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WHY LITHIUM?

1. What is the Vision 12.8V LiFePO4 battery?

The Vision 12.8V Lithium Iron Phosphate (LiFePO4) battery is a type of lithium-ion battery known for their long design life, good cycling capabilities and importantly their safety.

Lithium Iron phosphate or LFP is the short term for LiFePO4. LiFePO4 is proved to be a safe technology to compare with other lithium-ion batteries.

Other types of lithium-Ion batteries are:

Lithium Cobalt Oxide (LCO)

Lithium Manganese Oxide (LMO)

Lithium Nickel Manganese Cobalt (NMC)

Lithium Nickel Cobalt Aluminium Oxide (NCA)

Please note that LFP batteries have a different nominal voltage. Although they are made to 12V battery standard, the charging and discharging curve is different, a proper charger is required to recharge the LFP battery, please refer Question 15 for details.

2. If I want to upgrade my batteries from lead acid to LFP, what should I know?

When choosing LFP batteries to replace lead-acid batteries, you need to know the capacity of lead-acid batteries, voltage range, environment they will be used in. These parameters need to be consistent with the LFP batteries.

Also need to check if the equipment powered by the batteries is compatible with LiFePO4 batteries.

Things are also good to know:

- % Volume showing on the device may not be correct for LFP battery.
- Need to set a safety voltage for LFP battery. Over-discharge is prohibited. If the battery reaches safety voltage(cut-off), it must be recharged before use again.
- Use an LFP-specified charger to recharge the battery. (Li-ion is not equal to LFP)
- LFP battery has PCB built-in Battery Management System (BMS) which equalises and protects the LFP Battery from over-charging and over-discharging. Please refer to data sheet – page 2, Refer to Question 4.
- On normal operation, the BMS will not affect the battery's performance unless over-charge and over discharge occurs.
- LFP battery is more vulnerable than a lead acid battery, but it gives exceptional performance and life expectancy
- LFP can accept higher charging current, check data sheet for more details.



3. What are the functions of the Battery Management System?

BMS is built into the battery system, which is responsible for collecting and analysing the battery performance. The BMS monitors voltage, temperature and current of the single cells. The key function is to protect the lithium batteries and reduce the risk of damage the battery. The BMS protects the LFP battery against over-voltage, under-voltage, high temperature, low temperature, and internal short circuits. The BMS also balances the charge of each individual cell.

Please note the BMS is designed to protect the battery from any abuse. Normal operation should not trigger any protection. If any protection happens, leave the battery disconnected for a period and the battery protection will be released once it goes back to normal. Then do a recharge if the battery was over-discharged or stop charging if the battery is over-charged.

4. If I buy a 12v 100ah LFP battery, would I expect a longer life than the lead acid 12v100ah?

Generally, LFP has huge advantage on life expectancy than a lead acid battery. Data sheet shows that 50% DOD cycles will be around 4000 when it degrades to 80%.

INSTALLATION & STORAGE

5. Should I charge my LFP battery before I use it for the first time?

Yes. LFP batteries have less than 50% charged (SOC) from the factory for safe handling and transportation. This means the battery is not ready to use until it has been fully charged. It is imperative to charge the LFP battery with an approved LFP rated charger before using.

6. When I replace the lead acid battery with an LFP battery in my caravan, what shall I check or change on my settings?

The first check is to determine whether the current charging system in the caravan is designed to charge an LFP battery. If not then, an LFP charging system needs to be installed by a qualified installer. The warranty will void if the charging system is found to be unsuitable to charge an LFP battery.

If the charging system is rated for LFP:

Adjust the battery mode of the inverter to LiFePO4 battery mode, set the charging voltage to 13.8V, and set the charging current according to the recommended current in the specification. Set the safety cut-off voltage to 11.2V. Set an alarm on the power supply that showing alarm if the battery nearly empty. (Although the % is not accurate, it will still tell if the battery is empty or not, over discharge is not permitted and will void the warranty)

7. How can I get the most power out of my LFP battery?

Using a proper charger and proper cut-off device is ideal to get the most power out of the LFP battery. The maximum discharge current is stated on data sheet. Please check the data sheet before use.



8. What should I do before installation?

Before installation, please read all safety information in the user manual listed on our company website. If you have any questions about operation and safe use of the battery system, please contact YHI POWER 1300 722 028.

Before Operation:

- Qualified electric worker Qualification is mandatory.
- Remove all metal items, such as jewellery, watch, pen.
- To ensure the safety of construction personnel and equipment, disconnect the battery pack from the operating equipment during wiring.
- Pay attention to the terminal voltage polarity of the battery module.
- Make sure installation tools insulating and use tools correctly.
- Follow the connection port description and system connection diagram.
- It is absolutely forbidden to plug and unplug when the battery is working. Necessary operation should be done after the power supply is disconnected.
- Before the formal operation, ensure the power terminals are properly connected and tighten the terminals; When it is necessary to measure, be careful when using instruments and tools, to avoid short circuit and other accidents.

9. What tools would I need to install the LFP battery?

Installation tools include Torque Wrench, Cross Screwdriver, Insulating Gloves and Multi meter.

10. Can I mount the batteries in any position?

LFP batteries can be placed forward, side, but not upside down.

11. What is the difference between parallel and series connections?

Connection in series, No.1 Batt pos to No.2 Batt neg etc.

Connection in parallel, No1. Batt pos to No.2 Batt pos etc.

Note: Connect in series will increase the voltage of battery bank, and the capacity remains the same. Batteries are connected in series to match the inverter or power supply input voltage requirement. Required voltage can be 12V, 24V, 36V or 48V.

Connect in parallel will increase the capacity of battery bank. 2 of 12V 100AH in parallel connection will be 200AH battery bank. The voltage remains same, 12V.

12. What is the maximum quantity of batteries can I connect in series or / and parallel?

This battery BMS supports a matrix of 6 battery in series X 6 battery in parallel. A total of 36 batteries in the matrix.

13. Can I install the battery under the bonnet?

The battery should not be installed under the bonnet. Lithium LiFePO4 battery needs shock protection, battery shell is ABS material, strong impact will be broken.

Note: They should not be exposed to impact or crushing force. Battery is not suitable for cranking an engine.



CHARGING & DISCHARGING

14. What should I pay attention to when using an LFP battery?

Although it is 12V (12.8V nominal) battery, the LiFePO4 battery is using different technology from the conventional battery (Lead acid). A dedicated regulated LiFePO4 (LFP) charger is necessary to recharge the battery.

When using the LFP battery, a cut-off voltage 11.2V – 11.8V is recommended to set on your inverter/device/power supply.

Please note there is some information saying that an AGM charger can charge a LFP battery. Some AGM chargers can charge a LFP Battery, as they have similar specification to a LFP charger. A LFP charger is using Constant Current/Constant Voltage mode, which is like a 2-step charger. The bulk step is constant current charging and enter the absorb step if the voltage reaches to 14.4V. Please be careful the curve might be different. Before using an AGM battery charger, please check with the charger’s supplier to see if the charger meets the requirements to charge a LFP 12V battery.

15. What chargers should I use to charge the 12.8v LFP battery?

A specified LFP battery charger is required to recharge the battery. If the battery charger does not specify LFP, please check the specification of the charger to see if it can meet the charge curve on the data sheet. LFP batteries need a higher voltage and longer time during bulk stage than a lead acid bulk stage. Also check with the supplier of the charger to see if it can charge a LFP battery.

Please note that some chargers have a tag saying Li-ion, as Q1 mentioned, there are different Li-ion battery, a LFP battery has different Voltage compared to other Li-ion chemistry, a “Li-ion” charger may not be suitable for a LFP battery, check with the charger’s supplier.

A charger which can bulk charge the battery to 14.4V will be suitable for the LFP. LFP need a Constant Current/ Constant Voltage (or we called bulk/absorption) method to be fully charged. And any rejuvenation or pulse current must be disabled. Only 3-stage is required. Please also DO NOT float charge the battery for long term.

Some of the charger suggestion below:

LFP charger	Brand	Model	Remark
12.8V LFP charger	Projecta	Intelli-charger 5 stage Lithium battery charger	Automatic LFP battery
12.8V LFP charger	Victron	Blue Smart IP65 Charger	LI-ion (LiFePO4 mode)
12.8V LFP charger	ZEUS	PCCG-LFP14.4V15A	No Rejuvenation, no pulse current,

Caution: Charger with Auto-Rejuvenation, Auto-pulse current charger is NOT suitable for charging Lithium Iron Phosphate Battery (LiFePO4), a bulk charging does not end up to 14.4V will not be able to fully charge the battery.



16. What voltage and current figure should I set to charge the 12.8v LFP batteries?

For optimum performance, you can charge at 13.8V. The recommended charging current for the battery is 25A (for best battery health life), and the maximum charging current is 50A.

17. Can I discharge the LFP battery to 100% DOD?

Yes, however a safety cut-off voltage is required to be set as when the battery Voltage drops to the cut-off, the battery is fully discharged @ 11.2V. It is recommended to limit the Depth of Discharge (DoD) of batteries to 80% in order to optimize their lifespan and overall performance. In order to enhance safety measures, utilizing a controller to ensure an additional layer of protection is a must. Parameters of the controller need to be set within a more tightly-constrained limit relative to those of the Battery Management System (BMS).

18. How do I charge the battery?

Strongly recommend using a dedicated Lithium LiFePO4 Charger to recharge.

A Constant Current / Constant Voltage charge method is required.

Step 1, Constant current charging @ recommends current 0.25C, finish when the voltage raised to 13.8V. (BULK)

Step 2, Voltage stays @ 13.8V charging, finish when the current is less than 0.02C. (Absorb).

Step 3, Charger stops. No floating required.

Note: some of the charger provide a floating function after fully charge. For LFP, try to stop the charger as soon as it is fully charged, lithium battery has extremely low self-discharge. For longer life concern, floating charging is not required).

The constant current step may be able to charge the battery up to 90%, so that it takes longer time than a standard bulk step for a lead acid battery charger.

Please note that Li-ion may not equal to LFP on the charger, it could be different voltage setting. Applying the higher or lower voltage range to the battery may cause damage.

19. What can I do if the battery is cut-off at low V, and cannot be charged up?

- If the BMS protection is activated during use, please disconnect it from any load.
- Rest the battery for a while, around 20 minutes, then check the voltage on the battery.
- The protection will be disarmed if the voltage goes back to normal (11V). Then put the battery on charge to fully recharge the battery.

20. Can I charge the battery at bigger current than the recommended current?

Yes, if it is within the maximum current. However, the recommended current is good for the best healthy life of the LFP battery. Please refer to question 16.

21. Can I discharge the LFP battery at the bigger current than the recommended current?

The discharge current shall not exceed the maximum discharge current in the specification. The battery BMS will cut off the discharge if the current exceeds the maximum level.



22. Can I do reverse charge?

Reverse charge is prohibited.

23. Can I charge the LFP battery from my vehicle alternator?

It is not advisable to charge LFP batteries from the alternator as an alternator's output is direct current. If charging from the alternator is desired a LFP rated DC-DC charger with bulk function has to be installed. Please make sure your vehicle has enough spare power and there is no effect on the normal use of the vehicle.

The reason is that the Engine/Alternator is a DC power source (Just like a 240VAC), in order to charge the battery, there should be a proper charge device to charge the LFP battery. So that a DC-DC charger is needed to do a proper charge. 13.6-13.8 for the charging, max charger range is 14.4-14.6V. Max current is 0.5 times the nominal capacity (i.e., 50A for 100AH battery)

24. What type of solar charge controller do I need to charge my LiFePO4 batteries with my solar panels?

If solar charging is used, please set the regulator to the charging mode of LFP - lithium battery. When charged with controller, and the controller output is used to connect load: It is recommended that the controller is set as below parameters to avoid the battery fail to recover when the BMS cut off the battery for protection after a continuous small current discharge.

Overcharge Protection Voltage: 14.6V

Overcharge Recovery Voltage: 14.2V

Over-discharge Protection Voltage: 11.2V

Over-discharge Recovery Voltage: 10.6V

The above settings can ensure that the controller triggers the protection first instead of the battery BMS, which can prolong the service life of the battery.

25. What do I need to know about the operating environment?

In order not to trigger any protection please note that the following BMS allowing operating range:

Operating Humidity: 60±25%R.H.

Charging operating temperature: 0~50°C

Discharging operating temperature: -20°C~65°C

The environment temperature will also be considered in the warranty claims.

Note: For longer service life, please try to use the battery under a reasonable room temperature environment (25 °C) as the actual temperature in the battery could be higher than the environment. Please also avoid any direct sunlight and store in a cool place. Try to store the battery on 50% SOC.



26. Should I protect the LFP battery from vibration?

Lithium LiFePO₄ battery needs shock protection, battery shell is ABS material, strong impact will be broken.

27. How do I store my LFP battery?

The battery pack should be kept in a dry, cool environment when not in use. Do not immerse in water. And recharge every three months.

28. Should the max allowed current to be increased when connecting more than 1 batteries in parallel?

Connecting multiple lithium batteries in parallel increase the usable energy (AH), the maximum allowable charge and discharge current remains the same. Systems needs to be designed within the BMS margins of one battery.

WARRANTY

29. What warranty do I have to purchase the Vision LFP battery from YHI?

12V lithium LiFePO₄ battery warranty is 3 years.

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