class ABC extinguisher. Note: CO2 may be used but not directly on the cells due to thermal shock and potential cracking of cases.
Never remove or tamper with pressure-relief valves. Warranty void if vent valve is removed

Q: Can VRLA batteries be installed in sealed battery boxes?

A: NO! Never install any type of battery in a completely sealed container. Although most of the normal gasses (oxygen and hydrogen) produced in a VRLA battery will be recombined and not escape, oxygen and hydrogen will escape from the battery in an overcharge condition (as is typical of any type battery).
These potentially explosive gasses must be allowed to vent to the atmosphere and must never be trapped in a sealed battery box or tightly enclosed space!

Q: Does depth of discharge affect cycle life?

A: Yes! The harder any battery has to work, the sooner it will fail.
The shallower the average discharge, the longer the life. It's important to size a battery system to deliver at least twice the energy required, to assure shallow discharges.
Follow these tips for the longest life:
Avoid ultra-deep discharges. The definition of ultra-deep discharge may vary with application and battery type.
Don't leave a battery at a low stage of charge for an extended length of time. Charge a discharged battery as soon as possible.
Don't cycle a battery at a low state of charge without regularly recharging fully.
Use the highest initial charging current available (up to 30% of the 20-hour capacity per hour) while staying within the proper temperature-compensated voltage range.

Q: What is a thermal runaway?

A: The appropriate charge voltage depends on the battery temperatures. A warmer battery requires a reduced voltage. If the voltage is not reduced, current accepted by the battery increases. When the current increases, the internal heating increases. This can rise to destructive levels if not taken into consideration.
Thermal runaway can be prevented with:

- Temperature compensation monitoring at the battery —not at the charger.
- Limiting charging currents to appropriate levels.
- Allowing for adequate air circulation around the batteries.
- Using timers or ampere-hour counters.
- Using smart chargers that recognize the signature of a thermal runaway event which will shut the charger down.