

RECHARGEABLE LITHIUM ION BATTERY

PRODUCT SPECIFICATION

MODEL NO.: TL48100LFP-3U

DESCRIPTION: 48V 100Ah LITHIUM ION(LFP) BATTERY



Smart Energy Solutions for a Cleaner World

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DESCRIPTION:
LFP BATTERY PACK

MODEL NO.:
TL48100LFP-3U

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Revision History

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1. General Information

1.1. Scope

This specification defines the product specification of the rechargeable Lithium Ion Battery supplied by Zhejiang Hengrui Technology Co., Ltd.

1.2. Applications

Telecom BTS power backup, Small or Medium-Sized Renewable Energy Storage System

1.3. Product Classification

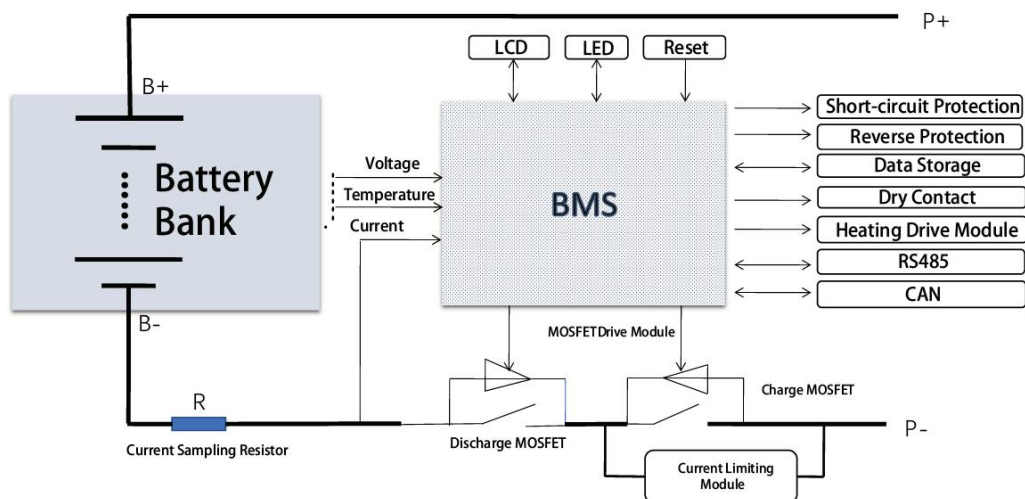
19" Standard Cabinet Suited Rechargeable Lithium Ion (LiFePO₄) Battery Pack.

1.4. Model No.

TL48100LFP-3U

1.5. Working Principal and Working Status

The 48V Lithium Ion Battery Pack is mainly working as 48VDC backup power source, and it consists of 15 cells of Lithium Iron Phosphate Battery Cells connected in series and telecom specialized high performance and high reliability Battery Management System (BMS). The battery's +/- output terminals are connected to the +/- terminals of rectifier. When the mains supply is normal, telecom equipment is powered by mains through rectifier and battery pack is also charged through rectifier; When the mains supply is outage, the 48V lithium ion battery pack is supplying power to telecom equipment without any time-delay to ensure telecom equipment is powered without any interruptions, until mains supply resumed or protective power cut-off by BMS due to over-discharge protection activated automatically.



Product Working Principal

1.6. Electrical Specification

No.	Item	Specification	Remarks
1.6.1	Nominal Capacity	4.8Kwh	Standard discharge ⁽¹⁾ capacity after standard charge ⁽²⁾
1.6.2	Usable Capacity	4.8Kwh	Depth of discharge is 100%
1.6.3	Battery Chemistry	Lithium Battery (LiFePO4)	
1.6.4	Depth of discharge	80%	Recommended DOD is less than 80%
1.6.5	Nominal DC Voltage	48.0V	Configuration:2P15S - VHR 3914895LFP-50Ah. Voltage of single cell is 3.2V.
1.6.6	Max Voltage Range	54.0V	
1.6.7	Min Voltage Range	41.0V	
1.6.8	Maximum Continuous Charge Current (CC Threshold)	100A	
1.6.9	Max Charge Power	4800w	
1.6.10	Over Current Protection for Charge	105A ± 3A	N.A.
1.6.11	Over Voltage Protection	3.80V/cell	N.A.
1.6.12	Maximum Continuous Discharge Current	100A	
1.6.13	Max Discharge Power	4800w	
1.6.14	Over Current Protection for Discharge	105A ± 3A	N.A.
1.6.15	Under Voltage Protection	2.75V/cell	N.A.
1.6.16	Operation Allowable Temperature Range	Charge: 0~60°C	N.A.
		Discharge: -20~60°C	N.A.
1.6.17	Rated DC Power	0.9kW	50%SOC
1.6.18	Self-discharge Rate/Month	≤3%	@ 25 ± 3°C,50%SOC
1.6.19	Design Life	12 years	NA.
1.6.20	Cycle Life(cycles)	≥5000	@ 25 ± 3°C,80%DOD, 0.2C/0.5C
1.6.21	Operation Allowable Humidity Range	≤95% RH	Operation
		≤85% RH	Storage

1.6.22	Recommended Storage temperature	0~40°C	Max. 6 month
1.6.23	IP rating	IP20	
1.6.24	Onboard Comms Port	RS485*2, RS232*1	
1.6.25	Weight	About 49kg	N.A.

- (1) Standard discharge : Constant current discharge(0.2CA) till the discharge end Voltage (41.25V) at 25 ± 3°C.
 (2) Standard charge : 54.0V ± 0.05V constant voltage and(0.2CA) current limited charge, for5.0 hours at 25 ± 3°C
 (3) Suggest charge method: At the ambient temperature 30°C ± 5°C, Set charger voltage to 54.00V
 a. Charge the battery with 50A(0.5C) until any cell reach 3.65V, to step b;
 b. Charge the battery with 20A(0.2C) until any cell reach 3.65V, to step c;
 c. Charge the battery with 12A(0.12C) until any rest cell reach 3.65V, charge finish.

1.7. Basic Parameter

Item	Settable (Yes or No)	Detailed Information	Default Setting Value	Remark
Charge Current Limit	No	Limited Charge Current Value	105A	Acceptability range: 105 ± 2A
	Yes	Method of Charge Current Limit	Overcharge activates current limit	N.A.
Sleep Voltage	Yes	Sleep Voltage Set Value	3.30 V	Acceptability range : 3.3 ± 0.02V
BMS Power consumption	No	Internal Circuit Power Consumption at Mode 1 – Fan is not activated or for natural cooling model with heat radiator	≤ 40 mA	N.A.
	No	Internal circuit power consumption during sleep	≤ 500 uA	
Charge Balancing	Yes	Balancing Activation Voltage Value	3.40 V	N.A.
	Yes	Balancing Activation Voltage Difference Value	50 mV	
	No	Balancing current	70 mA	
Full Charge Setting	Yes	Constant voltage value	54 ± 0.3V	When the current is less than the constant current value during constant voltage charging, BMS considers that the battery capacity is full and the charging MOSFET will be
	Yes	Constant current value	5.0A	

				cut off.
Capacity Setting	Yes	Full capacity setting	100Ah	N.A.
	Yes	Residual capacity setting	50Ah	

1.8. ProtectionParameter Setting

Item	Default State	Can be set (Yes or No)	Detail Information	Default Setting Value	Remark
Cell Over-charge Protection	on	Yes	Over-charge voltage detection value of Cell	3.80 V	Acceptability range: 3.80 ± 0.02V
	on	Yes	Over-charge detection delay time of Cell	1000 ms	Acceptability range: 1000 ~ 2500 ms
	on	Yes	Over-charge recovery voltage of Cell	3.34 V	Acceptability range: 3.34 ± 0.02V
Cell Over-discharge Protection	on	Yes	Over-discharge voltage detection value of Cell	2.75 V	Acceptability range: 2.75 ± 0.02V
	on	Yes	Over-discharge detection delay time of Cell	1000 ms	Acceptability range: 1000 ~ 2500 ms
	on	Yes	Over-discharge recovery voltage of Cell	3.10 V	Acceptability range: 3.10 ± 0.02V
Battery Module Over-charge Protection	on	Yes	Over-charge voltage detection value of Module	56.0 V	Acceptability range: 56.0 ± 0.3V
	on	Yes	Over-charge detection delay time of Module	1000 ms	Acceptability range: 1000 ~ 2500 ms
	on	Yes	Overcharge recovery voltage of Module	54.0V	Acceptability range: 54.0 ± 0.3V
Battery Module Over-discharge Protection	on	Yes	Over-discharge voltage detection value of Module	41.0V	Acceptability range: 41.0 ± 0.3V
	on	Yes	Over-discharge detection delay time of Module	1000 ms	Acceptability range: 1000 ~ 2500 ms
	on	Yes	Over-discharge recovery voltage of Module	46.5V	Acceptability range: 46.5 ± 0.3V
Over-current Protection	on	Yes	Charging overcurrent protection current 1	105 A	Acceptability range: 105 ± 3A
	on	Yes	Charging overcurrent detection delay time 1	4000 ms	Acceptability range: 3000 ~ 5500 ms
	on	Yes	Charging overcurrent protection current 2	125A	Acceptability range: 125 ± 3A

	on	Yes	Charging overcurrent detection delay time 2	100ms	Acceptability range: 100 ~ 500 ms
	on	Yes	Discharging overcurrent protection current 1	105 A	Acceptability range: 105 ± 3A
	on	Yes	Discharging overcurrent detection delay time 1	6000 ms	Acceptability range: 5000 ~ 7500 ms
	on	Yes	Discharging overcurrent protection current 2	125 A	Acceptability range: 125 ± 3A
	on	Yes	Discharging overcurrent detection delay time 2	500 ms	Acceptability range: 50 ~ 500 ms
Short-circuit Protection	on	No	Short-circuit detection current	200± 10A	N.A.
	on	-	Protection conditions	Load short circuit	N.A.
	on	Yes	Short circuit protection delay time	≤ 500 us	N.A.
	on	-	Protection recovery condition	Reset or recharge after load disconnection	N.A.
Temperature Protection	on	Yes	Charging high temperature protection	60 °C	Acceptability range: 60 ± 2 °C
	on	Yes	Charging high temperature recovery	55 °C	Acceptability range: 55 ± 2 °C
	on	Yes	Discharging high temperature protection	60 °C	Acceptability range: 60 ± 2 °C
	on	Yes	Discharging high temperature recovery	55°C	Acceptability range: 55 ± 2 °C
	on	Yes	Charging low temperature protection	0 °C	Acceptability range: 0 ± 2 °C
	on	Yes	Charging low temperature recovery	5 °C	Acceptability range: 5 ± 2 °C
	on	Yes	Discharging low temperature protection	-20°C	Acceptability range: -20 ± 2 °C
	on	Yes	Discharging low temperature recovery	-10 °C	Acceptability range: -10 ± 2 °C

1.9. Functions and Features

1.9.1 Voltage detection and protection function

The Product has the functions of cell and module voltage detection, over voltage, under voltage alarm and protection. The cell voltage detection accuracy is less than $\pm 10\text{mV}$ under normal temperature static conditions.

1.9.2 Current detection and protection function

The Product has the functions of charge and discharge current detection, alarming and protection. The charging current is shown as a positive current and the discharge current is shown as a negative current. The current sampling accuracy is less than $\pm 2\%$ under normal temperature conditions.

1.9.3 Temperature detection and protection function

With the function of cell and environment temperature detection, when the temperature is too high or too low the product will start up alarming and protection function. The temperature sampling accuracy is less than $\pm 2^\circ\text{C}$ within the operating temperature range. Four battery temperature detection points and one ambient temperature detection point (maximum 16 battery temperature detection points) are supported by default.

1.9.4 Short-circuit protection function

With short-circuit protection function, the short circuit delay time can be set by the host computer. The short circuit current should be less than 1200A.

1.9.5 Battery capacity calculation function

Cell algorithm: About the use of SOC and SOH, SOC uses the basic elements of the Ampere integration and OCV method. The Ampere integration method and voltage, by the adjustment of the algorithm, with higher precision data and Independent clock system, ensures reasonable display during a single cycle. And the SOC estimation accuracy is $\leq \pm 8\%$.

1.9.6 Balance function

When the battery pack is charged, if the cell voltage reaches the equalization turn-on voltage, and the maximum voltage difference is greater than the equalization voltage difference, the cell that meets the condition turns on the equalization function. Battery supports up to 6 channels simultaneously to turn on equalization. The maximum equalization current is about 75mA.

1.9.7 LED indication function

6 LED indicators are used to indicate the battery's status. 4 green indicators are used for showing battery SOC, 1 red indicator is used for showing failure indication, 1 green operating indicator is used for showing battery's operation status, i.e. standby, charging, discharging, etc.

1.9.8 Sleep and wake-up functions

NO.	Sleep condition	Wake-up condition	Remark
1	In the idle state (no charge, discharge, no communication), the lowest voltage of any cell is lower than the set sleep voltage (can be set), after 30 minutes, enter normal sleep.	Charge and discharge, communication, reset button, switch	N.A.

2	When the minimum cell voltage is lower than the cell over-discharge protection value (can be set) or the total voltage is lower than the overall over-discharge protection value (can be set), and after 1-2 minute, the under-voltage sleep is entered.	Charge, reset button, switch	N.A.
3	Battery will enter to normal sleep after keeping idle state (no charge and discharge, no communication)for 24 hours.	Charge and discharge, communication, reset button, switch	N.A.
4	Forcing sleep through the host computer or soft switch	Reset button, switch	N.A.

1.9.9 Communication function

1. It can communicate with the computer or host through RS485, upload and save the collected information.
2. Supporting CAN bus communication (optional).
3. Supporting 2G/3G/4G communication (optional).
4. Supporting Bluetooth communication (optional).

1.9.10 Host computer control function

- 1) Through the host computer to set the protection parameters such as overvoltage, undervoltage, overcurrent, overtemperature, under temperature, short circuit, as well as balance, sleep, capacity, and other functional parameters and various alarm parameters.
- 2) Supporting monitoring of battery pack related information, battery status information, etc.
- 3) Supporting storing and exporting related data
- 4) Supporting writing barcode
- 5) Remote Control and Telemetering

1.9.11 Serial port upgrade function

The management system can be upgraded via the RS485 interface.

1.9.12 Communication Protocols

Default setting protocol with baud rate 9600, and other protocols are also supported.

1.9.13 Charge current limiting function

After the current limiting module is assembled and enabled by the host computer, the charging current limiting function can be implemented. The current limiting mode is current limiting after charging and overcurrent; the current limiting value is $10 \pm 1A$.

1.9.14 Anti-reverse function

Battery has Anti-reverse circuit. After the system is powered on, during the installation process, the battery is reversely connected to the switching power supply, and the system will enter the state of reverse connection protection and stop the external output.

1.9.15 Parallel communication function

The parallel communication function can be realized through the RS485 interface, and it can support up to 6-digit DIP switches (typically 4-digit DIP switches) for setting addresses when communicating in parallel. After parallel connection, the battery pack data can be monitored cyclically through the parallel version of the host computer.

1.9.16 Data Storage

Battery supports no less than 800 battery status data storage functions, protects all data and regular historical data during all state transitions, and stores 1 historical data every hour.

1.9.17 Optimized electrical structure

The battery can be arranged vertically in the design/use of electrical structure to enhance the stability of the battery cells ; Electrical structure has made more strengthening on heat transfer and heat dissipation.

1.9.18 Pre-charge function

BMS has pre-charge function. For those applications with inverters and other power electronics connected to battery, considering large capacitors are used at charger side, pre-charge strategy can be set in BMS as per specific conditions.

1.9.19 Dry contact

2 circuits of dry contacts output are supported, and they are in normal-close mode. Dry Contact 1: Battery failure; Dry Contact 2: BMS failure.

1.9.20 Active output

2 circuits of active output are supported to control external warming-up and fans, etc. Warming-up power can reach up to 100W (warming up power is from battery self)

1.9.21 Buzzer

Buzzer alarming is supported.

1.9.22 LCD Display Screen

LCD display screen is provided as option.

1.9.23 Anti-theft function

(1) Software security

Through communication between BMS and switching power supply or other devices, it can determine whether there is communication failure between two batteries and devices to realize anti-theft function

(2) The structure of the security

Through the battery module and rack interlock to achieve anti-theft function

(3) GPS anti-theft

Through GPS positioning function to achieve security

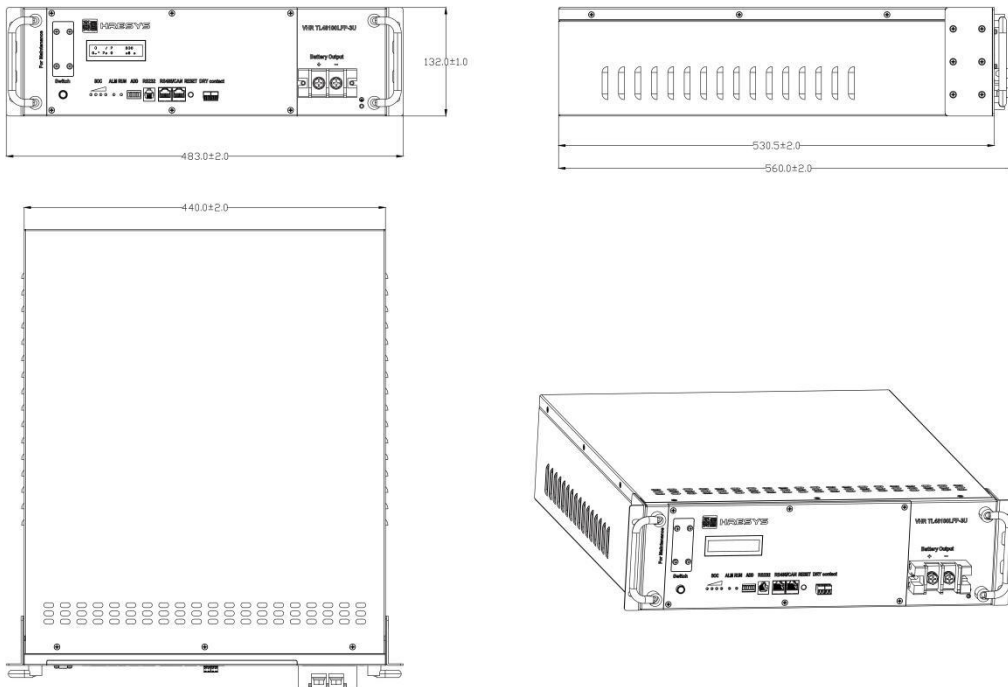
2. Appearance and Dimension

2.1. Appearance

There shall be no defects (deep scratch, crack, rust, discoloration, leakage, and so on), which may adversely affect the commercial value of the module.



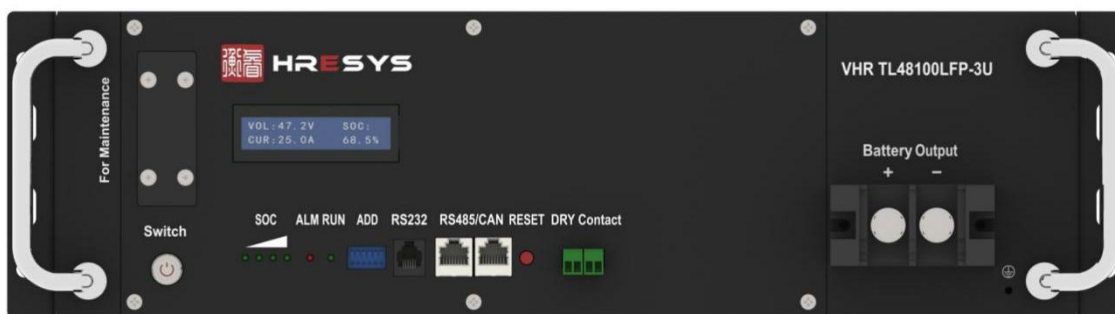
2.2. Dimension



Model No.	Nominal Voltage	Nominal Capacity	Dimension (W X D X H, mm)	Weight	Terminal			Remarks
					Material	Install way	Type	
TL48100LFP-3U	48V	100Ah	Width: 440.0mm (±2) Depth: 530.5mm (±2) Height: 132.0mm (±1)	Approx. 49kgs	Steel	Threaded insert	M6	3U

2.3. Interface

Drawing of Front Panel and Interface Description



No.	Name	Description	Remark
1	SOC	Capacity status	N.A
2	ALM	Red alarm light	N.A
3	RUN	Status of device running	N.A
4	ADD	Communication switch dip	Reserved
5	RS-232	RJ-11 for RS232 Communication and firmware update	N.A
6	RS-485	RJ-45 for RS485 Communication	2 X RS485 are internally parallel.
7	RESET	Reset button	N.A.
8	DRY CONTACT	The signal interface	It is usually triggered by alarm or protection
9	Battery Output	Nominal 48V output	Positive/Negative 100A
10	For Maintenance	For maintenance	N.A.
11	SWITCH	The power switch	Control the protection panel up and down
12	LCD	LCD display	Displays current system total voltage, current and battery status
13	GND	Protective ground	M4 screw

TL 48100LFP Serise Classification

No.	Module Name	LCD Screen	Dry Contact	Terminal Type
1	VHR TL48100-3U	Yes	Yes	2P
2	VHR TL48100-3U-A	NA.	Yes	2P
3	VHR TL48100-3U-B	NA.	Yes	4P
4	VHR TL48100-3U-C	Yes	Yes	4P

5	VHR TL48100-3U-D	Yes	NA.	2P
6	VHR TL48100-3U-E	Yes	NA.	4P
7	VHR TL48100-3U-F	NA.	NA.	2P
8	VHR TL48100-3U-G	NA.	NA.	4P

3. Recommended Charge/Discharge Modes and Conditions

2.4. Charge Modes and Conditions

Cell Temperature	Recommended Charge	Fast Continuous Charge
<0°C	No Charge Allowed	No Charge Allowed
0°C~10°C	Charge Current: 0.1C	Charge Current: 0.2C
10°C~20°C	Charge Current: 0.2C	Charge Current: 0.5C
20°C~30°C	Charge Current: 0.3C	Charge Current: 1.0C
30°C~40°C	Charge Current: 0.3C	Charge Current: 1.0C
40°C~60°C	Charge Current: 0.3C	Charge Current: 0.5C
>60°C	No Charge Allowed	

3.2. Discharge Modes and Conditions

Cell Temperature	Recommended Discharge	Fast Discharge
<-20°C	No Discharge Allowed	No Discharge Allowed
-20°C~0°C	Discharge Current: 0.2C	Discharge Current: 0.5C
0°C~20°C	Discharge Current: 0.5C	Discharge Current: 1.0C
20°C~50°C	Discharge Current: 0.5C	Discharge Current: 1.0C
50°C~60°C	Discharge Current: 0.5C	

>60°C	No Discharge Allowed
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4. Shipment

The battery should be packed in cartons under the condition of half capacity 20%-50% for shipment. The violent vibration, impaction or squeezing should be avoided in the transport process; neither is exposed in the sunlight nor rain. The batteries shall be shipped by normal transportation such as by road, by train, by ocean or by air.

5. Storage

The battery storage shall be in the clean and dry ventilation room at the temperature of 0 ~ 40°C and shall keep out of fire or heat and avoid touching corrosion elements. The batteries shall be charged every 8 or 12 months (0 ~ 30°C - 12month, 30 ~ 40°C - 8 month)during storage.

6. Installation Environment

Installation environment - Indoor only.

7. Warranty Period

Warranty period – 60 months

8. Caution and Prohibition in Handling

Warning for using the rechargeable lithium ion battery. Mishandling of the battery may cause heat, fire and deterioration in performance. Please be noticed the following cautions.

Cautions

- ❖ Please read the user manual carefully before using the lithium ion battery.
- ❖ No human body shall direct contact the positive/negative poles at the same time if the battery's voltage exceeds 36V safety voltage.
- ❖ Please read the specific charging device's user manual carefully before charging.
- ❖ When the battery is not charged after long exposure to the charger, discontinue charging.
- ❖ Please check the positive (+) and negative (-) direction before connection.
- ❖ Battery must be stored in a dry area with low temperature ($\leq 25^{\circ}\text{C}$) environment for long-term storage.
- ❖ Do not expose the battery in direct sunlight or heat.
- ❖ Do not use the battery in high static energy environment where the protection device can be damaged.
- ❖ When rust or smell is detected on first use, please return the product to the seller immediately.
- ❖ Keep the battery out of reach of children and pets.
- ❖ When battery life span shortens after long period of usage, please exchange to new battery.
- ❖ No metal objects (rings, watches, and other metal accessories, etc.) can be worn during the handling of battery.
- ❖ Charge time should not be longer than specified in the manual.
- ❖ Do not expose the battery out of the temperature range specified in the specification.

Prohibitions

- ❖ Do not use different charger to charge the battery.
- ❖ Do not charge with constant current higher than maximum charge current allowed.
- ❖ Do not disassemble or reconstruct the battery.
- ❖ Do not throw or cause impact.
- ❖ Do not pierce a hole in the battery with sharp objects, such as nail, knife, pencil, drill, etc.
- ❖ Do not mixing with other batteries.
- ❖ Do not solder on battery directly.
- ❖ Do not expose the battery to high heat, such as fire, etc.
- ❖ Do not put the battery into a microwave or high-pressure container.
- ❖ Do not use the battery in reverse.
- ❖ Do not connect positive (+) and negative (-) with conductive materials, such as metal, cables, etc.
- ❖ Do not immerge or wet battery with water or sea water.