PRODUCT SPECIFICATION

Rechargeable Lithium-ion Cell

产品规格书

锂离子电芯

Model 型 号： INR21700S-50P

Doc. No. 文件编号： PS-C046-001

Revision 版 本： A0

Prepared by 编制	Checked by 审核	Approved by 批准
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Content

目录

1 Scope 范围 1
2 Product Classification and Model 产品类别及型号 1
3 Nominal Specification 标称规格 1
4 Appearance and Dimension 外观尺寸 2
4.1 Appearance 外观 2
4.2 Dimension 尺寸 3
5 Standard test condition 标准测试条件 3
5.1 Environment condition 环境条件 3
5.2 Standard charge 标准充电 4
5.3 Standard discharge 标准放电 4
6 Characteristics 特性 4
6.1 Electrochemical Characteristics 电化学特性 4
6.2 Safety Characteristics 安全特性 4
7 Warranty 保证 13
8 Shipment and Storing Condition 运输和存储 13
8.1 Shipment 运输 13
8.2 Storing Condition 存储 13
9 Safety Instructions 安全守则 14
9.1 Danger 危险事项 14
9.2 Warning 警告事项 15
9.3 Caution 注意事项 15
10 Precautions for Designing of the Base Station, the Chargers and the Battery Packs 基站、充电器和电池组设计注意事项 16
10.1 Precautions for Designing of Base Station and the Charger 基站、充电器设计注意事项 16
10.2 Precautions for Battery pack Design 电池组设计注意事项 18
11 Handling Precautions for Lithium Ion Cells 锂离子电芯操作注意事项 20
11.1 Series Connections Precautions 串联注意事项 20
11.2 Inspection of the Battery pack before Shipping 电池组出货检查 21
11.3 Precautions on Pack Assembly 组装注意事项 21
12 Warranty Exemptions 保证豁免 21
13 Other Remarks 其他附注 21

1 Scope 范围

This specification defines the requirements of the lithium-ion cell to be supplied to the customer by LinkData New Energy Co., Ltd.

本规格书规定了联动天翼新能源有限公司提供的锂离子电芯的技术规格及要求。

2 Product Classification and Model 产品类别及型号

Product classification 产品分类	Cylindrical rechargeable lithium-ion cell 圆柱形可充电锂离子电芯
Product model 产品型号	INR21700S-50P

3 Nominal Specification 标称规格

Item 项目	Specification 规格
3.1 Standard discharge capacity 标准放电容量	Min.5000mAh. Charge: 1C(5A) CCCV 4.2V, 100mA cut-off, 25±2℃, rest 30min. Discharge: 0.2C(1A), 2.5V cut-off, 25±2℃. 1C = 5A. 最小容量:5000mAh; 25±2℃下，按照标准充电(1C(5A)恒流恒压充电到 4.2V ，100mA 截止)，搁置 30 分钟，0.2C (1A)放电到 2.5V。1C = 5A。
3.2 Nominal Voltage 标称电压	3.6V
3.3 Energy 能量	Min.18.0Wh Charge: 1C(5A) CCCV 4.2V, 100mA cut-off, 25±2℃, rest 30min. Discharge: 0.2C(1A), 2.5V cut-off, 25±2℃. 1C = 5A. 最小能量 18.0Wh。 25±2℃下，按照标准充电(1C(5A)恒流恒压充电到 4.2V ，100mA 截止)，搁置 30 分钟，0.2C (1A)放电到 2.5V。1C = 5A。
3.4 End-of -charge voltage 充电截止电压	4.2V
3.5 Discharge cut-off voltage 放电截止电压	2.5V
3.6 Standard Charge current 标准充电电流	5A
3.7 Standard Charge Time 标准充电时间	≤2h
3.8 Standard Discharge current	1A

Item 项目	Specification 规格
标准放电电流	
3.9 Maximum Pulse Discharge Current(10s) 最大脉冲放电电流（10s)	200A 10S（25±2℃下）
3.10 Maximum Charge Current 最大持续充电电流	15A
3.11 Maximum Continuous Discharge Current 最大持续放电电流	50A (without 80℃ temperature cut off） 50A（无温度截止） 80A(with 80℃ temperature cut off) 80A（80℃ 截止）
3.12 Cell Weight 电芯重量	67.0±1.5g
3.13 Cell Dimension 电芯尺寸	Diameter:21.35±0.15mm 直径：21.35±0.15mm Height:70.7±0.2mm 高度：70.7±0.2mm
3.14 Cell Internal Resistance 电芯内阻	≤4.0mΩ
3.15 Storage Temperature (for shipping state--20~30%SOC) 存储温度（运输状态--20~30%SOC）	1 year/1 年 -20~25℃ 3 months/3 个月 -20~45℃ 1 month/1 个月 -20~60℃
3.16 Operating temperature 电芯作业温度限制	Ambient Temperature : Charge :-10 to 45℃ Discharge: -40 to 60℃ 环境想温度： 充电：-10 到 45℃ 放电：-40 to 60℃
	Cell Surface Temperature Charge :-10 to 60℃ (recommended recharge release < 45℃) Discharge: -40 to 80℃ (must re-discharge release < 60℃) 充电：-10 到 60℃ （推荐恢复充电温度低于 45℃） 放电：-40 to 80℃ （恢复放电温度低于60℃）

4 Appearance and Dimension 外观尺寸

4.1 Appearance 外观

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

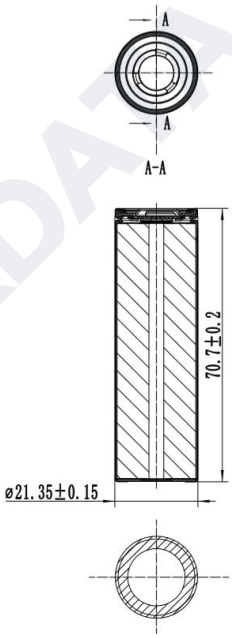
电芯外观应不允许存在擦伤、生锈、变色、污点、变形、泄漏等缺陷，影响外观。

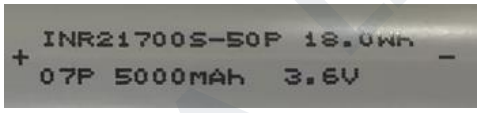
4.2 Dimension 尺寸

Shoulder Height (H) 电芯高度：70.7±0.2 mm（With plastic film）

Diameter (φ)电芯直径（测量位置电芯中部，30%SOC）：21.35±0.15mm（With plastic film）

Plastic film color 套膜颜色：grey 灰色





5 Standard test condition 标准测试条件

5.1 Environment condition 环境条件

Unless otherwise specified, all test stated in this product specification are conducted at temperature 25±2℃ humidity from 45% to 85%，and the pressure from 86 kPa to 106 kPa.

除特殊指定外，所有测试应按环境温度 25±2℃，湿度 45~85%的条件下进行，测试大气压在 86~106kPa。

Measurement equipment 测量设备

The voltage and current measurement device accuracy grade：0.5 mV and 0.5 mA or higher

电压、电流测量设备精度等级：不低于 0.5mV 和 0.5mA

AC Resistance meter：1KHz

交流阻抗仪测量频率：1KHz

Temperature meter precision：≤0.5℃

温度测试仪精度：≤0.5℃

Slide caliper ：0.01mm

游标卡尺精度：0.01mm

Electronic scale：0.1g

电子秤精度：0.1g

5.2 Standard charge 标准充电

This “Standard charge” means charging the cell CC-CV with constant charge current of 1C (5A) and constant voltage 4.2V and 0.02C (100mA) cut-off in CV mode. For test purpose, charging shall be performed at 25±2℃。
标准充电是指在 25±2℃环境下，电芯以 1C (5A)恒流充电至 4.2V 后，以 4.2V 恒压充电至电流为 0.02C (100mA)

5.3 Standard discharge 标准放电

“Standard discharge” shall consist of discharging at a constant current of 0.2C（1A）to 2.5V. Discharging is to be performed at 25±2℃。
标准放电是指在 25±2℃环境下，电芯以 0.2C（1A）恒流放电至 2.5V

6 Characteristics 特性

6.1 Electrochemical Characteristics 电化学特性

6.1.1 0.2C Discharge Capacity/Energy 0.2C 放电容量/能量

Cell shall be charged as per 5.2, rest for 30mins, discharged as per 5.3, record the discharge capacity. 电芯以 5.2 标准充电，搁置 30min，以 5.3 标准放电，记录放电容量/能量。	
Discharge Capacity 放电容量	≥5000mAh
Discharge Energy 放电能量	≥18.0Wh

6.1.2 DC Internal Resistance 直流内阻

1. Cell shall be charged as per 5.2;
2. Rest for 30mins;
3. Discharged as per 5.3 and record the discharge capacity C_0;
4. Cell shall be charged as per 5.2;
5. Cell shall be discharged with 0.2C and cut by the capacity of $1/2C_0$ to get 50% SOC;
6. Rest 180min to get the voltage of U_1;
7. Then discharge with current of I_0=5000mA for 10s to get the ending voltage of U_2;
8. DCR=$(U_1-U_2)/I_0$

1. 电芯以 5.2 标准充电；
2. 搁置 30 分钟；
3. 以 5.3 标准放电，记录放电容量 C_0；
4. 电芯以 5.2 标准充电；
5. 电芯以 0.2C 放电，以容量=$1/2C_0$ 截止，得到 50% SOC；
6. 搁置 180 分钟，得到电压 U_1；
7. 以 I_0=5000mA 放电 10s 得到电压 U_2；
8. 计算 DCR=$(U_1-U_2)/I_0$

DCR（50%SOC 1C10s） 直流内阻	≤11mΩ

6.1.3 Fast Charge 快速充电

Charge: 3C(15A) CCCV 4.2V, 100mA cut-off, 25±2℃ 。
25±2℃下，3C(15A)恒流恒压充电到 4.2V ， 100mA 截止。

6.1.4 Rate Discharge Capacity 倍率放电容量

1. Cell shall be charged as per 5.2;
2. Discharge with constant current to 2.5V at specified C rates;

(Take the standard discharge capacity as100% for reference)

1. 电芯以 5.2 标准充电；
2. 以给定的不同放电倍率电流恒流放电至 2.5V；

(以标准放电容量定义为 100%)

Discharge Rate 放电倍率	0.2C	0.5C	1C	3C	5C	6C	40A	50A	60A
Relative Capacity 容量保持率	100%	99%	98%	97%	97%	97%	97%	96%	70%

6.1.5 High-Low Temperature Discharge Performance 高低温放电性能

1. Cell shall be charged as per 5.2;
2. Store the cell at -40℃/-30℃/-20℃/25℃/55℃±2℃ for 4 hours ；
3. Discharge with constant current to 2.5V with 1C;

(Take the 1C discharge capacity @25℃ as reference to calculate the discharging ratio)

1. 电芯以 5.2 标准充电；
2. 在-40℃/-30℃/-20℃/25℃/55℃±2℃条件下搁置 4 小时；
3. 以 1C=5A 恒流放电至 2.5V 截止；

（以 25℃ 1C 放电容量为 100%进行参比）

Discharge Temperature 放电温度	-40℃	-30℃	-20℃	25℃	55℃
Relative Capacity 容量保持率	75%	80%	80%	100%	97%

6.1.6 -40℃ High Rate Discharge Capacity -40℃大倍率放电性能

1. Cell shall be charged per 5.2;
2. Store the cell at -40±2℃ fo 4hours;
3. Discharge the cell with constant current to 2.5V with 1C/2C/3C;

(Take the 1C discharge capacity @25℃ as reference to calculate the discharging ratio)

1. 电芯以 5.2 标准充电；
2. 在-40±2℃的条件下，搁置 4 h；
3. 以 1C/2C/3C恒流放电至 2.5V 电压截止

（以 25℃ 1C 放电放电容量为 100%进行参比）

Discharge Rate 放电倍率	1C	2C	3C
Relative Capacity 容量保持率	75%	80%	80%

6.1.7 RT +5A/-5A Cycle Life 室温 +5A/-5A 循环寿命

1. At an ambient temperature of 25±2°C, cell shall be charged to 4.2V by constant current of 5A and cut-off by 0.02C;
2. Discharging the cell at constant current 5A to 2.5V;
3. Rest for 30min;
4. A cycle is defined as one charge and one discharge until the discharge capacity less than 80% of initial capacity for twice, end up the cycle test.

1. 在 25±2℃环境温度下，用 5A 电流充电至 4.2V 后充电至 0.02C；
2. 5A 放电至 2.5V；
3. 搁置 30 分钟；
4. 一次循环包含充电和放电，直至连续两次放电容量低于首次容量 80%，则停止测试

1000 Cycles Capacity Retention 循环 1000 圈后剩余容量保持率	≥80%

6.1.8 RT +8A/-30A Cycle Life 室温 +8A/-30A 循环寿命

1. At an ambient temperature of 25±2°C, cell shall be charged to 4.2V by constant current of 8A and cut-off by 0.02C;
2. Discharging the cell at constant current 30A to 2.5V;
3. Rest for 30min;
4. A cycle is defined as one charge and one discharge until the discharge capacity less than 60% of initial capacity for twice, end up the cycle test.

1. 在 25±2℃环境温度下，用 8A 电流充电至 4.2V 后以恒压 4.2V 充电至 0.02C；
2. 30A 放电至 2.5V；
3. 搁置 30 分钟；
4. 一次循环包含充电和放电，直至连续两次放电容量低于首次容量 60%，则停止测试

600 Cycles Capacity Retention 循环 600 圈后剩余容量保持率	≥60%

6.1.9 RT +8A/-40A Cycle Life 室温 +8A/-40A 循环寿命

1. At an ambient temperature of 25±2°C, cell shall be charged to 4.2V by constant current of 8A and cut-off by 0.02C; 2. Discharging the cell at constant current 40A to 2.5V; 3. Rest for 30min; 4. A cycle is defined as one charge and one discharge until the discharge capacity less than 60% of initial capacity for twice, end up the cycle test. 1. 在 25±2℃环境温度下，用 8A 电流充电至 4.2V 后以恒压 4.2V 充电至 0.02C； 2. 40A 放电至 2.5V； 3. 搁置 30 分钟； 4. 一次循环包含充电和放电，直至连续两次放电容量低于首次容量 60%，则停止测试	
500 Cycles Capacity Retention 循环 500 圈后剩余容量保持率	≥60%

6.1.10 RT +15A/-30A Cycle Life 室温 +15A/-30A 循环寿命

1. At an ambient temperature of 25±2°C, cell shall be charged to 4.2V by constant current of 15A and cut-off by 0.02C; 2. Discharging the cell at constant current 30A to 2.5V; 3. Rest for 30min; 4. A cycle is defined as one charge and one discharge until the discharge capacity less than 60% of initial capacity for twice, end up the cycle test. 1. 在 25±2℃环境温度下，用 15A 电流充电至 4.2V 后以恒压 4.2V 充电至 0.02C； 2. 30A 放电至 2.5V； 3. 搁置 30 分钟； 4. 一次循环包含充电和放电，直至连续两次放电容量低于首次容量 60%，则停止测试	
200Cycles Capacity Retention 循环 200 圈后剩余容量保持率	≥60%

6.1.11 -10℃ +2.5A/-10A Cycle Life -10℃ +2.5A/-10A 循环寿命

1. At an ambient temperature of -10±2°C, cell shall be charged to 4.2V by constant current of 2.5A and cut-off by 0.02C; 2. Discharging the cell at constant current 10A to 2.5V; 3. Rest for 30min; 4. A cycle is defined as one charge and one discharge until the discharge capacity less than 60% of initial capacity for twice, end up the cycle test. 1. 在-10℃±2℃环境温度下，用 2.5A 电流充电至 4.2V 后以恒压 4.2V 充电至 0.02C； 2. 10A 放电至 2.5V； 3. 搁置 30 分钟； 4. 一次循环包含充电和放电，直至连续两次放电容量低于首次容量 60%，则停止测试	
100Cycles Capacity Retention 循环 100 圈后剩余容量保持率	≥60%

6.1.12 Storage Characteristic 存储性能

1. Cell shall be charged as per 5.2; 2. Rest 30mins; 3. Cell shall be discharged as per 5.3，Get the capacity= C_0; 4. Cell shall be charged as per 5.2; 5. Store the cell in 60 ℃for 30 days; 6. Cell shall be charged as per 5.2 and discharged as per 5.3; 7. Get the discharge capacity of Step 6 =C1; 8. Capacity recovering ratio =C1/C0 1. 电芯以 5.2 标准充电； 2. 搁置 30 分钟； 3. 电芯以 5.3 标准方式进行放电得到容量 C0； 4. 电芯以 5.2 标准充电； 5. 将电芯存储在 60±2℃的环境中 30 天； 6. 电芯以 5.2 标准充电后以 5.3 标准放电； 7. 记录第 6 步放电容量 C1； 8. 计算容量恢复=C1/C0

容量恢复率 Capacity recovery rate	≥90%

6.1.13 Status of the Cell as of Ex-factory 电芯出厂状态

The cell should be shipped between 3580-3600mV. 电芯出货电压范围为 3580-3600mV。

6.2 Safety Characteristics 安全特性

6.2.1 External Short Circuit Test 外部短路测试

1. Cell shall be charged as per 5.2; 2. Connect the positive and negative terminals by a copper wire at 57℃±4℃. The wire resistance shall be 80± 20mΩ; The test shall be terminated when either of the following two conditions occurs: a) The temperature drop of the cell reaches 20% of the maximum temperature; b) The short-circuit time reaches 24 hours. In case of dispute, choose the stricter one between (a) and (b) 3. Cell is observed for 1h after test Refer to GB31241-2022 1. 电芯以 5.2 标准充电； 2. 在 57℃±4℃环境中以 80±20mΩ外接阻抗进行外短；当出现以下两种情形之一时,试验终止: a) 电池温度下降值达到温度最大值的 20%; b) 短接时间达到 24h。 当有争议时，（a）和（b）选较严者 3. 测试完成后观察 1h 参考 GB31241-2022

Criteria: 通过标准：	No fire, no explosion. 不起火，不爆炸。

6.2.2 Over Charge Test 过充电测试

1. Cell shall be discharged as per 5.3;
2. 8A CC charge to 4.6V, then charge at a constant voltage of 4.6V; During the test, monitor the temperature change of the cell. When any of the following two situations occurs, terminate the test:

a) The continuous charging time of the cell reaches 7 h or the charging time defined by the manufacturer, whichever is larger;
b) The temperature drop of the cell reaches 20% of the maximum temperature;

In case of dispute, choose the stricter one between(a) and (b)

3. Observed for 1 h after test

Refer to GB31241-2022

1. 电芯以 5.3 标准放电；
2. 8A 恒流充电至 4.6V，然后以 4.6V 恒压充电；当出现以下两种情形之一时,试验终止:

a) 电池持续充电时间达到 7h;
b) 电池温度下降值达到温度最大值的 20%

当有争议时，（a）和（b）选较严者

3. 测试完成后观察 1 小时

参考 GB31241-2022

Criteria: 通过标准：	No fire, no explosion. 不起火，不爆炸。

6.2.3 Forced Discharge Test 强制放电测试

1. Cell shall be discharged as per 5.3;
2. 1C reverse charging for 90 minutes;
3. Observed for 1 h after test

Refer to GB31241-2022

1. 电芯以 5.3 标准放电；
2. 1C 反向充电 90min；
3. 测试完成后观察 1 小时

参考 GB31241-2022

Criteria: 通过标准：	No fire, no explosion. 不起火，不爆炸。

6.2.4 Low-pressure Test 低气压

1. Cell shall be charged as per 5.2;
2. Place the cell in a vacuum box at 20°C±5°C; vacuum to reduce the pressure in the box to 11.6 kPa (simulated altitude of 15 240 m); keep it for 6 h;
3. Observed for 1 h after test

Refer to GB31241-2022

1. 电芯以 5.2 标准充电；
2. 将电芯放置于真空箱中,抽真空将箱内压强降低至 11.6kPa(模拟海拔 15240m),并保持 6h；
3. 测试完成后观察电芯 1h。

参考 GB31241-2022	
Criteria: 通过标准：	No fire, no explosion, no leakage. 不起火、不爆炸、不漏液。

6.2.5 Temperature Cycling 温度循环

1. Cell shall be charged as per 5.2; 2. Place the fully charged cell in a temperature-controlled chamber at a temperature of 20°C±5°C and follow the procedure below.: a) Raise the temperature of the test chamber to 72°C± 2°C and keep it for 6 h; b) Lower the temperature of the test chamber to -40°C± 2°C and keep it for 6 h; c) Repeat steps (a) ~ (b) for a total of 10 cycles; d) Store at room temperature of 20°C±5°C for at least 6 h. During the test, the conversion time between each two temperatures shall not exceed 30 min. 3. Observed for 1 h after test Refer to GB31241-2022 1. 电芯以 5.2 标准充电； 2. 将电芯置入 20℃±5℃温度箱内，然后按以下步骤调节温度箱温度; a) 将试验箱温度升高为 72℃±2℃，并保持 6 h； b) 将试验箱温度降为-40℃±2℃，并保持 6 h； c) 重复步骤（a）~（b），共循环 10 次。 d) 在室温 20℃±5℃下至少保存 6 h。 试验过程中每两个温度之间的转换时间不大于 30 min 3. 测试完成后观察电芯 1h 参考 GB31241-2022	
Criteria: 通过标准：	No fire, no explosion, no leakage. 不起火、不爆炸、不漏液。

6.3 Mechanical Characteristics 机械特性

6.3.1 Vibration 振动

1. Cell shall be charged as per 5.2; 2. The vibration should be a sinusoidal waveform with a logarithmic frequency sweep from 7 Hz to 200 Hz, back to 7 Hz, the span is 15 minutes; 3. Cells are subjected to vibration tests in two directions, axial and radial; Perform 12 cycles in each direction, with a total of 3 h of vibration in each direction.. Refer to GB31241-2022/UN38.3 1. 电芯以 5.2 标准充电； 2. 振动波形为正弦波形，对数频率扫描从 7HZ 到 200HZ，回到 7HZ，跨度 15 分钟； 3. 电芯进行轴向和径向方向的振动测试；每个方向进行 12 个循环，每个方向循环时间共计 3 h 的振动。 参考 GB31241-2022/UN38.3

Criteria: 通过标准：	No fire, no explosion, no leakage 不起火、不爆炸、不漏液

6.3.2 Fall 跌落

1. Cell shall be charged as per 5.2; 2. Rest for 30min; 3. Drop the cell freely on the concrete slab at a drop height of 1 m. Drop the two ends of the cells once, and the cylindrical surface twice, for a total of four dropping tests; 4. Observed for 1 h after test Refer to GB31241-2022 1. 电芯以 5.2 标准充电； 2. 搁置 30 分钟； 3. 将电芯从 1m 的跌落高度自由落体跌落于混凝土板上。正负极电芯的正、负极端子分别向下各 1 次，大面 2 次共计进行 4 次跌落试验； 4. 测试完成后观察 1h 参考 GB31241-2022

Criteria: 通过标准：	No fire, no explosion, no leakage 不起火、不爆炸、不漏液

6.3.3 Crush 挤压

1. Cell shall be charged as per 5.2; 2. The cell is tested according to the following conditions: 3. Crush direction: Apply pressure perpendicular to the cell plate; 4. Crush plate form: two flat surfaces; 5. Crush speed:0.1mm/s; 6. Crush degree: When the crush pressure reaches 13.0kN±0.78kN or an voltage drop of one-third, stop the crush; 7. Observed for 1 h after test Refer to GB31241-2022 1. 电芯以 5.2 标准充电； 2. 按下列条件进行实验： 3. 挤压方向：垂直于电芯极板方向施压； 4. 挤压板形式：两个平面； 5. 挤压速度：0.1mm/s； 6. 挤压程度：挤压压力达到 13.0kN±0.78kN 或电压下降三分之一后停止挤压； 7. 测试完成后观察 1h 参考 GB31241-2022

Criteria: 通过标准：	No fire, no explosion 不起火、不爆炸

6.3.4 Heating Test 热箱测试

1. Cell shall be charged as per 5.2; 2. Put the cell to the oven, the temperature of the oven is increased to(130±2)℃ at a rate of (5±2)/min and maintain the temperature of 130℃ for 30min in the oven; 3. Observed for 1 h after test Refer to GB31241-2022 1. 电芯以 5.2 标准充电； 2. 将电芯置于热箱中，温度以（5±2℃）/min 的速率升至（130±2）℃并恒温 30 min； 3. 测试完成后观察电芯 1h。 参考 GB31241-2022

Criteria: 通过标准：	No fire, no explosion 不起火、不爆炸

6.3.5 Heavy impact 重物冲击

1. Cell shall be charged as per 5.2; 2. Place the cell on the platform surface. Place a 15.8mm ±0.2mm diameter metal rod horizontally on the upper surface of the geometric center of the battery. Use a 9.1kg ±0.1kg weight to drop freely from a height of 610mm ±25mm and strike the surface of the battery with the metal rod. 3. Observed for 6 h after test Refer to GB31241-2022 1. 电芯以 5.2 标准充电；

2. 将电池置于平台表面,将直径为 15.8mm±0.2mm 的金属棒横置在电池几何中心上表面，采用质量为 9.1kg±0.1kg 的重物从 610mm±25mm 的高处自由落体状态撞击放有金属棒的电池表面 3. 测试完成后观察 6h 参考 GB31241-2022`	
Criteria: 通过标准：	No fire, no explosion 不起火、不爆炸

7 Warranty 保证

The cell warranty period is made according to business contract. LinkData will replace no cells for free after shipment if there are problems due to customers' abuse or misuse instead of LinkData's manufacturing failure.
电芯的保质期限依合同而定，交货之后，如非联动天翼的制作原因，而是客户的滥用和误用造成的电芯质量问题，联动天翼不承诺免费更换。

LinkData will not be responsible for the trouble caused by handing in violation of caution in instructions.
联动天翼对违反安全守则操作所产生的问题不承诺任何责任。

LinkData will not be responsible for the trouble caused by matching electric circuit, battery pack and charger.
联动天翼对与电路、电池组和充电器搭配使用所产生的问题不承担任何责任。

LinkData will not be responsible for any defect of cells caused during assembling after acceptance.
出货后客户在电池组装过程中产生的不良电芯不在联动天翼质量保证的范围之列。

8 Shipment and Storing Condition 运输和存储

8.1 Shipment 运输

At time of shipment, the cells' state of charge shall be 20±10% of its rated capacity or less. The violent vibration, impaction or squeezing should be avoided in the transport process; neither is exposed in the sunlight nor rain. The cells shall be shipped by normal transportation such as by road, by ocean or by air.
电芯以 20±10%SOC 的荷电态进行运输，在运输过程中应防止剧烈振动、撞击、挤压，避免日晒雨淋。电芯适用于汽车、轮船、飞机等普通运输工具。

8.2 Storing Condition 存储

(1) Storage temperature and humidity (within 3 months) 存储温度及湿度（3 月内）

Cells should be stored in a stable environment characterized by low-humidity (less than 70% RH), free of corrosive gasses, and an ambient temperature between -20℃ and 40℃.
电芯存储在低湿（小于 70%RH）、无腐蚀性气体、环境温度在-20-40℃的稳定环境中。

To prevent rust, avoid condition that can create condensation such as rapid fluctuations in the ambient.
为防止生锈，存储环境应避免因温度剧烈产生冷凝的环境。

(2) Long duration storage 长时间存储

When long duration storage cells should be stored in a stable environment characterized by low-humidity (less than 70%RH), free of corrosive gasses, and an ambient temperature between 0℃and 20℃.
当电芯长时间存储时，需存储在低湿（小于 70%RH）、无腐蚀气体、环境温度在 0~20℃稳定的环

境中.

To prevent rust, avoid conditions that can create condensation such as rapid fluctuations in the ambient.

为防止生锈，存储环境应避免因温度剧烈产生冷凝的环境。

For long term storage, a discharged or partial charged stage of charge per 8.1 is recommended.

长期存储，推荐按第 8.1 条规定的荷电态执行。

9 Safety Instructions 安全守则

The cell contains flammable materials such as organic solvents. Mishandling the cell may cause fire, smoke, or an explosion and the cell's functionality will be seriously damaged. Protection circuitry must be designed into the application device to protect the cell. Additionally, LinkData highly recommends adding these safety instructions to the owner's manual. Please read and check the following prohibited actions before utilization.

电芯含有有机溶剂等易燃物质，如使用不当可能引起电芯冒烟、起火或爆炸，严重损伤电芯性能。必须在应用装置中增加保护电路用来保护电芯。同时，联动天翼公司强烈建议把这些安全守则加入到用户手册中。使用电芯前，请仔细阅读以下禁止条例。

9.1 Danger 危险事项

Do not use unauthorized charger, charge the cell by an electric outlet directly or a cigarette lighter charger。

禁止使用非专用充电器，插头（出口）或车载点烟插头为电芯充电。

Do not use or place the cell near an open flame, heater or high temperature (above 80℃).

禁止在火焰、热源旁或高温环境中（80℃以上）使用或放置电芯。

Do not immerse the cell in liquid such as water, beverages, or other fluids.

禁止将电芯浸入水、饮料或其它液体中。

Do not disassemble or reconstruct the cell.

禁止拆解或改造电芯。

Do not pierce a hole in the cell with sharp things. (such as nail, knife, pencil, drill)

禁止使用锐物体刺穿电芯（如钉子、刀、铅笔、钻头）。

Do not solder on cell directly.

禁止直接焊接电芯。

Do not use or assemble old and new batteries together.

禁止将新旧电芯一同装配或使用。

Do not put the cell into a microwave oven, dryer, or high-pressure container.

禁止将电芯置于微波炉、干燥器或高压容器中。

Do not expose the cell to high heat . (such as fire)

禁止将电芯暴露于高温下（如火中）。

Do not excessive impact to the cell.

禁止过度撞击电芯。

Do not step on the cell and throw or drop the cell on the hard floor.

禁止在硬地板上踩踏、投掷电芯。

Do not use the cell reversed.

禁止反极性使用电芯。

Do not connect positive(+) and negative(-) with metallic object intentionally.

禁止使用金属件直接将电芯正负极相连。

9.2 Warning 警告事项

Keep the cell away from small children. If the cell or any of its component parts is swallowed, seek medical attention immediately.

电芯应该远离婴幼儿存放。出现吞咽电芯的情况，请立即就医。

Do not use abnormal batteries. Immediately stop using the cell if there are noticeable abnormalities, such as smell, heat, discoloration, or deformity.

不要使用不正常的电芯。如果有明显的异常，例如异味、发热、变色或者畸形，请停止使用。

If the cell can not finish the charging process within the specified time, halt the charging process

如果电芯在规定的时间内不能完成充电过程，请停止充电步骤。

Do not use a leaking cell near open flame. If the cell or liquid leaking from the cell has an irritating odor, the cell should be kept away from any open flame. If exposed to an open flame, the cell could ignite and explode.

不要在靠近火焰的地方使用漏液电芯。如果电芯或者有液体流出的电芯产生刺鼻性气味，电芯应该保持远离火焰。如果将电芯置于火焰中，电芯可能会被点燃或者爆炸。

Do not touch a leaking cell. If liquid leaking from the cell gets into your eyes, immediately flush your eyes with clean water and seek medical attention. If left untreated, it will cause significant eye damage.

不要触摸漏液电芯。如果从电芯漏出的液体进入眼中，将会造成严重损害。如果从漏出的液体进入您的眼中，请立即用清水冲洗眼睛。请立即咨询医生。如果液体留在眼中，将会造成严重损害。

Pack the cell securely for transport. To prevent short-circuit or damage during transport, securely pack the cell in a case or carton.

运输时须固定包装好电芯。为了避免短路或者损伤，请将电芯固定装入一个盒体或纸箱内。

9.3 Caution 注意事项

Do not use or leave the cell in a location exposed to excessive heat, such as in direct sunlight or in a car. Doing so could cause the cell to generate heat, smoke, catch fire, or explode. It may also cause the cell’s performance and life to deteriorate.

不要在高温环境使用或放置电芯，例如在阳光直射下的汽车中。电芯可能会着火，冒烟，爆炸或者引起发热。同时，可能会造成电芯性能和寿命的劣化。

The battery pack has a protection circuit. Do not use the cell where static electricity in excess of 100V is

generated as it may damage the protection circuit. If the protection circuit fails, the cell may generate heat, catch fire, smoke, or explode.

电芯包有保护线路。在产生静电超过 100V 地方，不要使用电芯，可能会损害保护线路。如果电芯的保护线路被破坏，电芯可能会产热、着火、冒烟或爆炸。

Only charge the cell between 0℃ and 60℃. Charging outside of this temperature range may cause the cell to leak, generate heat, or result in serious damage. It may also cause the cell’s performance and life to deteriorate.

充电温度范围规定在 0℃~60℃之间。不要在规定的温度范围外对电芯进行充电。否则，会导致漏液、产热、者严重损伤。另外，可能会造成电芯性能和寿命的劣化。

Read the manual before use. Keep for future reference.

在使用前请阅读使用手册。请妥善保存本手册以供将来参考。

Please contact the supplier if the cell gives off an unusual odor, generates heat, or shows signs of rust prior to its initial use.

在首次使用时，如果电芯有不正常气味，发热或者生锈，请联系供货商。

Do not charge or discharge near flammable materials. Doing so could result in fire.

在充放电过程中，请远离易燃材料。可能会造成着火，冒烟，爆炸或者引起发热。

If electrolyte leaks from the cell and comes into contact with skin or clothing, immediately flush with water. Otherwise, it may cause skin irritation.

如果电解液从电芯中泄露，沾到衣服或者皮肤上，立即用水进行冲洗。否则，可能会刺激皮肤。

When disposing of the cell, recycle it according to local rules and regulations

使用后，请根据当地的法律、法规进行电芯回收。

10 Precautions for Designing of the Base Station, the Chargers and the Battery Packs 基站、充电器和电池组设计注意事项

10.1 Precautions for Designing of Base Station and the Charger 基站、充电器设计注意事项

(1) Charge 充电

The cell is charged by a method of constant current-constant voltage.

电芯使用恒流恒压的方式进行充电。

Regarding INR21700S-50P, the charging current should not exceed 15A/cell.

对于 INR21700S-50P 这款电芯，单体充电电流不能超过 15A。

The charging voltage should not exceed 4.20V/cell.

电芯充电电压不超过 4.20V。

The charging voltage is required to be set to less than 4.23V/cell with considering the accuracy of charger. Even if the charger is failed, the total safety shall be secured.

考虑到充电器的精度，须保证电芯充电电压低于 4.23V。即使充电器异常，整体的安全性需要得到

保障。

*LinkData recommend the charge voltage is controlled less than 4.20V (e.x 4.10V) for system.

联动天翼公司推荐系统充电电压控制小于 4.2V（如 4.10V）。

The charger shall be equipped with a pre-charge system.

充电器须带有预充电系统。

If cell voltage goes down to less than 2.5V/cell, the cell should be charged by maximum pre-charge current of 0.5A (0.1C). Once, the cell reached more than 2.5V/cell by the pre-charging, the charger can resume the standard charging method. However, if the cell voltage never recovers more than 3.0V/cell, the charger must be stopped and turned off.

如果单体电芯电压低于 2.5V，须以低于 0.5A（0.1C）的电流进行预充电，直到电芯电压超过 2.5V 后可调整为标准充电方式。如果电芯充电电压一直无法超过 3.0V，须停止并关闭充电器。

The charger shall be equipped a full charge detection.

充电器须配备一个完整的充电检测装置。

The charger shall detect the full-charged state by a timer, current detection or open circuit voltage detection. When the charger detects the full-charge, the charger shall stop charging. Do not apply the continuous charging (trickle charging) method.

充电装置能够通过计时器、电流检测或者开路电压检测到电芯满充电的状态。当充电检测装置检测到电芯充满电后，应停止继续充电。避免使用涓流充电方式。

The charging temperature should be confined to the range -10℃ to 60℃.

电芯充电应在-10-60℃下进行。

It is recommended that charging should be stopped to avoid continuous charging, when either of the following conditions are met:

当遇到以下条件时，建议结束充电避免持续充电。

The charging current reaches approximately 0.100A(0.02C) in CV mode.

恒压阶段充电电流到 0.100A（0.02C）。

-The charging time reaches 1.5h in case of charging at 5A (1C).

以 5A (1C)电流充电时间达到 4h。

(2) Discharge 放电

The discharge current should not exceed 50A/cell.

单体电芯放电电流须小于 50A。

The discharge temperature should be between -40℃ and 80℃.

电芯放电温度范围为-40℃-80℃。

The discharge end voltage should be more than 2.5V/cell.

单体电芯放电终止电压须高于 2.5V。

If cells are to be connected in series, please refer to Item 12.1.

如电芯进行串联连接，请参考 12.1 项。

*LinkData recommend the discharging end voltage is controlled more than 2.5V (e.x 3.0 V) for system.

联动天翼新能源有限公司系统推荐放电电压控制在 2.5V 以上（如 3.0V）。

(3) Over discharge 过放电

Do not discharge the cell less than 2.0V/cell.

禁止单体电芯放电至 2.0V 以下。

(4) Design of Base Station and chargers 基站和充电器设计

The cells should be kept away from heat generating electronic parts in order to avoid deterioration of cell performance.

电芯应远离发热电子元件，避免对电芯性能造成衰减。

(5) Strength of the battery pack enclosure 电池组外壳强度

The battery pack enclosure must be designed to have sufficient strength to resist damage from specified or typical expected mechanical stresses such as bending, twisting, and impact due to drop of application.

电池组外壳设计时需要具备足够强度来抵抗特定的机械压力，如来自下落应用时的弯曲、扭转和挤压。

10.2 Precautions for Battery pack Design 电池组设计注意事项

(1) Shape, mechanism and material of Battery Packs 电池组的形状、机理和材料

The battery pack should be designed so it cannot connect to unauthorized chargers.

电池组应设计为无法使用未授权的充电器进行充电。

The battery pack should be designed so it cannot connect with unauthorized equipment and/or devices.

电池组应设计为无法与未授权的装备和设备相连使用。

The terminal shape should be designed to avoid short circuit issues. In addition, the battery pack should be equipped with an over current protection function in order to prevent from external short circuit issues.

电池组正负极端子外形设计应避免短路问题。此外，电池组应装备过电流保护装置，避免外部短路的发生。

The terminal shape and structure should be designed so that it can not connect in backwards.

电池组端子形状和结构设计应避免正负极反接发生。

The battery pack should be designed to prevent static electricity, electrolyte, or water ingress issues.

电池组设计应具备防静电功能并且能够阻止电解液、水的浸入。

The battery pack should be designed so the protection circuit functions can be inspected during the assembly process.

电池组应设计成在组装阶段，电路保护功能可检测。

The battery pack should be designed so electrolyte cannot reach to the protection circuit board even if

electrolyte leak out of the cells.

电池组应设计成即便电芯发生了漏液，电解液也不能到达保护线路板。

The cells should be fixed by tape or glue in the case. If the battery pack is dropped, the cells should be protected against dents, deformations, and other mechanical stresses.

电芯应使用胶带、胶水固定在壳体中。如电池组发生跌落，电芯不能出现凹痕、变形或其它机械应力。

Plastic cases should be closed with glue. If an ultra sonic welding method is applied to the case sealing, LinkData will not accept any responsibilities for any defects.

塑料箱使用胶密封。如果以上箱体在密封时使用超声波焊接方式，对于出现的任何缺陷，联动天翼不承担任何责任。

The pack shall be designed so end users cannot remove or disassemble the cells.

电池组应设计成无法拆解或转移电芯。

The battery pack should be designed with considering control of temperature distribution in the battery pack, Otherwise there is the risk that Cell's life becomes short by it.

电池组设计应考虑控制温度分布，否则会缩短电芯使用寿命。

(2) Protection circuit 保护电路

The following protection circuit should be equipped in the battery pack:

以下保护电路须装备在电池组中：

Overcharge protection 过充电保护

We recommend the overcharge protection engages when cell voltage reaches more than 4.25V/cell then, the current shall be shut down.

建议当单体电芯电压超过 4.25V，过充保护启动，切断电流。

*The operation voltage of overcharge protection should be set according to charging voltage. (e.x If charging voltage is set to 4.10V, the overcharge protection should operate when cell voltage reaches more than 4.15V/cell.)

*过充电保护电压应根据充电电压设定（如当充电电压设定为 4.10V，充电电压超过 4.15V 时，过充电保护须启动）

Over discharge protection 过放电保护

-If cell voltage reaches approximately 2.0V/cell, we recommend that the over discharge protection circuit shuts down the discharge current and the circuit consumption current is set to less than 1 μA.

如果单体电芯电压达到 2.0V，推荐过放保护电路须切断放电电路，电路消耗电流设定小于 1 μA。

*The operation voltage of over discharge protection should be set according to discharging end voltage.(e.x If discharging end voltage is set to 3.0V, the over discharge protection should operate when cell voltage reaches less than 2.7V/cell.)

*过放电保护电压应根据放电电压设定（如当放电电压设定为 3.0V，放电电压低于 2.7V 时，过放电保护装置须启动）

Over current protection 过电流保护

If discharge current exceeds approximately 60A/cell, the over current protection will shut down the current.

如果单体电芯放电电流超过约 60A，过电流保护应该切断放电电流。

(3) Electric circuit 电路

To avoid over discharge mode during long storage times, the consumption current of the battery pack’s protection circuit should be set as low as possible.

为了避免长期存储出现过放电模式，电芯包保护线路的消耗电流应该设置得尽量小。

(4) Cell connection 电芯连接

The cells should not be connected using a soldering process and an ultrasonic welding method. Additionally, the cells also should be protected by indirect thermal and vibration influence. In order to avoid any damages, cells should be connected to lead plates by a spot welding method.

电芯不能使用锡焊和超声波焊接工艺。此外，电芯连接时须避免间接产热及振动影响。为避免受到损伤，电芯应通过点焊的方式连接到引线板上。

11 Handling Precautions for Lithium Ion Cells 锂离子电芯操作注意事项

This section describes handling precautions for lithium ion cells which will be assembled as Battery Packs with LinkData. This Battery pack consists of INR21700S-50P.

此部分用来解释用于组装电池组的联动天翼单体电芯操作注意事项。电池组由 INR21700S-50P 型号电池组成。

11.1 Series Connections Precautions 串联注意事项

When cells are connected in series in battery pack, make sure that the lot number, shipping charge date, and capacity rank match. Please do not mix cells with different lot numbers, shipping charge dates, or capacity ranks. The voltage variability between cells should be within 20mV.

电池组内电芯进行串联，须确认好批次、运输充电状态及容量档位的匹配。不要使用不同批次、运输充电状态及容量档位的电芯。电芯的电压差需要在 20mV 以内。

The lot number, the shipping charge date and the capacity rank are indicated on the shipping carton label.

电芯批次、运输充电状态以及容量档位应当标注在运输纸箱标签上。

If cells are connected in series, the discharge end voltage should be set more than 2.5V/cell.

如果电芯进行串联，单体电芯放电终止电压设定值须大于 2.5V。

*LinkData recommend the discharging end voltage is controlled more than 2.5V(e.x 3.0V) for system.

联动天翼建议系统电压设定大于 2.5V（如 3.0V）。

11.2 Inspection of the Battery pack before Shipping 电池组出货检查

All Battery Packs shall be inspected for:

所有电池组须检查以下各项：

Voltage 电压

Internal Resistance 内阻

Function of protection circuit 保护线路功能

Thermistor resistance 热敏电阻

Thermal fuse 热熔断器

11.3 Precautions on Pack Assembly 组装注意事项

Do not use potentially abnormal cells which have been dropped, shorted, or deformed during handling or assembly even if no damage is readily apparent. Do not use cells giving off the odor of electrolyte.

禁止在组装时使用跌落、短路、变形（即使表面无明显损伤）等存在潜在危险的电芯。禁止使用散发电解液气味的电芯。

Do not bring cell near or into contact with heat sources such as soldering irons.

禁止将电芯靠近或接触热源，如焊烙铁。

Do not lift the core pack by holding the lead wires or the printed circuited board. Do not unnecessarily twist or bend the lead wires or the printed circuited board.

禁止移动如导线或印制线路板等核心部件。禁止随意拧动或弯曲导线或印制线路板。

12 Warranty Exemptions 保证豁免

LinkData will not be liable for any damages that are caused by violations of the precautions in this specification.

联动天翼对违反规格书内注意事项造成的任何损失不承担责任。

LinkData will not be liable for any problems caused by design defects of the Battery Packs, Base Station, or chargers.

联动天翼对因电芯包、电动车和充电器的设计缺陷造成的任何问题不承担责任。

LinkData will not accept return of any abnormal cells that were damaged due to any incorrect assembly process.

13 Other Remarks 其他附注

If there are problems in this specification, LinkData will take them into consideration.

如此规格书存在问题，联动天翼会对该问题进行考虑。

LinkData can discuss specification or precautions that are not described in this specification.

联动天翼会对本规格书中未描述的规格或注意事项进行讨论。

Do not use the provided cells for other applications.

禁止将所供电芯用作其它应用。

In case of any discrepancy between the Chinese and English versions, the Chinese version shall prevail

若发生中英文表述歧义，以中文表述为准。