

PRODUCT SPECIFICATION

Lithium Iron Phosphate (LFP) Rechargeable Cell

Cell Type: IFpP40130220-100 (3.2 V 100 Ah)

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1. Scope

This Product Specification describes the technical requirements, test procedures and precautionary notes of the prismatic-type Lithium Iron Phosphate (LFP) rechargeable cell to be supplied to the customer by Siri Techno Fabs (STF).

2. Cell Type

IFpP40130220-100 — 3.2 V 100 Ah LFP prismatic cell for energy storage, with M6 internal-thread terminals.

2.1 Specification

Item	Specification	Condition
Maximum Charging Voltage	3.65 V	/
Nominal Voltage	3.2 V	/
Rated Capacity	100 Ah	0.2C discharge to 2.5 V, 25±2°C
Standard Charging Current	0.5C	/
Max. Continuous Charge Current	1C	/
Max. Discharge Current	3C for 30 s	100% SOC, 25±2°C
Discharge Cut-off Voltage	2.5 V	/
Operating Temperature (Charge)	0 ~ 45°C	65±20% RH
Operating Temperature (Discharge)	-20 ~ 60°C	65±20% RH
Recommended Storage Temperature	15 ~ 35°C	/
Cell Weight	Approx. 2.3 kg	/
AC Internal Resistance	≤ 0.6 mΩ	AC 1 kHz
Cell Dimensions	Thickness: 40.2 ± 0.5 mm Width: 130.2 ± 0.5 mm Length: 220.0 ± 1.0 mm	Including wrap film

2.2 Cell Dimension

Both terminal poles are M6 × 1.0 internal thread, tightening torque ≤ 8 N·m. The positive terminal is aluminium; the negative terminal is nickel-plated copper.

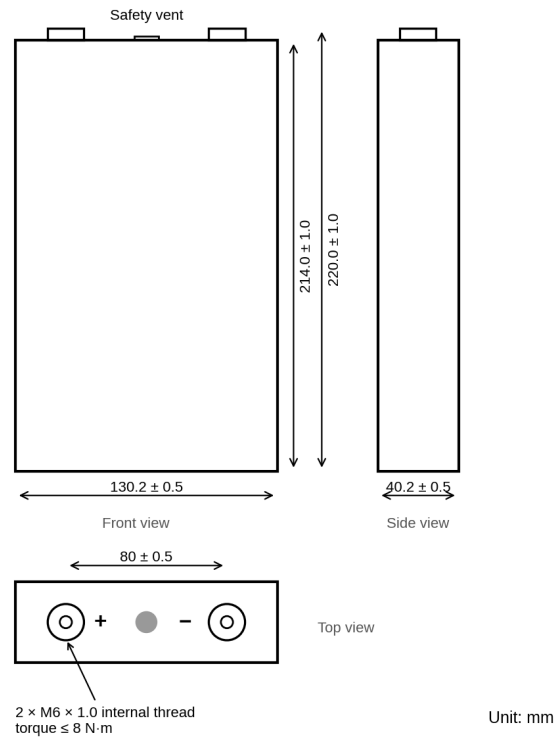


Figure 1. Mechanical dimensions of the IFpP40130220-100 cell (mm, not to scale, including wrap film)

3. Electrical Performance

3.1 Standard Test Conditions

Unless otherwise specified, all tests stated in this Specification are conducted at a temperature of $25 \pm 2^\circ\text{C}$ and relative humidity of $65 \pm 20\%$ RH. Tests performed outside these conditions will produce obvious deviation in the results.

3.2 Electrical Characteristics

Item	Test Method and Condition	Criteria
Standard Charge	Charge at constant current 0.5C to 3.65 V, then at constant voltage 3.65 V until the current declines to $\leq 0.05\text{C}$.	Charge voltage = 3.65 V Charge rate = 0.5C
Initial Impedance	Internal resistance measured at AC 1 kHz within 1 hour after standard charge.	$\leq 0.6 \text{ m}\Omega$
Cell Voltage	Cell state upon shipment.	$\geq 3.0 \text{ V}$
Initial Capacity	(1) Before charging, discharge at 0.5C to 2.5 V and rest for 10 minutes. (2) Capacity is the 0.2C discharge capacity to 2.5 V after standard charge.	$\geq 100 \text{ Ah}$

Item	Test Method and Condition	Criteria
High Rate Discharge Performance	(1) Before charging, discharge at 0.5C to 2.5 V and rest for 10 minutes. (2) Charge 0.5C CC to 3.65 V, CV to 0.05C, rest 10 minutes. (3) Capacity is the 1C discharge capacity to 2.5 V.	≥ 95% of initial capacity
Cycle Life	At 25±2°C, 65±20% RH: 1) Charge 0.5C CC to 3.65 V, CV to ≤ 0.05C. 2) Rest 30 min. 3) Discharge 0.5C to 2.5 V. 4) Rest 30 min. 5) Repeat 1)–4); each repetition is one cycle.	≥ 80% of initial capacity after 3500 cycles
Charge Retention and Recovery at Room Temperature	Standard charge, store at 23±5°C for 28 days, discharge at 0.5C to 2.5 V (retention). Recharge by the standard method and discharge at 0.5C to 2.5 V (recovery).	Retention ≥ 93% Recovery ≥ 95% of initial capacity
Charge Retention and Recovery at High Temperature	Standard charge, store at 55±2°C for 7 days; at 25±2°C discharge at 0.5C to 2.5 V (retention). Recharge by the standard method at 25±2°C and discharge at 0.5C to 2.5 V (recovery).	Retention ≥ 93% Recovery ≥ 95% of initial capacity
High Temperature Performance	Standard charge, store at 55±2°C for 5 hours, then discharge at 0.5C to 2.5 V under this condition.	≥ 95% of initial capacity

4. Safety Performance

All tests below are carried out on equipment with forced ventilation and an explosion-proof device. Unless stated otherwise, cells are charged in accordance with Standard Charge before testing.

Item	Test Method and Condition	Criteria
Forced-discharge (Reverse Charge) Test	At 20±5°C, discharge at 0.5C to 2.5 V and rest 0.5 h; reverse the positive and negative poles and charge at 1C constant current for 90 minutes.	No fire, no explosion
Overcharge Test	After standard charge, rest 10 minutes; then charge at 3C constant current to 5 V.	No fire, no explosion
Short-circuit Test	After standard charge, short-circuit externally for 10 minutes; external resistance 80±20 mΩ.	No fire, no explosion
Heating Test	After standard charge, heat in an oven at 5±2°C/min to 130±2°C and hold for 10 minutes.	No fire, no explosion
Impact Test	Place the cell on a flat surface fixed in a jig; drop a 10 kg weight freely from 1.0 m onto the sample. Cell deformation is permitted.	No fire, no explosion
Crush Test	After standard charge, crush perpendicular to the cell plates with a hydraulic cylinder to 13±1 kN; release once maximum force is reached.	No fire, no explosion

Item	Test Method and Condition	Criteria
Temperature Cycling Test	After standard charge, cycle in a temperature chamber per the profile in 4.1 for 10 cycles; observe for 1 hour.	No leakage, no fire, no explosion
Drop Test	After standard charge, drop the cell freely from 1.5 m onto a wooden floor, twice on each face.	No fire, no explosion

4.1 Temperature Cycling Profile

Temperature	Duration	Cumulative Time	Transition Requirement
20°C	0 h	0 h	/
70°C	4 h	4 h	Reach within 30 min
20°C	2 h	6 h	Reach within 30 min
40°C	4 h	10 h	Reach within 30 min
20°C	2 h	12 h	Reach within 30 min

4.2 Appearance Inspection

There shall be no defects such as scratches, flaws, cracks or leakage that may adversely affect the performance or commercial value of the cell.

5. Storage and Others

The best storage temperature is 15 ~ 35°C; storage outside this range will affect cell performance. Any matters not specified in this Specification shall be mutually agreed between the customer and STF.

6. Characteristic Curves

For reference only. All tests are carried out under standard conditions.

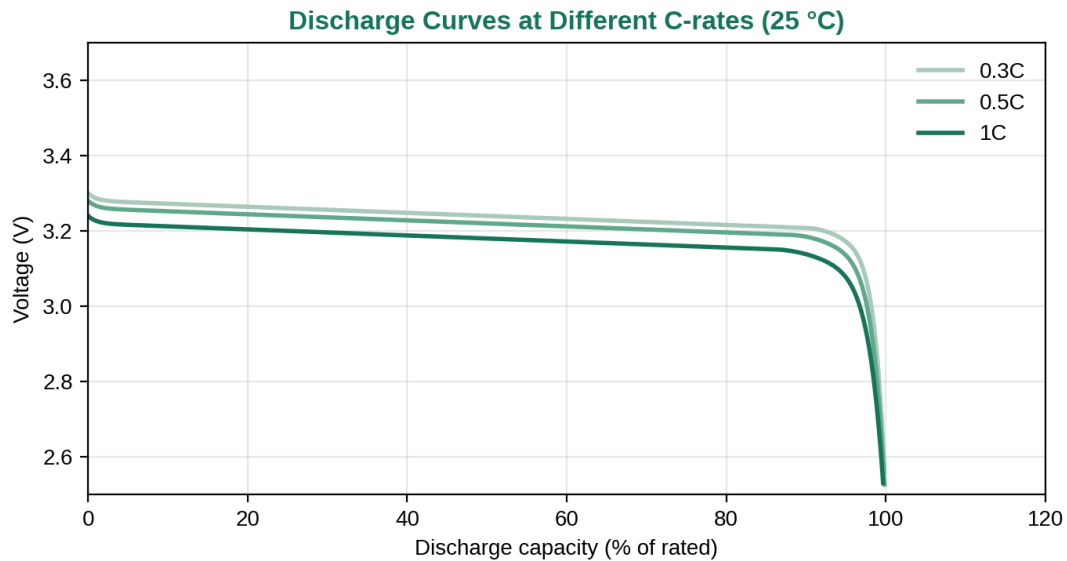


Figure 2. Discharge curves at 0.3C, 0.5C and 1C (25 °C)

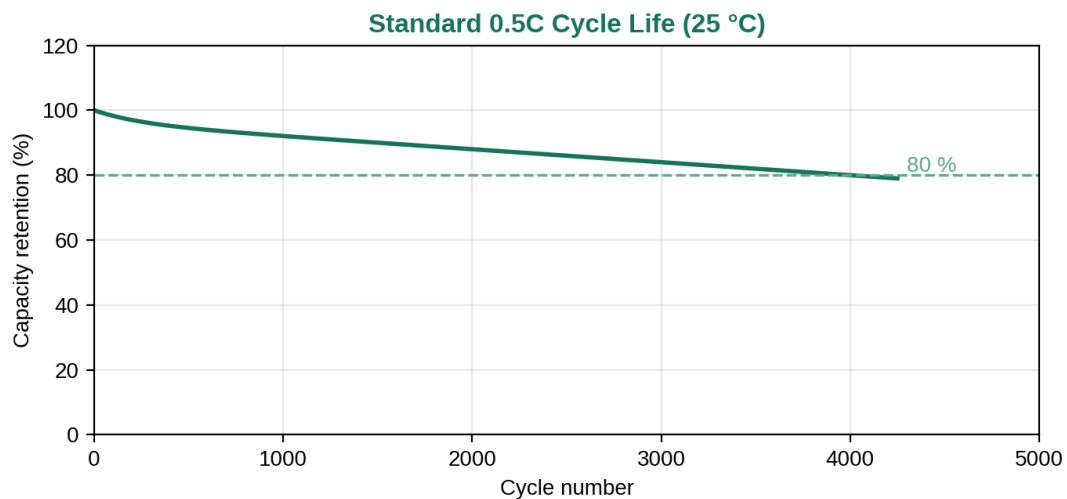


Figure 3. Standard 0.5C/0.5C cycle life (25 °C)

7. Precautions and Safety Instructions

Lithium-ion rechargeable batteries subjected to abusive conditions can cause damage to the cell and/or personal injury. Please read and observe the precautions below before use.

Note 1: The customer is required to contact STF in advance if and when the customer needs applications or operating conditions other than those described in this document. Additional experimentation may be required to verify performance and safety under such conditions.

Note 2: STF takes no responsibility for any accident when the cell is used under conditions other than those described in this document.

Note 3: STF will inform customers in writing of improvements regarding proper usage and handling of the cells, if deemed necessary.

Note 4: The cell must be used under the protection of a battery management system (BMS). When cells are used in combination, the BMS must have an equalisation (balancing) function to balance voltage differences within the pack and ensure normal pack performance.

Note 5: During the design of the host device or battery pack, customers are advised to involve STF in reviewing the battery installation and safety protection scheme.

7.1 Charging

7.1.1 Charging Power

Charging power shall be less than the maximum value specified in this Specification. Charging above the recommended value may deteriorate the charge/discharge, mechanical and safety performance of the cell and may lead to heating or leakage, seriously affecting service life.

7.1.2 Charge Voltage Limit

Cells shall be charged at a voltage not exceeding 3.65 V/cell, the absolute maximum. The charger and pack protection circuit shall be designed to comply with this condition. Charging above the maximum voltage is very dangerous; it may damage the cell's electrical and mechanical safety performance, cause heat generation or leakage, shorten service life and create safety problems.

7.1.3 Charge Temperature

Cells shall be charged within 0 ~ 45°C ambient temperature. Below 10°C, charge with a small current (not more than 0.2C). Below 0°C, charging is prohibited. Long-term low-temperature charging affects performance and service life and creates safety problems.

7.1.4 Prohibition of Reverse Charge

Reverse charging is prohibited. Confirm polarity before wiring. Reverse charging may damage the cell, degrade its performance and safety, and cause heat generation or leakage.

7.2 Discharging

7.2.1 Discharge Power

The cell shall be discharged at less than the maximum discharge current specified in this Specification. High discharge current may significantly reduce capacity or cause over-heating, and will seriously affect service life.

7.2.2 Discharge Temperature

Cells shall be discharged within -20 ~ 60°C ambient temperature. The optimum discharge temperature range is 25 ~ 35°C; outside this range the discharge current shall be controlled, otherwise service life will be affected.

7.2.3 Over-discharge

Cells may become over-discharged through self-discharge if not used for a long time. To prevent over-discharge, charge cells periodically to maintain a voltage between 3.2 V and 3.4 V. Over-discharge may cause loss of cell performance, characteristics or battery functions.

7.3 Other Requirements for Charging and Discharging

When many cells are used in the same group, charge and discharge them under the same current and temperature conditions. Differences cause performance variation within the group and, in serious cases, affect the whole battery pack.

7.4 Notice for Designing the Battery Pack

- The pack enclosure shall have sufficient mechanical strength to protect the cells from mechanical shock and shall be made of flame-retardant material.

- No cell movement inside the battery pack shall be allowed.
- Short circuits inside the battery pack or host device shall be prevented.
- Sufficient insulation shall be provided between wiring and cells. The pack or host device shall be structured with no potential short circuit that may generate smoke or fire.

7.5 Storage

- Store cells at $-20 \sim 45^{\circ}\text{C}$ and $65 \pm 20\%$ RH. Long-term storage will cause irreversible damage to cell performance.
- For long-term storage the cell voltage shall be within $3.2 \sim 3.4 \text{ V}$.
- For storage over 3 months: temperature $15 \sim 35^{\circ}\text{C}$, humidity $65 \pm 20\%$ RH.
- During the warranty period, cells below 3.2 V shall be recharged with $10 \sim 50 \text{ A}$ every 3 months until the voltage reaches 3.4 V ; otherwise serious irreversible damage will result.

7.6 User's Guideline for Safety Handling

The following information, or equivalent statements, shall be made available to the user on the battery label, the host-device label, the owner's manual, or in a help file or website:

- Do not disassemble or open, crush, bend or deform, puncture, or shred.
- Do not modify or remanufacture, insert foreign objects, immerse or expose to water or other liquids, or expose to fire, explosion or other hazards.
- Only use the battery for the system for which it was specified.
- Only use the battery with a charging system qualified with the system per standard. An unqualified battery or charger may present a risk of fire, explosion, leakage or other hazard.
- Do not short-circuit a battery or allow metallic or conductive objects to contact the battery terminals.
- Replace the battery only with another battery qualified with the system per standard.
- Do not leave a battery at rest for a long time (over 6 months); a safety incident may occur when recharging it.
- Promptly dispose of used batteries in accordance with local regulations.
- Battery usage by children should be supervised.
- Avoid dropping the device or battery. If dropped on a hard surface and damage is suspected, take it to a service centre for inspection.
- Improper battery use may result in fire, explosion or other hazard.
- In the event of a leak, do not allow the liquid to contact skin or eyes. If contact occurs, wash with plenty of water and seek medical advice.
- Seek medical advice immediately if a battery has been swallowed.
- Communicate the appropriate steps to be taken if a hazard occurs.

The following system-level indications, or equivalent statements, may be displayed with recommended actions as appropriate:

- Abnormal battery temperature alert.
- Abnormal host-device and/or battery DC input voltage alert.
- Abnormal current draw alert.
- Battery communication fail / time-out alert.
- Incompatible battery alert.

- Alert for other malfunctions that may lead to hazards.

7.7 Cycle Life

Cycle life refers to the cycle life obtained by the test method under the conditions specified above. Service conditions not specified in this Specification will affect the cycle life.

7.8 Others

- Never disassemble cells; disassembly may generate an internal short circuit and cause fire or other problems.
- Electrolyte is harmful. If it contacts the skin or eyes, flush immediately with fresh water and seek medical advice.
- Never incinerate or dispose of cells in fire.
- Never soak cells in liquids such as fresh water, sea water or drinks such as soft drinks, juices or coffee.
- Battery replacement shall be done only by the cell supplier or device supplier, never by the user.
- Do not use damaged cells. If the cell package is deformed, smells of electrolyte or leaks, do not use it and keep it away from fire.
- The curves in this Specification are for reference only.
- STF reserves the right to change and revise the design and this Specification without prior notice.

8. Warranty

- The cells shall comply with this Specification within 12 months from the manufacture date stipulated on the cell marking ("Warranty Period"). During the Warranty Period, STF will replace, at no cost to the customer, cells that fail to conform to this Specification.
- STF will not be responsible for any losses where the cells are misused, abused, or used in any manner deviating from or in breach of the conditions set out in this Specification.
- STF will not be responsible where the cells are rendered nonconforming for reasons caused by parties other than STF or by circumstances beyond the control of STF.
- Operating methods that neither follow this Specification nor have been agreed in writing by STF are not covered by the warranty.

9. Warning Statement

WARNING

Batteries are potentially dangerous and proper precautions must be observed in handling and maintenance.

Running tests on the batteries improperly may result in severe personal injury or property damage.

Work on batteries must be performed only with proper tools and protective equipment.

Battery maintenance must be carried out by personnel knowledgeable about batteries and trained in the safety precautions involved.

Failure to observe the above may cause various hazards.

Customer Inquiry

Cell Type: IFpP40130220-100

If the customer requires applications or operating conditions other than those described in this document, please record the requirements below and contact STF in advance. STF can design and build such products according to special requests where attainable.

No.	Special Request	Criteria
1		
2		
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10		

Company Name: _____ Signature: _____ Date: _____