**NO.: WBY-YJY-CN2023120702-14-ZHJ**

# Product Development Agreement
# 12.8V30Ah Battery
# System Specification

## A0 Version

| Prepared By | Checked By | Approved By |
|---|---|---|
| | | |

| | |
|---|---|
| Customer Approved | Signature: |
| | Date: |
| | Company Name:<br>（Company Stamp） |

| Address: Economic Development Zone of Hangbu town, Shucheng County, Lu'an, China | | |
|---|---|---|
| Tel:+86-0564-8030526 | Post Code:231300 | Web: www.lvwobattery.com |


| Anhui Lvwo Recycling Energy Technology Co., Ltd. | Contract NO.: WBY-YJY-CN2023120702-14-ZHJ |
|---|---|

## Description of changes to technical documents

**Changes to successive versions of this document are set out below:**

| NO. | Version No. | Description of changes | Changing Time | Modifier |
|---|---|---|---|---|
| 1 | A0 | Initial version | 2023-12-7 | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

# Content


I. Battery system design reference technical document ..... 1
II. Supply list ..... 1
III. Battery system usage requirements ..... 1
IV. Battery parameters ..... 2
4.1. Testing conditions ..... 2
4.2. Basic performance ..... 3
4.3. Environmental characteristics ..... 5
4.4. Safety characteristics ..... 5
V. Schematic diagram of product external dimension ..... 7
VI. Caution label and nameplate ..... 8
VII. Specifications and parameters of BMS ..... 8
7.1. Physical and wiring diagram of BMS ..... 8
7.2. Electrical parameter ..... 8
VIII. Charger ..... 12
IX. Conditions of use ..... 12
9.1. Packaging ..... 12
9.2. Transportation ..... 13
9.3 Storage ..... 13
X. User responsibility letter ..... 13
XI. Dangerous matters ..... 13
XII. Warnings and precautions ..... 14

# I. Battery system design reference technical document

GB 2894 Safety Signs（neq ISO 3864：1984）

GB 16179 Guidelines for the Use of Safety Signs

GB 8897.4-2008 Primary Batteries (Part 4) Safety Requirements for Lithium Batteries

GB 21966-2008 Safety Requirements for Lithium Primary Cells and Batteries in Transportation

GJB 4477-2002 General Specification for Lithium-ion Battery Packs

# II. Supply list

| NO. | Version | Unit | Quantity | Notes |
|---|---|---|---|---|
| 1 | 12.8V30Ah battery | pcs | 1 | |
| 2 | | pcs | | |
| 3 | | pcs | | |

# III. Battery system usage requirements

1. Battery system operating external ambient temperature requirements: charging and discharging：charging -10℃～60℃, discharging -20℃～60℃;
2. Battery system working external environment humidity requirements: 10%≤humidity≤90%RH;
3. Battery system operation state try to maintain more than 20% SOC;
4. When the battery system is not in use for a short period of time, it is required to maintain more than 60% SOC and be stored in a dry, clean and well-ventilated warehouse at 5℃～45℃.
5. During the loading process of the battery pack, it is required to carry and put it gently, and strictly prevent it from falling, rolling and impacting;
6. The battery pack shall not be placed upside down or lying down in the storage state; it is strictly prohibited to expose the battery pack to sunlight, rain or water for a long time;

7. Ensure that the battery system in the operation or storage state away from flammable and explosive substances, high temperature environment;
8. It is strictly prohibited to force the battery system to operate under the state of short circuit, overcharge and high temperature alarm;
9. Strictly prohibit customers from disassembling the battery system without permission;

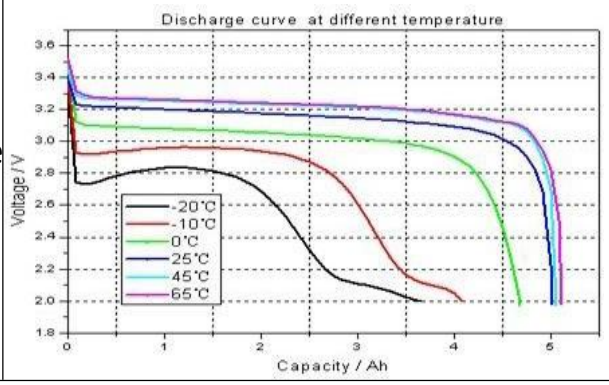
# IV. Battery parameters

## 4.1. Testing conditions

If there is no special requirement, the experiment should be carried out in the environment of

temperature: 25℃±2℃, relative humidity: 15~90 %RH, atmospheric pressure: 70kPa~106kPa.

## 4.2. Basic performance

| Cell parameter | | | |
|---|---|---|---|
| **NO.** | **Item** | **Parameters** | **Notes** |
| 1 | Battery type | Lithium iron phosphate battery | |
| 2 | Rated voltage/ capacity | 3.2V/6Ah (IFR32700) | |
| 3 | Cell voltage range | 2.5V-3.65V | |
| 4 | Cell weight | 140g | |
| 5 | Cell dimension | Cell diameter： 32mm，<br>Cell height： 71mm | |
| 6 | Anode material | Olivine-typed lithium iron phosphate material | |
| 7 | Negative electrode materials | Synthetic graphite | |
| 8 | Electrolyte compositio | Lithium hexafluorophosphate | |
| 9 | Electrolyte morpholog | Lean liquid | |
| 10 | Operating temperatur e | Charging 0℃-60℃；<br>Discharging-20℃-60℃ | |
| 11 | Charging retention capability | 97%（25℃,30days） | |
| 12 | Cycle times | ＞4000 cycles (0.2 C cycle, room temperature, capacity retention rate: 80%) | |
| 13 | The discharge curve of cell at -20℃, -10℃, 0℃, 25℃, 45℃ and 65℃ |  | |

Address: Economic Development Zone of Hangbu town, Shucheng County, Lu'an, China

Tel: +86-0564-8030526 | Post Code:231300 | Web: www.lvwobattery.com


| Battery pack system parameter | | | |
|---|---|---|---|
| 1 | Rated voltage | 12.8V | 4 series |
| 2 | Battery pack voltage range | 10-14.6V | Per cell 2.5V-3.65V |
| 3 | Rated capacity | 30Ah | |
| 4 | Total energy | 384Wh | |
| 5 | SOC range | 10%-100% | |
| 6 | Charging and discharging capacity efficiency | ≥96% | |
| 7 | Standard charging current（A） | 15 | Recommended 0.5C and below |
| 8 | Standard discharging current（A） | 15 | Recommended 0.5C and below |
| 9 | Max. continuous charging and discharging current (A) | 30 | |
| 10 | Total weight | 3.5kg(Estimation) | |
| 11 | Ambient relative humidity | 10%-90% | |
| 12 | Shell material | Plastic case | |
| 13 | Series-parallel system | 4S 5P in one pack | |
| 14 | Charging and discharging ambient temperature | Charging -10℃～60℃, Discharging -20℃～60℃ | |
| 15 | Battery dimension（mm） | 190*125*170mm（L*W*H） | |
| 16 | Input/Output method | M8 T e r m i n a l | |
| 17 | Whether to configure Bluetooth function | NO | Optional |

## 4.3. Environmental characteristics

（Charging according to the standards, and after full charge, let stand for 0.5h to do the following tests.）

| Ambient temperature | Discharging current | Battery capacity requirements |
|---|---|---|
| 25℃ | 1.0I1A | The measured discharging capacity of the battery pack is not less than 100% of the nominal capacity, and the appearance is not deformed or burst. |
| 0℃ | 1.0I1A | The measured discharging capacity of the battery pack is not less than 90% of the nominal capacity, and the appearance is not deformed or burst. |
| -10℃ | 1.0I1A | The measured discharging capacity of the battery pack is not less than 75% of the nominal capacity, and the appearance is not deformed or burst |
| 55℃ | 1.0I1A | The measured discharging capacity of the battery pack is not less than 95% of the nominal capacity, and the appearance is not deformed or burst. |

## 4.4. Safety characteristics

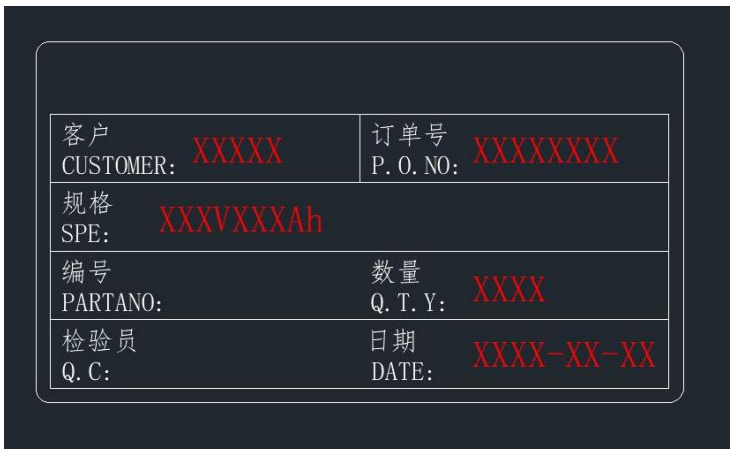
| Items | Specification parameters | Notes |
|---|---|---|
| Insulated electricity | ≥10MΩ | With insulation resistance tester DC 500V test voltage, the battery positive and negative terminal interface (terminal) were tested on the battery pack metal shell, insulation resistance value ≥ 10MΩ. |

| | | |
|---|---|---|
| Insulation strength | No breakdown, no flaring phenomenon | Battery positive and negative terminal interface respectively on the battery pack metal casing can withstand 50Hz, RMS 500V AC voltage (leakage current ≤ 10mA) or 710V DC voltage for 1min, there should be no breakdown, no flaring phenomenon. |
| Anti-soaking | No leakage, smoke, fire or explosion | The fully charged battery pack should be immersed in 3.5% NaCl solution, the water depth should be completely less than the battery pack, and the water depth should be kept for 2h. After taking out, the battery pack should be placed at the ambient temperature of 15℃ ~ 35℃, relative humidity of 25% ~ 85%, and atmospheric pressure of 86kPa ~ 106kPa for 4h. |
| Drop-resistant | No obvious damage, no leakage,shell rupture, fire or explosion, and the battery pack and each position have no displacement when shaking up and down. | When the battery pack is fully charged, choose any 6 angles, and drop to the cement floor once from the highest height set (0.8m ~ 1.8m). |
| Constant humidity | No obvious deformation, rust, smoke or explosion, its capacity should not be less than 90% of the measured base capacity | Once the battery pack is fully charged and equipped with a Battery Management System (BMS), it is placed in a constant temperature and humidity chamber at 60°C ±2°C with a relative humidity of 90% to 95% for 12 hours. Subsequently, it is removed and allowed to stand for 2 hours at an ambient temperature of 25°C ±2°C for visual inspection before discharging with a current of 1.0I1A to the cut-off voltage. |
| Vibration measurement | No explosion, no fire, no deformation, no parts falling off, no abnormal voltage, no sharp discharge current. | After fully charging the battery pack, it is securely fixed on a vibration table in the horizontal plane. The battery pack is then subjected to vibrations with an amplitude of 5mm and a maximum stroke of 10mm, with vibration frequencies ranging from 10Hz to 55Hz. Vibration tests are conducted in the x, y, and z directions of the battery pack, with each direction undergoing frequency-sweep testing between 10Hz and 55Hz for a duration of 90 minutes ± 5 minutes. After the completion of the test, it is left idle for 1 hour. |

# V. Schematic diagram of product external dimension



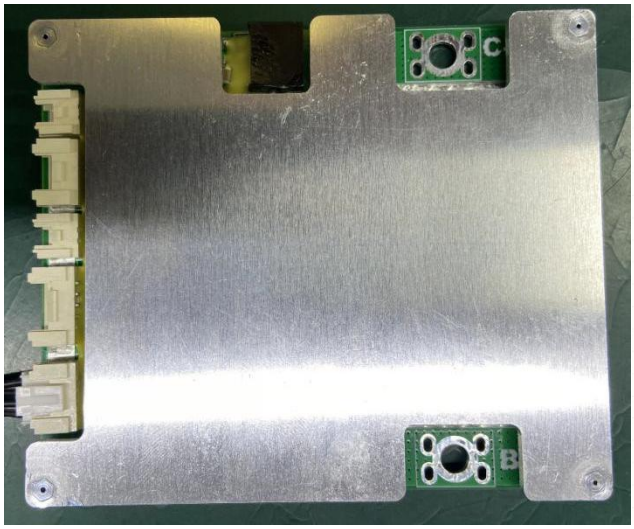
# VI. Caution label and nameplate

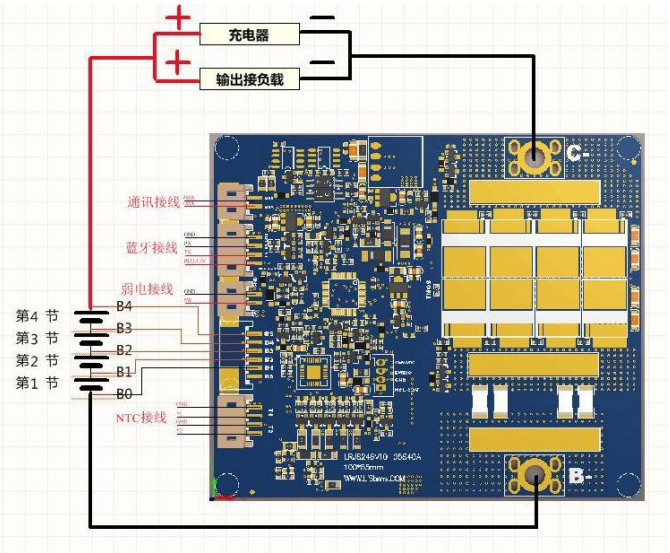



**Nameplate**

# VII. Specifications and parameters of BMS

## 7.1. Physical and wiring diagram of BMS






## 7.2. Electrical parameter

| Function | Test item | Parameter | Precision | Unit | Notes |
|---|---|---|---|---|---|
| PACK capacity | Pack capacity calibration | 30 | / | (AH) | |

| | | | | | |
|---|---|---|---|---|---|
| Charging voltage | Rated charging voltage | 14.4 | / | (V) | |
| Continuous current | Max. charging current | 15 | / | (A) | Proposed value |
| | Max. discharging current | 15 | / | (A) | Proposed value |
| Balance | Balanced turn-on voltage | 3400 | ±50 | (mV) | |
| | Balance opening differential pressure | 30 | ±10 | (mV) | |
| | Balanced current | 60 | ±20 | (mA) | |
| Charging protection | Over charge protection voltage | 3650 | ±50 | (mV) | Parameter adjustable |
| | Over charge protection delay | 1000 | ±500 | (mS) | Parameter adjustable |
| | Over charge recovery voltage | 3500 | ±50 | (mV) | Parameter adjustable |
| | Overcharge protection recovery condition | The voltage reaches the recovery or the discharge resumes | | | |
| | Charging over current | 30 | ±5 | (A) | Parameter adjustable |
| | Charging over current protection delay | 3000 | ±1000 | (mS) | Parameter adjustable |
| | Over discharge protection voltage | 2500 | ±50 | (mV) | Parameter adjustable |
| | Over discharge protection delay | 1000 | ±500 | (mS) | Parameter adjustable |
| | Over discharge protection recovery voltage | 2800 | ±50 | (mV) | Parameter adjustable |
| | Over discharge protection recovery conditions | The disconnect load voltage reaches the release voltage | | | |
| | Discharging over current 1 protection current | 35 | ±10 | (A) | Parameter adjustable |
| | Discharging over current 1 protection delay | 1000 | ±500 | (mS) | Parameter adjustable |
| | Discharging over current 2 protection current | 50 | ±10 | (A) | Parameter adjustable |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Discharging over current 2 protection delay | 500 | ±200 | (mS) | Parameter adjustable |
| | Discharging over current 2 protection delay | 500 | ±200 | (mS) | Parameter adjustable |
| | Discharging over current recovery condition | Disconnect load/access charger | | | |
| | Short circuit protection current | YES | | (A) | Parameter adjustable |
| | Short circuit protection delay | 500 | ±300 | (uS) | Parameter adjustable |
| | Short circuit protection recovery condition | Disconnect charger/access load | | | |
| temperature protection | Charging high temperature protection | 55 | ±5 | (℃) | Parameter adjustable |
| | Charging high temperature protection recovery | 50 | ±5 | (℃) | Parameter adjustable |
| | Charging low temperature protection | -5 | ±5 | (℃) | Parameter adjustable |
| | Charging low temperature protection recovery | 0 | ±5 | (℃) | Parameter adjustable |
| | Discharging high temperature protection | 65 | ±5 | (℃) | Parameter adjustable |
| | Discharging high temperature protection recovery | 60 | ±5 | (℃) | Parameter adjustable |
| | Discharging low temperature protection | -20 | ±5 | (℃) | Parameter adjustable |
| | Discharging low temperature protection recovery | -15 | ±5 | (℃) | Parameter adjustable |
| | MOS high temperature protection | 100 | ±5 | (℃) | Parameter adjustable |

| | | | | | |
|---|---|---|---|---|---|
| | MOS high temperature protection recovery | 70 | ±5 | (℃) | Parameter adjustable |
| Pack over voltage protection | Pack over voltage protection voltage | 14.6 | ±0.5 | (V) | Parameter adjustable |
| | pack over voltage protection recovery | 14 | ±0.5 | (V) | Parameter adjustable |
| | Protection delay | 1000 | ±500 | (mS) | Parameter adjustable |
| Pack under voltage protection | Pack under voltage protection voltage | 10 | ±0.5 | (V) | Parameter adjustable |
| | Pack under voltage protection recovery | 11.2 | ±0.5 | (V) | Parameter adjustable |
| | Protection delay | 1000 | ±500 | (mS) | Parameter adjustable |
| MOS temperature rise | 40A continuous discharging 1H | / | 60°±5 | (℃) | |
| Self-consuming power | Self-consuming operating power | 25 | ±10 | (mA) | |
| | Self consumption power in dormancy | 80 | ±10 | (uA) | |
| | Deep dormancy | 50 | ±10 | (uA) | |
| Internal resistance | Internal resistance of charge/discharge loop | 1 | ≦20 | (uA) | |
| Operating condition | Operating temperature:℃ | -20 → 85(℃) | | | |
| | Operating humidity:RH | ≤85% | | - | |
| Storage condition | Storage temperature: ℃ | -20 → 45 (℃) | | | |
| | Storage humidity :RH | ≤85% | | - | |
| Dimension | L*W*H | 100*85*9mm | | （mm） | |

# VIII. Charger

1. Dedicated Lithium Iron Phosphate Battery Charger

2. Max. Input Voltage ≤ 14.6 (CC/CV)

3. Max. Continuous Output Current ≤ 30 A

**Notes:** To prevent overcharging due to charger or BMS failure, the charger shall cut off first at the end of charging.

# IX. Conditions of use

## 9.1. Packaging

9.1.1. Method: □ Neutral carton (Domestic) □ UN carton (Export) □ Wood pallet (Bulk container export).

9.1.2. Each battery pack should have outer packaging and should be accompanied by a product manual and a certificate of conformity. The packaged product should be placed in a dry, dust-free, and moisture-proof packaging box. The outer packaging of dangerous goods should indicate the product name, model, voltage, capacity, quantity, gross/net weight, logo, battery serial number, etc. Neutral packaging does not include the above content. There should be necessary signs such as “Handle with care,” “Keep dry,” “This side up,”“Keep away from fire,”and so on.

9.1.3. Shipping documents: Shipping inspection report, product manual, host computer software, communication protocol (electronic file), etc.

9.1.4. Shock and pressure prevention measures: Fill shock-absorbing materials on both external sides (top and bottom) of the battery module.

9.1.5. Waterproofing, anti-scattering, handling: Battery module in nylon bag, tightened with strapping, pallet.

### 9.2. Transportation

Battery packs should be packaged in boxes for transportation, ensuring protection against severe vibrations, impacts, or compression. They should be shielded from exposure to sunlight and rain, and can be transported using vehicles such as cars, trains, ships, or airplanes.

### 9.3. Storage

9.3.1. Battery packs are typically stored at a state of charge of 20%-40% in a clean, dry, well-ventilated indoor area with an environment temperature of -5°C to 35°C and a relative humidity not exceeding 75%. The packs should be placed flat with a minimum distance of 100mm from the ground.

9.3.2. Batteries should not be stored together with reactive chemicals or dusty items.

9.3.3. Batteries should not be subjected to any mechanical impact or heavy pressure.

9.3.4. Batteries should be kept away from direct sunlight, heat sources, with a distance from heat sources not less than 2 meters.

9.3.5. Every 3 months from the date of manufacture, a 0.2-0.5C current charge should be applied for 30-60 minutes, at a temperature range of 25°C ± 5°C.

## X. User responsibility letter

Users must follow the instructions on the battery label or the Anhui Lvwo Recycling Energy Technology Co., Ltd. battery specification sheet. If improper use by the user leads to damage such as overheating, fire, or explosion in the power system, the company will not be liable.

## XI. Dangerous matters

Failure to carefully read the following items may result in battery leakage, explosions, or fires.

11.1. Do not submerge the battery in water or get it wet;

11.2. Do not use or store the battery near a heat source (such as fire or heater);

11.3. Do not reverse the positive and negative poles;

11.4. Do not directly connect the battery to a wall outlet or car cigarette lighter socket;

11.5. Do not throw the battery into fire or heat it;

11.6. Do not short-circuit the positive and negative poles of the battery with wires or other metal objects, and do not transport or store the battery with necklaces, hairpins, or other metal objects;

11.7. Do not strike, throw, or subject the battery to mechanical vibrations;

11.8. Do not pierce the battery casing with nails or other sharp objects, and do not hit or step on the battery;

11.9. Do not disassemble the battery in any way;

11.10. Do not charge the battery in a fire or under extreme heat conditions.

## XII. Warnings and precautions

- No unqualified personnel are not allowed to dismantle or repair the battery system.
- Only use the designated charger for charging the battery system.
- Do not immerse the power system in water or saltwater. Store the battery in a cool, dry environment when not in use.
- If the power system emits odors, heats up, changes color or shape during charging or discharging, or shows any abnormalities, stop operation immediately and seek professional assistance.
- In case of a battery fire, use dry sand or a nitrogen fire extinguisher.
- Do not dispose of the battery system in fire or heat sources.
- When installing or using the battery, remove metal jewelry or other metal items, handle the battery carefully, especially when placing it in a metal container.