



INSTALLATION & OPERATION MANUAL

This manual only applies to Relion Lithium Batteries. It does not apply to other lithium batteries or chemistries.

I. Safety

Lithium Iron Phosphate (LiFePO₄) batteries are an inherently safe chemistry. Please reference RELiON's Lithium Iron Phosphate Safety Document (available on our website at reliombattery.com) for more details. However, as with any electronics, safety measures should always be taken. Please adhere to the instructions within this manual for safe handling and operation.

- 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
- Do not smoke near batteries
- Keep sparks, flames and metal objects away from batteries
- Have RELiON's LiFePO₄ SDS on the premises
- Have a Class D fire extinguisher 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. LiFePO₄ Battery Basics (vs. Lead-Acid)

3.1. Basic Construction

RELiON LiFePO₄ battery packs include two main components:

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

3.2. Cell and Battery Pack Voltages

Lithium Iron Phosphate (LiFePO ₄) Nominal Voltage	Lead-Acid Equivalent Nominal Voltage
Cell = 3.2V	Cell = 2.0V
12.8V – 4 cells in series	12V
25.6V – 8 cells in series	24V
38.4V – 12 cells in series	36V
51.2V – 16 cells in series	48V



4. Battery Installation

4.1. Battery Connections

To maximize the performance and to ensure safe operation of your battery, use the appropriate cable size and tighten connections using the proper torque value. Refer to the data sheet for your particular battery's 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.



4.2. Cable Size

Choose the appropriate cable size based on the expected load of your system. See the table below – ENEC 310.15 (B)(16) – Allowable Ampacities of Insulated Conductors Rated 0-2000 Volts based on ambient temperature of 30°C (86°F).

Wire Gauge (AWG) – Copper Conductors	Ampacity (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, over-heating 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 with a protective cap or non-conductive tape prior to battery disposal to a lithium recycler.

4.5. Battery Orientation

Lithium batteries can be placed upright or on their sides.



4.6. Series or Parallel Connections

When connecting batteries in series or parallel, please 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. Please reference RELiON's LiFePO₄ Charging Instructions document (available on our website at reliionbattery.com) for series and parallel charging.

5. Battery Storage

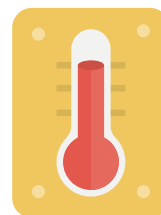
5.1. Storage Temperature

LiFePO₄ batteries can be stored between -20°C to 60°C (-4°F to 140°F).

5.2. Storage Conditions

Store batteries at 50% SOC to minimize irreversible capacity loss.

If batteries are stored for long periods of time, cycle the batteries at least every 6 months.



6. Battery Discharging

6.1. Discharge Temperature

Lithium Iron Phosphate batteries generate a fraction of the heat of other lithium chemistries making them very safe. LiFePO₄ batteries can safely operate between -20°C to 60°C (-4°F to 140°F). All RELiON LiFePO₄ come with a BMS that protects the battery from over-temperature. If the BMS disconnects due to high temperature, wait until the temperature reduces and the BMS reconnects the battery circuit before using or charging the battery. Please refer to your battery data sheet for BMS high temperature cut-off value.

6.2. Discharging your LiFePO₄ Battery

LiFePO₄ batteries can be discharged up to 100% of their capacity. However, to optimize the performance of your LiFePO₄ battery, and to avoid the BMS disconnecting the battery circuit, we recommend limiting the discharge to 80%. Please refer to your battery data sheet for the continuous and peak rates 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. Please note that we recommend storing batteries at 50% state of charge (SOC) to minimize irreversible capacity loss.

7.2. Charging Temperature

Lithium Iron Phosphate batteries generate a fraction of the heat of other lithium chemistries making them very safe. LiFePO₄ batteries can safely charge between -20°C to 55°C (-4°F to 131°F). However, at temperatures below 0°C (32°F) the charge current must be reduced as follows:

1. 0°C to -10°C (32°F to 14°F) charge at 0.1C (10% of the battery capacity)
2. -10°C to -20°C (14°F to -4°F) charge at 0.05C (5% of the battery capacity)

LiFePO₄ batteries do not require temperature compensation for voltage when charging at hot or cold temperatures. All RELiON LiFePO₄ come with a BMS that protects the battery from over-temperature. If the BMS disconnects due to high temperature, wait until the temperature reduces and the BMS reconnects the battery circuit before using or charging the battery. Please refer to your battery data sheet for BMS high temperature cut-off value.

7.3. Charging with Lead-Acid Chargers

Most lead-acid battery chargers can be used with LiFePO₄ batteries as long as they are within the appropriate voltage guidelines. AGM and Gel algorithms typically fall within the LiFePO₄ voltage requirements. The voltage for flooded battery charging algorithms are often higher than LiFePO₄ 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 a good practice to replace your charger. Since the BMS protects the battery, using lead-acid chargers will not damage the battery. Please refer to RELiON's Lithium Charging Instruction document (available on our website at reliionbattery.com) for complete charging instructions and parameters.

8. BMS Operation

All RELiON LiFePO₄ batteries come with in internal or external BMS. The BMS protects against:

1. Under-Voltage – during discharge
2. Over-Voltage – during charge or regen conditions
3. Over-Current – during discharge and charge
4. Over-Temperature – during discharge or charge
5. Short-Circuit Protection – protects battery cells from damage

Refer to the data sheet for your battery's specific discharge criteria. 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 reduce to reconnect the battery. If your equipment has parasitic loads, it may require a physical disconnect of the terminals to reconnect the battery circuit. Please note, that 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 LiFePO₄ batteries at an authorize lithium recycling facility.



10. Technical Support

If you have technical questions about the Product, please contact the place of purchase or RELiON Battery directly at 803-547-7288 or our toll-free number 844-385-9840.