

Customer: Artemide SpA

## Li-ion Cylinder Battery Pack Specification

- Pack Type: 3P Cell+PCM+ Connector Wire
- Battery Model: ET-18650-2000mAh-3P-ART
- Typical Cell Capacity: 2000 mAh
- Customer Code: TBD
- Total Page: 10

Prepared By/Date	Checked By/Date	Approved By/Date
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## Content

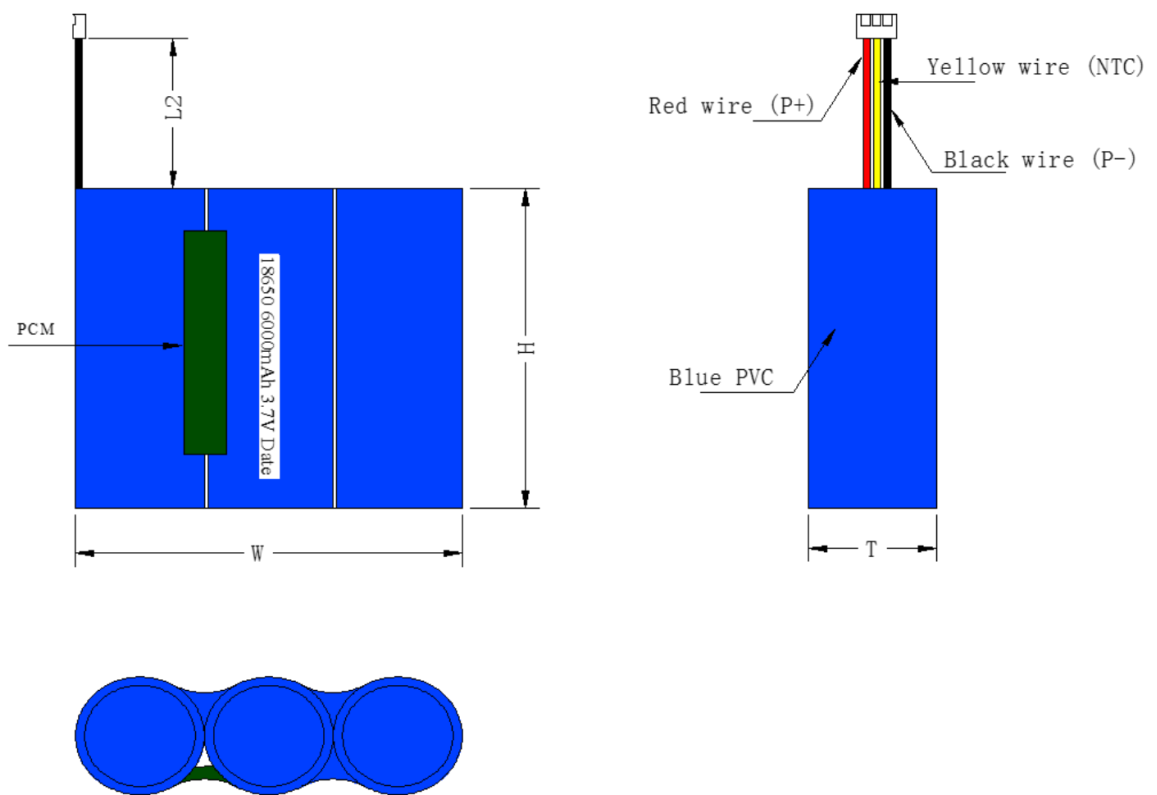
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## 2. Scope

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 Elco Elettronica Srl.

## 3. Initial Dimension



Remark:Date

Unit ( mm )

T Max	19.0	W Max	55.5	H Max	68.0
T <sub>1</sub> Max	/	L	60±3	L1	/
		Connector Wire	JST-XHP-3P UL3239 26#		
PCM	G3J+8205A*2+10KNTC				

## 4. Specification

NO.	Item	Specifications	
4.1	Nominal capacity	6000mAh	0.2C Discharge
	Minimum capacity	5900 mAh	0.2C Discharge
4.2	Initial Impedance	$\leq 110\text{m}\Omega$	
4.3	Battery Weight	Approx(约): 160g	
4.4	Nominal voltage	3.7V	
	Fully charge voltage(FC)	4.2V	Defined in this DOC: FC = 4.2V
	Fully discharge voltage(FD)	2.75V	Defined in this DOC: FD = 2.75V
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 $\leq 0.01\text{C}$	
4.7	Standard Charging time	Approx 4 hours	
	Fast Charging time	Approx 3 hours (1C Charge Current)	
4.8	Max. charge current	0°C ~ 15°C	0.2C
		15°C ~ 25°C	0.5C
		25°C ~ 45°C	1C
4.9	Max. discharge current	-10°C ~ 15°C	1C
		15°C ~ 60°C	1C
4.10	Standard Discharge Current	Constant current 0.2 C end voltage FD	
4.11	Charge cut-off voltage	Ref. 8.1 VDET1	
4.12	Discharge cut-off Voltage	Ref. 8.1 VDET2	
4.13	Storage temperature	-20°C ~ 60°C	$\leq 1$ month
		-20°C ~ 45°C	$\leq 3$ month
		-20°C ~ 25°C	$\leq 1$ year
4.14	Recoverable capacity	Constant current 0.5C charge to FC, then constant voltage FC charge to current declines to 0.01C, rest for 10min, constant current 0.5C discharge to FD, rest for 10min.Repeat above steps 3 times, recording the maximum capacity	
4.15	Storage Humidity	$\leq 75\%$ RH	
4.16	Appearance	Without distortion and leakage	
4.17	Before shipment voltage	$\geq 3.6$ V	
4.18	Standard testing condition	Temperature: $23 \pm 2^\circ\text{C}$ Humidity: $\leq 85\%$ RH Atmospheric Pressure: 86-106 Kpa	

**Remark:**

- From 4.1 to 4.12, the testing condition is following 4.17 (standard testing condition)
- Operating temperature: charging 0°C~45°C- Discharging-10°C~60°C

If the working condition is out of 4.17, 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.	$\geq 300$ min
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 10min, constant current 0.2 C discharge to FD, rest 10min. Repeat above steps till continuously discharging capacity Higher than 70% of the Initial Capacities of the battery.	$\geq 500$ times

## 6 .Environment Performance

No.	Item	Test Methods and Condition	Criteria
6.1	Leakage-Proof	At standard testing condition, after full charge with standard charge, store at $55\pm 2^{\circ}\text{C}$ , $60\pm 10\%\text{RH}$ for 1 week.	No leakage (visual inspection)
5.4	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.	$\geq 255$ min

## 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 an 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 X, Y, Z 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 $13 \pm 0.2\text{kN}$ (1.72Mpa) ,Once the maximum force has been applied, the force is released.	No fire No explosion,

7.4	Short Circuit (20°C)	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 0.1 Ω. Tests are to be conducted at temperature 20 ± 5°C	No fire No explosion,
7.5	Short Circuit (55°C)	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 0.1 Ω. Tests are to be conducted at temperature 60 ± 5°C.	No fire No explosion,
7.6	Impact	At standard testing condition, After standard charging, A 56mm diameter bar is inlaid 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,

\* Above testing of safe characteristic must be with protective equipment.

## 8. Protection Circuit

### 8.1 PCM Standard

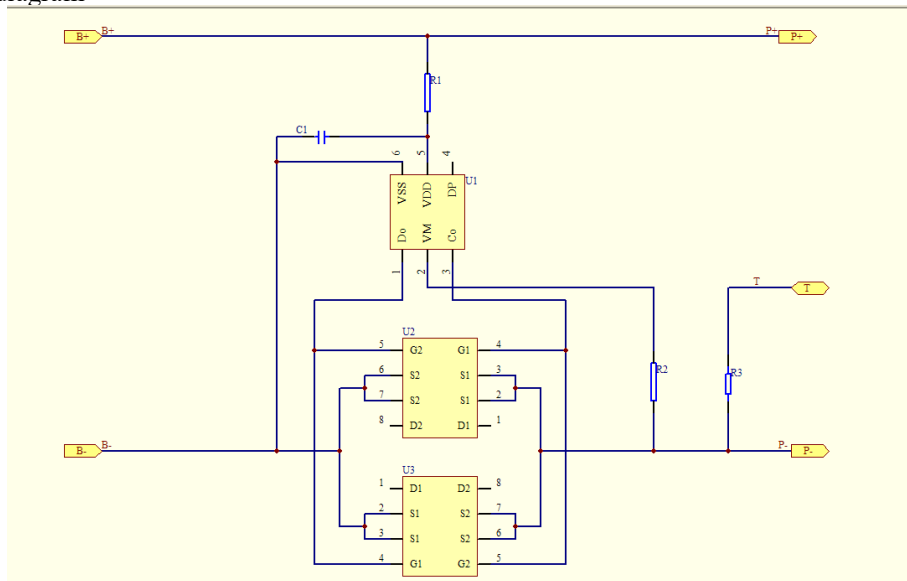
Item	Symbol	Content	Criterion
Over charge Protection	VDET1	Over charge detection voltage	4.28 ± 0.025V
	tVDET1	Over charge detection delay time	960~1400ms
	VREL1	Over charge release voltage	4.08 ± 0.05V
Over discharge protection	VDET2	Over discharge detection voltage	3.0 ± 0.05V
	tVDET2	Over discharge detection delay time	115~173ms
	VREL2	Over discharge release voltage	3.0 ± 0.05V
	IDP	Over current detection current	2~5A
	tVDET3	Detection delay time	7.2~11ms

		Release condition	Cut load
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 ≤ 50m Ω
Current consumption	IDD	Current consume in normal operation	3.5 μ A Type 7.0 μ A Max

8.2 BOM For PCM

NO.	Location	Part name	Specification	Packtype	Q'ty	Maker
1	U1	Protection IC	G3J	SOT-23-6	1	
2	U2	MOSFET	8205A	TSSOP-8	2	
3	R1	Resistance	470 Ω ± 5%	0603	1	
4	R2	Resistance	2K Ω ± 5%	0603	1	
5	RT	NTC	10K ± 5% B=3435	SMT	1	
6	C1	Capacitance	0.1 μ F	0603	1	
7	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. Elco Elettronica 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

- The customer is requested to contact Elco Elettronica 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.
- Elco Elettronica will take no responsibility for any accident when the battery is used under other conditions than those described in this Document.
- Elco Elettronica will inform, in a written form, the customer of improvement(s) regarding proper use and handling of the battery, if it is deemed necessary.
- Any matters that this specification does not cover should be conferred between the customer and Elco Elettronica.