INVICTA LITHIUM BATTERIES

LITHIUM BATTERY FAQS

WHAT IS A LITHIUM BATTERY?

Just like standard lead acid batteries, Lithium batteries consist of positive plates (cathod es) and negative plates (anodes) as well as insulating separators to avoid short circuits between the positive and negative plates, and finally electrolyte, which is the conductive liquid although unlike flooded lead acid batteries, there is no free liquid in LiFePO4 batteries.

A lithium battery differs in the materials used for the above mentioned components, especially the cathode and also the process undertaken during charge and re-charge. A lead acid battery undertakes chemical reactions, which change their components. Lithium just transfers ions during the charge and discharge process leaving everything else the same.

ARE ALL LITHIUM BATTERIES THE SAME?

The term "Lithium" or "Lithium Ion" refers to a family of batteries in which ions move from the negative electrode (anode) to the positive electrode (cathode) during discharge and back again when being charged. The point to note in this definition is that it refers to a "family of batteries". Just like Lead Acid family which contains Absorbent Glass Mat (AGM) and Gel types, there are a number of different "Lithium Ion" technologies within the Lithium Ion family. They each utilize different materials for their cathode and (to a lesser degree) anode and as a result exhibit different characteristics, which makes some more suitable than others for different applications.

WHAT ARE THE DIFFERENT TYPES OF LITHIUM ION BATTERIES?

According to Battery University, the most well-known types of lithium Ion batteries are:

LITHIUM NICKEL COBALT ALUMINIUM (NCA)

- 3.6V nominal
- High specific energy – 200-260Wh/Kg
- Average safety characteristics (Typically 150°C)

LITHIUM NICKEL MANGANESE COBALT OXIDE (NMC)

- Cell voltage – 3.7V nominal
- High specific energy – 150-220Wh/Kg
- Good safety characteristics (Typically 210°C)

LITHIUM IRON PHOSPHATE (LIFEPO4)

- Cell voltage – 3.2V nominal
- Moderate specific energy – 90 – 120Wh/Kg
- Excellent safety characteristics (Typically 270°C)

POWERHOUSE BATTERIES

Powerhouse Batteries Unit 1 / 2 Amesbury Loop WA Perth
T: (08) 9562 3725 M: 0400 864 840
E: admin@phbatteries.com.au W: powerhousebatteries.com.au

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WHY USE LIFEPO4 FOR LEAD ACID REPLACEMENT APPLICATIONS?

- Safest form of Lithium Ion when considering temperature and abuse such as overcharge/discharge, short circuit and penetration
- High thermal runaway point
- Similar voltage to SLA (3.2V per cell = 12.8V)
- Good all round performance making it flexible for many applications
- Environmentally friendly, phosphate is not hazardous and so is friendly both to the environment and health.
- Slow capacity loss – meaning they can sit for longer without requiring re-fresh charge.
- High cycle life
- Cost effective

WHY IS LIFEPO4 SAFER THAN OTHER LITHIUM BATTERY TYPES?

The LiFePO4 batteries are the safest type of lithium batteries. Phosphate based technology possesses superior thermal and chemical stability which provides better safety characteristics than those of Lithium-ion technology made with other cathode materials. Lithium phosphate cells are incombustible in the event of mishandling during charge or discharge, they are more stable under overcharge or short circuit conditions and they can withstand high temperatures. LifePO4 has a very high thermal runaway temperature when compared to the other types at approximately 270oC as compared to as low as 150oC.
LiFePO4 is also more chemically robust when compared to other variants.

WHY IS IEC62619 CERTIFICATION SO IMPORTANT?

Most reputable manufactures will have IEC62133 and / or UL1642 (now unified) for their Lithium cells. These tests are for "lithium cells and for batteries made from them for portable applications". The test and subsequent certification ensures safety of the cells (and batteries if tested) in conditions such as

- Overcharge
- Short circuit
- Thermal abuse
- Crushing
- Forced discharge, etc.

Most reputable companies have undertaken the testing on their cells only and not the complete battery system.

Invicta Lithium batteries are tested not just at the cell level, but also as the complete battery system, via certification according to the international standard IEC62619 – "lithium cells and batteries for industrial applications". This extra step tests the cells put together into a system along with an internal Battery Management System, BMS.

Some of the safety aspects tested under IEC62619 include:

- Assembly of cells into packs
- Short circuit propagation (between cells)
- BMS protection against
- Over charge – Voltage and Current
- Over temperature
- Short circuit
- Impact
- Thermal abuse
- Annual factory audit – to ensure consistency.

DOES A INVICTA LITHIUM BATTERY NEED TO BE INSTALLED IN A SPECIAL LOCATION?

No, they can be installed in any rotation and in the same location as your current Lead Acid. However, please note that the BMPRO Invicta Lithium range is NOT suitable for under bonnet applications.

HOW DOES THE BATTERY COPE WITH MECHANICAL / PHYSICAL DAMAGE?

Under the IEC and UN38.3 the batteries and cells undergo a range of mechanical abuse testing including Impact, Drop and Vibration testing, in order to pass the test the battery must not leak, vent, disassemble, rupture or ignite.

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DO I CHARGE LITHIUM BATTERY DIFFERENTLY TO LEAD ACID?

DIFFERENCE IN CHARGING PROFILES

A charging profile is a reference to the way voltage and current vary during a full charge of a battery, and it does differ depending on the type of battery, because they are functionally dissimilar and constructed in different ways. For example, a fully charged lead acid battery will have a voltage of around 12.6-12.7V, whereas a LiFePO4 battery has voltage around 13.3-13.4V at full charge. At 20% capacity, a lead acid battery will have a voltage around 11.8V, whereas a lithium battery will hold its voltage at approximately 13V.

FASTER CHARGING

Without getting too technical, the LiFePO4 battery has a much smaller voltage tolerance and, because of that, the 'trickle' charge of the deep-cycle battery does not apply. And that means a LiFePO4 battery can be charged faster while minimising the risk of overcharging.

WHY MULTISTAGE CHARGER?

In discharge cycle, or when powering a load, a chemical reaction takes place that causes electrons to flow between the positive and negative electrodes via the battery electrolyte.
A charger reverses that chemical reaction, thus, recharging the battery. A typical charging voltage for a 12V battery varies between 12.9V and 14.1V. While a constant voltage and current will charge a battery quickly, it's considerably better for a deep-cycle battery's health if a 'trickle' charge is used over a longer period of time. Multi-stage chargers are considered best for this purpose.

CHARGING LITHIUM BATTERIES

LiFePO4 batteries operate a little differently but an appropriate charge is also best for maximum battery life. Generally speaking, a constant current (only really restricted by the charger output) will flow until the battery reaches 90-95% of its state of charge (SOC). Once that point is reached, the current will reduce, while the voltage will do the opposite, rising to a cut off voltage of a theoretical 16.8V (but, in reality, is usually around 14.7V).

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