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NO.:

Product Development Agreement 12.8V100Ah Energy Storage Product Specification

A0 Version

Prepared By	Checked By	Approved By

Customer Approved	Signature:
	Date:
	Company Name: （Company Stamp）

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	Contract NO.:

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	2023-10-26	

Content

I. Scope of application

This specification sheet is suitable for the development of 12.8V100Ah Energy Storage Battery Pack by Anhui Lvwo Recycling Energy Technology Co., Ltd. It describes the external dimensions, performance indicators, battery management system parameter settings, appearance identification of the battery pack, conditions for use and storage, as well as usage guidelines.

II. 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

GB 31241-2014 Portable Electronic Products Lithium-ion Batteries and Battery Packs Safety Requirements

III. Supply list

NO.	Version	Unit	Quantity	Notes
1	12.8V100Ah battery pack	pcs	1	
2	Product specification	Pcs	1	
3				

IV. 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 -10℃～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;

V. Battery pack performance technical specifications

5.1 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.

5.2 Basic performance

NO.	Item	Parameters		Notes
Cell parameters				
1	Battery type	Lithium iron phosphate battery		**LiFe 32700**
2	Rated voltage/capacity	3.2V/6Ah		
3	Cell voltage range	2.50V-3.65V		
4	Cell weight	147±5g		
5	Cell dimension	Cell diameter	32.2±0.3mm	
		Cell height	70.5±0.3mm	
6	Operating temperature	Charging temperature	0℃～60℃	

		Discharging temperature	-20℃～60℃	
7	Charging retention capability	97%（25℃,30days）		
8	Cycle times	＞4000 cycles (0.2 C cycle, room temperature, capacity retention rate: 80%)		
Battery 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	102Ah		
4	Total energy	1536Wh		
5	Series-parallel system	4S17P		
6	SOC range	10%-100%		
7	Charging and discharging capacity efficiency	≥95%		
8	Standard charging current（A）	100		
9	Standard discharging current（A）	100		
10	Max. continuous discharging current (A)	100		
11	Max. continuous charging current (A)	100		
12	Over current protection (A)	130		
13	Total weight	13.1KG（Estimation）		
14	Ambient relative humidity	10%-90%		

15	Operating temperature	Charging temperature	0℃～60℃	
		Discharging temperature	-20℃～60℃	
16	Storage temperature	Short term (1 month)	-10℃～45℃	Storage should be charged to more than 60% of capacity
		Long-term (Within 1 year)	0℃～35℃	
17	Heating control	NO		
18	Shell material	plastic shell		
19	Battery dimension	330*172*215mm		
20	Input/Output method	M8 Terminal		

5.3 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.

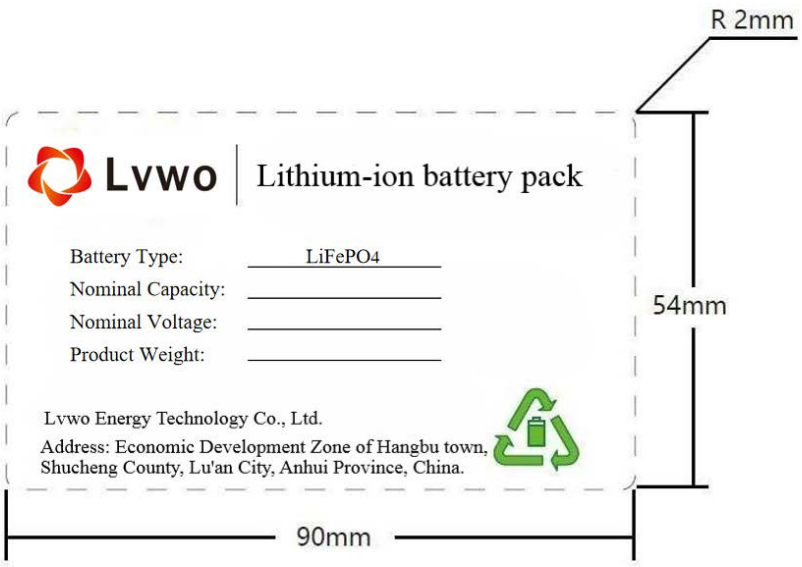
5.4 Safety characteristics

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.

VI. Schematic diagram of product external dimension

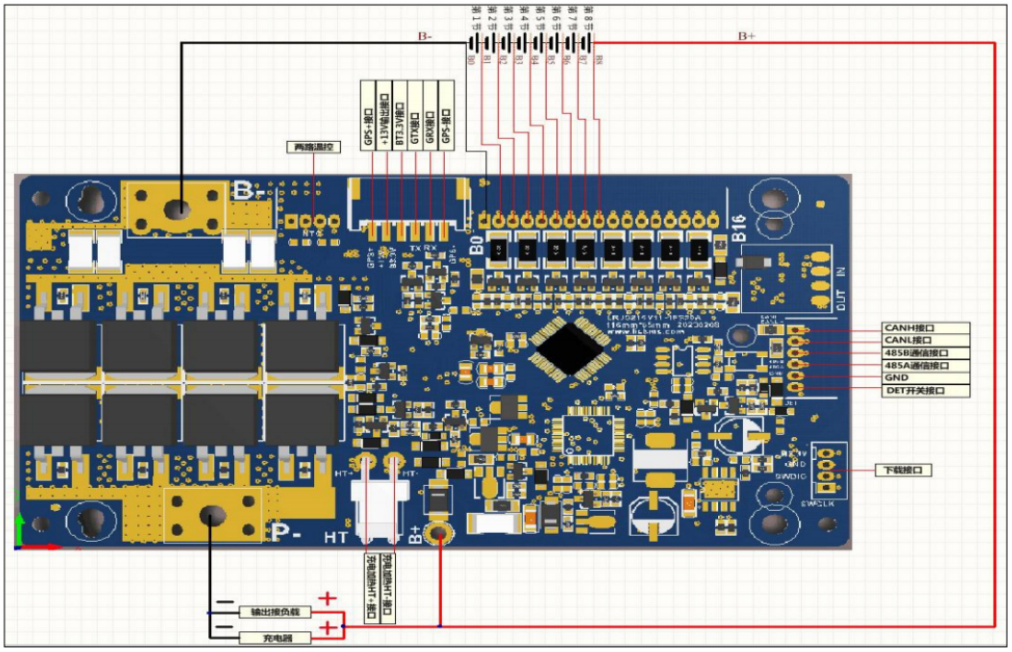
Battery pack structure dimension diagram

VII. Label and nameplate



VIII. Specifications and parameters of BMS

8.1 Physical and wiring diagram of BMS



8.2. Electrical parameter

Function	Test item	Parameter	Precision	Unit	Notes
PACK capacity	Pack capacity calibration	100	/	(AH)	
Charging voltage	Rated charging voltage	14.4	/	(V)	
Continuous current	Max. charging current	100	/	(A)	Proposed value
	Max. discharging current	100	/	(A)	Proposed value
Balance	Balanced turn-on voltage	3400	±40	(mV)	
	Balance opening differential pressure	30	±10	(mV)	
	Balanced current	50	±30	(mA)	
Charging protection	Over charge protection voltage	3650	±50	(mV)	Parameter adjustable
	Over charge protection delay	2000	±1000	(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	130	±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	180	±10	(A)	Parameter adjustable
	Discharging over current 1 protection delay	1000	±1000	(mS)	Parameter adjustable
	Discharging over current 2 protection current	300	±10	(A)	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	65	±5	(℃)	Parameter adjustable
	Charging high temperature protection recovery	55	**±5**	**(℃)**	Parameter adjustable
	Charging low temperature protection	0	**±5**	**(℃)**	Parameter adjustable
	Charging low temperature protection recovery	5	**±5**	**(℃)**	Parameter adjustable
	Discharging high temperature protection	70	**±5**	**(℃)**	Parameter adjustable
	Discharging high temperature protection recovery	60	**±5**	**(℃)**	Parameter adjustable
	Discharging low temperature protection	-10	±5	(℃)	Parameter adjustable
	Discharging low temperature protection recovery	0	±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	13.8	±0.5	(V)	Parameter adjustable
	Protection delay	1000	±500	(mS)	Parameter adjustable
Pack under voltage protection	Pack under voltage protection voltage	10.0	±0.5	(V)	Parameter adjustable
	Pack under voltage protection recovery	11.6	±0.5	(V)	Parameter adjustable
	Protection delay	1000	±500	(mS)	Parameter adjustable
MOS temperature rise	100A continuous discharging 1H	-	-	(℃)	
Self-consuming power	Self-consuming operating power	26.9	±5	(mA)	
	Self consumption power in dormancy	97	≦150	(uA)	
	Deep dormancy	16.9	≦50	(uA)	
Internal resistance	Internal resistance of charge/discharge loop	1	≦20	(mΩ)	
Operating condition	Operating temperature:℃	-20 → 85		(℃)	
	Operating humidity:RH	≤85%		-	
Storage condition	Storage temperature: ℃	-20 → 45		(℃)	
	Storage humidity :RH	≤85%		-	
Dimension	L*W*H	150*85*23（With screw）		（mm）	

IX. Packaging、transportation and storage

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.

(1) Do not submerge the battery in water or get it wet;

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

(3) Do not reverse the positive and negative poles;

(4) Do not directly connect the battery to a wall outlet or car cigarette lighter socket;

(5) Do not throw the battery into fire or heat it;

(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;

(7) Do not strike, throw, or subject the battery to mechanical vibrations;

(8) Do not pierce the battery casing with nails or other sharp objects, and do not hit or step on the battery;

(9) Do not disassemble the battery in any way;

(10) Do not charge the battery in a fire or under extreme heat conditions.

(11) Do not put batteries in microwave ovens or pressure containers

(12) Do not use a primary battery (such as dry cell battery) together with batteries of different capacities, types, or models.

(13) Do not continue using the battery if it emits odors, heat, deforms, changes color, or shows any other abnormalities; immediately remove the battery from the appliance or charging device and stop using it if it is in use or charging.

(14) Batteries should be kept out of reach of children.

(15) If a battery leaks or emits an odor, promptly move it away from open flames; leaked electrolytes may cause fire or explosion.

(16) If battery leakage causes electrolyte to enter the eyes, do not rub; instead, rinse with water and seek medical help immediately to prevent eye damage.

XII. Precautions

- Strictly follow the instructions for using the lithium battery pack. If the battery leaks and the electrolyte comes into contact with the skin or clothes, immediately rinse the affected area with running water to prevent skin inflammation.
- Read the device manual for batteries, and correctly install and remove the batteries.
- If the battery terminal is dirty, wipe it clean with a dry cloth before use. Otherwise, the battery terminals may have poor contact, leading to energy loss or inability to charge.
- 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.