INSTALLATION & OPERATION MANUAL

Lithium Iron Phosphate Batteries

This manual covers the safe installation, charging, operation, maintenance, and storage of ATB Power lithium iron phosphate ($LiFePO_4$ / LFP) battery systems with an integrated battery management system (BMS). Read it in full before installing or charging any battery.

BMS-MANAGED · MAINTENANCE-FREE · DROP-IN

Flat discharge, stable thermal profile, daily deep-cycle duty.

APPLIES TO

Lithium Motive (LFP-M): $LiFePO_4$ monoblocs for floor care, MEWP/AWP, golf, and light utility, in 24V, 36V, 48V, and 72V systems.

Lithium ESS (LFP-E): $LiFePO_4$ rack and wall energy-storage systems for solar, backup, and off-grid (where supplied).

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1 Important Safety Information

$LiFePO_4$ is one of the most thermally stable lithium chemistries, but a battery still stores significant energy. Installation and service must be performed only by trained personnel who have read and understood this manual. Keep this manual with the equipment.

WARNING — READ BEFORE HANDLING

- **Do not short-circuit.** A short across the terminals delivers very high current and can cause burns, arcing, or fire. Remove jewelry, use insulated tools, and keep metal objects away from the terminals.
- **Do not open or disassemble.** The pack and its BMS are sealed. Opening it exposes live cells and can cause a short or injury.
- **Do not crush, puncture, drop, or deform.** Mechanical damage to cells can cause an internal short and thermal event.
- **Do not expose to fire, water, or extreme heat.** Do not immerse the battery or operate it outside the rated temperature range.
- **Stop immediately** if you observe abnormal heat, swelling, odor, smoke, deformation, or noise. Disconnect if safe, move people away, and ventilate the area.
- **Electric shock.** Higher-voltage systems (48V and 72V) can present a shock hazard. Treat the system as live at all times.

In Case of a Damaged Battery or Fire

- A $LiFePO_4$ fire is best controlled with large amounts of water to cool the cells, or with a Class D / lithium-rated extinguisher. CO_2 will not cool the cells.
- A damaged or swollen battery may vent flammable, irritating gas. Evacuate and ventilate the area and do not inhale the vapor.
- Isolate a damaged battery outdoors, away from combustibles, and contact ATB Power and your local authorities for disposal.

> **DO NOT**
>
> Do not charge below 0°C. Do not exceed the rated charge voltage or current. Do not connect batteries of different voltage, capacity, age, or state of charge in the same bank. Do not use a lead-acid or unmanaged charger without an LFP profile. Do not defeat or bypass the BMS.

2 Product Overview & Technology

ATB lithium batteries use lithium iron phosphate ($LiFePO_4$) cells assembled into series/parallel monoblocs with an integrated battery management system (BMS). They deliver a flat discharge voltage, high usable capacity, fast charge acceptance, long cycle life, and a stable thermal profile, with no watering, no off-gassing, and no acid-spill risk.

Cell Chemistry & Configuration

The nominal cell voltage is 3.2 V. Cells are connected in series to build the system voltage: 8 cells (8S) for a 24 V system, 12S for 36 V, 16S for 48 V, and 24S for 72 V. Parallel groups increase capacity. Typical capacities range from about 105 Ah to 304 Ah per monobloc.

Battery Management System

Every pack includes a BMS that protects the cells and balances them during charge. The BMS provides over-charge, over-discharge, over-current/short-circuit, and over/under-temperature protection, and disables charging below 0°C. See Section 7.

> **KEY POINT**
>
> An ATB lithium monobloc is a managed system, not a bare battery. Always use a charger set to the correct **$LiFePO_4$ profile and system voltage**, and operate within the temperature and current limits on the product datasheet.

3 Receiving, Inspection & Storage

On Receipt

- Inspect each battery for shipping damage, cracks, dents, or swelling. Report freight damage to the carrier immediately. Do not install a damaged battery.
- Confirm the model, system voltage, and capacity match your application and charger.
- Batteries ship at a partial state of charge (typically 40–60%). Fully charge before first use.

Storage

Store batteries indoors in a clean, dry, ventilated place, away from heat and direct sunlight. $LiFePO_4$ self-discharges slowly, but the BMS draws a small standby current, so a stored battery will gradually lose charge.

- Store at a **40–60% state of charge** for best calendar life.
- Storage temperature: short-term (≤ 1 month) –20°C to +45°C; longer term (≤ 3 months) 0°C to +45°C. Cooler storage within range slows ageing.
- For long-term storage, recharge the battery for 2–3 hours every **3 months** to keep it in the recommended state-of-charge band.
- Do not leave a battery fully discharged. A pack left flat for a long time can fall into BMS under-voltage lockout and may not recover.

> **CAUTION**
> Storing a lithium battery fully discharged, or leaving it in deep over-discharge, can permanently damage the cells.

4 Installation

Correct installation is the first step to safe, long-life operation.

Location & Environment

- Mount in a clean, dry location with room for air circulation. ATB monoblocs use passive (natural-convection) cooling, so do not seal them in an airtight box or block airflow.
- Keep the battery away from heat sources and direct sunlight. Best life and performance are achieved near 15–30°C.
- Protect from water ingress and from continuous heavy vibration beyond the product rating.

Orientation & Mounting

- Mount the battery the right way up unless the datasheet states otherwise. Secure it so it cannot move under vibration, shock, or vehicle motion.
- Support the full base and verify the rack or tray load rating.

> **LEAD-ACID RETROFIT**
> ATB lithium monoblocs are sized to common lead-acid footprints for direct upgrade. Lithium is lighter than the lead-acid pack it replaces; on counterbalanced machines, **external counterweight compensation may be required** to maintain the original machine stability. Confirm with the equipment manufacturer.

Cabling & Connections

- Size cables for the maximum charge and discharge current. Under-sized cables overheat, drop voltage, and are a fire hazard.
- Observe correct polarity. Make the final connection at the load/charger, not at the battery, where practical. Never reverse polarity.

- Keep terminal connections clean and tight; tighten to the torque marked on the battery. Re-check after the first weeks of service.

Series & Parallel

- Connect batteries in series or parallel only where the product datasheet and BMS explicitly allow it. Many monoblocs are designed for single-unit use at their rated system voltage.
- When banks are permitted, use only identical models at the same state of charge, fully charge each unit first, and use equal-length cables so current is shared evenly.
- Do not mix lithium with lead-acid in the same bank, and do not mix different lithium models.

> **CAUTION**
> Incorrect series/parallel wiring can overload the BMS, cause uneven current sharing, and damage the batteries. If you are unsure whether a model can be banked, contact ATB Power before wiring.

5 Charging

Use a charger designed for $LiFePO_4$ set to the correct system voltage. A standard constant-current / constant-voltage (CC/CV) lithium charger is suitable. Lithium batteries do **not** need, and should not be given, a continuous float or equalization charge.

Charge Method

- **Constant current (CC):** charge at the rated current up to the charge voltage. Standard charge current is 0.5C; maximum is 1C unless the datasheet states otherwise (C = rated capacity in Ah).
- **Constant voltage (CV):** hold the charge voltage until the current tapers to about 0.05C, then stop. The BMS balances the cells near the top of charge.

Charge Voltage by System ($LiFePO_4$, 25°C)

SYSTEM	CELLS (S)	NOMINAL	CHARGE VOLTAGE	DISCHARGE CUT-OFF
24 V	8S	25.6 V	29.2 V	20.0 V
36 V	12S	38.4 V	43.8 V	30.0 V
48 V	16S	51.2 V	58.4 V	40.0 V
72 V	24S	76.8 V	87.6 V	60.0 V

Per cell: nominal 3.2 V, charge 3.65 V, discharge cut-off 2.5 V. Always defer to the specific model datasheet where it gives different values.

Temperature Limits

- Charge only between **0°C and +65°C**. Charging below 0°C damages lithium cells; the BMS blocks charging when the battery is too cold.
- Discharge between –35°C and +65°C. Capacity is reduced at low temperature and recovers as the battery warms.

Commissioning & In Service

- Fully charge before first use.
- Recharge after use; there is no memory effect and partial charging is fine. There is no need to fully discharge before recharging.
- If the BMS has cut off on low voltage, recharge promptly to wake and balance the pack.

DO NOT

Do not use a lead-acid charger profile, a desulfation/equalization mode, or an uncontrolled power supply. Do not exceed the charge voltage or current. Do not charge a battery that is damaged, swollen, or below 0°C.

6 Operation

Discharge & Cycle Life

$LiFePO_4$ delivers a flat voltage through most of the discharge, so equipment runs at near-full performance until the battery is nearly empty. Keep discharge within the rated current. Rated cycle life is at least 2000 cycles to 80% of nominal capacity at 80% depth of discharge under controlled conditions; actual life depends on depth of discharge, temperature, and charge management.

Temperature Effects

- Rated capacity is specified at 25°C. Usable capacity falls at low temperature and recovers when the battery warms.
- Sustained high temperature accelerates ageing. Keep the battery near 15–30°C for best life.

State of Charge

The flat $LiFePO_4$ discharge curve means resting voltage is a poor state-of-charge indicator. Use the BMS state-of-charge readout or a coulomb-counting gauge where available. The rest-voltage figures below are approximate only.

STATE OF CHARGE	PER CELL (REST)	24 V SYSTEM	48 V SYSTEM
100%	~3.40 V	~27.2 V	~54.4 V
70%	~3.30 V	~26.4 V	~52.8 V
40%	~3.25 V	~26.0 V	~52.0 V
20%	~3.20 V	~25.6 V	~51.2 V
0%	~2.50 V	~20.0 V	~40.0 V

Approximate rest voltages for $LiFePO_4$ at 25°C after the battery has settled. Voltage under load reads lower. Do not rely on voltage alone to judge state of charge.

7 Battery Management System (BMS)

The integrated BMS continuously monitors cell voltages, current, and temperature, and balances the cells during charge. It will automatically protect the battery by disconnecting or limiting it when a limit is reached:

- **Over-charge / over-voltage:** stops charging if any cell reaches its upper limit.
- **Over-discharge / under-voltage:** disconnects the load to protect the cells.
- **Over-current / short circuit:** disconnects to prevent damage and fire.
- **Over- / under-temperature:** limits or stops charge/discharge; blocks charging below 0°C.

After a protection event, remove the cause (reduce load, warm or cool the battery, or apply a correct charge) and the BMS will normally re-enable the battery. Applying a charge is the usual way to recover from an under-voltage cut-off. If the battery does not recover, contact ATB Power.

8 Maintenance & Inspection

ATB lithium batteries are maintenance-free in normal use. Periodic inspection keeps them safe and reliable.

- Keep the battery clean and dry. Wipe with a dry or slightly damp cloth; do not use solvents.
- Inspect for damage, swelling, corrosion, or loose connections. Re-torque terminals to specification.
- Verify the charger output voltage and that it uses the correct $LiFePO_4$ profile.
- For batteries in storage, recharge to the 40–60% band every 3 months.
- Keep firmware/charger settings as supplied; do not modify BMS parameters.

9 Troubleshooting

SYMPTOM	LIKELY CAUSE	ACTION
Will not charge	Battery too cold (<0°C); wrong charger; BMS fault	Warm battery above 0°C; use correct LFP charger/ voltage; recycle charger power
Sudden loss of output	BMS over-current, over-discharge, or over-temperature cut-off	Reduce load, let temperature normalize, then recharge to reset
Short runtime	Low charge, cold temperature, ageing, partial charge	Fully charge; check temperature; check charger taper; test capacity
Battery seems dead / no voltage	Deep over-discharge; BMS in protection/ sleep	Apply a correct charge to wake the BMS; if no recovery, contact ATB Power
Swelling, heat, odor, smoke	Cell damage or fault	Stop use immediately, isolate safely, do not charge, contact ATB Power

STOP AND ISOLATE IF

The battery is hot, swelling, leaking, smoking, or making noise. Disconnect if it is safe to do so, move it away from combustibles and people, ventilate the area, and do not attempt to charge it.

10 Transport, End-of-Life & Recycling

Transport

Lithium iron phosphate batteries are regulated as Class 9 dangerous goods for transport (UN3480 for batteries shipped alone, or UN3481 for batteries packed with or installed in equipment). They must be shipped at a partial state of charge, protected against short circuit and damage, and packaged, marked, and labeled per the current ADR, IMDG, and IATA lithium-battery rules. Confirm requirements with your carrier before shipping. Do not ship a damaged or recalled battery without specialist advice.

Recycling & Disposal

- Do not dispose of lithium batteries in household waste, in fire, or in water.
- Return spent batteries to an authorized lithium-battery recycler or to the point of purchase.
- Protect terminals against short circuit before transport to recycling. Follow all local, national, and regional regulations.

11 Specifications Quick Reference

PARAMETER	VALUE
Chemistry	Lithium iron phosphate ($LiFePO_4$)
Cell nominal / charge / cut-off	3.2 V / 3.65 V / 2.5 V
System voltages	24 V (8S), 36 V (12S), 48 V (16S), 72 V (24S)
Standard / max charge current	0.5C / 1C
Charging temperature	0°C to +65°C (no charging below 0°C)
Discharging temperature	–35°C to +65°C
Storage temperature	–20°C to +45°C (≤1 mo); 0°C to +45°C (≤3 mo)
Recommended storage SOC	40–60%; recharge every 3 months
Cycle life	≥ 2000 cycles to 80% capacity (80% DoD)
Cooling	Passive (natural convection)
Float / equalization	Not used on lithium

SUPPORT

For model-specific values, banking approval, charger selection, or technical support, contact ATB Power at **info@atbpower.com** or **atbpower.com**. Operating the battery outside the conditions in this manual can shorten its service life.

This manual provides general guidance for ATB lithium iron phosphate ($LiFePO_4$) battery systems. Where a specific battery datasheet or label states different values for voltage, current, temperature, or torque, those model-specific values take precedence. Specifications are subject to change without notice.