



FORTRESS LITHIUM BATTERY INSTALLATION MANUAL

SECURE YOUR ENERGY WITH FORTRESS LITHIUM BATTERY SYSTEMS

Fortress battery systems utilize the industry's most environmentally benign chemistry- Lithium Iron Phosphate, which eliminates operating temperature constraints, toxic coolants and the risk of thermal runaway and fire. The built-in smart Battery Management System (BMS) integrates multilevel safety concepts: Overcharge and Deep Discharge Protection; Voltage and Temperature Observation.

Fortress High-performance Lithium Battery are manufactured at the highest quality standard. It comes with large power capacity, with a fast charging and continuous discharge power. The proprietary architecture and BMS eliminate the need for cooling or ventilation, which creates an efficient round-trip conversion.

Fortress Lithium Battery is safe, easy to install, consistently reliable, highly efficient. It provides you the lowest lifetime energy cost.

This installation manual contains information concerning important procedures and features of Fortress Lithium battery. Read all the instructions in this manual before installation, operation, transportation, storage and maintenance.

Safety Protocol and Protective Features:



IMPORTANT NOTE: Circuit Breakers, Disconnects and Fuses should be employed throughout several points of a power storage and generation installation to effectively isolate and protect all components of the system to safeguard against faults, short circuits, polarity reversals or a failure of any component in the overall system. Fuses, breakers, wiring ratings and values should be determined by established standards and evaluated by certified electricians, licensed installers, and regional code authorities. The Fortress Lithium Batteries must always be installed with a charge controller and the appropriate settings to protect the batteries from open PV voltage and other high voltage charging sources. The Fortress Battery Management System (BMS) alone will not protect the batteries from these extreme electrical phenomena. Failure to adhere to installation protocol will void the Warranty.



CAUTION: Verify polarity at all connections with a standard volt meter before energizing the system. Reverse polarity at the battery terminals will void the Warranty and destroy the batteries. Do not short circuit the batteries.

Most batteries pose some risk of shock or sparking during the installation and initial wiring and connection process. Wearing insulated gloves, clothing and footwear and using electrically insulated tools are required when working with Fortress Power Lithium Batteries. Cover, restrain or remove jewelry or conductive objects (metal bracelets, rings, belt buckles, metal snaps, zippers, etc.) when working with any electrical or mechanical device. Cover or restrain long hair and loose clothing when working with any electrical or mechanical device.



CAUTION: Do not combine Fortress Lithium Batteries with other brands or chemistries; Do not mix Fortress Lithium Batteries from different installations, clients, or job sites.



CAUTION: Do not disassemble or modify the battery. If the battery housing is damaged, do not touch exposed contents.

1. TRANSPORTATION AND HANDLING

Do not operate or store battery outside of operating limits; Do not knock, drop, puncture or crush battery; Do not expose battery to flames, incinerate or direct sunlight; Do not open battery case or disassemble battery; Do not lift battery by the terminal cables; Do not vibrate battery; Do not expose battery to water or other fluids.

2. INSTALLATION

2.1 Tools

1) Insulated tools sized to match nuts, bolts, and cables in use Voltmeter

2) Personal protective equipment

2.2 Inspection

- To check the battery package, type, quantity, appearance and other components
- Check if there is any damage on the battery box
- Check the battery terminals and connections to make sure they are clean, free of dirt, fluids and corrosion
- All battery cables and their connections should be tight, intact, and NOT broken or frayed
- Replace any damaged batteries and cables
- Check torque on terminal bolts



IMPORTANT NOTE: Please inform us within 7 days after receipt of goods if any problems, otherwise we deem clients have no objection to the goods.

2.3 Installation

- Clean cable connections. Broken, frayed, brittle, kinked or cut cables should be replaced
- Install and secure new battery. Be careful not to ground the terminals to any metal mounting, fixture, or body part
- Connect battery cables first and ground negative cable to avoid sparks
- Recommended terminal torque is 7.0 – 7.7 Nm (5.1 – 5.7 ft-lb)
- Power Cabling for the Fortress Power Battery is not included. System Wiring Basics Refer to published electrical wiring specifications and ratings, refers to the below Battery Cable Sizing Chart. Your qualified installer or application specifications will determine the wire gauge for your system.



CAUTION: Verify polarity at all connections with a standard volt meter before energizing the system.

Reverse polarity at the battery terminals will void the Warranty and destroy the batteries. Do not short circuit the batteries.

2.4 Parallel connection

Fortress Lithium Batteries are designed for parallel operation only - do not arrange in series for increased voltage. Series arrangement can result in damage to Fortress Lithium Batteries and will void warranty!

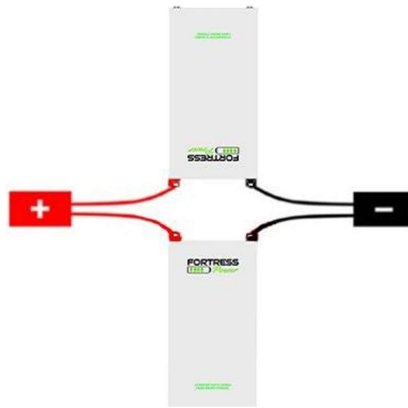
Fortress Lithium Batteries with the same capacity may be connected in parallel for up to 2 units only. All wires should be an appropriate gauge and constructed to handle the loads that will be placed upon it. Heavy gauge, high strand copper wire is the industry standard due to its stability, efficiency and overall quality. A qualified installer should understand this and must adhere to the industry standard and published electrical guidelines.




CAUTION!

For parallel connecting: • Maintain identical wire lengths from each Fortress Power Battery terminal to the common bus. • Use identical wire construction from each Fortress Power Battery terminal to the common bus.

Storage Capacity and total available Amperage is increased by Parallel arrangements. The following illustration shows two Fortress Lithium Batteries in Parallel. Note the overall Voltage range is not changed. The available amperage from the system has been doubled. The following illustration shows two Fortress Lithium Batteries in Parallel.



 **CAUTION!** Before you turn on the two parallelly connected Fortress Power Batteries, make sure both batteries have the same State Of Charge (SOC) to avoid the current flow from the higher voltage battery into the lower voltage battery. The large current could potentially damage one or both batteries.

2.5 Retrofitting

Retrofit Fortress Lithium batteries to an existing system is not recommend. Like all other batteries, Fortress Lithium Battery's open voltage will diminish during the operation. Parallel batteries with different open voltage may cause reverse currents, which could damage the batteries.

2.6 Connection Terminals

The Fortress Lithium Batteries are equipped with two M10 threaded terminals with a lock washer and nut. The right hand stud resides in a red high temperature molded insert. This connection is for the positive lead. The left hand stud resides in a black high temperature insert. This connection is for the negative lead. 10mm ring terminals along with proper size wiring cables are required to connect battery to inverter/charger. Do not reverse polarity, doing so will void warranty. Use a volt meter to check polarity before connecting terminals.

Water Resistant Plastic Terminal Covers are also included and will be in place when your units arrive. The boots are to be placed over the cable terminations and will stretch to form a water-resistant seal around the base of the molded inserts and terminal connections.

 **NOTE!** Without exception, product experiencing terminal burn out will not be warranted.

2.6 Mounting Hardware

The Fortress Power Batteries are designed to stand on the floor with 4 wheels on the bottom. If it's wished, the wheels can be disassembled. It's recommend to put the Batteries on durable racks to avoid flooding. Please refer to the Fortress Lithium Battery Data Sheet for weight and dimension.

KEY POINTS SUMMARY:

1. Each Fortress Lithium Battery contains circuitry that protects the Lithium Ferrite Phosphate cells from overcharging, over-discharging, and excessive load amperage. If the values specified are exceeded, the battery will enter a protective shut down state. In some cases, this may result in the need to re-initialize an inverter charger or other pieces of equipment in the installation. In other cases, the inverter's system settings may be saved within the inverter memory storage and will not need to be reset. This is not an absolute standard but is common among most inverter chargers. Check your inverter manufacturer

specifications.

- 2. If the battery enters a self-protective mode, negligible voltage readings will be present until the unit is reset. In some instances, after a prolonged shut down, a charge might need to be manually applied to the energy storage bank. Should this occur, please contact Fortress Power for technical support. Fortress Lithium Batteries are designed to remain robust and safe under most circumstances.
- 3. Although each Fortress Lithium Battery contains circuitry that protects the Lithium Ferrite Phosphate cells from overcharging, over-discharging and excessive load amperage, Fortress Lithium Batteries must always be installed with a charge controller and the appropriate settings to protect the batteries from open PV and other high voltage sources. Fortress Lithium Batteries alone will not protect from extreme electrical phenomena.
- 4. GRID TIED SYSTEMS: Once the Fortress Lithium Battery has been installed, turn on the entire system to test. Once testing has been completed, please disconnect the batteries from the load center until your local Utility Inspector is ready to turn on the entire system. The charge controllers and inverter monitoring systems can drain the Fortress Lithium Batteries over an extended period of time when the entire system is not fully operational due to the electrical draw of the system components.
- 5. OFF GRID SYSTEMS: Do not connect the Fortress Lithium Batteries until the entire system is ready to turn on and is fully operational.
- 6. See Charge Controller Settings in the Appendix of this manual. Fortress Lithium Batteries are compatible with almost all Inverter Chargers and Charge Controllers. Please contact Fortress Power to learn the recommended settings for any device not explicitly covered in this manual.

2.7 Final Connection of the Installation

Final installation and operation guidelines will be dictated by your Electrician and Installer based on the overall properties of and procedures for the equipment in your installation and any code requirements that apply to your region. Fortress Power technicians and sales staff are available to provide any additional information on the Fortress Lithium Batteries as needed. Please be aware of the potential electrical hazards before interacting with any and all electrical or mechanical devices. Please take all necessary safety precautions in your projects and installations.

3. OPERATING

3.1 Operating environment

Charge Temperature(Min./Max.)	0-45°C
Discharge Temperature(Min./Max.)	-20°C -60°C
Humidity	10%-90%RH

3.2 Storage


Do not expose battery to high temperatures. Fortress Lithium Batteries should be stored out of direct sunlight under the following temperature conditions.

Storage Temperature(Min./Max.)	-20°C -45°C
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Systems should be put into storage at 60% SOC and checked monthly to ensure the system SOC does not fall below 20%. At 20% SOC the battery will self-discharge in approximately 2 months. Also check the voltage every 3 months and recycle every 6 months if the battery is not use for long time.

3.3 Charging

Never attempt to charge a battery without first reviewing and understanding the instructions for the charger being used.

 **CAUTION! Do not attempt to charge the battery below 32 F (0 degrees C). Attempts to charge at subfreezing temperatures can adversely affect State of Health (SOC) and cycle life and will void the warranty; never charge battery if it is frozen; never charge a visibly damaged battery.**

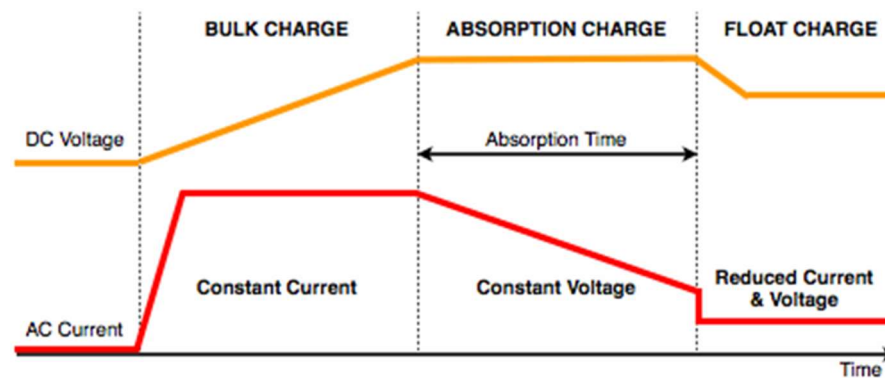
Only use a Fortress Power approved Lithium Ferrite Phosphate (LFP) charger if ancillary charging is required before installation, testing or troubleshooting. Failure to use a Fortress Power approved LFP charger will damage the battery and void the warranty.

Please follow the following steps to use the charger to charge the battery:

- 1) Connect the charger leads to the battery.
- 2) Make sure that the charger lead, both at the charger and the battery side, connections are tight.
- 3) Turn the charger on.

3.4 Charge Stage

- 1) Charge at constant current(CC) to 58.4VDC (Bulk)
- 2) Maintain constant voltage(CV) 58.4 VDC (Absorption)
- 3) Terminate when charge current drops below 0.05C and
- 4) During the float charge the voltage maintain at 54.4VDC
- 5) Max. charge voltage is 58.4VDC (over charge protection)



CAUTION!

Recommended charging current is 50A, Max. 100A

(Please follow the specification on Fortress Lithium Battery Datasheet.)

3.5 Discharging

- Do not discharge battery below operating voltage
- Do not discharge battery at rates greater than maximum continuous current
- Do not operate in conditions that will exceed the internal operating temperatures of the battery

4. GUIDE FOR OPERATING PARAMETERS

Before commissioning the energy storage system, the appropriate controller and inverter settings must be programmed per the manufacturer's recommendations. Consult the manufacturer's manuals and/or access technical support (Darfon, Schneider, Outback, SMA and Magnum, Outback).

Although Fortress Lithium batteries are capable of performing at very high rates and depths of discharge within a very wide temperature range, in order to achieve extended life cycles and to comply with the Warranty, the following guidelines should be followed:

Recommended operating parameters of charger/Inverters For 3,000 Cycles:

- Low cut-off Voltage: 46.4V
- High cut-off Voltage: 58.0V
- Operating temperature range: 14 F to 130F (-5 °C to 49°C)
- Discharge/Charge Rate: < 100 Amps

Recommended operating parameters of charger/Inverters For 6,000 Cycles:

- Low cut-off Voltage: 47.5 V
- High cut-off Voltage: 57V
- Operating temperature range: 32 F to 110 F (0°C to 43°C)
- Discharge/Charge Rate: < 30 Amps
- Storage must be equal to or more than twice the rated output of the Inverter

At the End of Cycle Life

- Equivalent to 70% Retained Capacity

4. PROTECTION AND FAULTS

In the event of a fault the battery protection circuit will open its internal relay/mosfet disconnecting the negative battery terminals from the internal cells. The battery uses a solid state relay/mosfet and precautions should be taken to reduce voltage spikes and large inductance in the application.

Over Voltage Fault	62.4±0.4V
Over Voltage Recovery	60.8±0.8V
Low Voltage Fault	32.0±0.8V
Low Voltage Recovery	36.80±1.6V

If batteries enter a self-protective mode, negligible voltage readings will be present until the unit resets. In some instances, after a prolonged shut down, a charge might need to be manually applied to the energy storage bank. Should this occur, please contact Fortress Power for technical support. Fortress Lithium Batteries are designed to remain robust and safe under most circumstances.

5. SERVICE AND MAINTENANCE

Batteries should be carefully inspected on a regular basis in order to detect and correct potential problems. This routine should be started when the batteries are first received.



PLEASE CONTACT US FOR TECHNICAL SUPPORT

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