AMARA RAJA BATTERIES LIMITED
(An Amara Raja Johnson Controls Company)

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AMARON

QUANTA
UNINTERRUPTED LIFE

SILVER BOOK

All that you wanted to know about batteries, but did not know whom to ask...

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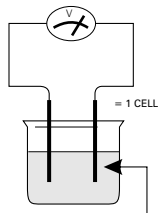
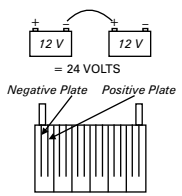
Notes

What is a battery?



The plate with the more positive potential is denoted as the positive plate



6 CELL = 12 VOLT LEAD ACID BATTERY

A battery is an electric storage device, which can be found in any number of shapes, sizes, voltages and capacities.

When two conducting materials (often-dissimilar metals) are immersed in a solution, an electrical potential will exist between them. If connected together through a closed circuit, a current will flow. The value of this potential (or voltage) is dependent on the materials used, giving rise to a whole family of battery types each having benefits and restrictions in use. Examples are: lead acid nickel cadmium, lithium, silver alkaline.

This manual is concerned only with one battery technology - the most successful - lead acid (lead and lead oxide immersed in sulphuric acid). Each cell has a 2 volt potential.

A battery is simply a number of cells connected together with a given voltage and capacity the more the number of cells, higher is the voltage ger the plates, the larger is the capacity. Purely for convenience, batteries are made in 12 volt blocks with 6 cells, but are also available in 6 volt, 4 volt and even 2 volt single cell blocks.

Batteries can be connected in series to achieve whatever voltage is required (add the number of 2 volt cells), and in parallel to achieve the capacity required (add the capacities of each parallel battery or string of batteries). For larger systems, a number of series connected strings may be connected in parallel with each other. This achieves both a higher voltage and capacity.

The lead acid battery

There are two concepts in lead acid batteries:

1. Sealed Maintenance Free (SMF) or Valve Regulated Lead Acid (VRLA)

2. Open-vented

There are three basic applications:

1. Industrial
2. Automotive
3. Traction

Warning: The battery must be used only for the Purpose specified.

This guide is focused on **industrial standby applications** and not automotive and traction use.

Industrial batteries are available in two distinct groups with the following features:

OPEN-VENTED	SMF/VRLA
Older technology	Environment friendly
Require separate battery room	use directly in office environment
Regular routine maintenance	"Maintenance free"
Separate safety requirements	self - contained and safe
Store/use in vertical position	Store/use in any orientation
Can require extensive cabling	Can be used internal or adjacent to load
VRLA has in many instances replaced the open-vented type.	

Battery Basics

Branch addresses

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Definitions

Battery - One or more cells

Float/Standby - Continuous charging for use in a emergency or back-up situation.

Cyclic - Continual discharge/recharge application often associated with UPS and traction applications.

Battery string or bank - A number of batteries connected in series will constitute one string. Strings can then be connected in parallel to achieve the required capacity.

Monobloc - A phrase used to describe a multi-celled single block, like the 12 V Amaron Quanta™ batteries.

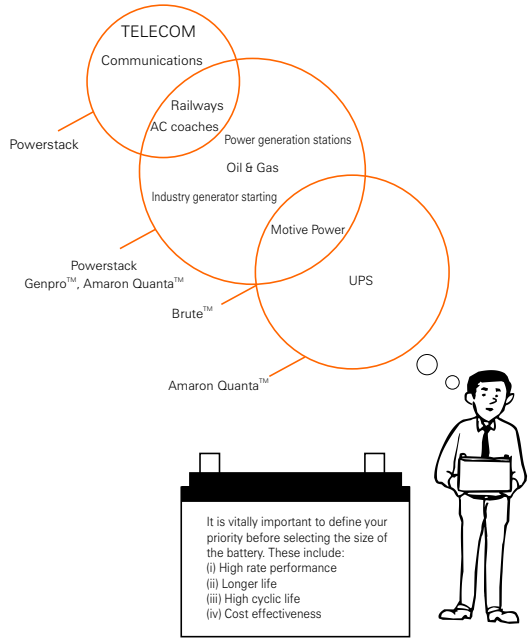
Wet/Flooded - Open-vented lead acid cells which need topping up, i.e., Not maintenance free.

Stationary - Applications using static placed batteries.

Top-charging - A service charge during or after storage, Usually at a level slightly higher than normal float voltage.

Typical applications

Amara Raja pioneered the use of SMF technology in India and focuses only on SMF barreries.



To optimise battery duty and life for your application, make sure you choose the right product from the Amara Raja range.

Choosing the correct size of battery

As mentioned earlier, batteries come in all shapes and sizes, from types no larger than a shirt button, to battery systems filling an entire room.

To find the size of battery you require, you generally need two pieces of information - **battery load** and **back-up time.**

Battery Load

Whether you power lights, motors, electronic equipment or a toy vehicle, your equipment will draw a load in Amps. If this is unknown, then the equipment will have a rating expressed in Watts, which may simply be converted to Amps by dividing the value by the normal voltage of the system.
Example: You have chosen Amaron Quanta™ for high cycle life and wish to drive a power tool rated at 120 watts, 12 volts. Here, the load current is 120 divided by 12, i.e., 10 Amps.

Back-up time

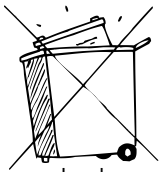
This is the time require the battery to support the load described above and is often called autonomy or discharge time. Example, to power a UPS for a total of 3 hours before recharging. With these two pieces of information, use our selection graph to plot an intersection point from which you will determine a required size or capacity in ampere-hours (Ah). The selection graph has been rationalized into rounded figures of capacity. If your intersection point falls between two lines, choose the next highest value.

Abbrevitations

VRLA	-	Value Regulated Lead Acid Battery
SMF	-	Sealed Maintenance Free
CCV	-	Closed Circuit Voltage
OCV	-	Open Circuit Voltage
WPC	-	Watts Per Cell
Pb	-	Chemical Symbol or lead
UPS	-	Uninterrupted Power Supply
Ah	-	Ampere hour. The unit of battery capacity.
DOM	-	Date Of Manufacture
EOD	-	End Of Discharge
VPC	-	Volts Per Cell
NC	-	Number Of Cells
Vf	-	Float voltage
Vs	-	Starting voltage
Lav	-	Average current
Sg	-	Specific gravity
Cn	-	Defined capacity of the battery to the 'n' time period.
20 hr rate	-	The capacity a battery will deliver over 20 hrs.

Disposal/Recycling

- Finally, when a battery has reached the end of its life, it must be returned to the point of sale or to a licensed battery dealer for recycling.

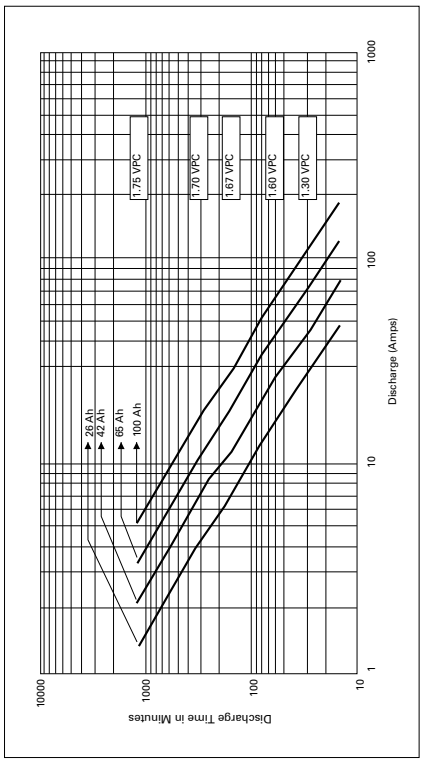


- Do not throw used batteries in a bin. SMF batteries contain substances harmful to the environment. So, return it to your supplier or take to an authorised smelter for disposal.

- Never bury in the ground or incinerate at end of life. Batteries contain harmful substances making them unsafe.

- Return the spent battery to your supplier or any licensed battery dealer for recycling.

Battery capacity selection chart



Charging

Correct charging of a SMF battery is essential in optimizing battery performance and life although a constant voltage charge should be applied, optimum charging also depends on temperature (nominally 27°C), charge current (maximum 25% of battery capacity), and ripple current (minimum). Two basic categories of charging exist:

Float/Standby

This charging method is normally used in applications, such as emergency back-up when the battery is required only upon mains failure, e.g., Alarm panels, emergency lighting. In each case, the battery is continuously on charge and consequently, the recommended voltages are slightly lower than cyclic charging so as not to damage the battery. (Float voltage for Amaron Quanta™ range = 13.5 V per 12 V module).

Boost

Boost charging is used in applications where the battery is repeatedly discharged, then charged, e.g., UPS, portable equipment, etc. A higher charging voltage is used, but should NEVER be left on indefinitely, since it will overcharge and destroy the battery. (Cyclic voltage for Amaron Quanta™ range = 13.8 V per 12 V module).
For optimum performance:

- Use a combination of float & boost charging
- Always recharge the battery immediately after discharging.

Battery Basics

Battery Ssfty

- Batteries are electrically live at all times, take great care never to short circuit the battery terminals.

- High DC voltages are more dangerous than the mains.

- Batteries are often heavy, take care when lifting and transporting batteries.

- Do not attempt to remove the battery lid or tamper with the battery's internal working. SMF batteries are "maintenance free" requiring no electrolyte top-up or measurement of specific gravity.

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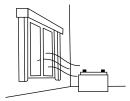
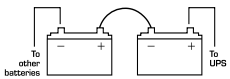
Maximise battery life

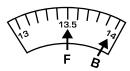


- Always install the batteries in a properly ventilated room.

- Keep the batteries away from heat sources and sparks.

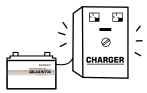


- Ensure proper cabling and lug crimping between UPS and battery



- Maintain float charge for the batteries @ 13.5 V per 12 volt module.

- Boost charge the batteries once in 6 months @ 13.8 V per 12 volt module.



- After a discharge, charge the batteries immediately.

- Check for proper torque at terminal bolt connections once in 6 months.

Battery Storage, care and maintenance

The storage or shelf life of a SMF battery is usually between 3 and 6 months at 27°C Stating from a charged condition.

- Never store in a discharges or partially discharged state.
- Always store in a dry, clean, cool environment in a fully packaged condition.
- If storage of 12 months or longer is required, supplementary charging is required.

Design Life

Float: Each battery type will have a prescribed float design life. Please be aware of this life expectancy and replace the battery as it approaches the end of its life. Keep a reference or label the battery to show its date of installation to facilitate replacement at the correct time. Factors other than time may affect the life of the battery and this will be indicated by a reduction in capacity. The battery should be changed, when the capacity is reduced to a level that will prevent it from fulfilling its required duty. This may be well in advance of its design life if, for example, the ambient temperature is considerably above 27°C.

Amaron Quanta™ offers you a flat life of 4-6 years, a good 20% more than most other SMF batteries.

Cyclic: Each battery suited to cyclic use will reach the end of its life after a prescribed number of cycles. This number is dependent upon the depth of discharge of each cycle. The deeper the discharge, the less number of cycles to to end of life. Depth of discharge is expressed as the percentage of the battery capacity required per duty cycle.

Amaron Quanta™ also offer high cyclic life e.g., 1250-1325 cycles for 30% depth of discharge.

Battery Care

To ensure optimum battery performance and life, take care of youe battery by observing the following:

Sulphation/Undercharge

If a battery has an open-circuit voltage lower than its rated value, than sulphation may well be the cause. When a battery is left in a discharged state or for prolonged periods of storage, lead sulphate crystals begin to form, acting as a barrier to recharge and will prevent normal battery operation.

Depending on the degree of sulphation, a battery may be recovered from this condition by constant current charging at a higher voltage, with the current limited to one-tenth of the battery capacity, for a maximum of 72 hours..

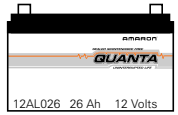
Note: The applied voltage will exceed the normal recommendation and so the battery must be monitored (not left unattended) and removed from charge if excess heat is dissipated. The voltage required to “force” this maximum current into the battery will reduce as the battery recovers, until normal charging takes place.

In extreme circumstances, a battery may never fully recover from sulphation and must therefore be replaced.

Overcharge

Optimum charging relies mainly on voltage, current and temperature factors which are interrelated and all of which can cause overcharge. Excessive charge voltages will force a high overcharge current into the battery, which will dissippate as heat, and may cause gas emission through the safely value. Within a short period of time, this will corrode the positive plate material and accelerate the

Battery Basics



Battery towards end of life. Under these conditions, the heat produced inside the battery can lead to thermal runway due to the increased electro-chemical reaction within the battery. The battery may swell before failing and will be irrecoverable from this state. This situation is potentially dangerous.

Temperature

The recommended normal operating temperature is 27^{o}C. High temperature will reduce battery service life often quite dramatically. In extreme cases, this can cause thermal runway, resulting in high oxygen/hydrogen gas production and battery swelling. Batteries are irrecoverable from this condition and should be replaced. High temperature will give increased performance, but with a corresponding loss in life. Low temperatures will help to ensure a long service life, but batteries used at low temperatures have reduced capacity.

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