Kullfallet Battery Manual

Björn Morén 2026-04-17

Summary

This is the manual for the LiFePO4 battery pack used at Kullfallet. The battery is maintenance free and you don't need to read this manual to operate the battery. Refer to this document if you have any issues with the battery.

Supplier

Shenzhen Luyuan Technology Co., Ltd. Contact: Amy Wan (owner).

https://szluyuan.en.alibaba.com/

16 x EVE LF280K, 3.2 V 280 Ah cells. Grade "B" (not for EV use). Voltage, IR and capacity matched.

2 x JiKong BMS, JK-B2A8S20P, 2 A, 8S.

Measured at Luyuan office before shipping:

Cell no	**Mfg date**	**Capacity**	**IR**	**Cell no**	**Mfg date**	**Capacity**	**IR**
A1	2023-07-24	309.4 Ah	0.19 mΩ	**B1**	2023-07-23	309.8 Ah	0.19 mΩ
A2	2023-07-23	308.6 Ah	0.19 mΩ	**B2**	2023-07-24	310.9 Ah	0.19 mΩ
A3	2023-07-23	308.9 Ah	0.18 mΩ	**B3**	2023-07-24	311.9 Ah	0.19 mΩ
A4	2023-07-23	308.0 Ah	0.18 mΩ	**B4**	2023-07-23	309.9 Ah	0.18 mΩ
A5	2023-07-23	309.2 Ah	0.18 mΩ	**B5**	2023-07-23	309.6 Ah	0.18 mΩ
A6	2023-07-23	308.6 Ah	0.17 mΩ	**B6**	2023-07-23	309.5 Ah	0.17 mΩ
A7	2023-07-23	309.0 Ah	0.17 mΩ	**B7**	2023-07-23	309.8 Ah	0.17 mΩ
A8	2023-07-23	308.0 Ah	0.17 mΩ	**B8**	2023-07-24	309.6 Ah	0.17 mΩ

Pack configuration

Two packs of 8 cells in series each. One BMS per pack. One 300 A fuse per pack.

Nominal voltage 25.60 V. Capacity 309 Ah.

Total capacity of 618 Ah, 15.8 kWh.

I started using the battery on 2023-12-14.

EVE LF280K data

Primary use is for electric vehicles. Cells from the manufacturing line are tested, and if they pass the strict EV requirements they are called “EV grade cells”. Cells that don’t pass are still fully usable for solar power and called “Grade A”, “Grade B” or “Storage grade” cells, and sold separately on Alibaba.

- Nominal capacity 280 Ah
- Nominal voltage 3.2 V
- Max continuous discharge rate 1C (280A), max peak discharge rate 2C (560 A)
- Self discharge 3%/month
- Initial IR <= 0.25 mOhm
- Weight 5490 g
- Charge cut-off voltage 3.65 V
- Standard charge cycle: 2.50V to 3.65V, 25 C, 0.5P, 300 kg clamping force. Lifespan 6000 cycles.
- Newer datasheets specify charging rate in terms of power (0.5P), not current (0.5C).
- Charge temp: 0 C – 60 C.
- Discharge temp: -30 C – 60 C.
- Max torque on terminals: 6 Nm.
- Size: 207.2 x 173.7 x 71.7 mm.

A fully charged and rested LFP cell has a voltage of 3.37 V. Immediately after a full charge the voltage is higher, but quickly drops with a minimal load.

System specs

- **Inverter**: 3 kW continuous (125 A), 6 kW peak (250 A). One battery can power the inverter if needed. Having two batteries makes for good redundancy.
- **Charge controller**: max 100 A = 0.18C.
- **Normal discharge current**: 3 A / 0.005C (72 W winter mode), 12 A / 0.02C (300 W summer mode), and 42 A / 0.08C (1000 W well pump)

Charge settings

Charging methods are a carry-over from lead acid chargers, because most chargers are designed for that chemistry. However, they can be set up to work for LFP.

- The **bulk phase** charges the battery with constant current and the voltage rises steadily. When the voltage reaches a certain target, the charger switches to absorption.
- The **absorption phase** charges with constant voltage and current drops steadily. After a specific time and/or reaching below a specific current, the charger switches to float.
- The **float phase** keeps the cell at a specific voltage, so it is topped up while loads are used. If the cell is already at 100% SOC, this means no charge current at all.

Person	Bulk voltage	Absorption time	Tail current	Float voltage
Björn Morén	3.45 V	2 hr	0.02C	3.375 V
UpNorthAndPersonal	3.50 V	-	-	3.37 V
Will Prowse	3.625 V	-	-	3.40 V
Will Prowse, long life	3.525 V	-	-	3.40 V
Steve_S	3.45 V	45 min	-	3.437 V
Off-Grid Garage	3.45 V	60 min	-	3.35 V
Solar Engineering YT	3.45 – 3.55 V			
Sunshine_eggo, slow	3.45 V	2 hr	0.02C	3.375 V
Sunshine_eggo fast	3.55 – 3.60 V	30 min	0.05C	3.375 V
Mikefitz, 0.25 C	3.50 V	-	-	3.35 V

https://diysolarforum.com/threads/best-lifepo4-charge-controller-settings-known-to-man-for-maximum-service-life-and-minimum-battery-stress-5-000-10-000-cycles.34813/

Current tail means to stop the absorption phase when the current drops to a specific value. Most chargers don't support this method.

No need for temp compensation for LFP.

The higher bulk voltage you pick, the bigger the risk the BMS will have a cell that reaches the OVP limit (cell over voltage protection limit), which will disconnect the battery.

For a simple charge profile that only has a bulk phase and a float phase (no absorption), then it is crucial to pick the correct voltage to end the bulk. For a given charge rate, for example, 0.1C, a specific bulk voltage will get the pack to specific SOC: 3.40 V = 93.5%. 3.45 V = 96%. 3.50 V = 97.5%. 3.55 V = 98%. 3.60 V = 99% (see chart on last page). But this is only half the story because with solar, the charge rate varies with available sunshine. A lower charge rate, for example 0.05C will get the pack to a higher SOC for the same voltage. 0.05C @ 3.50 V = 98.5%. Each bulk voltage has a certain charge rate where the pack will get to 100%. Any rate below that will get the pack overcharged, which we want to avoid.

So picking a bulk voltage is a compromise between how close you want to get to 100% SOC for your max charge rate, and how well you want to be protected against overcharging at low charge rates. In other words, every bulk voltage has a span of charge rates that it works well for. However you should not go below 3.40 V because the charge curve starts to get very flat after that, and the resulting SOC will vary widely between charges.

My charger can deliver max 100A (0.18C), a very modest charge rate for EV batteries. A bulk voltage of 3.45 V will get the pack to 96% SOC at the highest charge rate, which is fully acceptable, only shortening the range by 4%. Any lower charge rate will get the pack closer to 100%. From the chart I estimate that a 0.02C rate (11 A / 285 W) will get the pack to 100% SOC, and anything below that will overcharge the pack.

Float should always be 3.37 V, the natural resting state of a 100% SOC cell (or slightly higher 3.375 V / 27.00 V).

Sungold charger settings

I don't know if this charger uses absorption or if it goes straight from bulk to float. This means that there is a risk it stays in absorption for some time, which means it will continue charging even when the cells are fully charged, which will result in damage from over charging. To minimize this risk, the lowest possible bulk voltage is used. It is also very uncommon to use the Sungold with the generator when the battery has a high SOC, so this problem is easy to avoid: **only use the generator when the SOC is getting low**.

Sungold charge profile: "AGM 1" profile. 14.1 V absorption (3.52 V), 13.4 V float (3.35 V).

Victron SmartSolar 250/100 settings

Download the VictronConnect app from Google Play or the App Store.

Bluetooth pairing pin: 823031.

Using the VictronConnect app:

- Battery voltage: 24 V
- Max charge current: 60 A. This is to prolong the lifespan of all components. The controller and adjacent components get a bit hot when using higher currents.
- Absorption voltage: 27.60 V (3.45 V)
- Float voltage: 27.00 V (3.375 V)
- Equalization: disabled
- Re-bulk voltage offset 0.20 V = 27.00-0.20 = 26.80 V (3.35 V). If the battery drops below this voltage, the controller enters the bulk stage again
- Absorption duration: fixed
- Absorption time: 2h 0m (can be this long because it will be limited by tail current)
- Tail current: 15.0A (0.02C = 11.8 A plus 100 W consumption = 3.9 A, total = 15.7 A)
- Temperature compensation: disabled

JK BMS

- Max continuous current 200 A, max peak current 350 A.
- Balancing current: 2 A.

Download the JK BMS app from Google Play or the App Store.

Password: 1111. Settings password 2222. ~~Default password: 1234. Default settings password: 123456.~~

Battery A, BMS: Vendor ID: JK_B2A8S20P. Serial number: 3051240026. Hardware version: V11.XW. Software version: V11.262H. Version V4.16.2.

Battery B, BMS: Vendor ID: JK_B2A8S20P. Serial number: 3051240169. Hardware version: V11.XW. Software version: V11.262H. Version V4.16.2.

Over time it might happen that some cells are not at the charge level of the other cells. The BMS has a cell balancing function that fixes this problem. It goes into balancing mode when at least one cell is above the **Start Balance Voltage (3.40 V)** and at the same time the voltage difference between the cell with the highest and lowest voltage is greater than the **Balance Trigger Voltage (0.010 V)**. Then it discharges the highest voltage cell into an internal super capacitor, and uses that energy to charge the lowest voltage cell, then repeats.

Start Balance Voltage should not be too low (it leads to needless shuffling between cells and potential “runners”) or too high (not enough time to balance the cells which leads to “runners”). Over time the BMS might get the resistance of the balancing leads slightly wrong, which will make it over-estimate the voltage of a cell when charging and under-estimate the voltage when discharging. This happened in February 2026, when I used a Start Balance Voltage of 3.37 V, leading to three cells becoming “runners” and triggering an Over Voltage Protection. So when cells were getting near full SOC, it aggressively removed charge from the runners, then when at full SOC it aggressively added charge to the runners. The adding part was larger than the removal part. Over time it becomes over charged. The solution to this is to set the **Start Balance Voltage higher, 3.40 – 3.45 V**, which seems to be the common value.

The Balance Trigger Voltage value should be around 0.010 V.

For other values, just accept the default LFP settings in the JK BMS.

To get the pack up and running with the JK BMS, you need to first turn it on. It has no on/off switch, instead the turn on is triggered when the voltage of the charger is 2 V or higher than the voltage of the pack. For a charge voltage of 3.50 V (28 V), this means the cells would have to be at 3.25 V (26 V), which is 10% SOC, so it is not practical. Instead you can manually turn on the BMS by connecting the positive side of a 9 volt battery to the negative end of the cells (the B- lead of the BMS). Then briefly touch the negative side of the 9 volt battery to the P- lead of the BMS (the lead that goes to the system busbar).

Settings for phone app (via Bluetooth)

- Cell count: 8
- Battery capacity: 280 Ah
- Balance Trig. Volt: 0.010 V
- Calibrating Volt: (do not change initially, later set it to whatever the charge controller measures when almost no current is flowing in/out of the battery)
- Calibrating Curr: (do not change)
- Start Balance Volt: 3.45 V
- Max Balance Curr: 2.0 A

- Cell OVP: 3.60 V (over voltage protection)
- Cell OVPR: 3.55 V (over voltage protection reset)
- Cell UVPR: 2.65 V (under voltage protection reset)
- Cell UVP: 2.60 V (under voltage protection)
- Power Off Voltage: 2.50 V
- Continued Charge Current: 100 A (max continuous charge current)
- Charge OCP Delay: 30 s (how long to allow max charge current to be exceeded)
- Charge OCPR Time: 60 s (reset time after exceeding max charge current)
- Continued Discharge Curr: 200 A (max continuous discharge current)
- Discharge OCPR Time: 60 s (reset time after exceeding max charge current)
- Charge OTP: 70 C (max cell temperature while charging)
- Charge OTPR: 60 C (reset temperature if exceeded Charge OTP)
- Discharge OTP: 70 C (max cell temperature while discharging)
- Discharge OTPR: 60 C (reset temperature if exceeded Discharge OTP)
- Charge UTP: 3.0 C (min cell temperature while charging)
- Charge UTPR: 5.0 C (reset temperature if exceeded Charge UTP)
- MOS OTP: 100 C (max MOS transistor temperature)
- MOS OTPR: 80 C (reset temperature of exceeded MOS OTP)
- SCP Delay: 1500 us
- SCPR Time: 60 us
- Device addr: 0
- User Private Data: Userdat

Fuses

With an IR of 0.25 mOhm, a 3.2V cell can deliver a 12.8kA current in short circuit. Standard practice for multiple parallel batteries is to have a fuse on each in case one battery short circuits. Taking the 0AWG leads into account, the R gets to around 0.65 mOhm, so the fuse must be able to reliably break a 5 kA current. Such fuses can be very expensive ($100 USD). One type of cheap 5 kA break fuses is MRBF, which are mounted directly on the battery terminal to save space (marine application).

I use a MRBF fuse of 300 A on each battery.

Top balancing

Top balancing means to charge all cells individually to become 100% SOC, then connecting them together to a battery. This should normally be done before you start using the battery. However, a battery with a BMS will eventually become balanced by the BMS itself; it is just a matter of how long time it takes. The only risk is that the cells are so unbalanced that one of them will trigger OVP as you approach 100% SOC. So for the very first cycle, you keep a close track on the voltage of all the cells as they approach 100% SOC. When one of them gets very close to OVP (Over Voltage Protection turn off), turn off the charger and let the BMS balance the cells for a few hours until the delta is 10 mV. Then turn on the charger again and repeat until you reach 3.50 V.

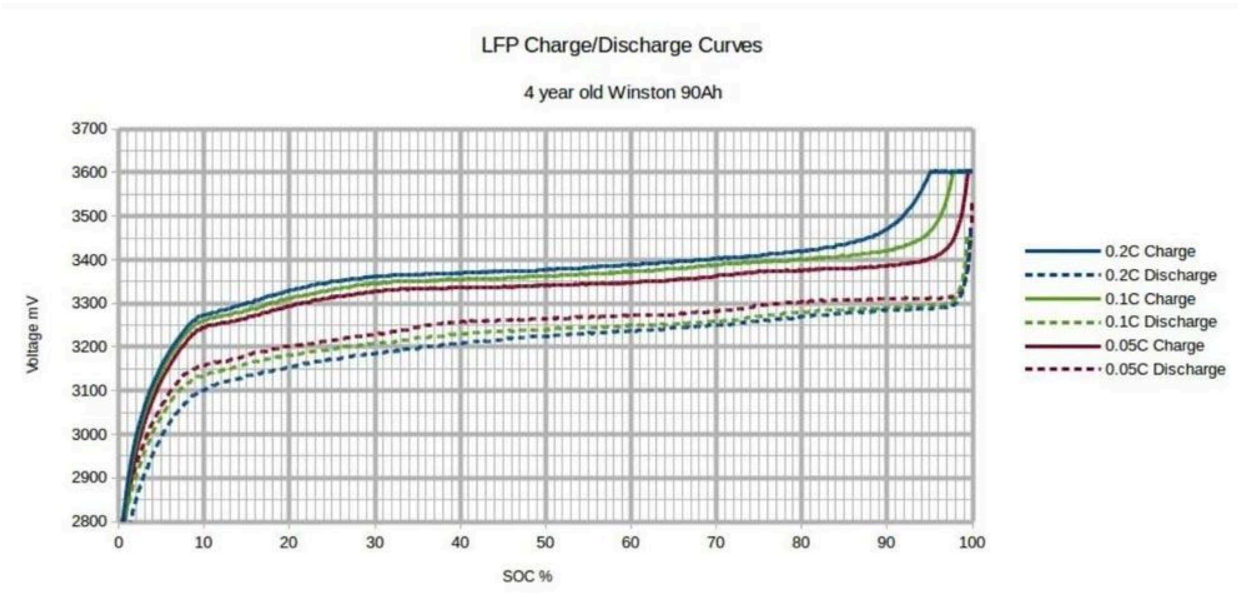
Cell compression

According to the manufacturer specs, the cells should be compressed with a 300 kg force before use. This will add to the cycle life of the cells. The compression counteracts the natural tendency of swelling as the cell gets charged. A cell swells more at high charge rates and especially when it is overcharged. This can in extreme cases lead to delamination (the layers of material in the anode and cathode separate).

However, for solar applications the charge rate is low, and overcharging is rare. It is also very rare to hit cycle life before calendar life. In other words, the natural degradation of the cell is what will eventually wear it out, not the number of charge cycles. So cell compression is normally not used for solar.

Charge curves

- LFP cells are designed to be charged much more quickly than is possible with solar, typically 0.5C or 1C. A lower charge rate will extend lifetime and also have higher return trip efficiency.
- Cell voltage is very flat from 15% to 85% SOC. SOC can only reliably be determined at < 15% and > 85% SOC.
- Chargers are normally designed for lead acid but can be reconfigured for LFP.
- Unlike lead acid, a LFP cell is sensitive to overcharging. This degrades it over time, and should be avoided.
- A LFP cell is very sensitive to over discharge, which will instantly break it.
- All voltages above the 100% SOC voltage (3.37 V) will eventually make the cell overcharged, if you give it enough time.
- Very few people charge at the manufacturer recommended voltage of 3.65 V because it wears out the cells quicker. This voltage is designed for quick charging, and doesn't apply to solar. A very common voltage is instead 3.50 V.
- Algorithms for optimal charging involve constant current (bulk) charging followed by constant current (absorption) charging, which terminates after a specific time or when the current drops to a certain level. This is too complex for normal chargers, and it will not work for solar where the available current varies throughout the day.
- A simplified charging model instead uses bulk charging until a certain voltage is reached, and then charge is terminated, and switched to floating, which maintains the cell at 3.37 V.
- Different charge rates result in different SOC when the target voltage is reached. From the diagram below: At 0.2C charge rate, 3.50V means 92% SOC. 0.1C = 96%. 0.05C = 98%. Very low charge rates will reach 100% SOC before the target voltage is reached, and thereby over charging the cell.
- My system uses at most 0.1C (60A), which will charge the cell to 95% SOC. Most of the time rate is lower and the SOC will approach 100%.



- Capacity varies greatly with cell temperature. +40 C = 107%, +25 C = 100%, +10 C = 94%, 0 C = 80%. Voltage also varies with temperature; it increases as the temperature goes up. Lifespan is shorter at temperatures above +40 C.

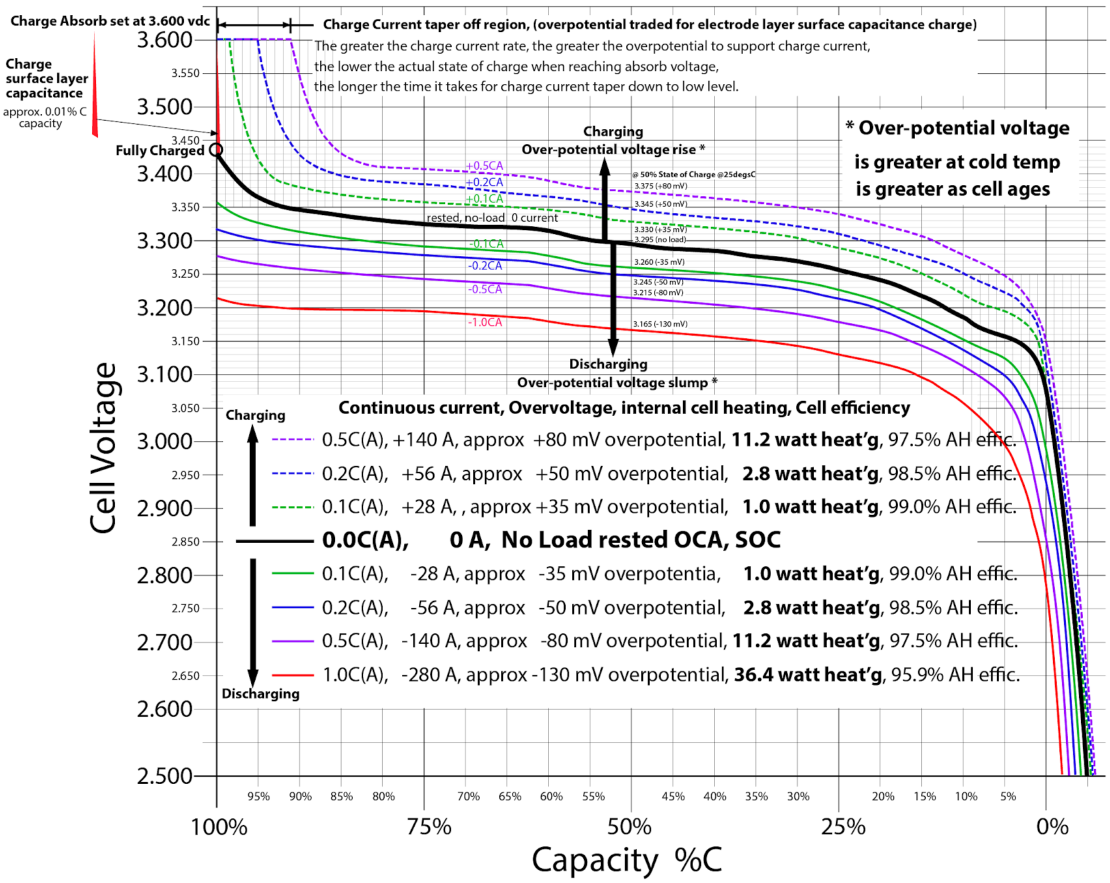
New cell initial performance of EVE LF280 LiFePO4 280 AH discharge & charge curves at cell current rate equilibrium @ 25 degs C

at any SOC point, if cell current is brought to zero cell current then within several minutes, rested cell voltage will return to unloaded cell voltage

(overpotential depends on cell condition, increases 3x to 5x as cell ages)

(overpotential increases at colder cell temperatures)

(overpotential has two primary components, IR conductors resistance of cell and lithium ion mobility within cell)



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