



# ***Maximus-Racing***

## **Specification**

**for**

## **Cylindrical-lithium-ion Cell**

**Battery Type: IFR18650P**

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1. This product specification describes the technique requirements, test procedure and precaution notes of cylindrical type Lithium-ion Rechargeable cell to be supplied to customer by Maximus-Racing.

## 2. Description

2.1 Product: Lithium-ion Rechargeable cell

2.2 Model (Type): IFR18650P

2.3 Designation: IFR ——— 18 650 P

①                      ②                      ③                      ④

2.3.1: ① Indicates the performance of cell

The letters "IFR" define Lithium-ion Rechargeable cell of LiFePO<sub>4</sub> series cathode.

2.3.2: ② Indicates the diameter of cell

18 = 18 mm

2.3.3: ③ Indicates the overall height of cell

650 = 65 mm

2.3.4: ④ Indicates the performance of cell

The letter "P" defines high power/ rate cell

## 3. Cell Size

For details, please refer to Figure A.

Item	Description	Dimensions
H	Height ( Bare Cell )	65.5 mm max
D	Diameter ( Bare Cell )	18.3 mm max

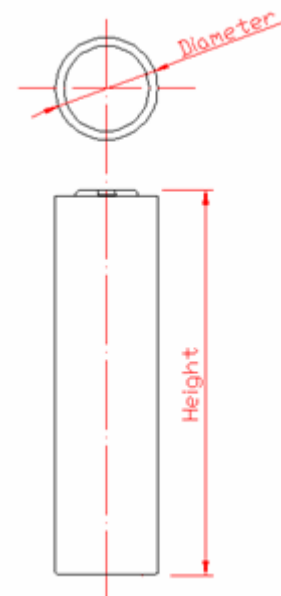


Figure A<sup>+</sup>

## 4. Cell Construction

A cell is made of cathode, anode, separator, can and cap.



## 5. Specification

Item		Specification	Remark	
5.1	Typical capacity	1100mAh	1C rate discharge capacity	
5.2	Minimum capacity	1080mAh		
5.3	Internal impedance	≤12mΩ	By 1kHz AC	
5.4	Nominal voltage	3.2V		
5.5	Cell weight	40g±2g		
5.8	Standard discharge conditions (1C)	Constant current	1100 mA	
		End-of-charge voltage	2.0V	
5.6	Standard charge method	Constant current	550mA	
		Charge voltage	3.65V±0.05V	
		Cut-off current	50 mA	
5.7	Fast charge method	Constant current	2200mA	
		Charge voltage	3.65V±0.05V	
		Cut-off current	50 mA	
5.9	Max continuous discharge current	30A		
5.10	Pulse discharge at 10 Sec	50A		
5.11	Specific power	> 80W		
5.12	Cycle life	over 500 cycles	10C continual discharge (100% DOD)	
5.13	Operating temperature	Charging ambient temperature	0~45°C	Cell skin temperature should not exceed 65°C .
		Discharging ambient temperature	-20~45°C	Cell skin temperature should not exceed 80°C
		Storage temperature	-40~50°C	
5.14	Shelf life	1 year	Typical value from ship state	
5.15	Appearance	Without break, scratch, distortion, contamination, leakage.		



## 6. Test conditions

### 6.1 Standard test conditions

Unless otherwise specified, all tests stated in this Product Specification are conducted at temperature  $23\pm 2^{\circ}\text{C}$  and humidity  $65\pm 10\% \text{RH}$ .

## 7. / Electrical Characteristics

/ Test Item	/ Test Method	Criteria
7.1 1C Discharge performance (1C)	A cell is charged using standard charge method (spec. 5.6), stored at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 0.5h, and then 1C constant current discharged to 2.0V.	the discharging time is not less than 1h.
7.2 10C Discharge performance (10C)	A cell is charged using standard charge method (spec. 5.6), stored at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 0.5h, and then 10C constant current discharged to 2.0V.	the discharging time is not less than 5min.
7.3 High temperature performance	A cell is charged using standard charge method (spec. 5.6), stored at $55^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 2h, then 1C constant current discharged to 2.0V. After that, fetch out the cell and place it in the ambient temperature of $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 2h, then check its appearance	1. the discharging time is not less than 51min; 2. no distortion, no rupture.
7.4 Low temperature performance	A cell is charged using standard charge method (spec. 5.6), stored at $-20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 16h~24h, then discharged to 2.0V at a constant current of 0.2C. After that, fetch out the cell and place it in the ambient temperature of $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 2h, then check its appearance.	1. the discharging time is not less than 3h; 2. no distortion, no rupture
7.5 Charge(Capacity) retention	A cell is charged using standard charge method (spec. 5.6), and stored at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 28days, then discharged to 2.0V at a constant current of 0.2C.	Capacity retention: 85%Ch
7.6 Cycle life	A cell is charged using standard charge method (spec. 5.6), and stored for 0.5h~1h, then discharged to cut-off voltage, after that, stored 0.5h~1h prior to next charge/discharge cycle. The cell shall be continuously charged and discharged for 500 times.	Capacity retention: $\geq 75\%$



## 8. Environment Characteristics/

Test item	/ Test method	Criteria
8.1 Constant temperature and humidity	A cell is charged using standard charge method (spec. 5.6), and stored at $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ (90~95%RH) for 48h, then placed in room temperature for 2h. After that, check its appearance prior to being discharged to cut-off voltage at a constant current of 1C.	1. No distortion, no rust, no fume, no explosion; 2. The discharging time is not less than 36min.
8.2 Vibration test	A cell is charged using standard charge method (spec. 5.6), then installed onto the vibration desk with clamps. Equipment parameters of frequency and amplitude are as follows (the frequency is to be varied at the rate of 1oct/min between 10 and 55 Hz and repeat vibration for 30min. The cell is to be tested in three mutually perpendicular directions): frequency: 10Hz~30Hz amplitude: 0.38mm frequency: 30Hz~55Hz amplitude: 0.19mm	1. No scratch, no leakage, no fume, no explosion; 2. The min voltage is 3.2V.
8.3 Shock test	A cell is charged using standard charge method (spec. 5.6), then secured to the testing machine by means of rigid mount which supports all mounting surfaces of the cell. Each cell shall be subjected to a total of three shocks of equal magnitude. The shocks are to be applied in each of three mutually perpendicular directions. The acceleration and impulse time are as follows: acceleration of impulse peak value: $100\text{m/s}^2$ , shock frequency: 40~80times/min, impulse lasting time: 16min, shock times: $1000 \pm 10$	1. No scratch, no leakage, no fume, no explosion; 2. The min voltage is 3.2V.
8.4 Drop test	A cell is charged using standard charge method (spec. 5.6), then dropped from a height of 1000mm to a wooden board (18-20mm thick) which is placed on the concrete ground. Cells shall be dropped in each of three mutually perpendicular directions. Total drop times are 6. After that, the cell is discharged to cut-off voltage at CC of 1C, then repeat charge & discharge at a current of 1C until the discharge time is not less than 51min, the cycle times should be not more than 3.	No leakage, no fume, no explosion.



## 9. Safety test

All below tests are carried out on the equipments with forced ventilation and explosion-proof device. Before test all cells are charged using standard charge method (spec. 5.6), and stored 24h prior to testing.

Test Item	Test Method	Criteria
9.1 Impact test	A cell is to be placed on the impact flat. A 10 kg weight is to be dropped from a height of 1m onto the cell, the distortion is allowed.	No fire, no explosion
9.2 Crush testing	A cell is to be placed on the crush flat, the axis is parallel to the crush flat, it is to be crushed between two flat surfaces. Crushing force is approximately 13 KN and hold for 1 min	No fire, no explosion
9.3 Heating test	A cell is to be heated in a circulating air oven. The temperature of the oven is to be raised at a rate of $5^{\circ}\text{C} \pm 2^{\circ}\text{C}$ per minute to a temperature of $150^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and remain for 30min at that temperature before the test is discontinued.	No fire, no explosion
9.4 (3C/10V) Overcharge test	A cell is discharged to cut-off voltage at CC of 1C, then it is to be subjected to CC/CV power by connecting its positive & negative terminal, then set the current as 3C, the voltage as 10V, after that, Charge the cell up to 10V at CC of 3C, until that last 7h at the voltage of 10V or the voltage is no more increased.	No fire, no explosion
9.5 Short-circuit test	A Cell is to be short-circuited by connecting the positive and negative terminals of the cell with copper wire having a maximum resistance load of 50m. Monitor its temperature while testing, the cell is to be discharged until the cell case temperature has returned to $10^{\circ}\text{C}$ less than peak temperature.	1. No fire, no explosion 2. Max. temp. < $150^{\circ}\text{C}$
9.6 Nail penetration test	A cell is to be penetrated completely the center of the largest side at the speed of 20-40mm per second by a $\phi 3.0\text{mm}$ stainless steel nail and hold for 1 min.	1. No fire, no explosion 2. Max. temp. < $150^{\circ}\text{C}$



## 10. / Shipment

The Cell shall be shipped in voltage range of 3.20 ~ 3.40 V or in accordance with customer's requirement. The remaining capacity before charging shall be changed depending on the storage time and conditions.

## 11. / Warranty

The Warranty period of cell is made according to business contract. However, even though the problem occurs within this period, Maximus-Racing won't replace a new cell for free as long as the problem is not due to the failure of manufacturing process or is due to customer's abuse or misuse.

- > Maximus-Racing will not be responsible for trouble occurred by handling outside of the precautions in instructions.
- > Maximus-Racing will not be responsible for trouble occurred by matching electric circuit, cell pack and charger.
- > Maximus-Racing will be exempt from warranty any defect cells during assembling after acceptance.

## 12. Precautions and safety instructions

Lithium-Ion rechargeable batteries subject to abusive conditions can cause damage to the cell and/or personal injury. Please read and observe the standard cell precautions below before using utilization.

Note1. The customer is required to contact Maximus-Racing, if and when the customer needs other applications or operating conditions than those described in this document.

Note2. Maximus-Racing will take no responsibility for any accident when the cell is used under other conditions than those described in this Document.

### 12.1.0 Standard cell/Precaution

- 12.1.1 Do not expose the cell to extreme heat or flame.
- 12.1.2 Do not short circuit, over-charge or over-discharge the cell.
- 12.1.3 Do not subject the cell to strong mechanical shocks.
- 12.1.4 Do not immerse the cell in water or sea water, or get it wet.
- 12.1.5 Do not reverse the polarity of the cell for any reason.
- 12.1.6 Do not disassemble or modify the cell.
- 12.1.7 Do not handle or store with metallic like necklaces, coins or hairpins, etc.
- 12.1.8 Do not use the cell with conspicuous damage or deformation.
- 12.1.9 Do not connect cell to the plug socket or car-cigarette-plug.
- 12.1.10 Do not make the direct soldering onto a cell.
- 12.1.11 Do not touch a leaked cell directly.
- 12.1.12 Do not use for other equipment.
- 12.1.13 Do not use Lithium-ion cell in mixture.





12.1.14 Do not use or leave the cell under the blazing sun (or in heated car by sunshine).

12.1.15 Keep cell away from children.

12.1.16 Do not drive a nail into the cell, strike it by hammer or tread it.

12.1.17 Do not give cell impact or fling it.

## 12.2 Cell operation instruction

### 12.2.1 Charging

\* Use a constant current, constant voltage ( CC/CV) lithium-ion (Li+) cell charge controller.

### 12.2.2 Storage recommendations

#### a. Storage Temperature and Humidity

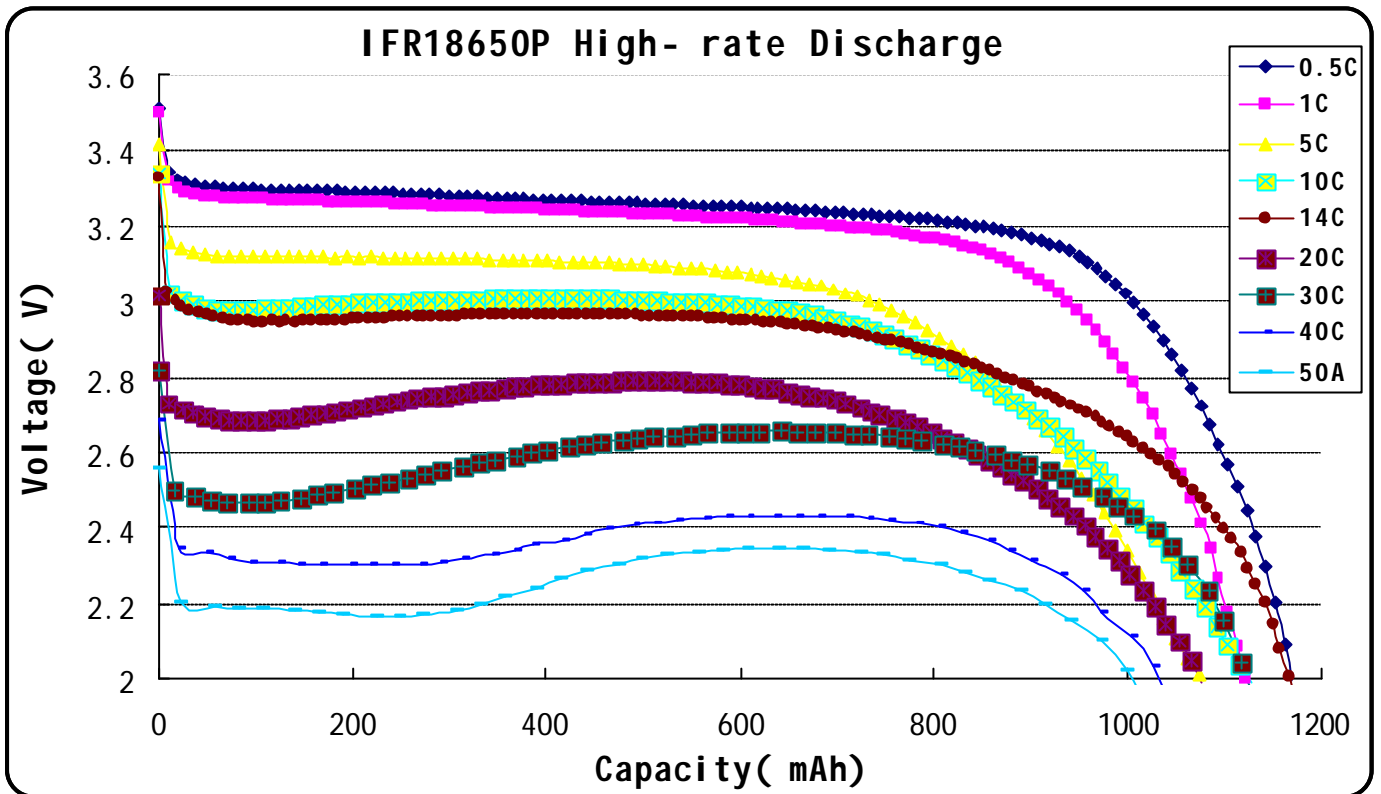
Storage the cell at  $-40 \sim 50^{\circ}\text{C}$ , low humidity and no corrosive gas atmosphere.

No press on the cell

## 13. Requirement for safety assurance

For the sake of safety assurance, please discuss the equipment design, its system and protection circuit of Lithium-ion cell with Maximus-Racing in advance. And consult about the high rate current, rapid charge and special application in the same way.

# IFR18650P- 1100mAh



## 1C Charge/ 10C Discharge

