Li-ion Cylinder Battery Pack Specification

Pack Type: 4PCell+PCM+ Wire

Battery Model: NUE14SYY145003X200A

Typical Cell Capacity (mAh): 3200

Prepared By/Date /	Checked By/Date /	Approved By/Date /
HDX	LQL	LP
2019-04-01	2019-04-01	2019-04-01

Customer Approval	Signature/Date
	Company Name
	Company Stamp

Content

1. Amendment Records

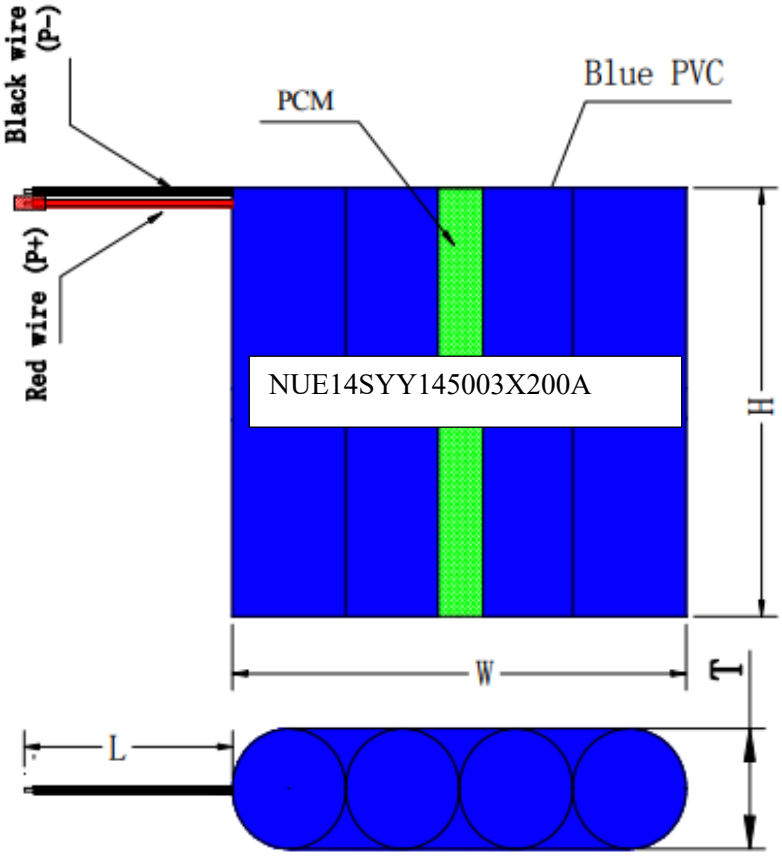
Product Amendment Records List

Edition	Date	Mark	Amendment content	Approved by
A0	2019-04-01	/	NEW RELEASE	LP

2. Scope

This specification describes the basic performance, technical requirement, testing method, warning and caution of the Li-ion Cylinder rechargeable battery pack, the pack defined in this documentation is an assembly which include battery, PCM, wire etc., the specification only applies to NuEnergy Storage Technologies.

3. Initial Dimension



Remark: Date

Unit (mm)					
T Max	16	W Max	60	H Max	53
T1 Max	/	L	75±3	L1	/
		Connector Wire	UL3302/22# 1.3		
PCM	G3J+8205A*2				

4.Specification

NO.	Item	Specifications	
4.1	Nominal capacity	3200mAh	0.2C Discharge
	Minimum capacity	3100 mAh	0.2C Discharge
4.2	Initial Impedance	≤120m	
4.3	Battery Weight	Approx. 64g	
4.4	Nominal voltage Fully charge voltage (FC) Fully discharge voltage (FD)	3.7V 4.2V 3.0V	 Defined in this DOC: FC = 4.2V Defined in this DOC: FD = 3.0V
4.5	Standard charge current	0.5 C	
4.6	Standard charging method	0.5C CC (constant current) charge to FC, then CV (constant voltage FC) charge till charge current decline to ≤0.01C	
4.7	Standard Charging time Fast Charging time	Approx. 6 hours Approx. 5 hours	 0.5C Charge Current
4.8	Max. charge current	0℃15℃	0.2C
		15℃25℃	0.5C
		25℃45℃	0.5C
4.9	Max. discharge current	-10℃15℃	0.2C
		15℃60℃	0.5C
4.10	4.8 4.9 7.7/7.8/7.9		
4.11	Standard Discharge Current	Constant current 0.2 C end voltage FD	
4.12	Charge cut-off voltage	Ref. **8.1** VDET1	
4.13	Discharge cut-off Voltage	Ref. **8.1** VDET2	
4.14	Storage temperature -20℃~60℃	≤1 month	Percentage of recoverable capacity no less than 80% of the initial capacities
	-20℃~45℃	≤3 month	
	-20℃~25℃	≤1 year	
4.15	Recoverable capacity	Constant current 0.2C charge to FC, then constant voltage FC charge to current declines to 0.01C, rest for 10minconstant current 0.2C discharge to FD, rest for 10min.Repeat above steps 3 times, recording the maximum capacity	
4.16	Storage Humidity	≤75% RH	
4.17	Appearance	Without distortion and leakage	
4.18	Before shipment voltage	≥3.7V	
4.19	Standard testing condition	Temperature: Humidity: Atmospheric Pressure:	23±2℃ ≤75%RH 86-106 Kpa

Remark: 1. From 4.1 to 4.12, the testing condition is following 4.19 (standard testing condition)

2. Operating temperature: charging: 0℃~45℃; Discharging: -10℃~60

3. If the working condition is out of 4.19, the performance will be some shift.

5. General Performance

No.	Item	Test Methods and Condition	Criteria
5.1	0.2C Capacity	At standard testing condition, after full charge with standard charge, rest 10min, then discharging at 0.2C to voltage FD, recording the discharging time.	≥300min
5.2	Cycle Life	At standard testing condition constant current 0.2C charge to FC, then constant voltage charge to current declines to 0.01C, rest 10minconstant current 0.2C discharge to FD, rest 10min. Repeat above steps till continuously discharging capacity Higher than 70% of the Initial Capacities of the battery.	≥300 times

6. Environmental Performance

No.	Item	Test Methods and Condition	Criteria
6.1	Leakage-Proof	At standard testing condition, After full charge with standard charge, store at 55±2℃, 60±10%RH for 1 week.	No leakage (visual inspection)
6.2	Capability of keeping electricity	At standard testing condition After full charge with standard charge, no outer loading circuit, rest the pack 28days, discharging at 0.2C to voltage FD, recording the discharging time.	≥255min

7. Mechanical characteristics and Safe Characteristic

No.	Item	Test Methods and Condition	Criteria
7.1	Vibration Test	At standard testing condition, After full charge with standard charge, fixed the cell to vibration table and subjected to vibration cycling that the frequency is to be varied at the rate of 1Hz per minute between 10Hz and 55Hz, the excursion of the vibration is 1.6mm. The cell shall be vibrated for 180 minutes per axis of XYZ axes.	No leakage No fire No explosion

7.2	Free Drop	At standard testing condition, after full charge with standard charge. The Battery is to be dropped from a height of 1 meter onto concrete ground. Free drop one time respectively from XYZ positive and negative axis (six Directions).	No leakage No fire No explosion
7.3	Crush	At standard testing condition, after standard charging, Crush between two flat plates. Applied force is about 13 ± 0.2kN(1.72Mpa), Once the maximum force has been applied, the force is released.	No fire No explosion
7.4	Short Circuit 20℃	At standard testing condition, after standard charging, each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1Ω. Tests are to be conducted at temperature 20±5℃	No fire No explosion
7.5	Short Circuit 55℃	At standard testing condition, after standard charging, each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1Ω. Tests are to be conducted at temperature 60±5℃.	No fire No explosion
7.6	Impact	At standard testing condition, After standard charging, A 56mm diameter bar is inlayed into the bottom of a 10kg weight. And the weight is to be dropped from a height of 1m onto a sample battery and then the bar will be across the center of the sample.	No fire No explosion
7.7	External short circuit	1. The battery should be in 20 ℃ ± 5 ℃ environment temperature constant at 0.2 C discharge exile to terminate with specified electrical voltage of 3.0 V. 2. Charge: according to 45 ℃ high temperature and low temperature10℃respectively, in the high or low temperature environment let stand 1-4 hours, according to the charging 0.2 C to 4.25 V, until the charging current is reduced to 0.05 C. Remove the battery after charging temperature let stand	No fire No explosion

		for 1-2 hours. 3. External short circuit test: use an external resistor of 80m ± 20m wire connected to the batteries extreme external short circuit, plus or minus in the test cell can maintain 24 hours or external temperature down to the highest temperature rise 20%, meet the one,	
7.8	Internal short circuit	1. The battery should be in 20 ℃ ± 5 ℃ environment temperature constant at 0.2 C discharge exile to terminate with specified electrical voltage of 3.0 V. 2. Charge: according to 45 ℃ high temperature and low temperature10℃respectively, in the high or low temperature environment let stand 1-4 hours, according to the charging 0.2 C to 4.25 V, until the charging current is reduced to 0.05 C. Remove the battery after charging temperature let stand for 1-2 hours. 3. Disassemble the battery and place the core of the nickel particle in the aluminum foil bag and then put it in the specified high temperature or low temperature box for 45 + 5 minutes. 4. Remove batteries from the sealed packaging, batteries voltage detection terminal and monitoring the surface temperature of thermocouple, put the batteries in extrusion equipment, placed the position of nickel particles on pressure head directly. 3. Bottom surface of moving part of the press equipment is made of Nitrile rubber of Acryl. which is put on the 10mm*10mm stainless steel shaft. Nitrile rubber bottom surface is for cylindrical cell test. For prismatic test 5mm*5mm (2mm thickness) Acryl is put on the Nitrile rubber. The fixture is moved down at the speed of 0.1mm/S monitoring the cell voltage. when voltage drop caused by the internal short-circuit is detected, stop descent immediately and keep pressing jig in the position for 30S and then release the pressure. Voltage is monitored more than 100 times per second and if voltage is dropped more	No fire No explosion

		than 50 mV compare to the initial voltage, it is defined to internal short circuit has occurred. if the pressure reaches 800N for cylindrical cell and 400N for prismatic cell, stop descent immediately and then keep in the position.	
7.9	Thermal abuse	1. The battery should be in 20 ℃ ± 5 ℃ environment temperature constant at 0.2 C discharge exile to terminate with specified electrical voltage of 3.0 V. 2. Charge: according to 45 ℃ high temperature and low temperature10℃respectively, in the high or low temperature environment let stand 1-4 hours, according to the charging 0.2 C to 4.25 V, until the charging current is reduced to 0.05 C. Remove the battery after charging temperature let stand for 1-2 hours. 3. 3. Place the batteries in a gravity or circulating air convection oven, oven temperature by 5 ℃ / min plus or minus 2 ℃ / min speed up to 130 ℃ + 2 ℃, the battery needs to be placed in this environment for 30 min, the termination	No fire No explosion

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

8.Protection Circuit

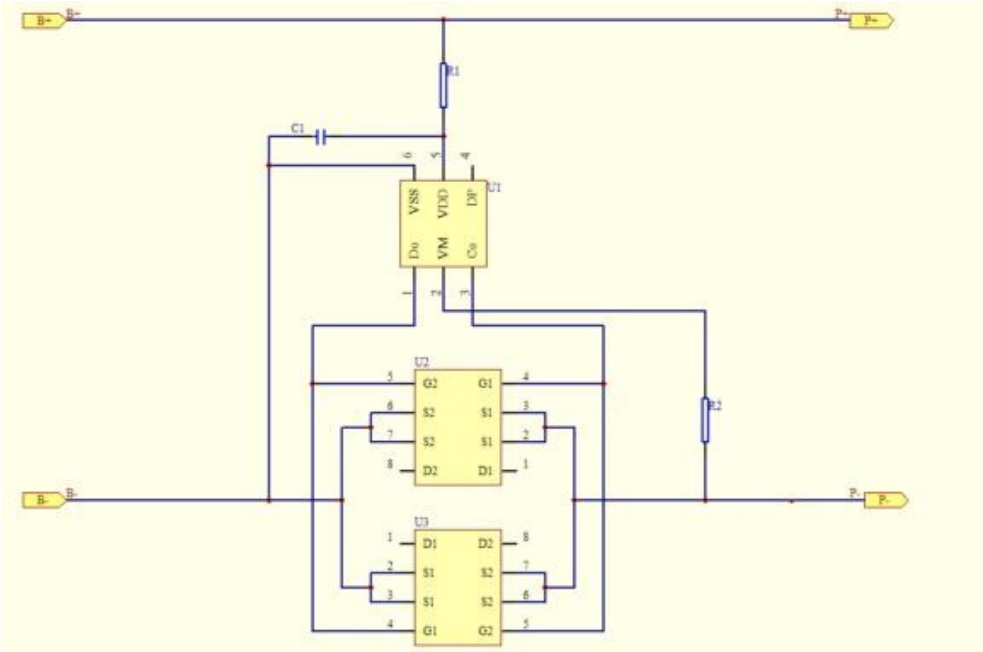
8.1 PCM Standard

Item	Symbol	Content	Criterion
Over charge Protection	VDET1	Over charge detection voltage	4.28±0.025V
	tVDET1	Over charge detection delay time	960~1400ms
	VREL1	Over charge release voltage	4.08±0.05V
Over discharge protection	VDET2	Over discharge detection voltage	3.0±0.05V
	tVDET2	Over discharge detection delay time	115~173ms
	VREL2	Over discharge release voltage	3.0±0.05V
	IDP	Over current detection current	2~6A
	tVDET3	Detection delay time	7.2~11ms
		Release condition	Off load charging
Short protection		Detection condition	Exterior short circuit
	TSHORT	Detection delay time	150~540uS
		Release condition	Cut short circuit
Interior resistance	RDS	Main loop electrify resistance	VC=4.2V, RDS≤70mΩ
Current consumption	IDD	Current consumes in normal operation	3.5μA Type 7.0μA Max

8.2 BOM For PCM

NO.	Location	Part name	Specification	Pack type	Q'ty	Maker
1	U1	Protection IC	G3J	SOT-23-6	1	
2	U2 U3	MOSFET	8205A	TSSOP-8	2	
3	R1	Resistance	470Ω±5%	0603	1	
4	R2	Resistance	2KΩ±5%	0603	1	
5	C1	Capacitance	0.1μF	0603	1	
6	PCB	Print circuit board	/	/	1	

8.3 Schematic diagram



9.Warnings

Load circuit may cause voltage and current, and the voltage or current may add to pack, the voltage or current must be controlled as lower than RWV and RWI, larger voltage or current may damage the PCM of pack.

To prevent the possibility of the pack from leaking, heating, fire. Please observe the following precautions:

- The soft aluminum packing foil is very easily damaged by sharp edge parts such as Ni-tabs, pins and needles. Do not strike at pack with any sharp edge parts.
- Do not immerse the pack in water and seawater
- Do not use and leave the pack near a heat source as fire or heater
- When recharging, use the battery charger specifically for that purpose
- Do not reverse the positive and negative terminals
- Do not connect the pack to an electrical outlet
- Do not discard the pack in fire or heat it
- Do not short-circuit the pack by directly connecting the positive and negative terminal with metal object such as wire

- Do not transport and store the battery together with metal objects such as necklaces, hairpins etc.
- Do not strike or throw the pack.
- Do not directly solder the pack or battery and pierce the battery with a nail or other sharp object.

10. Cautions

- Do not use or leave the pack at very high temperature (for example, at strong direct sunlight or a vehicle in extremely hot conditions).Otherwise, it can overheat or fire or its performance will be degenerate and its service life will be decreased.
- Do not use it in a location where static electricity is great, otherwise, the safety devices in the pack may be damaged, which will cause hidden trouble of safety.
- If the pack leaks and the electrolyte get into the eyes, do not rub eyes, instead, rinse the eyes, with clean running water, and immediately seek medical attention. Otherwise, eye injury can result.
- If the pack takes off an odor, generates heat, becomes discolored or deformed, or in any way appear abnormal during use, recharging or storage, immediately remove it from the device or battery charge and stop using it.
- In case the pack terminals are dirt, clean the terminals with a dry cloth before use. Otherwise power failure or
- charge failure may occur due to the poor connection with the instrument.
- Be aware discharged battery may cause fire or smoke, tape the terminals to insulate them.
- The pack should be stored at room temperature, charged to about 40% to 60% of capacity. In case of over-discharge, pack should be charged for one time every 3 months while storing and batteries should be discharge and charge after being stored more than a year in order to activate it and restore energy.

11. Handling of Battery

1 Soft Aluminum foil

Easily damaged by sharp edge parts such as pins and needles, Ni-tabs, comparing with metal-can-cased LIB.

- Don't strike battery with any sharp edge parts
- Trim your nail or wear glove before taking battery
- Clean worktable to make sure no any sharp particle

2 Sealed edge may be damaged by heat above 100°C, bend or fold sealed edge.

3 Prohibition short circuit

Never make short pack circuit. It generates very high current which causes heating of the cells and may cause electrolyte leakage, gassing or explosion that are very dangerous. The LIP 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.

4 Mechanical shock

- LIP cells have less mechanical endurance than metal-can-cased LIB.
- Falling, hitting, bending, etc. may cause degradation of LIP characteristics.

12.Period of Warranty

The period of warranty is one year from the date of shipment. NuEnergy Storage Technologies guarantees to give a replacement in case of battery with defects proven due to manufacturing process instead of the customer abuse and misuse.

13. Others

1. The customer is requested to contact NuE 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.

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

3. NuE will inform, in a written form, the customer of improvement(s) regarding proper use and handing of the battery, if it is deemed necessary.

4. Any matters that this specification does not cover should be conferred between the customer and NuE.