AA Portable Power Corp
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1. Scope

This document describes the Product Specification of the LiFePO4 rechargeable cell supplied by AA Portable Power Corp .

2. Model：LFP-26650-3300

3. Specification

No.	Items	Specifications
1	Charge cut-off voltage	3.65V
2	Nominal voltage	3.2V
3	Minimal capacity	3200mAh @ 0.2C Discharge
4	Nominal capacity	3300mAh @0.2C Discharge
5	Standard charge current	0.2C
6	Standard charging method	0.2C CC (constant current) charge to 3.65V, then CV (constant voltage 3.65V) charge till charge current decline to ≤ 0.05C
7	Charging time	Standard charge: 7.0 hours Ref
8	Max. charge current	2C
9	Max. continue discharge current	10A (Cell skin temperature cannot exceed 80°C)
10	Discharge cut-off voltage	2.0V
11	Operating temperature	Charging: 0°C ~ 45°C Discharging: -20°C ~ 60°C (Cell skin temperature cannot exceed 80°C)
12	Storage temperature/humidity	Temperature -10°C ~ +35°C Humidity 65%±20%RH (Recommended to store 23 ± 5°C for long term storage)
13	Cell Weight	80.0g±1.0g
14	Cell Dimension	Length: 65.5±0.3 mm Width: 26.3±0.2 mm

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4. Cell Performance Criteria

4.1. Electrical characteristics

No.	Items	Test Method and Condition			Criteria
1	Standard Charge	Charging the cell initially with constant current at 0.2C and then with constant voltage at 3.65V till charge current declines to 0.05C.			N.A.
2	Rated Cap 0.2C	Capacity measured with discharge current of 0.2C with 2.0V cut-off voltage after the standard charge.			≥3250mAh
	Rated Cap 0.5C	Capacity measured with discharge current of 0.5C with 2.0V cut-off voltage after the standard charge.			≥3200mAh
	Rated Cap 1C	Capacity measured with discharge current of 1C with 2.0V cut-off voltage after the standard charge.			≥3150mAh
	Rated Cap 2C	Capacity measured with discharge current of 2C with 2.0V cut-off voltage after the standard charge.			≥3100mAh
	Rated Cap 3C	Capacity measured with discharge current of 3C with 2.0V cut-off voltage after the standard charge.			≥3050mAh
3	Life Expectation	Test condition： Temperature: 23±5°C Charge: 0.5C CC to 3.65V, and CV to 0.05C cut off Discharge: 0.5C discharge to 2.0V 80% or more of 1st cycle capacity at 0.2C discharge of operation			≥ 2000 times
4	Storage Performance	Cell stored at 25°C with 50% SOC			
			1 Month	3 Months	6 Months
		Cap Retention	90%	85%	80%
		Cap Recovery	95%	90%	85%
5	Initial Impedance	Internal resistance measured at AC 1KHz after 50% charge			≤ 20 m ohms
6	Cell Voltage	As of shipment			3.2V ~ 3.4V

4.2 Safety Performance

No.	Items	Test Method and Condition	Criteria
1	Overcharge (3C/10V)	Charge the cell with current of 3C, till the voltage of the cell reach 10V and current reduce to 0A. Monitor the variation of the cell's temperature in the process of the test. Stop the test when the temperature of the cell falls to value 10ºC lower than the peak value.	No explosion No fire
2	Over Discharge	Charge: 1C CC to 3.65V and CV to 0.05C cut off, Discharge the cell with 1C current for 2.5 hours.	No explosion No fire No leakage
3	Nail test	Charge: 1C CC to 3.65V, and CV to 0.05C cut off, Standby for 1 hour, then measure OCV, A nail is penetrated vertically through the center of the cell and left for over 1h. The diameter of the nail is 2.5~3.5 mm.	No explosion No fire
4	Short test (25°C)	The battery to be fully charged with standard charging condition, and short the positive and negative terminals for 4 hrs with wire resistance = 30m Ohm at 25°C.	No explosion No fire
5	Short test (55°C)	The battery to be fully charged with standard charging condition, and short the positive and negative terminals for 4 hrs with wire resistance = 30m Ohm at 55°C.	No explosion No fire
6	Heating test (130°C)	The battery to be fully charged with standard charging condition, and put into the chamber for heating at 130°C / 30mins.	No explosion No fire

4.3 Environmental and Mechanical Test

No.	Items	Test Method and Condition	Criteria
1	Vibration test	After standard charging, 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 30 minutes per axis of x, y axes.	No leakage No fire No explosion
2	Drop test	The battery to be fully charged with standard charging condition, and dropped from a height of 1m to concrete floor for 6 times (+/- direction on x, y axes).	No leakage No fire No explosion
3	Impact test	The battery to be fully charged with standard charging condition, and put a rod with diameter = 15.8mm on the cell, and then heavy block (weight = 9.1Kg) crash on the cell from a certain height (height = 61.0cm).	No explosion No fire

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4	Crush test	Cell is to be crushed between two flat surfaces, the crushing is to be continued until applied force of 13 kN, and once the maximum force has been obtained it is to be released. Measure its temperature and observe event.	No explosion No fire
5	Shock test	The battery to be fully charged with standard charging condition, and subjected to 6 shocks/axis, 18 total, of peak acceleration of 150g and pulse duration of 6 ms.	No explosion No fire No leakage

4.4 Visual inspection

There shall be no such defect as scratch, flaw, crack, and leakage, which may adversely affect commercial value of the cell.

4.5 Standard environmental test condition

Unless otherwise specified, all tests stated in this Product Specification are conducted at below condition:

Temperature: 23 ± 5°C

Humidity: 65 ± 20% RH

5 Storage and Others

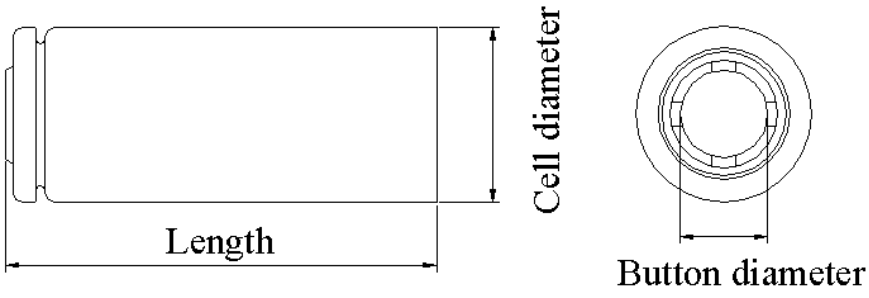
5.1 Long Time Storage

If the Cell is stored for a long time, the cell's storage voltage should be 3.2V ~ 3.4V and the cell is to be stored in a condition as No. 4.4.

5.2 Others

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

6 Cell Drawing (all unit in mm, not in scale)



Cell Diameter (mm)	Cell Length (mm)	Button Diameter (mm)
26.3±0.2	65.5±0.3	15.0±0.3

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Handling Precautions and Guideline

For Lithium-Ion Rechargeable Batteries

Preface

This document of 'Handling Precautions and Guideline' shall be applied to the cell LFP-26650-3300.

Note (1):

The customer is requested to contact AAPPC 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.

Note (2):

AAPPC will take no responsibility for any accident when the cell is used under other conditions than those described in this document.

Note (3):

AAPPC will inform, in a written form, the customer of improvement(s) regarding proper use and handling of the cell if it is necessary.

1. Charging

1.1. Charging current:

Charging current should be less than the maximum charge current specified in the Product Specification. Charging with higher current than recommended value may cause damage to cell electrical, mechanical and safety performance and could lead to heat generation or leakage.

1.2. Charging voltage:

Charging shall be done by voltage less than that specified in the Product Specification (3.65V/cell). Charging beyond 3.70V, which is the absolute maximum voltage, must be strictly prohibited. The charger shall be designed to comply with this condition. Charging with higher voltage than maximum voltage may cause damage to the cell electrical, mechanical safety performance and could lead to heat generation or leakage.

1.3. Charging temperature:

The cell shall be charged within -10°C ~ 45°C range in the Product Specification.

1.4. Prohibition of reverse charging:

Reverse charging is prohibited. The cell shall be connected correctly. The polarity has to be confirmed before wiring. In case of the cell is connected improperly, the cell cannot be charged. Reverse charging may cause damage to the cell which may lead to degradation of cell performance and damage the cell, which will cause heat generation or leakage.

2. Discharging

2.1. Discharging current

The cell shall be discharged at less than the maximum discharge current specified in the Product Specification. High discharging current may reduce the discharging capacity significantly or cause over-heat.

2.2. Discharging temperature

The cell shall be discharged within -20°C ~ 60°C range specified in the Product Specification.

2.3. Over-discharging

It should be noted that the cell would be at an over-discharged state by its self-discharge characteristics in case the cell is not used for long time. In order to prevent over-discharging, the cell shall be charged Periodically to maintain between 3.2V and 3.4V. Over-discharging may causes loss of cell performance, characteristics, or battery functions. The charger shall be equipped with a device to prevent further discharging exceeding a cut-off voltage specified in the Product Specification. Also the charger shall be equipped with a device to control the recharging procedures as follows:

The cell battery pack shall start with a low current (0.01C) for 15 - 30 minutes, i.e. pre-charging, before rapid charging starts. The rapid charging shall be started after the (individual) cell voltage has been reached above 3V within 15 - 30 minutes that can be determined with the use of an appropriate timer for pre-charging. In case the (individual) cell voltage does not rise to 3V within the pre-charging time, then the charger shall have functions to stop further charging and display the cell/pack is at abnormal state.

3. Protection Circuit Module (PCM)

The cell/battery pack shall be with a PCM that can protect cell/battery pack properly. PCM shall have functions of (1) overcharging prevention, (2) over-discharging prevention, and (3) over current prevention to maintain safety and prevent significant deterioration of cell performance. The over current can occur by external short circuit.

3.1. Overcharging prohibition:

Overcharging prevention function shall stop charging if any one of the cells of the battery pack reaches 3.70V.

3.2. Over-discharge prohibition:

Over-discharging prevention function shall work to avoid further drop in cell voltage of 2.0V or less per cell in any cell of the battery pack. It is recommended that the dissipation current of PCM shall be minimized to 0.5uA or less with the over-discharge prevention.

The protection function shall monitor each bank of the battery pack and control the current all the time.

4. Storage

The cell shall be storied within -10°C ~ 35°C range environmental conditions. If the cell has to be stored for a long time (Over 3 months), the environmental condition should be:

Temperature: 23 ± 5°C

Humidity: 65 ± 20%RH

The voltage for a long time storage shall be 3.3V ~ 3.4V range.

5. Others

5.1. Prevention of short circuit within a battery pack

Enough insulation layers between wiring and the cells shall be used to maintain extra safety protection. The battery pack shall be structured with no short circuit within the battery pack, which may cause generation of smoke or firing.

5.2. Prohibition of disassembly

5.2.1. Never disassemble the cells

The disassembling may generate internal short circuit in the cell, which may cause gassing, firing, or other problems.

5.2.2. Electrolyte is harmful

LIP battery should not have liquid from electrolyte flowing, but in case the electrolyte come into

contact with the skin, or eyes, physicians shall flush the electrolyte immediately with fresh water and medical advice is to be sought.

5.3. Prohibition of dumping of cells into fire

Never incinerate nor dispose the cells in fire. These may cause firing of the cells, which is very dangerous and is prohibited.

5.4. Prohibition of cells immersion into liquid such as water

The cells shall never be soaked with liquids such as water, seawater, and drinks such as soft drinks, juices, coffee or others.

5.5. Battery cells replacement

The battery replacement shall be done only by either cells supplier or device supplier and never be done by the user.

5.6. Prohibition of use of damaged cells

The cells might be damaged during shipping by shock. If any abnormal features of the cells are found such as damages in a plastic envelop of the cell, deformation of the cell package, smelling of an electrolyte, an electrolyte leakage and others, the cells shall never be used any more.

The Cells with a smell of the electrolyte or a leakage shall be placed away from fire to avoid firing.