

LiFePO4 Battery

Customer No: KH00019408

Part No: YT26650F 12.8V 6400mAh

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Prepared by	Review by	Approved by
WANG Bang-quan	WANG Bang-quan	CHEN Jing-min

Customer Acknowledge:	
Signature:	
Date:	

Document Revision History

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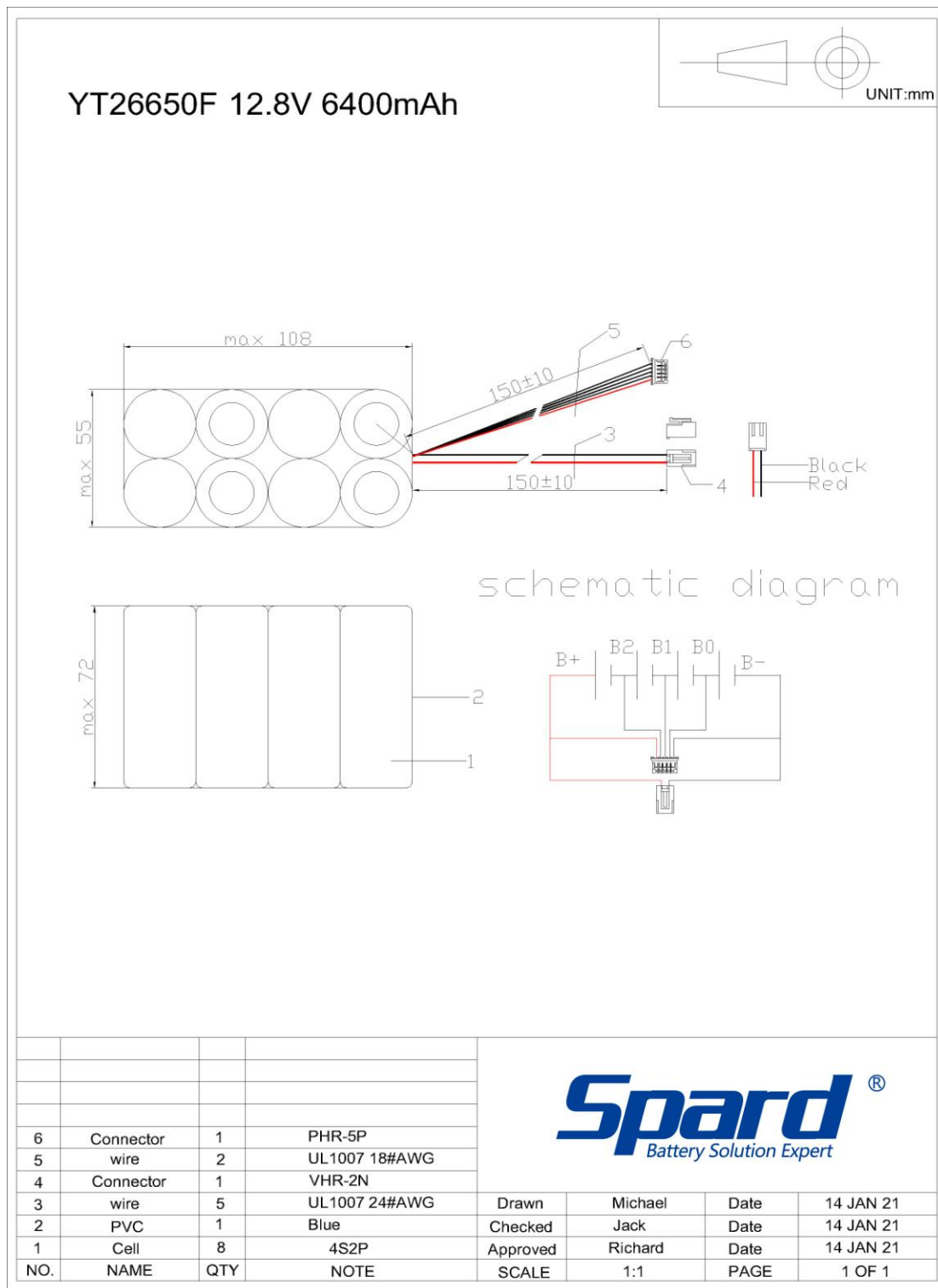
1.Preface

This document describes the Product Specification of the LiFePO4 rechargeable battery supplied by YUNTONG.

2.Battery configuration.

2.1 Model. : YT26650F 12.8V 6400mAh

2.2 Assembly Drawing. (unit: mm)



3. Specification

NO.	Items	standard	Remarks
1.	Nominal capacity	6400mAh	Discharge Current:0.2C Cut-off voltage:2.5Vcell
	Minimum capacity	5760mAh	
2	Charging voltage	14.6V	
3	Nominal voltage	12.8V	
4	Discharge cut-off voltage	10.0V	
5	Charging current	Standard : 0.2C	
		Rapid : 0.5C	
6	Discharging current	Standard : 0.2C	Continuous discharge
		Max: 6.0A	Continuous discharge
		PEAK: 12.0A	≤1s
7	Standard charge	0.2C CC(constant current) charge to 3.65V/cell, then CV(constant voltage) 3.65V/cell charge 3.5hours or 64mA (0.01C) cut off.	
8	Rapid charge	0.5C CC(constant current) charge to 3.65V/cell, then CV(constant voltage) 3.65V/cell charge 2.5hours or 64mA (0.01C) cut off.	
9	Max. charge current	0.5C	
10	Internal Impedance	Max: 180mΩ	AC 1KHz after standard charge
11	Energy	81.92Wh	
12	Weight	Approx: 700g	
13	Operating Temperature.	Charge : 0 ~ +45°C	Forbid to outrun provision scope a work.
		Discharge : -10 ~ +60°C	
14	Storage Temperature	-10 ~ +45°C	See the section 5th

4. Battery Cell Performance Check and Test

Require

(1) Visual inspection: There shall be no such defect as scratch, flaw, crack, and leakage, which may adversely affect commercial value of the cell.

(2) Standard environmental test condition

Humidity: $65 \pm 20\%$

Temperature: $25 \pm 2^\circ\text{C}$

4.1 Common Performance

NO	Items	Test Method and Condition	standard
1	Charging Performance.	The battery can be charged when using the original charger. The standard charge mode :under the temperature of $25 \pm 2^\circ\text{C}$, Charge the cell to 3.65V/cell initially with constant current at 0.2C and then with constant voltage at 3.65V/cell (accuracy $3.65 \pm 0.05\text{V}$)/cell charge 3.5hours or 64mA (0.01C) cut off.	N.A.
2	Discharging performance.	The capacity means the discharge capacity of the cell, which is measured with discharge current of 0.2C with 2.5V/ cell cut-off voltage after the standard charge.	$\geq 5760\text{mAh}$
3	Cycle Life	The cycle life shall be conducted as the following procedures: Step 1:charge the cell with the standard charge Step 2:discharge the cell at 0.2C to 2.5V; Step 3: repeat Step 1 and Step 2 for 1000 times. The capacity after 1000 cycles is expected to be equal to or more than 60% of the rated capacity. (Remark: single cell)	≥ 1000
4	Temperature Dependence of Capacity	Capacity comparison at each temperature, measured with constant discharge current 0.2C with 2.0V/cell cut-off after Standard Charge shown below. If charge temperature and discharge temperature are not the same, the interval for temperature charge comes to 3 hours. Charge Temp: $20 \pm 5^\circ\text{C}$	Discharge Temp. As capacity -10°C: 60% +25°C:100% +60°C: 95%
5	Charged Storage Characteristics	Capacity after 28 days storage at $25 \pm 2^\circ\text{C}$, from Standard Charge, measured under the same conditions stated No. 2	Remaining capacity (after 25°C storage) $\geq 80\%$
6	Capacity instauration characteristics	Battery after 28 days storage at $25 \pm 2^\circ\text{C}$. From Standard Charge, then measured under the same conditions stated No. 2	Recovery capacity $\geq 90\%$
7	Battery Voltage	As of shipment.	12.8V~13.6V

4.2 Safety Performance

NO.	Items.	Test Methods and Condition.	standard
1	Constant Humidity and Temperature Characteristics	After full charge ,store at $40^{\circ}\text{C}\pm 2^{\circ}\text{C}$, (90% ~95%RH) for 48h. After test, place at $25\pm 2^{\circ}\text{C}$ for 2h and then discharge with 1C to end-voltage.	The discharge time is required $\geq 36\text{min}$.
2	Drop Test	Under the temperature of $25\pm 2^{\circ}\text{C}$, after full-charging the battery with 0.2C, then drop it freely from 1.2 meter height onto the hard 18~20mm board. Do it 2 times.	No explosion, no fire, no leakage.
3	Over charge testing	Charge the cell at 3C current at $22\pm 2^{\circ}\text{C}$ with a voltage limit of 5V and Current close to 0A.	No fire or explosion
4	Short-circuit testing	At $20\pm 5^{\circ}\text{C}$, After standard charging, connect batteries' anode and cathode by wire which impedance less than $50\text{m}\Omega$, keep 6h.	No explosion, no fire; The maximum Temperature 150°C .
5	Heating	Cell is heated in a circulating air oven at a rate of $(5\pm 2)^{\circ}\text{C}$ per minute to 130°C ,and then placed for 30 minute at 130°C	No explosion, no fire;
6	Vibration Test	Cell (as of shipment) vibrated for 90 minutes for each of the three mutually perpendicular planes with total excursion of 1.9mm and with frequency of 10 Hz to 55 Hz at the sweep rate of 1 Hz per minute.	No leakage, Capacity recovery rate 90% (Standby 3hours).

※ Above testing of safe characteristic must be with protective equipment.

5. Storage and Shipment Requirement

Item.		Requirement.
Storage temperature	Short period less than 1 month	-10°C~+45°C
	Long period less than 6 months	0°C~+35°C
	Long period less than 1 year	0°C~+25°C
Humidity	60±15% RH	
During long storage, please refresh the battery every 3 months, which charging battery fully, discharging battery to empty and then charging battery with 50% capacity.		

6. Scope:

All data involves voltage and weight to stack-up battery are equal to the value of unit cell time the number of unit cell which consisted in the stack-up batteries

Example: Stack-up batteries consisting E unit cells series

Nominal voltage of unit cell=3.2V

Nominal voltage of stack-up batteries = $3.2V \times 4 = 12.8V$

7. Warranty Time.

Warranty time is 12 months from the date when the LiFePO₄ rechargeable battery ship out from YUNTONG factory. But If the LiFePO₄ rechargeable battery is found to have a problem due to use outside of YUNTONG recommended specification, YUNTONG will have no responsibility for the battery.

8. Others.

Any matters that this specification does not cover should be conferred between both parties.

Handling Precautions and Guideline

For LiFePO4 Rechargeable Batteries

Subject to change without notice

Preface

This document of 'Handling Precautions and Guideline LiFePO4Rechargeable Batteries' shall be applied to the battery cells manufactured by YUNTONG POWER CO., LTD.

Note (1):

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

Note (2):

YUNTONG will take no responsibility for any accident when the cell is used under other conditions than those described in this Document.

Note (3):

YUNTONG will inform, in a written form, the customer of improvement(s) regarding proper use and handling of the cell, if it is deemed necessary.

1. Charging

1) Charging current:

Charging current should be less than maximum charge current specified in the Product Specification. Charging with higher current than recommended value may cause damage to cell electrical, mechanical and safety performance and could lead to heat generation or leakage.

2) Charging voltage:

Charging shall be done by voltage less than that specified in the Product Specification (3.65V/cell). Charging over 3.65V, which is the absolute maximum voltage, must be strictly prohibited. The charger shall be designed to comply to this condition. It is very dangerous that charging with higher voltage than specified value may cause damage to the cell electrical, mechanical safety performance and could lead to heat generation or leakage.

3) Charging temperature:

The cell shall be charged within the specified temperature range in the Product Specification.

4) Prohibition of reverse charging:

Reverse charging is prohibited. The cell shall be connected correctly. The polarity has to be confirmed before wiring. In case of the cell is connected improperly, the cell cannot be charged. Simultaneously, the reverse charging may cause damaging to the cell which may lead to degradation of cell performance and damage the cell safety, and could cause heat generation or leakage.

2. Discharging

1) Discharging current

The cell shall be discharged at less than the maximum discharge current specified in the Product Specification. High discharging current may reduce the discharging capacity significantly or cause over-heat.

2) Discharging temperature

The cell shall be discharged within the temperature range specified in the Product Specification.

3) Over-discharging:

It should be noted that the cell would be at an over-discharged state by its self-discharge characteristics in case the cell is not used for long time. In order to prevent over-discharging, the cell shall be charged periodically to maintain between 3.25V and 3.3V. Over-discharging may causes loss of cell performance, characteristics, or battery functions.

The charger shall be equipped with a device to prevent further discharging exceeding a cut-off voyage specified in the Product Specification. Also the charger shall be equipped with a device to control the recharging.

Procedures as follows:

The cell battery pack shall start with a low current (0.01C) for 15 - 30 minutes pre-charging, before rapid charging starts. The rapid charging shall be started after the individual cell voltage has been reached above 2.6V within 15 - 30 minutes which can be determined with the use of an appropriate timer for pre-charging. In case the individual cell voltage does not rise to 2.6V within the pre-charging time, then the charger shall have functions to stop further charging and display the cell/pack is at abnormal state.

3. Protection Circuit Module (PCM)

1) The cell/battery pack shall be with a PCM which can protect cell/battery pack properly.

PCM shall have functions of (i) overcharging prevention, (ii) over-discharging prevention, (iii) over current prevention to maintain safety and prevent significant deterioration of cell performance. The over current can occur by external short circuit.

2) Overcharging prohibition:

Overcharging prevention function shall stop charging if any one of the cells of the battery pack reaches 3.6V.

3) Over-discharge prohibition:

Over-discharging prevention function shall work to minimize Current consume to avoid further drop in cell voltage of 2.5V or less per cell in any cell of the battery pack. It is recommended that the dissipation current of PCM shall be minimized to 0.5uA or less with the over-discharge prevention. The protection function shall monitor each bank of the battery pack and control the current all the time.

4. Storage

The cell should be stored within the proper temperature range specified in the Product Specification.

5. Handling of Cells

1) Consideration of strength of film package

(i)Aluminium laminated film. (ii) Easily damaged by sharp edge parts such as pins and needles, comparing with metal-can-cased LIB. (iii)Sealed edge May be damaged by heat above 100°C.

2) Prohibition short circuit

Never make short circuit cell. It generates very high current which causes heating of the cells and may cause electrolyte leakage, gassing or explosions that are very dangerous. The cell tabs may be easily short-circuited by putting them on conductive surface. (Such outer short circuit may lead to heat generation and damage of the cell.) An appropriate circuitry with PCM shall be employed to protect accidental short circuit of the battery pack.

3) Mechanical shock

Li-FePO₄ (LIFE) cells have less mechanical endurance than metal-can-cased LIB.

Falling, hitting, bending, etc. may cause degradation of cell characteristics.

4) Handling of tabs

The LIFE cells tabs are not exceedingly strong, especially the aluminium tabs for the terminal. Do not put much force on LIFE cell tabs (Aluminium tab may easily be torn off by shear force.). Do not bend tabs unnecessarily.

6. Notice for Designing Battery Pack

1) Pack toughness

Battery pack should have sufficient strength and the LIFE cell inside should be protected from mechanical shocks.

2) Cell fixing

The LIFE cell should be fixed to the battery pack by its large surface area.

No cell movement in the battery pack should be allowed.

3) Inside design

No sharp edge components should be inside the pack containing the LIFE cell.

4) Tab connection

Ultrasonic welding is recommended for LIFE cell tab connection method.

Battery pack should be designed that shear force are not applied to the LIFE cell tabs.

5) For mishaps

Battery pack should be designed not to generate heat even when leakage occurs due to mishaps.

i) Isolate PCM (Protection Circuit Module) from leaked electrolyte as perfectly as possible.

ii) Avoid narrow spacing between bare circuit patterns with different voltage. (Including around connector).

iii) LIFE battery should not have liquid from electrolyte, but in case If leaked electrolyte touches bare circuit patterns, higher potential terminal material may dissolve and precipitate at the lower potential terminal, and may cause short circuit. The design of the PCM must have this covered.

7. Notice for Assembling Battery Pack

Shocks, high temperature, or contacts of sharp edge components should not be allowed in battery pack assembling process.

1) Do not solder directly to LIFE cell tabs. Do not bring heated tools such as soldering Iron close to LIFE cells. Temperature above 80°C may cause damage to the LIFE cell and degrade its performances.

2) In case that the battery pack is fixed by ultrasonic welding, it is necessary not to apply too much ultrasonic welding power to LIFE cell and electronic circuits such as PCM. Otherwise it may cause serious damage to the cells and electronic circuit.

8. Others

1) Cell connection

i) Direct soldering of wire leads or devices to the cell is strictly prohibited.

ii) Lead tabs with pre-soldered wiring shall be spot welded to the cells. Direct soldering may cause damage of components, such as separator and insulator, by heat generation.

2) Prevention of short circuit within a battery pack

Enough insulation layers between wiring and the cells shall be used to maintain extra safety protection. The battery pack shall be structured with no short circuit within the battery pack, which may cause generation of smoke or firing.

3) Prohibition of disassembly

i) Never disassemble the cells

The disassembling may generate internal short circuit in the cell, which may cause gassing, firing,

explosion, or other problems.

ii) Electrolyte is harmful

LIFE battery should not have liquid from electrolyte flowing, but in case the electrolyte come into contact with the skin, or eyes, physicians shall flush the electrolyte immediately with fresh water and medical advice is to be sought.

4) Prohibition of dumping of cells into fire

Never incinerate nor dispose the cells in fire. These may cause explosion of the cells, which is very dangerous and is prohibited.

5) Prohibition of cells immersion into liquid such as water

The cells shall never be soaked with liquids such as water, seawater, drinks such as soft drinks, juices, coffee or others.

6) Battery cells replacement

The battery replacement shall be done only by either cells supplier or device supplier and never be done by the user.

7) Prohibition of use of damaged cells

The cells might be damaged during shipping by shock. If any abnormal features of the cells are found such as damages in a plastic envelop of the cell, deformation of the cell package, smelling of an electrolyte, an electrolyte leakage and others, the cells shall never be used any more.

The Cells with a smell of the electrolyte or a leakage shall be placed away from fire to avoid firing or explosion.

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YUNTONG Power Co., Ltd

Tel: 86-760-23699099

Fax: 86-760-23699066

Email: info@yuntong-batt.com

www.yuntong-batt.com
