

HIGH/TAR

PRODUCT
SPECIFICATION

DOC NO.: IFpP71173208-314
SHEET : 1 OF 19
ECN NO. Q/KAGG1487-2024

Specification Approval Sheet (Cell)

产品规格确认书（电芯）

Model: IFpP71173208-314

型号: IFpP71173208-314

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	Company Name:	
	Company Stamp:	

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AMENDMENT RECORDS
(规格变更记录)

Revision No.	Description	Date	Remark
A0	新编 New version	2023.11.17	
A1	版本格式变更 Version format change	2024.07.08	
A2	重量规格调整 Adjustment of weight specification	2024.09.05	
A3	电芯尺寸变更 Cell Dimension change	2024.10.21	

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1 Scope 适用范围

This document describes the Product Specification and application requirements of the Lithium-ion rechargeable cell supplied by Jiangsu Highstar Battery Manufacturing Co.,LTD.

本规格说明书描述了江苏海四达电源有限公司生产的于可充电锂离子电芯的产品性能指标。

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型号: IFpP71173208-314

3 Specification 规格

3.1 General parameter 基本参数

No.	Items (项目)	Standards 标准	Remarks (备注)
3.1.1	Min. Capacity 最小容量	314Ah	0.5P, 25±2℃ 2.5-3.65V
3.1.2	Min. Energy 最小能量	1004.8Wh	0.5P, 25±2℃ 2.5-3.65V
3.1.3	Initial IR 初始内阻	≤0.25mΩ	25±2℃ 30%SOC
3.1.4	Operating voltage 工作电压	2.5V~3.65V 2.0~3.65V	Cell temperature T>0℃ 电芯温度 T>0℃ Cell temperature T≤0℃ 电芯温度T≤0℃
3.1.5	Energy efficiency 能量效率	≥94%	RT, 0.5P charge to 3.65V, rest 30 min; 0.5P discharge to 2.5V, rest 30 min; Cycle 5 times, and take the average energy efficiency of the last 3 times. (P=1004.8W) 室温, 0.5P充电至3.65V, 静置30min, 0.5P放电至2.5V, 搁置30 min; 循环5次, 取后3次能效平均值。(P=1004.8W)
3.1.6	Shipping capacity 出货容量	94.2±2Ah	30%SOC
3.1.7	Residual capacity loss 自放电	≤3%/月 Per month ≤3%	30%SOC, 25±2℃ Storage 30%SOC, 25±2℃ 存储
3.1.8	Weight 电池重量	5.60kg±0.3kg	
3.1.9	Cell dimension 电芯尺寸(含蓝膜)	厚度 Thick: 71.7±0.8mm 宽度 Width :173.7±0.5mm 高度 Length :207.2±0.5mm 中心距 Center distance:123.0±0.2mm	Under 300kgf±20kgf clamping force, SOC Delivery 300±20kgf 夹紧力下, 出货 SOC
3.1.10	25℃ Standard Cycle 25℃标准循环	8000Cycles	Under 300kgf±20kgf clamping force, 25℃ ±2℃ 0.5P/0.5P, 2.5~3.65V, Energy retention 70%. 300±20kgf 夹紧力下, 25℃±2℃ 0.5P/0.5P, 2.5V~3.65V, 能量保持率≥70%
3.1.11	Operation Temperature 工作温度	Charging: 0~60℃ 充电: 0~60℃	
		Discharging: -30~60℃	

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		放电: -30~60℃	
3.1.12	Storage Temperature 存储温度	0~35℃ (一年)	Delivery SOC State 出货 SOC 状态
		-20~45℃ (三个月)	
3.1.13	Application altitude 应用海拔	≤5000m	

3.2 Charging model 充电模式

No.	Items (项目)	Standards 标准	Remarks (备注)
3.2.1	Standard charge power 标准充电功率	0.5P	25±2℃
3.2.2	Standard charge voltage 标准充电电压	Cell max voltage 3.65V 单体电池最大 3.65V	N.A
3.2.3	Standard charge method 标准充电模式	0.5P constant power charge to 3.65V, rest 30min 0.5P 恒功率充电至 3.65V, 静置 30min。	
3.2.4	Standard charge temperature 标准充电温度	25±2℃	Cell Temperature 电芯温度
3.2.5	Charging temperature 充电温度	0~60℃	No matter what charge mode the battery is in, stop charging once the cell temperature exceeds this charge temperature range. 无论电芯以何种模式充电, 一旦发现电芯 温度冲过充电温度, 立即停止充电。
3.2.6	Charge upper limit voltage	Max 3.65V 最大 3.65V	The voltage range of cell charging, if exceed this charge upper limit, charging should be stopped immediately. 超过该电压上限值应立即停止充电。

3.2.7 Other charge condition 其他充电模式

Cell temperature/℃ 电芯温度/℃		0<T	0≤T <10	10≤T <15	15≤T <20	20≤T <25	25≤T <45	45≤T <50	50≤T <55	55≤T <60	T≥60
Max charge power (P)	0~100%SOC	0	0.15	0.3	0.4	0.5	0.5	0.5	0.3	0.25	0

3.3 Discharging model 放电模式

No.	Items (项目)	Standards 标准	Remarks (备注)
3.3.1	Standard discharge power 标准放电功率	0.5P (502.4W)	25±2℃
3.3.2	Standard discharge voltage 标准放电电压	2.5V 2.0V	Temperature 温度: T>0℃ Temperature 温度: T≤0℃
3.3.3	Standard discharge method 标准放电模式	0.5P constant power discharge to 3.65V, rest 30min 0.5P 恒功率放电至 3.65V, 静置 30min。	

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3.3.4	Standard discharge temperature 标准放电温度	25±2℃		Cell Temperature 电芯温度							
3.3.5	Discharging temperature 放电温度	-30~60℃		The temperature range of cell discharging, if exceed this temperature range, discharging should be stopped immediately. 超过放电温度范围，立即停止放电。							
3.3.6 Other discharge condition 其他放电模式											
Cell temperature/℃ 电芯温度/℃		T<-30	-30≤T<-10	-10≤T<0	0≤T<10	10≤T<20	20≤T<30	30≤T<40	40≤T<50	55≤T<60	T≥60
Max Discharge power (P)	0~100%SOC	0	0.5	0.8	1.0	1.0	1.0	1.0	0.7	0.5	0
3.4 High/Low discharging capacity 高低温容量											
No. 序号	Parameter 参数	Specification 产品规格		Condition 条件							
3.4.1	Capacity@55℃ 55℃放电容量	≥314Ah		新电池状态，55℃，0.5P，2.5V~3.65V Fresh cell，55℃，0.5P，2.5V~3.65V							
3.4.2	Capacity@-20℃ -20℃放电容量	≥251Ah		新电池状态，-20℃，0.5P，2.0V~3.65V Fresh cell，-20℃，0.5P，2.0V~3.65V							
4 Cell Performance Criteria and Test Conditions 电芯性能标准以及测试条件											
4.1 Standard environmental test conditions 标准测试环境											
Unless otherwise specified, all tests in this standard are carried out under the test conditions required by the test items: tests beyond this condition will produce obvious deviation to the test results.											
Temperature : 25℃±2℃											
Relative Humidity : 65%±20%											
除非特别说明，本标准书中所有测试均在测试项目要求的测试条件环境下进行：超出此条件环境下的测试均会对测试结果产生明显偏差。											
温度： 25℃±2℃											
湿度： 65%±20%											
4.2 Safety Performance 安全性能测试											
No.	Items (项目)	Test Method and Condition (测试方法和条件)		Criteria (标准)							
4.2.1	Over discharge 过放	After standard charge, install the test fixture. Keep the cell under pressure of 300±20kgf. The cell shall be discharged at constant current of 314A for 90 minutes or stop when the voltage reaches 0V. Observe for 1h (One of the conditions is preferred to stop test). 电池标准充电后，安装测试夹具，预紧力 300±20kgf。以 314A 电流放电 90 分钟或电压达到 0V 时停止放电。观察 1h（其中一个条件优先达到即停止试验）。		No Leakage, No Explosion or Catch Fire 不爆炸、不起火、不漏液							
4.2.2	Overcharge	After standard charge, install the test fixture. Keep the cell under		No Fire, No Explosion							

	过充	pressure of 300±20kgf. The cell shall be charged at 314A with cutoff voltage 5.475V or charging time reached 60min.Observe for 1h (One of the conditions is preferred to stop test). 电池标准充电后，安装测试夹具，预紧力 300±20kgf。以 314A 电流恒流充电至 5.475V 或充电时间达到 60min。观察 1h（其中一个条件优先达到即停止试验）。	不爆炸、不起火
4.2.3	Short Test 短路试验	After standard charge, short circuit externally for 10 minutes with line resistance <5mΩ, observe for 1 hour. 电池标准充电后，将电池正负极经外部短路 10min，外部线路电阻值小于 5mΩ。观察 1h。	No Fire, No Explosion 不爆炸、不起火
4.2.4	Fall Test 跌落试验	After standard charge, cell's positive and negative terminals fall down from 1.5m height to the concrete ground, Observe for 1h. 电池充电后，电池正负极端子向下从 1.5m 高度处自由跌落到水泥地上，观察 1h。	No Leakage, No Explosion or Catch Fire 不爆炸、不起火、不漏液
4.2.5	Heating Test 加热试验	After standard charge, the cell shall be stored in a oven with the heat rate of 5℃/min±2℃/min up to 130℃±2℃, maintain 30mins, Observe 1h. 电池充电后放入烘箱，烘箱按照 5℃/min±2℃/min 的速率由室温升至 130℃±2℃，保持此温度 30min 后停止加热。观察 1h。	No Fire, No Explosion 不爆炸、不起火
4.2.6	Crush Test 挤压试验	After standard charge, according to the following test conditions: 1) crush direction: perpendicularly to the cell plates; 2) crush plate shape: half cylinder of radius 75mm ,the length of the half cylinder is larger than the size of the cell; 3) crush speed: (5±1) mm/s; 4) crush degree: until the cell voltage is 0 V or deformation reaches 30% or crush force reaches 13±0.78 kN; 5)Observe 1h. 电池充电后，按下列条件进行试验： 1) 挤压方向：垂直于蓄电池极板方向， 2) 挤压板形式：半径 75mm 的半圆柱体，半圆柱体的长度 L 大于被挤压电池的尺寸， 3) 挤压速度：(5±1) mm/s， 4) 挤压程度：电压达到 0V 或变形量达到 30%或挤压力达到(13±0.78) kN 后停止挤压， 5) 观察 1h。	No Fire, No Explosion. 不爆炸、不起火
4.2.7	Low Pressure Test 低气压	After standard charge, install the test fixture. Keep the cell under pressure of 300±20kgf. The cells are to be stored for 6 hours at an absolute pressure of 11.6 kPa. Observe for 1h. 电池标准充电，安装测试夹具，预紧力 300±20kgf。电池放置于真空箱室，抽真空至 11.6kPa，静置 6h。观察 1h。	No Leakage, No Fire, No Explosion 不泄露、不起火、 不爆炸

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4.2.8

Temperature
Cycling Test
温度冲击试验

After standard charge, the cell is put into the oven , cycling according to following chart, cycle 5 times, observe 1h.

电池标准方法充电, 电池放入温度箱中, 按照下图表进行调节, 循环次数 5 次, 观察 1h。

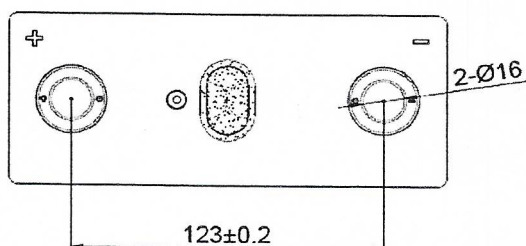
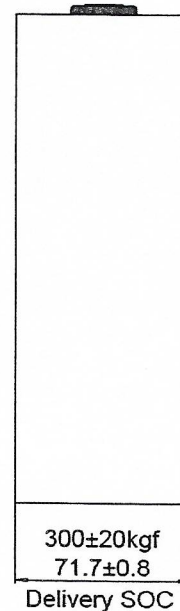
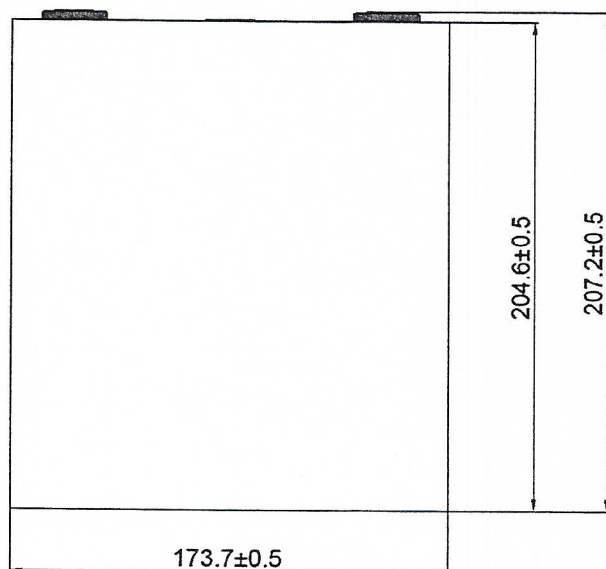
温度 (°C)	时间增量 (min)	累计时间 (min)	温度变化率 (°C/min)
25	0	0	0
-40	60	60	13/12
-40	90	150	0
25	60	210	13/12
85	90	300	2/3
85	110	410	0
25	70	480	6/7

No Leakage, No Fire, No
Explosion
不泄露、不起火、
不爆炸

5. Cell Dimension 电芯尺寸

Unit: mm, not in scale, included wrapped foil 单位: mm, 图纸非比例, 包蓝膜

The positive terminal and negative terminal is aluminum 正负极极柱为铝极柱



6.Special Warning 特别提示

Handling Precautions and Guideline for Lithium-Ion Rechargeable Batteries

锂离子充电电芯使用指示及注意事项

Statement (1):

Customers are requested to contact HIGHSTAR 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.

声明一:

客户若需要将电芯用于超出文件规定以外的设备,或在文件规定以外的使用条件下使用电芯,应事先联系海四达,因为需要进行特定的实验测试以核实电芯在该使用条件下的性能及安全性。

Statement (2):

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

声明二:

对于在超出文件规定以外的条件下使用电芯而造成的任何意外事故,海四达概不负责。

Statement (3):

HIGHSTAR will inform, in a written form, customers of improvement(s) regarding proper usage and handling of cells, if it is deemed necessary.

声明三:

如有必要,海四达会以书面形式告知客户有关正确操作使用电芯的改进措施。

Statement (4):

The cell must be used under the protection of power management system; When used in combination, the power management system must have the equalization function to balance the voltage difference in the battery pack and ensure the normal performance of the battery pack.

声明四:

电池使用时须在有电源管理系统保护下使用;组合使用时,电源管理系统必须具有均衡功能,能对电池组内电压差进行均衡,确保电池组发挥正常性能。

Statement (5):

During designation of host device or battery pack, it's better for customers to get HIGHSTAR involve to review the cell installation and safety protection scheme. This is very helpful to safety of cell application.

声明五:

客户在产品的设计过程中,最好邀请海四达共同完成电池安装及电池安全保护装置部分的设计,这对电池的安全使用会很有帮助。

6.1 Charge 充电

6.1.1 Charging current:

Charge current should be less than the maximum value specified in the Product Specification. Charging with current higher than the recommended value may deteriorate the charge and discharge performance, mechanical performance and safety performance of the cell, and may lead to heating or leakage, which will seriously affect the service life of the cell. If you have special needs, please contact with the company.

充电电流:

充电电流不得超过本标准书中规定的最大充电电流。使用高于推荐值电流充电将可能引起电芯的充放电性能、机械性能和安全性能等变差,并可能会导致发热或泄漏,会严重影响电池使用寿命。如有特殊需要,请与公司联系沟通。

6.1.2 Charge Voltage limit:

Batteries shall be charged shall be done by voltage less than that specified in the Product Specification (3.65V/cell). Charging beyond 3.65V, which is the absolute maximum voltage, must be strictly prohibited. The charger and protection circuit of battery pack shall be designed to comply with this condition. It is very dangerous that charging with higher voltage

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than the maximum value and may cause damage to the cell electrical, mechanical safety performance and could lead to heat generation or leakage. In serious cases, it will affect the service life of the cell and even cause safety problems.

充电电压限制

充电电压不得超过本规格书中规定的额定电压（3.65V/电芯）。3.65V 为充电电压最高极限，充电器和电池保护电路的设计应满足此条件。电芯电压高于额定电压值时，将可能引起电芯的充放电性能变差、可能会导致发热或泄漏，严重时会影响电池使用寿命甚至会产生安全问题。

6.1.3 Charge Temperature:

Batteries shall be charged at 0°C-60°C environment temperature specified in the Product Specification. In case of environment temperature is lower than 10°C, batteries shall be charged with a little current (no larger than 0.2C). If the environment temperature is lower than 0°C, charge shall be prohibited. Charging at low temperature will affect the service performance and service life of the cell, and long-term low-temperature charging will produce safety problems.

充电温度:

电芯必须在 0°C~60°C 的环境温度范围内才能进行充电。环境温度低于 10°C 时，须以小电流（不大于 0.2C）充电；当环境温度低于 0°C 时，应禁止充电。低温下充电会影响电池使用性能和寿命，长期低温充电会产生安全问题。

6.1.4 Prohibition of Reverse Charge:

Reverse charging is prohibited. Cells 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. the reverse charging may cause damage to the cell which may lead to degradation of cell performance and damage the cell safety, and could cause heat generation or leakage.

禁止反向充电:

正确连接电池的正负极，严禁反向充电。若电池正负极接反，应保证无法对电芯进行充电。反向充电会降低电芯的充放电性能、安全性，并会导致发热、泄漏。

6.2 Discharge 放电

6.2.1 Discharge current:

The cell shall be discharged at less than the maximum discharge current specified in the Product Specification. High discharging current may reduce the discharge capacity significantly or cause over-heat. At the same time, it will seriously affect the service life of the cell.

放电电流:

放电电流不得超过本规格书规定的最大放电电流，大电流放电会导致电芯容量剧减并导致过热，同时会严重影响电池使用寿命。

6.2.2 Discharge Temperature:

Cells shall be discharged at -30°C~60°C environment temperature specified in the Product Specification. The optimum discharge temperature range is 25°C~ 35°C; The discharge current shall be controlled when it exceeds the optimal temperature range, otherwise the service life will be affected. If necessary, please contact the company.

放电温度:

电芯可在 -30°C~60°C 的环境温度范围内进行放电，最佳放电温度范围 25°C~35°C；超出最佳温度范围使用时需对放电电流进行控制，不然会影响使用寿命，如有需要，请与公司联系沟通。

6.2.3 Over-discharge:

It should be noted that cells would be at an over-discharged status due to self-discharge characteristics in case they were not used for a long time. In order to prevent over-discharging, cells shall be charged periodically to maintain the voltage between 3.2V and 3.4V. Over-discharging may cause the loss of cell performance, characteristics, or cell functions.

过放电:

需注意的是，在电芯长期停止使用期间，它可能会因其自放电特性而处于某种过放电状态。为防止过放电的发

生, 电芯应定期充电, 将其电压维持在 3.2V 至 3.4V 之间。过放电会导致电芯性能、电池功能的丧失。

6.3 Other requirements for charging and discharging 充放电其余需求

If many cells are used in the same group, try to make the cells charge and discharge under the same current and temperature. If there are differences, there will be differences in the performance of the same group of cells, which will affect the performance of the whole battery pack if in serious case.

如是许多电芯同组使用, 要尽量使电芯在相同的电流和温度等环境下进行充放电使用, 如有差异会对同组电芯的性能产生差异, 严重时会影响整组电池性能的发挥。

6.4 Notice for Designing Battery Pack 电池结构设计注意事项

6.4.1 Pack Design 外壳设计

Battery pack should have sufficient strength to make sure the cell(s) inside is protected from mechanical shock.

电池外壳应有足够的机械强度以保证其内部电芯免受机械损伤, 材质为阻燃性材料。

6.4.2 Cell Fixing 电芯的安装

6.4.2.1 No cell movement in the battery pack should be allowed.

电芯不得在壳内活动。

6.4.2.2 Prevention of short circuit in a battery pack or host device.

防止电芯在电池包装或主机内产生短路。

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

引线与电芯之间要有足够的绝缘层以保证绝对安全。电池壳内不得有任何短路发生隐患, 以防止冒烟或着火。

6.5 Storage 贮存

The cell shall be stored at the environmental condition of -20°C- 45°C and 65%±20% RH. Long term storage will cause irreversible damage to cell performance.

The voltage for a long time storage shall be 3.2V-3.3V range.

If the cell has to be storied for a long time (Over 3 months), the environmental condition should be:

Temperature: 0°C-35°C

Humidity: 65%±20%RH

During the warranty period, the cell with cell voltage lower than 3.3V shall be recharged with 31A ~ 62A current every 3 months until the voltage reaches 3.4V, otherwise it will cause great irreversible damage to the cell performance.

电芯储存可在温度 -20°C~ 45°C, 湿度为 65%±20%RH 的环境中, 长期储存会对电池性能产生不可逆损伤。

长期存储电池 (超过 3 个月) 须置于温度为 0°C-35°C、湿度为 65%±20%RH 的环境中, 电压为 3.2V~3.4V。

保质期内每隔 3 个月对电池电压低于 3.2V 的电池用 31A~62A 电流进行补充电, 至电压达到 3.4V, 不然会对电池性能产生较大不可逆损伤。

6.6. Application conditions 应用条件

Customer shall ensure that the following application conditions in connection with the products are strictly observed:

客户应当确保严格遵守以下与电池相关的应用条件:

6.6.1. Customer shall procure that each product shall be used under the strict monitor, control and protection by the BMS incorporated by HIGHSTAR. When the cell is first used, it must be fully charged and discharged for activating it and giving fully capacity.

客户应配置电池管理系统, 严密监控、管理与保护每个电池。电芯初次使用必须进行小电流满充满放以激活, 以保证后续使用中容量的充分发挥。

6.6.2 Customer shall keep relevant records of the BMS monitoring data throughout the entire service life of each product, including keeping record of number of occurrence of rush charge, which could be used in the determination and judgment of any product warranty and liability claim entitlement. No warranty or liability claim should be considered without BMS

diagnosis records (at a regular basis, esp. during maintenance) of the relevant product.

客户应保存完整的电池运转的监测数据，用作产品质量责任划分的参考。不具备完整的电池系统使用期限内的监测数据的，海四达不承担产品质量保证责任。

6.6.3 Prevent draining any product down to over discharge state. A product may be permanently damaged internally when the cell voltage is lower than 2.0 V and which shall be strictly prohibited, failing what HIGHSTAR's warranties under the contract shall cease to apply, thereby releasing the HIGHSTAR from any liability in connection therewith. After discharge cut-off in accordance with paragraph 3.6, internal power consumption of the system should be reduced to a minimum to prolong the idle time before recharge. Customer undertakes to educate the users of the products or other parties who may come to handle the products to recharge the cells at minimum time intervals to prevent reaching the over-discharge state.

避免电池到达过放状态。电池电压低于 2.0V 时，电池内部可能会遭到永久性的损坏，此时海四达的产品质量保证责任失效。根据本技术协议第 3.3 条，当实际放电截止电压低于标准放电截止电压时，系统内部能耗降低到最小，并在重新充电之前延长休眠时间。客户需要培训使用者在最短的时间内重新充电，防止电池进入过放状态。

6.6.4 Batteries should avoid charging at low temperatures prohibited by this Technical Agreement (including standard charging, fast charging and emergency charging), otherwise accidental capacity reduction may occur. Battery management system should be controlled with different charging current according to different temperatures specified in this agreement. It is forbidden to charge under the temperature stipulated in this technical agreement. Otherwise, HIGHSTAR will not undertake the responsibility of quality assurance.

电池避免在本技术协议禁止的低温条件下充电(包括标准充电，快充，紧急情况充电)，否则可能出现意外的容量降低现象。电池管理系统应依照本协议规定的不同温度以不同的的充电电流进行控制。禁止在低于本技术协议规定的温度条件下充电，否则海四达不承担质量保证责任。

6.6.5 The design of the electric box must fully consider the heat dissipation problem of the cell. HIGHSTAR does not take the responsibility due to the overheating of the cell or batteries caused by the thermal design problem of the electric box.

电箱设计中应充分考虑电芯的散热问题，由于电箱散热设计问题导致的电芯或电池过热损坏，海四达不承担质量保证责任。

6.6.6 The design of the electric box must fully consider the waterproof and dustproof problems of the cells. The electric box must meet the waterproof and dustproof grade stipulated by the relevant national standards. The HIGHSTAR does not take the responsibility due to damage to the cell or batteries (such as corrosion, rust, etc.) caused by water and dust.

电箱设计中应充分考虑电芯的防水、防尘问题，电箱必须满足 UL 和 IEC 有关标准规定的防水、防尘等级。由于防水、防尘问题而导致的电芯或电池的损坏（如腐蚀、生锈等），海四达不承担质量保证责任。

6.6.7. It is forbidden to mix different P/N batteries in the same battery system, otherwise, HIGHSTAR will not be responsible for quality assurance.

禁止不同P/N料号电芯在同一电池系统中混用，否则海四达不承担质量保证责任。

6.6.8 The BMS should meet the following basic detection and control requirements

BMS管理系统需满足以下最基本的检测和控制需求

No.	Parameter 参数	Specification 产品规格	Action 保护动作
6.6.8.1	Stop charging 充电终止	3.65V	Stop charging when cell voltage reaches 3.65 V 电池的电压达到 3.65V 时，BMS 申请终止充电
6.6.8.2	First overcharge protection 第一级过充电保护	$\geq 3.70V$	Stop charging when cell voltage reaches 3.70 V 当电池电压达到 3.70V，BMS 强制终止充电
6.6.8.3	Second overcharge protection 第二级过充电保护	$\geq 3.85V$	When the battery voltage reaches 3.85V, the BMS is forced to terminate charging, and the BMS should be locked until technicians solve the problem. 当电池电压达到 3.85V，BMS 强制终止充电，且

			BMS 应锁定直到技术人员解决问题
6.6.8.4	Stop discharge 放电终止	Minimum 2.5V 最小 2.5V	Minimize the discharging current when cell voltage reaches 2.5V. 当电池的电压到达 2.5V, BMS 申请终止放电
6.6.8.5	First over discharge protection 第一级过放保护	Minimum 2.45V 最小 2.45V	Stop discharging when cell voltage reaches 2.45V 当电池的电压到达 2.45V, BMS 强制终止放电
6.6.8.6	Second over discharge protection 第二级过放保护	Minimum 2.3V 最小 2.3V	When the cell voltage is less than 2.3V, the cell should be charged back to 50% SOC at 0.1C in time, and the BMS should be locked until technicians solve the problem. 当电池电压低于 2.3V 时, BMS 强制终止放电, 应及时以 0.1C 回充至 50%SOC, 且 BMS 应锁定直到技术人员解决问题
6.6.8.7	Short circuit protection 短路保护	No short circuit allowed 不允许短路	When a short circuit occurs, the battery (cell) is disconnected by the overcurrent protection device. 发生短路时, 由过流保护装置断开电池(电池)
6.6.8.8	Over current protection 过流保护	参考第 3.2 和 3.3 条 Reference 3.2&3.3	Control discharge current by BMS to values within specification 电池管理系统控制充放电电流符合规格
6.6.8.9	Over temperature protection 过热保护	参考第 3.2 和 3.3 条 Reference 3.2&3.3	Stop charging and discharging when temperature exceeds specification 当温度超过本技术协议规定时, 终止充电/放电
6.6.8.10	Charging upper limit capacity 充电容量保护	Charging capacity <351.68Ah 充电容量小于 351.68Ah	Charging capacity protection, charging capacity must be less than 112% of then nominal capacity 充电容量上限保护, 充电容量小于标称容量的 112%

6.7 User's Guideline for Safety Handling 用户安全操作信息

6.7.1 The following information, or equivalent statements, shall be made available to the user through one or more of the following means, as appropriate: printed on the label for the cell, printed on the label for host device, printed in the owner's manual, or posted in a help file or Internet website:

下列信息或类似的申明必须通过一种或多种适当的途径让用户知晓, 可选择的途径包括: 电池标签、主机标签、用户手册、储存于帮助文档或互联网:

6.7.1.1 Do not disassemble or open, crush, bend or deform, puncture, or shred;

请勿拆解或打开、挤压、弯折、变形、刺穿、敲碎;

6.7.1.2 Do not modify or remanufacture, attempt to insert foreign objects into the cell;

请勿修改或改装, 不要试图将外物插入电池;

6.7.1.3 Do not immerse cells into water or other liquids, or expose to fire, explosion, or other hazard.

禁止将电池浸入或暴露在水或其它液体中, 远离火源、爆炸物和其他危险;

6.7.1.4 Do not expose them to any high temperature environment exceeding operation temperature as set out in paragraphs 3.9&3.10, otherwise it may cause fire. At all use time, cell temperature should not exceed 60 °C, shut down system by BMS when it occurs.

禁止将电池长时间暴露在超过本技术协议第 3.2 条和第 3.3 条规定的温度条件的高温环境中, 否则可能会导致火灾。在任何正常的充放电使用情况下, 电芯温度不能超过 60°C, 如果电芯温度超过 60°C, 电池管理系统需关闭电池, 停止电池运行。

6.7.1.5 Only use the cell for the system for which it was specified.

只能使用本系统规定的电池；

6.7.1.6 Only use the cell with a charging system that has been qualified with the system per standard. Use of an unqualified cell or charger may present a risk of fire, explosion, leakage, or other hazard.

只能使用通过标准认证具有充电管理系统的电池，使用未经认证的电池或充电器可能存在起火、爆炸、或其它危险；

6.7.1.7 Do not short circuit a cell or allow metallic or conductive objects to contact the cell terminals, otherwise high current and temperature may cause body injury or fire hazards. Metallic cell terminals exposed from plastic packaging and ample safety precautions should be implemented to avoid short circuiting them during system integration or connections.

禁止电池正负极短路，也不要让金属或其它导体接触电池接电端子；否则强电流和高温可能导致人身伤害或者火灾。在电池系统组装和连接时，应有足够的安全保护，以避免短路。

6.7.1.8 Replace the cell only with another cell that has been qualified with the system per standard. Use of an unqualified cell may present a risk of fire, explosion, leakage, or other hazard.

更换电池时只能使用通过标准认证的电池，使用未经认证的电池可能存在起火、爆炸或其它危险；

6.7.1.9 Don't keep a cell at rest for a long time (over 6 months). Safety accident may happen when recharging a cell which has a rest for a long time.

避免电池长时间放置不用（6个月以上），长期放置不用的电池重新充电时可能会发生安全问题。

6.7.1.10 Promptly dispose of used batteries in accordance with local regulations.

按当地法规迅速处理报废电池；

6.7.1.11 Cell usage by children should be supervised.

儿童使用电池应受到监督；

6.7.1.12 Avoid dropping the phone or cell. If the phone or cell is dropped, especially on a hard surface, and the user suspects damage, take it to a service center for inspection.

不要跌落主机或电池，如果主机或电池不慎跌落（尤其在硬表面上），用户怀疑电池损坏，则应找服务中心检查；

6.7.1.13 Improper cell use may result in a fire, explosion, or other hazard.

不正确使用电池可能发生燃烧、爆炸或其它危险。

6.7.1.14 Products should be securely fixed to solid platform, and power cables should be securely attached by fastener to avoid intermittent contact which may cause arcing and sparks.

客户应将电池安全地固定在固体平面上，并将电源线安全地束缚在合适的位置，以避免摩擦而引起电弧和火花。

6.7.1.15 Do not service cells and electrical connections within plastic package of cell. Improper electrical connection within a cell may cause overheating in service.

严禁用塑料封装电池或用塑料进行电气连接。不正确的电气连接方式可能会造成电池使用过程中发生过热现象。

6.7.1.16. When the electrolyte leaks, skin and eye contact with the electrolyte should be avoided. In case of contact, a large amount of clean water should be used to clean the contact area and seek help from the doctor. It is forbidden for any person or animal to swallow any part or substance contained in the cell.

当电解液泄露时，应避免皮肤和眼睛接触电解液。如有接触，应使用大量的清水清洗接触到的区域并向医生寻求帮助。禁止任何人或动物吞食电池的任何部件或电池所含物质。

6.7.1.17 Protect cells from mechanical shock, impact and pressure. Internal electrical circuit may short circuit to generate high temperature and fire hazards.

尽力保护电池，使其免受机械震动、碰撞及压力冲击，否则电池内部可能短路，产生高温和火灾。

6.7.1.18 When cells charging is terminated improperly for reasons such as exceeding allowable charging time, cut-off due to exceeding charging voltage or cut-off due to exceeding charging current, all these events are defined as "improper charge termination". Such event may indicate that there is current leaking within a cell system or some components have started to

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malfunction and subsequent charging of such cell system without finding and fixing root cause of problem may cause potential overheat or fire hazards. When such event occurs, the BMS should lock itself up to prevent subsequent charging and notice should be given to the user to return the vehicle to dealer for servicing. Subsequent charging should only be resumed after the system has been thoroughly checked by qualified technician who can identify and fix root cause attributed to the "improper charge termination".

电池充电过程中可能发生不适当的终止充电现象。如:超出允许的充电时间充电, 充电电压过高而终止充电或充电电流过强而终止充电。上述现象被定义为“不适当的终止充电”。当发生以上现象时, 可能意味着电池系统出现漏电或某些部件出现故障。在没有找到根本原因并彻底解决之前继续对该电池充电可能会引起电池过热或发生火灾。当发生以上现象时, 电池管理系统应该通过自动锁定功能, 禁止后续的充电, 并提醒使用者将装载有该电池的交通工具退回到经销商处进行系统维护。该电池只有经过有认证资格的技术人员全面检查, 确定根本原因并彻底解决、改善后方可恢复充电。

6.7.1.19 Cell fire or explosion may be caused by improper operation during abuse test. The test can only be carried out in a professional laboratory by professionals equipped with appropriate protective equipment. Otherwise, it may lead to serious personal injury and property loss.

在进行滥用测试实验时如操作不当可能会引起电池起火或者爆炸。该测试实验只能由配备适当的防护装备的专业人员在专业的实验室进行。否则, 可能会导致严重的人身伤害和财产损失。

6.7.2 The following indications, notifications, and dialog/messages, at the system level, or an equivalent statement, may be displayed along with recommended actions as appropriate:

下列指示、通告、语句、信息或类似的申明应通过适当途径让用户知悉:

6.7.2.1 Abnormal cell temperature alert.

不正常的电池温度警示;

6.7.2.2 Abnormal host device and/or cell dc input voltage alert.

不正常的主机或电池的直流输入电压警示;

6.7.2.3 Abnormal current draw alert.

不正常的电流警示;

6.7.2.4 Cell communication fail/time-out alert.

电池通讯失败或超时警示;

6.7.2.5 Incompatible cell alert.

不相容电池警示;

6.7.2.6 Alert for other malfunctions that may lead to hazards.

可能导致危险的其它故障警示。

6.8 Product end of life management 产品寿命终止管理

6.8.1 This cell is designed to service with a finite life time. The customer shall develop and implement an active tracking system to monitor and record impedance of each Product in its entire service life. HIGHSTAR and its customer shall come into agreement about internal resistance and capacity measurement methods, HIGHSTAR and/or its customer shall stop using any of the products when its resistance exceeds 200% of its internal resistance or its capacity fading to 70% of typical capacity @25°C. Failure to comply with this requirement shall render HIGHSTAR's warranties under the Contract inapplicable, thereby releasing HIGHSTAR from any liability in connection therewith.

电池的使用期限是有限的。客户应该建立有效的跟踪系统监测并记录每个使用期限内电池的内阻和容量。内阻以及容量的测量方法和计算方法需要客户和海四达共同讨论和双方同意。当使用中的电池的内阻超过这个电池最初内阻的 200%或容量小于等于标称容量 70%(25°C), 应停止使用电池。违反该项要求, 将免除海四达依据产品销售协议以及本技术协议所应承担的产品质量保证责任。

6.8.2 The cell life determination conditions can refer to paragraph 3.1.10 cycle life. The service conditions not specified in

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this specification will affect the cycle life.

电芯循环寿命应是指在 3.1.10 条件下的循环寿命。不在此规格书规定的使用条件下均会影响循环寿命。

6.9 Others 其它事项

6.9.1 Prohibition of Disassembly 严禁拆卸电芯

6.9.1.1 Never disassemble cells. The disassembling may generate internal short circuit in the cell, which may cause firing or other problems.

在任何情况下不得拆卸电芯。拆卸电芯可能会导致内部短路，进而引起着火及其它问题。

6.9.1.2 Electrolyte is harmful. 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.

电解液有害。万一有电解液泄漏而接触到皮肤、眼睛或身体其它部位，应立即用清水冲洗电解液并就医。

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

在任何情况下，不得燃烧电芯或将电芯投入火中，否则会引起电芯燃烧，这是非常危险的，应绝对禁止。

6.9.3 The cells shall never be soaked with liquids such as water, seawater, drinks such as soft drinks, juices, coffee or others. 不得将电芯浸泡液体，如淡水、海水、饮料（果汁、咖啡等）。

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

更换电芯应由电芯供应商或设备供应商完成，用户不得自行更换。

6.9.5 Prohibition of use of damaged cells

禁止使用已损坏的电芯

6.9.6 The cells might be damaged during shipping by shock. If any abnormal features of the cells are found such as 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.

电芯在运输过程中可能因撞击等原因而损坏，若发现电芯有任何异常特征，如外壳破损，闻到电解液气味，电解液泄漏等，该电芯不得使用。有电解液泄漏或闻到异常味道的电池应远离火源以避免着火。

7.Limited Warranty and Liabilities 有限保证和责任

7.1 Limited Warranty period 有限保证期限

The cells shall compile with this specification within 12 months from the manufacture date as stipulated on cell marking ("Warranty Period"). In the Warranty Period, HIGHSTAR will replace cells which fail to confirm to this specification at no cost to Customer.

自电芯标识显示的制造日期之日起 12 月内（“保证期限”），电芯应符合本规格书的规定。在此保证期限内，海四达免费为客户更换不符合本规格书规定的电芯。

7.2. Disclaimer 免责声明

Under the following conditions, HIGHSTAR will not take any responsibility incurred in any losses resulting from the use of cells:

在以下条件下，海四达对客户因使用电芯而引起的任何损失不承担赔偿责任：

7.2.1. If the product demand unit does not use the product according to the provisions of this specification, causing social impact and affecting the reputation of HIGHSTAR, HIGHSTAR will investigate the responsibility of the product demand unit. According to the degree of impact on HIGHSTAR, the product demander should provide compensation to HIGHSTAR.

如果由于产品需求单位不按本说明书中的规定进行使用，造成社会性影响，并对海四达的声誉造成影响的，海四达将会追究产品需求单位的责任。根据对海四达造成的影响程度，产品需求单位需向海四达提供赔偿。

7.2.2 The cells are misused, abused or are used in any manner deviated or in breach of conditions as set out in this specification and beyond the allowable conditions of this specification.

误用、滥用电芯或违反本规格书规定和超出本规格书的允许条件使用的电芯；

7.2.3 The cells are rendered to be nonconforming to this specification for reasons caused by parties other than HIGHSTAR or by circumstances beyond the control of HIGHSTAR.

非海四达原因导致的或海四达不能控制的原因导致的电芯不符合本规格书的规定。

7.2.4 HIGHSTAR reserves the right to change and revise the design and product specification Approval Sheet without prior notice; Before ordering HIGHSTAR products, the buyer needs to confirm the latest status of the products in advance with HIGHSTAR.

海四达保留在没有预先通知的情况下改变和修正设计及产品规格确认书的权力; 买方在订购海四达产品前, 需与海四达提前确认产品的最新状态。

7.2.5 English specifications are for reference only. Please refer to the technical specifications of the Chinese version.

英文规格释义仅供参考, 请以中文版技术规格要求为准。

7.3 Limited Warranty range 有限保证范围

Customer is recommended to follow this specification to use. Or customer can use an alternative operation method mutually agreed by customer and HIGHSTAR. Using an operation method neither according to the specification nor agreed by HIGHSTAR in written will cause the resulting change in product quality are not applicable to the warranty scope promised by HIGHSTAR.

推荐客户完全按照此产品规格书上所描述的要求进行操作, 或采用经过客户与海四达双方确认的其他条件。如果客户采用的使用方法既没有按照本规格书的要求, 也没有经海四达具有法定有效的书面同意, 所导致产品质量变化不适用于海四达公司承诺的保质保证范围内。

8. Risk Warning 风险警告

8.1 Waring statement 警示声明

WARNING

CELL ARE POTENTIALLY DANGEROUS AND PROPER PRECAUTIONS MUST BE OBSERVED IN HANDLING AND MAINTENANCE.

RUNNING TESTS ON THE CELLS IMPROPERLY MAY RESULT IN SEVERE PERSONAL BODY INJURY OR PROPERTY DAMAGES.

WORK ON CELLS MUST BE PERFORMED ONLY WITH PROPER TOOLS AND PROTECTIVE EQUIPMENT MUST BE USED.

CELL MAINTENANCE MUST BE CARRIED OUT BY PERSONNEL KNOWLEDGEABLE OF CELLS AND TRAINED IN THE SAFETY PRECAUTIONS INVOLVED.

FAILURE TO OBSERVE THE ABOVE MAY CAUSE VARIOUS HAZARDS.

警告

电池存在潜在的危險, 在操作和维护时必须采取适当的防护措施!

不正确地滥用测试实验, 可能导致严重的人身伤害和财产损失!

必须使用正确的工具和防护装备操作电池。

电池的维护必须由具有电池专业知识并经过安全培训的人士执行。

不遵守上述警告可能造成多种灾难。

8.2. Types of Hazards 危险类型

Customer acknowledges the following potential hazards in connection with the usage and handling of the Products:

客户知悉在电池使用和操作过程中存在以下潜在的危險:

8.2.1 Working with cell can expose the handler to chemical, shock and/or arcing hazards. Although a person's body might react to contact with direct current voltage differently than from contact with alternate current voltage, Customer shall take a conservative position and consider the risk of shock or electrocution to be the same for both alternate current and direct

current exposures greater than 50 V.

操作者在操作时可能会受到化学品、电击或者电弧的伤害。尽管人体对遭受直流电与交流电的反应不同，但是高于 50V 的直流电压与交流电对人体的伤害是同样严重的，因此客户必须在操作中采取保守的姿势以避免电流的伤害。

8.2.2 Cells expose its handler to chemical hazards associated with the electrolyte used in the cell.

存在来自电池中的电解液的化学风险。

8.2.3 When selecting work practices and personal protective equipment, customer and its employees should consider potential exposure to these hazards and therefore prevent accidental short-circuit that can result in electrical arcing, explosion, and/or “thermal runaway” of the cells.

在操作电池和选择个人防护装备时，客户及其雇员必须考虑到以上潜在的风险，防止发生意外短路，造成电弧、爆炸或热失控。

HIGHSTAR**PRODUCT
SPECIFICATION**DOC NO.: IFpP71173208-314SHEET : 19 OF 19ECN NO. Q/KAGG1487-2024**Customer Inquiry 产品规格需求****Model: IFpP71173208-314**

The customer is requested to write down your information and contact HIGHSTAR in advance, if the customer needs applications or operating conditions other than those described in this document. HIGHSTAR could design and build such products according to your special request if it is attainable.

我司也可以根据客户的特殊要求而设计、制造符合要求的电池产品，如果贵公司有本规格书描述之外的性能要求，请您写在下面并回签给我司：

	Special Request(要求)	Criteria(规格)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Company Name: _____ Signature: _____ Date: _____