



# LFP Series LiFePO4 Lithium Pack For Replace VRLA Battery

LiFePO4 Lithium Battery with SLA Shell  
12.8V7Ah ~ 400Ah  
25.6V10Ah ~ 200Ah



# User Manual

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## 1. SAFETY

Lithium Iron Phosphate (LiFePO<sub>4</sub>) batteries are safe to use indoors and outdoors. However, as with any electronics, safety measures must always be taken. Please follow the instructions within this user manual for safe handling and operation of this LiFePO<sub>4</sub> lithium batteries.

- Always wear protective gear when handling batteries
- Use a wrench with a rubber coated handle
- Do not place any objects on top of batteries
- Do not place batteries on a metallic surface
- Check that all cables are in good condition
- Make sure all cable connections are properly tightened
- Install and remove batteries using the lifting handles provided
- Keep sparks, flames and metal objects away from batteries
- It has MSDS on the premises
- Have a fire extinguisher of the following type: a foam extinguisher, CO<sub>2</sub>, ABC dry chemical, powdered graphite, copper powder or soda (sodium carbonate) on the premises

## 2. EQUIPMENT

The following equipment may be required to install your battery:

- Protective Gear, gloves and eye protection
- Wrench with insulated/rubber coated handle
- Voltmeter

## 3. LiFePO<sub>4</sub> BATTERY BASICS

### 3.1. Basic Construction

LiFePO<sub>4</sub> battery packs include two main components:

1. Individual cells assembled inside an ABS plastic or a steel case
2. An internal BMS (Battery Management System) to protect the battery from misuse

## 3.2. Battery Pack Voltages

| Lithium Iron Phosphate (LiFePO4) Nominal Voltage |                      |
|--|----------------------|
| Cell = 3.2V                                      |                      |
| 12.8V  | – 4 cells in series  |
| 25.6V  | – 8 cells in series  |
| 38.4V  | – 12 cells in series |
| 48.0V  | – 15 cells in series |
| 51.2V  | – 16 cells in series |

## 4. Battery Installation

### 4.1 Battery Connections

To maximize battery performance and ensure safe operation of your battery, use the appropriate cable size and tighten connections using the proper torque value. It is recommended to use a washer. Place the washer between the cable lug and nut, not between the cable lug and battery terminal surface. LFP Series lithium batteries come with free bolts and washers included. Refer to the data sheet for your particular battery's torque value and the size of the included bolts.

### 4.2 Cable Size

Choose the appropriate cable size based on the expected load of your system. See the table to the right. Allowable Ampacities for copper cables rated at 167 °F (75°C) operating at an ambient temperature of 86°F (30°C).

| Wire Gauge (AWG) –<br>Copper Conductors | Ampacity<br>(Amps) |
|---|--------------------|
| 14                                      | 25                 |
| 12                                      | 30                 |
| 10                                      | 40                 |
| 8                                       | 55                 |
| 6                                       | 75                 |
| 4                                       | 95                 |
| 2                                       | 130                |
| 1                                       | 150                |
| 1/0                                     | 170                |
| 2/0                                     | 195                |
| 4/0                                     | 260                |

### 4.3 Torque Values

Terminal connections should adhere to the appropriate torque values for the specified terminal type to provide optimum electrical conductivity. Refer to the data sheet for your particular battery's torque value. Over- or under-tightening the connections can result in terminal breakage, overheating and/or terminal melting. Use a rubber handled or insulated wrench when making terminal connections to avoid an external short circuit.

## 4.4 Terminal Protection

Battery terminals may be covered with a plastic cap to prevent an external short circuit. Terminals must be covered prior to battery disposal to a lithium recycler.

## 4.5 Battery Orientation

LFP Series LiFePO4 batteries can be installed upright or on their sides. Please ensure the battery is fastened if installed in a moving vehicle, such as in an RV or a boat.

## 4.6 Series or Parallel Connections (Just for capacity Over 50Ah include 50Ah)

When connecting batteries in series or parallel, please follow these guidelines:

(1) Make sure each battery is within 50mV (0.05V) of each other before putting them in service. This will minimize the chance of imbalance between batteries. If your batteries get out of balance, the voltage of any battery is >50mV (0.05V) from another battery in the set, you should charge each battery individually to rebalance. LFP Series 12V LiFePO4 batteries support series connections up to 4 units(24V 2 unites).

(2) Size batteries in parallel accordingly: The capacity of batteries (rated in amp hours) when connected in parallel is increased by the multiple of the batteries connected (2x, 3x, 4x, etc). However, the current ratings (discharge and charge) for parallel batteries is only increased by 75% of the multiple of the batteries connected (1.5x, 2.25x, 3x, etc). LFP Series 12V LiFePO4 batteries support parallel connections of up to 4 units (24V 2 units).

(3) Please reference LFP series LiFePO4 Charging Instructions document for series and parallel charging.

| Specifications for Batteries in Parallel |      |      |      |      |
|--|------|------|------|------|
| Battery Quantity                         | 1    | 2    | 3    | 4    |
| Voltage                                  | 12.8 | 12.8 | 12.8 | 12.8 |
| Capacity (Ah)                            | 100  | 200  | 300  | 400  |
| Max Continuous Discharge Current         | 100  | 150  | 225  | 300  |
| Peak Discharge Current                   | 200  | 300  | 450  | 600  |
| Rec'd Charge Current                     | 50   | 75   | 113  | 150  |
| Max Charge Current                       | 100  | 150  | 225  | 300  |

## 5. BATTERY STORAGE

### 5.1. Storage Temperature

- Recommended storage temperature: -5 to +35°C (23 to 95 °F)
- Storage up to 1 month: -20 to +60°C (4 to 140 °F)
- Storage up to 3 month: -10 to +35°C (14 to 95 °F)
- Extended storage time: +15 to +35°C (59 to 95 °F)

It is highly recommended to store lithium batteries indoors during the off season.

### 5.2. Storage SOC

It is recommended to store LiFePO<sub>4</sub> batteries at about a 50% state of charge (SOC). If batteries are stored for long periods of time, cycle the batteries at least every 6 months. Do not store batteries that are discharged.

## 6. BATTERY DISCHARGING

### 6.1 Discharge Temperature

LiFePO<sub>4</sub> batteries generate a fraction of the heat of other lithium chemistries when discharging, making them very safe. LiFePO<sub>4</sub> batteries can safely discharge between -20°C to 60°C (-4°F to 140°F). All LFP Series LiFePO<sub>4</sub> come with a BMS that protects the battery from low temperatures and high temperatures. If the BMS disconnects due to low temperature, the battery must warm up for the BMS to reconnect. If the battery disconnects due to high temperature, wait until the temperature reduces. Please refer to your particular battery's data sheet for BMS low temperature and high temperature cut-off values.

### 6.2 Discharging your LiFePO<sub>4</sub> Battery

LiFePO<sub>4</sub> batteries can be discharged up to 100% of their capacity. However, to optimize the performance of your LiFePO<sub>4</sub> battery, and to avoid the BMS disconnecting the battery, we recommend limiting the discharge to 80%. Please refer to your battery data sheet for the maximum rate of discharge for your specific battery model.

## 7. BATTERY CHARGING

### 7.1 When to Charge your LiFePO4 Battery

If LiFePO4 batteries are not fully discharged, they do not need to be charged after each use. LiFePO4 batteries do not get damaged when left in a partial state of charge (PSOC). You can charge your LiFePO4 batteries after each use or when they have been discharged up to 80% (20% SOC). If the BMS disconnects the battery due to low voltage, at 100% depth of discharge, remove the load to reconnect the battery circuit and charge immediately. You must use a LiFePO4 battery charger in order for the BMS to reconnect.

### 7.2 Charging Temperature

Lithium Iron Phosphate batteries generate a fraction of the heat of other lithium chemistries when charging, making them very safe. LiFePO4 batteries can safely charge between 0° C to 45° C (32° F to 113° F). LFP Series Low Temperature series (LT) can be charged between -20° C to 45° C (-4° F to 113° F). The LT series has a built-in heating system which activates when the temperature reaches the freezing point. It works by warming up the lithium cells to above freezing and only then the BMS would allow in the charging current. LiFePO4 batteries do not require temperature compensation for voltage when charging at hot or cold temperatures. All LFP Series LiFePO4 come with a BMS that protects the battery from under-temperature and over-temperature. If the BMS disconnects due to low temperature while charging, the battery must warm up for the BMS to reconnect and continue charging. If the battery disconnects due to high temperature, the BMS won't allow the battery to recharge until the battery's temperature is reduced. Please refer to your particular battery's data sheet for BMS low temperature and high temperature cut-off values.

## 7.3. Charging with Lead-Acid Chargers

Most lead-acid battery chargers can be used with LiFePO<sub>4</sub> batteries as long as they are within the appropriate voltage parameters. AGM and Gel algorithms typically fall within the LiFePO<sub>4</sub> voltage requirements, but you are still required to check the charging algorithm of your specific charger. The voltage for flooded battery charging algorithms are often higher than LiFePO<sub>4</sub> requirements, which will result in the BMS disconnecting the battery at the end of the charge cycle and may result in the charger displaying an error code. If this happens, it is generally good practice to replace your charger. Since the BMS protects the battery, using lead-acid chargers will not damage the battery. Please refer to LFP Series's Lithium Charging Instruction document for complete charging instructions. Important: If your battery's BMS disconnects due to low voltage during discharge, the battery's voltage will read 0V. In this case, a lead-acid battery charger may not be able to reconnect the BMS and recharge the battery. This is because a lead-acid battery charger requires a voltage reading to start charging. A LiFePO<sub>4</sub> battery is required to reconnect the BMS, as it is designed to 0V. This is why it's always recommended to use a charger designed for LiFePO<sub>4</sub> batteries.

## 8. BMS OPERATION

All LFP Series LiFePO<sub>4</sub> batteries come with a BMS, which protects against: Under and Over-Voltage/Current - during charging and discharging Temperature Extremes - low and high temperature cut-off Protection from Shorts - internal circuit. If the BMS disconnects the battery due to voltage or current limits, you must remove the load to reconnect the battery. If the BMS disconnects the battery due to temperature limits, you must wait for the temperature to adjust to reconnect the battery. While short-circuit protection protects the battery's cells, it still may produce a spark and damage your cable or bolt, so it is best to avoid short circuit conditions.

## 9. BATTERY RECYCLING

Terminals must be covered with a protective cap or non-conductive tape prior to battery disposal to lithium recycler. Dispose of LiFePO<sub>4</sub> batteries at an authorized lithium recycling facility or send it to seller or us.