

Model 型号	IFR33140	Spec No. 规格书编号	PBRI-C33-D06-02	Version NO. 版本	A
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SPECIFICATION OF PRODUCT

产品交付规格书

型号 (Model) : IFR33140

Designed 设计制作	Designer Checked 产品设计审核	QC Checked 品质审核	Sales Checked 销售审核	Approved 批准

Customer Signature 客户接收栏
公司名称 (Company name) :
批 准 (Approved by) :
日 期 (Signature Date) :

2024 年 6 月

LiitoKala Power CO., LTD.
深圳市鑫盛力电源有限公司

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客户要求 (Customer Request)

NO. 序号	Special Requirements 特殊要求	Specification 标准
1		
2		
3		
4		
5		

客户代码 (Customer Code) : _____

签 字 (Signature) : _____

日 期 (Date) : _____

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术语定义 (Definition of Terms)

Terms 术语	Definition 定义
Product 产品	"Product" in this specification refers to 15 Ah rechargeable cylindrical lithium ion cell produced by LiitoKala Power CO., LTD. 本规格书中的“产品”是指深圳市鑫盛力电源有限公司生产的 15Ah 可充电圆柱锂离子电池。
customer 客户	Refers to the buyer in the product sales contract of LiitoKala Power CO., LTD. 指《深圳市鑫盛力电源有限公司产品销售合同》中的买方。
Rate 倍率 (C)	The ratio of the charge/discharge current to the rated capacity value. For example, the cell capacity is 15Ah, when the charging or discharging current is 15A, the charging or discharging rate is 1C. 充/放电电流与电池的额定容量值的比率。例如, 电池容量为 15Ah, 当充电或放电电流为 15A 时, 则充电或放电倍率为 1C。
State of charge 荷电状态 (SOC)	Under no-load conditions, the ratio of the cell capacity state to the rated capacity measured in Ah or Wh. For example, if the capacity is 15Ah as 100% SOC, when the capacity is 0Ah, the SOC is 0%. 在无负载的情况下, 以安培小时或者以瓦特小时为单位计量的电池容量状态与额定容量的比值。如: 若将容量为 15Ah 的状态视为 100%SOC, 则容量为 0Ah 时, SOC 为 0%。
Standard charging 标准充电	The charging mode described in Article 3.2 of this specification. 本规格书第 3.3 条所述的充电模式。
Standard discharging 标准放电	The discharging mode described in Article 3.3 of this specification. 本规格书第 3.4 条所述的放电模式。
DC Resistance 直流电阻 (DCR)	The ratio of the voltage changes of the cell to the corresponding current change under working conditions. 工作条件下电池的电压变化与相应的电流变化之比。
Units 测量单位	“V” (Volt) 伏特(V) “A” (Ampere) 安培(A) “Ah” (Ampere-Hour) 安培-小时(Ah) “Wh” (Watt-Hour) 瓦特-小时(Wh) “mΩ” (MilliOhm) 毫欧姆(mΩ) “°C” (degree Celsius) 摄氏度(°C) “mm” (millimeter) 毫米(mm) “s” (second) 秒(s) “Hz” (Hertz) 赫兹(Hz)

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1. 基本信息 (Basic Information)

1.1. 前言 (Preface)

This Product Specification describes the technique requirements, test procedure and precaution notes of prismatic type lithium-ion rechargeable cell to be supplied to customer by LiitoKala Power CO., LTD.

本产品规格书规定了由深圳市鑫盛力电源有限公司生产的锂离子电芯技术要求, 测试方法及注意事项。

1.2. 产品 (Product)

Cylindrical Lithium-ion Rechargeable cell

圆柱锂离子可充性电芯

1.3. 产品型号 (Type)

LiitoKala—— I F R 33 140

① ②③④⑤ ⑥

① The letter "LiitoKala" defines LiitoKala Power CO., LTD.

"LiitoKala"代表深圳市鑫盛力电源有限公司。

② The letter "I" defines Lithium-ion.

"I"代表锂离子。

③ The letter "F" defines Ferrum.

"F"代表铁元素。

④ The letter "R" defines Rotundity .

"R"代表圆柱形。

⑤ The letter "33" defines the diameter of the cell.

"33"代表电芯直径为 33mm₀

⑥ The letter "140" defines the height of the cell.

"140"代表电芯高度为 140mm₀

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2. 电池规格参数 (Specification Parameters)

2.1. 电池基本参数 (Basic Parameters)

NO. 序号	Item 项目	Specification 标准		Remarks 备注
1	Average capacity@3.65~2.5V 均值容量@3.65~2.5V	15200	mAh	1C discharge 1C放电
	Minimum capacity@3.65~2.5V 最小容量@3.65~2.5V	14500	mAh	1C discharge 1C放电
2	AC-IR 交流内阻	≤3	mΩ	AC 1 kHz@25°C 出货状态30%SOC
3	DC-IR 直流内阻	≤8	mΩ	25°C@2C 30s 出货状态30%SOC
4	End-of-charge Voltage 充电限制电压	3.65	V	
5	End-of-charge Current 充电截止电流	750	mA	0.05C
6	End-of-discharge Voltage 放电截止电压	2.5 2.0	V	T>0°C T≤0°C
7	Nominal Voltage 额定电压	3.2	V	
8	Standard Charging current 标准充电电流	7500	mA	0.5C
9	Fast charge 快速充电电流	15000	mA	1C
10	Standard Discharge current 标准放电电流	7500	mA	0.5C
11	Max Continuous Discharge current 最大连续放电电流	30000	mA	3C
12	Operating Temperature Range (surface temperature of cell) 操作温度范围 (电芯表面温度)	Charging Temp. 充电温度	0~55°C	
16		Discharging Temp. 放电温度	-20~60°C	
17		Storage Temp. 存储温度	-20~45°C	≤1 month ≤1个月
18			0~45°C	≤3 months ≤3个月
19			0~25°C	≤1 year ≤1年
20		Storage Humidity 存储湿度	≤70% RH	

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2.2.产品规格 (Product Specification)

2.2.1. 尺寸、重量指标 (Dimension and Weight)

NO. 序号	Item 项目	Specification 标准	Test Method Chapter 测试方法章节
1	Cell Dimension 电芯尺寸	Diameter: $\Phi 33.3 \pm 0.4$ mm (coated) 直径: $\Phi 33.3 \pm 0.4$ mm (包膜)	3.5.1.
		Height : 140.5 ± 0.5 mm (pole contained) 高度: 140.5 ± 0.5 mm (含极柱)	3.5.1.
2	Cell Weight 重量	266 ± 10 g	3.5.2.

2.2.2. 电性能指标 (Electrical Performance)

NO. 序号	Test Item 测试项目	Specification 标准	Test Method Chapter 测试方法章节
1	不同温度放电性能 (1.0C 放电) Temperature Dependence of Discharge Capacity (1.0C discharge)	-20°C Retention Ratio -20°C容量保持率	$\geq 70\%$ 3.5.3.1.
		-10°C Retention Ratio -10°C容量保持率	$\geq 80\%$ 3.5.3.1.
		0°C Retention Ratio 0°C容量保持率	$\geq 85\%$ 3.5.3.1.
		25°C Retention Ratio 25°C容量保持率	100% 3.5.3.1.
		45°C Retention Ratio 45°C容量保持率	$\geq 100\%$ 3.5.3.1.
		60°C Retention Ratio 60°C容量保持率	$\geq 100\%$ 3.5.3.1.
2	100% SOC Temperature Charge Retention and Regain 100% SOC 荷电保持与恢复能力	28d, 25°C, 100%SOC 容量保持率 $\geq 96\%$, 容量恢复率 $\geq 97\%$	3.5.3.2.
		28d, 45°C, 50%SOC 容量恢复率 $\geq 95\%$	3.5.3.2.
		7d, 55°C, 100%SOC 容量保持率 $\geq 95\%$, 容量恢复率 $\geq 96\%$	3.5.3.2.
3	循环 (Cycle)	Normal Temperature Cycle Life 常温循环寿命	After 2500 cycles, Capacity retention $\geq 70\%$ Initial capacity 2500 周后容量保持率 $\geq 70\%$ 初始容量 3.5.3.3.

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		45°C Cycle Life 45°C循环寿命	After 1000 cycles, Capacity retention \geq 70% Initial capacity 1000 周后容量保持率 \geq 70%初始容量	3.5.3.4.	

2.2.3 安全性能指标 (Safety Performance)

NO. 序号	Test Item 测试项目	Specification 标准	Test Method Chapter 测试方法章节
1	Over-charge Test 过充电测试	No explosion, no fire 不爆炸、不起火	3.5.4.1.
2	Over-discharge Test 过放电测试	No explosion, no fire 不爆炸、不起火	3.5.4.2.
3	Short-circuit Test 短路测试	No explosion, no fire 不爆炸、不起火	3.5.4.3.
4	Crush Test 挤压测试	No explosion, no fire 不爆炸、不起火	3.5.4.4.
5	Heating Test 加热测试	No explosion, no fire 不爆炸、不起火	3.5.4.5.
6	Temperature cycling test 温度循环	No explosion, no fire 不爆炸、不起火	3.5.4.6.

2.3. 电池图纸 (Outline Dimensions)

See the attachment (Fig. A).
见附录图 A₀

2.4. 外观 (Appearance)

There shall be no such defects as rust, discoloration, leakage which may adversely affect commercial value of the cell.

电池应无明显擦伤、裂痕、锈渍、变色或电解液泄漏这类对电池商用价值有影响的缺陷。

3. 试验条件 (Standard Test Condition)

3.1. 环境条件 (Environment Condition)

Unless otherwise specified, all tests stated in this Product Specification should be conducted at temperature 25°C \pm 2°C and humidity 65% \pm 20% RH.

若无特别要求, 此规格书上的产品测试条件均为温度: 25°C \pm 2°C; 湿度: 65% \pm 20% RH₀

3.2. 测量设备 (Measuring Equipment)

The accuracy of measuring instruments and meters should meet the following requirements:

测量仪器、仪表准确度应满足以下要求:

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- (1) 电压测量装置 (Volt measuring Equipment) : $\pm 0.1\%$;
- (2) 电流测量装置 (Amp measuring Equipment): $\pm 0.1\%$;
- (3) 温度测量装置 (Temp measuring Equipment) : $\pm 0.5^{\circ}\text{C}$;
- (4) 尺寸测量装置 (Dimension measuring Equipment) : $\pm 0.01\text{mm}$;
- (5) 重量测量装置 (Weight measuring Equipment) : $\pm 0.1\text{g}$

3.3. 标准充电方式 (Standard Charge Method)

The "Standard Charge" means charging the cell at a constant current of 0.5C until the voltage is 3.65V, then charged at a constant voltage of 3.65V until its current is less than 0.05C. For test purpose, charging shall be performed at $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$.

“标准充电”即在环境温度为 $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 的条件下, 先以恒定电流 0.5C 充电至 3.65V, 再以 3.65V 的恒压充电至电流小于 0.05C。

3.4. 标准放电方式 (Standard Discharge Method)

The "Standard Discharge" means discharging the cell at a constant current of 0.5C until the voltage is 2.5V. For test purpose, discharging shall be performed at $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$.

“标准放电”即在环境温度为 $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 的条件下, 以恒定电流 0.5C 放电到 2.5V_O

3.5. 测试方法 (Test Method)

3.5.1. 尺寸 (Dimension)

Use a caliper to measure the diameter and height of the cell.
使用卡尺测量电芯直径和高度。

3.5.2. 重量 (Weight)

Use an electronic scale to measure the weight of the cell.
使用电子秤测量电池的重量。

3.5.3. 电性能 (Electrical Characteristics)

3.5.3.1. 不同温度放电性能 (Temperature Dependence of Discharge Capacity)

When the temperature $> 0^{\circ}\text{C}$, the cell is stored for 6 h and then discharged with 1 C current until the voltage comes to 2.0 V; if the temperature $\leq 0^{\circ}\text{C}$, the cell will be stored for 12 h and then discharged with 1C current until the voltage comes to 2.0 V.

放电温度 $> 0^{\circ}\text{C}$, 电芯搁置 6 h 后以 1 C 电流放电至 2.5V; 放电温度 $\leq 0^{\circ}\text{C}$, 电芯搁置 12h 后以 1 C 电流放电至 2.0V_O

3.5.3.2. 荷电保持与恢复能力 (Temperature Charge Retention and Regain)

Capacity after storage at certain time and temperature after the standard charged measured with discharge current

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of 1 C to cut-off voltage. Then capacity after 0.5C charge and 1C discharge for 3 cycles.

电芯按规定充电, 以不同温度和时间存储后, 以 1C 电流放电至截止电压测试容量保持容量, 电芯以 0.5C 充电, 再以 1C 放电循环 3 次, 第三次为恢复容量。

3.5.3.3. 常温寿命循环 (Normal Temperature Cycle Life)

Each cycle is an interval between 0.5C charges to 3.65V with 0.05C cut-off and 1C discharge with 2.5V cut-off at 25°C±2°C. Record the capacity after 2500 cycles at 25°C.

电芯以 0.5 C 电流充电至 3.65V, 0.05C 电流截止, 以 1C 电流放电至 2.5V, 25°C±2°C 连续进行充放电循环 2500 次后, 记录常温容量。

3.5.3.4. 45°C 循环寿命 (45°C Cycle Life)

Each cycle is an interval between 0.5C charges to 3.65V with 0.05C cut-off and 1C discharge with 2.5V cut-off at 45°C±2°C. Record the capacity after 1000 cycles.

电芯以 0.5C 电流充电至 3.65V, 0.05C 电流截止, 以 1C 电流放电至 2.5V, 45°C±2°C 连续进行充放电循环 1000 次, 记录容量。

3.5.4. 安全性能 (Safety Test)

All below tests are carried out on the equipment with forced ventilation and explosion-proof device. Before test, all cells should be charged in accordance with 3.3.

下述试验应在有强制排风条件及防爆措施的装置内进行, 在试验前所有的电芯都按 3.3 规定标准充电方式充电后再进行以下试验。

3.5.4.1. 过充电测试 (Over-charge Test)

Stop charging after charging with constant 1.0 C current until reaching 1.5 times of the charging termination voltage or charging time reaching 1.5h.

以 1.0C 电流恒流充电至达到充电终止电压的 1.5 倍, 或充电时间达到 1.0h 后停止充电。

3.5.4.2. 过放电 (Over-discharge Test)

Discharge at a constant current of 1C for 90 minutes and observe for 1 h.

以 1C 恒流放电 90min 后, 观察 1h.

3.5.4.3. 短路测试 (Short-circuit Test)

Short-circuit the standard charged cell by connecting positive and negative terminal by less 5 mΩ wire for 10min.

使用外部线路总电阻 < 5 mΩ 短接电芯的正负极 10min。

3.5.4.4. 挤压测试 (Crush Test)

A cell is to be crushed between two flat surfaces. The force for the crushing is to be applied by a hydraulic ram or similar force mechanism. The flat surfaces are to be brought in contact with the cells and the crushing is to be continued

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until voltage reaches 0V, the deformation reaches 15%, or the squeezing force reaches 100kN or 1000 times the weight of the test subject.

将电芯置于挤压设备的两个挤压平面之间, 用液压油缸或类似的力挤压, 挤压面与电芯接触, 当电压达到 0V 或变形量达到 15%或挤压力达到 100kN 或 1000 倍实验对象重量后停止挤压。

3.5.4.5. 加热测试 (Heating Test)

A cell is to be heated in a gravity convection or 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 $130^{\circ}\text{C}\pm 2^{\circ}\text{C}$ and remain for 30 min and observed 1h.

将电芯放在电热鼓风干燥箱中加热, 温度以 $5^{\circ}\text{C}\pm 2^{\circ}\text{C} / \text{min}$ 的速率由室温升至 $130^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 并保持 30min, 观察 1h。

3.5.4.6. 温度循环测试 (Temperature cycling test)

Put the cell in a low temperature box of $-40\pm 2^{\circ}\text{C}$ for 1h and keep it for 90min, then put it in a high temperature box of $85\pm 2^{\circ}\text{C}$ for 90min and keep it for 300min, take it out and place it at $25\pm 2^{\circ}\text{C}$ for 70min, repeat the above operation 5 times and observe 1h.

将电芯放入 $-40\pm 2^{\circ}\text{C}$ 的低温箱调节 1h, 保持 90min, 然后将其放入 $85\pm 2^{\circ}\text{C}$ 的高温箱调节 90min, 保持 300min, 取出后在 $25\pm 2^{\circ}\text{C}$ 放置 70min, 重复上述操作 5 次, 观察 1h。

4. 电池操作说明及注意事项 (Cell Operation Instruction and Precautions)

4.1. 储存建议 (Storage Recommendations)

4.1.1. 短期存放 (Short Period Storage)

* Storage the cell at temperature of $0^{\circ}\text{C} \sim 45^{\circ}\text{C}$ (less than 3 months), low humidity and no corrosive gas atmosphere.

电芯短期存放 (不超过 3 个月) 应储存在 $0^{\circ}\text{C} \sim 45^{\circ}\text{C}$ 温度范围, 低湿度和不含腐蚀性气体的环境中。

* No press on the cell.
不要让电芯承受任何压力。

4.1.2. 长期存放 (Long Period Storage)

* In case of long period storage (more than 3 months), storage the cell at temperature range of $0^{\circ}\text{C} \sim 25^{\circ}\text{C}$, low humidity, no corrosive gas atmosphere.

电芯长期存放 (超过 3 个月) 应存储在 $0^{\circ}\text{C} \sim 25^{\circ}\text{C}$ 温度范围, 低湿度和不含腐蚀性气体的环境中。

* No press on the cell.
不要让电芯承受任何压力。

4.2. 运输 (Shipment)

The capacity of delivery cell is approximately at 30% of charging. It is not specified more than 30% capacity remain at customer, because of self-discharge. During transportation, keep the cell from acutely vibration, impacting,

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solarization, drenching.

出货电芯处于 30%充电状态, 由于电芯存在自耗, 运送到客户端的电芯无法完全保证 30%荷电量。运输过程应防止剧烈振动、冲击、日晒雨淋。

4.3. 操作说明 (Operation Instruction)

4.3.1. 充电 (Charging)

- * Charge the cell in an ambient temperature range of 0°C to 55°C.
电芯充电环境温度范围: 0~55°C₀
- * Charge the cell at a constant current of 7500mA until 3.65V is attained. Charge rates greater than 15000mA are not recommended.
以 7500mA 的电流恒流充电至 3.65V, 超过 15000mA 的电流建议不要使用。
- * Maintain charge voltage at 3.65V for 1 hour (recommended for maximum capacity).
保持恒压 3.65V 充电 1 小时 (最大容量)。
- * Cell must be charged with constant current-constant voltage method.
必须使用恒流恒压方式对电芯进行充电。

4.3.1.1. 温度梯度充电方案 (Temperature gradient charging scheme)

	SOC	Temperature Gradient 温度梯度				
		0°C~5°C	5°C~10°C	10°C~15°C	15°C~45°C	45°C~55°C
Charge Current 充电电流	100%	0.05C	0.05C	0.05C	0.05C	0.05C
	90%	0.15C	0.3C	0.4C	0.5C	0.5C
	80%	0.25C	0.3C	0.4C	0.5C	0.5C
	70%	0.25C	0.3C	0.4C	0.5C	0.5C
	60%	0.25C	0.3C	0.4C	0.5C	0.5C
	50%	0.25C	0.3C	0.4C	0.5C	0.5C
	40%	0.25C	0.3C	0.4C	0.5C	0.5C
	30%	0.25C	0.3C	0.4C	0.5C	0.5C
	20%	0.25C	0.3C	0.4C	0.5C	0.5C
	10%	0.25C	0.3C	0.4C	0.5C	0.5C
	0%	0.25C	0.3C	0.4C	0.5C	0.5C

4.3.2. 放电 (Discharging)

- * Recommended cut-off voltage to 2.5V. Recommended max continuous discharge current is 45000mA.
建议放电终止电压为 2.5V, 建议最大持续恒流放电电流为 45000mA₀
- * For maximum performance, discharge the cell in an ambient temperature range of -20°C to 60°C.

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为了达到较好的性能, 电芯的放电环境温度范围: -20~60°C。

4.3.3. 电芯防范措施 (Standard Cell Precaution)

- * Do not expose the cell to extreme heat or flame.
不要将电芯暴露在极热或有火星的环境中。
- * Do not short circuit, over-charge or over-discharge the cell.
不要将电芯短路, 过充或过放。
- * Do not subject the cell to strong mechanical shocks.
不要使电芯承受过重的机械冲击。
- * Do not immerse the cell in water or seawater, or get it wet.
不要将电芯浸入海水或水中, 或者使其吸湿。
- * Do not reverse the polarity of the cell for any reason.
不要颠倒电芯的正负极。
- * Do not disassemble or modify the cell.
不要拆卸或修整电芯。
- * Do not handle or store with metallic like necklaces, coins or hairpins, etc.
不要和项链, 硬币或发夹等金属物品放置在一起。
- * Do not use the cell with conspicuous damage or deformation.
不要使电芯受到明显的损害或变形。
- * Do not connect cell to the plug socket or car-cigarette-plug.
不要将电芯与插座连接。
- * Do not make the direct soldering onto a cell.
不要直接焊接电芯。
- * Do not touch a leaked cell directly.
不要直接接触泄漏的电芯。
- * Do not use for other equipment.
不要将电芯用于其它设备。
- * Do not use Lithium-ion cell in mixture.
不要将锂离子电芯混合使用。
- * Do not use or leave the cell under the blazing sun (or in heated car by sunshine).
不要将电芯放置在太阳光直射的地方。
- * Keep cell away from children.
将电芯放置在远离儿童的地方。
- * Do not drive a nail into the cell, strike it by hammer or tread it.
不要针刺、锤打或践踏电芯。
- * Do not give cell impact or fling it.
不要撞击或投掷电芯。

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4.4.其他 (Others)

For the sake of safety assurance, if there are equipment design, lithium ion cell system protection circuit, fast charging and other special application, please consult LiitoKala first.

为了安全起见,如有设备设计,锂离子电池系统保护电路或高电流,快速充电和其它方面的特殊应用, 请先咨询鑫盛力公司相关事宜。

5.质量保证 (Warranty)

The warranty period of cell is made according to business contract. HowLiitoKalar, LiitoKalan though the problem occurs within this period, LiitoKala won't replace a new cell for free as long as the problem is not due to the failure of LiitoKala manufacturing process or is due to customer's abuse or misuse.

自出货之日起, 电芯的保质期限依合同而定。但是, 在此期限内, 如果非鑫盛力公司的制程原因而是客户的误用造成的电芯质量问题, 鑫盛力公司不承诺免费更换。

- > LiitoKala will not be responsible for trouble occurred by handling outside of the precautions in instructions.
鑫盛力公司对违反安全守则操作所产生的问题不承担任何责任。
- > LiitoKala will not be responsible for trouble occurred by matching electric circuit, cell pack and charger.
鑫盛力公司对与电路、电芯组、充电器搭配使用所产生的问题不承担任何责任。
- > LiitoKala will be exempt from warranty any defect cells during assembling after acceptance.
出货后客户在电芯组装过程中产生的不良电芯不在鑫盛力公司质量保证的范围之列。

6.联系方式 (Consultation)

As to the obscurity, contact the following:

Address: 6F building 5, MaoBang industrial Area, Gentleman's cloth,
GuanLan Town, Baoan District, Shenzhen City, Guangdong China

Email: sales@liitokala.com.cn

Website: <http://www.liitokalar.com.cn>

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附录一: IFR33140 图纸 (Appendix I: IFR33140 Drawing)

A cell is made of cathode pole piece, anode pole piece, diaphragm, aluminum shell, positive plate and negative plate etc, the full-size cell size is shown in Figure A.

电芯由正极极片、负极极片、隔膜、铝壳、正极盖板和负极盖板等组成, 全尺寸 (包膜) 电芯尺寸如图 A 所示。

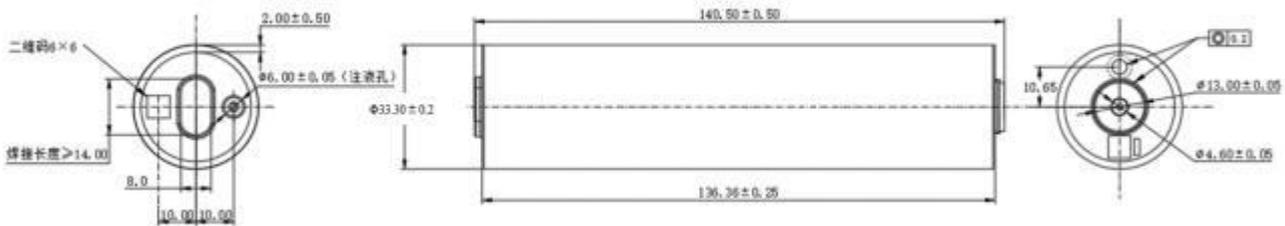


Figure A (图 A)

Each box contains 60 PCS cell, as shown in figure B.

每箱 60pcs 电芯, 如图 B 所示。

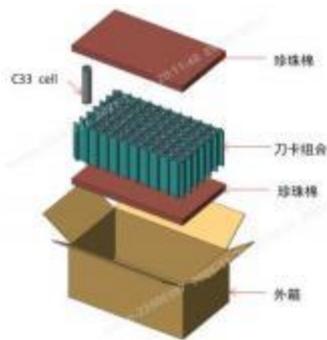


Figure B (图 B)

Each cardboard has 40 boxes, divided into 5 layers, as shown in figure C.

每卡板 40 个箱子, 分 5 层, 如图 C 所示。

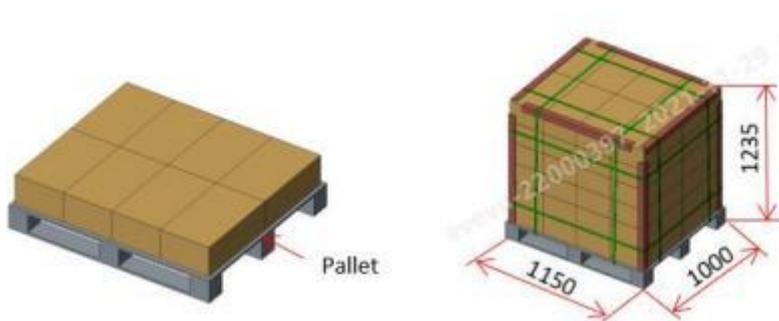


Figure C (图 C)