

圆柱形钠离子电池规格书

型 号: NaCR32140-MP10

标称容量: 10.0Ah

编 制: 方东林

审 核: 曹凯/韦晓敏

批 准: 陈 伟

发放部门: 电池技术研究院

生效日期: 2025-06-19

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产品变更履历表

版本	变更内容	变更日期	编制	审核	批准
A	初版发行	2023-06-20	方东林	韦晓敏	陈伟
B	1.修改电池重量为 $265 \pm 5\text{g}$ 2.修改低温充电截至电压 $-10^{\circ}\text{C} \leq T \leq$ 为 3.65V , $-20^{\circ}\text{C} \leq T \leq -10^{\circ}\text{C}$ 为 3.5V	2023-12-15	方东林	韦晓敏	陈伟
C	1. 脉冲放电, 条件: $25^{\circ}\text{C} <$ 电池表面温度 $< 60^{\circ}\text{C}$, 且电池 SOC $> 50\%$; 规格: 支持 15C , $3\text{s} \rightarrow$ 支持 20C , 3s 2. 25°C 循环, 条件: 25°C , 0.5C $2 \sim 3.95\text{V}$, 容量保持率 $\geq 70\%$; 规格: $\geq$ 3000 次 $\rightarrow \geq 5000$ 次 3. 电芯重量, 规格: $265 \pm 5\text{g} \rightarrow 266 \pm 4\text{g}$	2025-04-09	黄庭远	韦晓敏	陈伟
D	1. 增加电池本体喷码 32140NSMP10 与产品型号的等效性说明	2025-06-06	黄庭远	韦晓敏	陈伟
E	1. 增加英文版本	2025-06-19	黄庭远	曹凯/韦晓敏	陈伟

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1. 适用范围

本产品规格书描述了型号为 NaCR32140-MP10 钠离子电池的产品性能指标。

本产品主要参考以下标准进行性能指标的评价：

GB 38031 《电动汽车用动力蓄电池安全要求》

GB/T 31486 《电动汽车用动力蓄电池电性能要求及试验方法》

GB/T 31484 《电动汽车用动力蓄电池循环寿命要求及试验方法进行性能指标的评价》

GB/T 31485—2015 《电动汽车用动力蓄电池安全要求及试验方法》

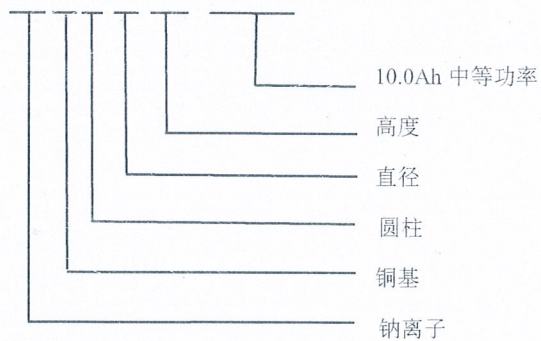
UL 1642

2. 产品类型

2.1 名称：圆柱形钠离子电池

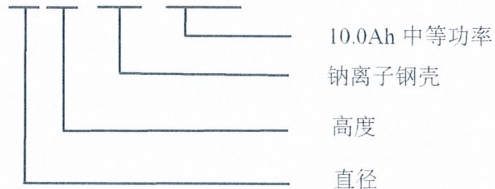
2.2 型号：Na C R 32140-MP10

型号：Na C R 32140 -MP10



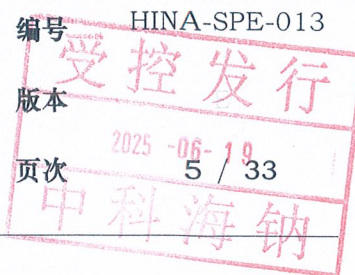
2.3 电池本体喷码：32140NSMP10（产品型号的等效标识）

电池本体喷码：32140 NS MP10



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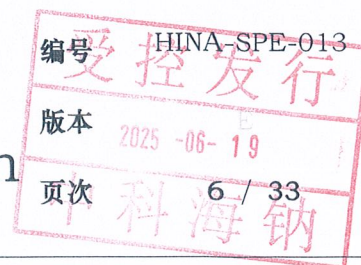
3. 电池参数

3.1 基本参数

序号	项目	标准		备注
1	标称容量 @3.95V~2.0V	10.0	Ah	0.5C 放电@25℃
2	额定电压	3.0	V	/
3	交流内阻	≤3	mΩ	AC 1 kHz, 3.2V
4	直流内阻	≤10	mΩ	2C 30s, 3.2V
5	电池重量	266±4	g	/
6	电池尺寸	直径: Φ33.2±0.2 高度: 140±0.3	mm	外形尺寸
7	充电截止电压	3.95 3.65 3.50	V	0℃<T -10℃≤T≤0℃ -20℃≤T<-10℃
8	充电截止电流	500(0.05C) 1000(0.1C)	mA	T>0℃ T≤0℃
9	放电截止电压	2.0	V	可放电至 0V
10	标准连续充电电流	5000	mA	0.5C
11	最大连续充电电流	30000	mA	3C CC to 3.95V 充入容量>90% 温升<20℃
12	标准连续放电电流	5000	mA	0.5C
13	最大连续放电电流	30000	mA	3C CC to 2V 放出容量>90% 温升<20℃
14	能量密度	≥110	Wh/kg	/

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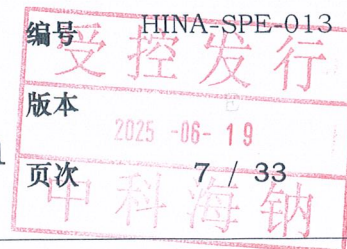
3.2 电性能参数

3.2.1 充电性能

项目	子项目	电池表面温度	标准充电	快速充电	脉冲充电
充电性能	温度与充电性能	>70℃	不允许充电		
		45~70℃	0.5C	2C	不允许充电
		30~45℃	0.5C	3C	5C 且 电池 SOC≤40%，时间<8min
		15~30℃	0.5C	1C	3C 且 电池 SOC≤50%，时间<15min
		0~15℃	0.33C	0.5C	不允许充电
		-10~0℃	0.2C (3.65V) 70%SOC	不允许充电	
		-20~-10℃	0.1C (3.5V) 60%SOC	不允许充电	
	子项目	电池表面温度	产品规格	条件	
	倍率	25±2℃	充电容量≥95%额定充电容量	2C CC to 3.95V 温升≤8℃	
		25±2℃	充电容量≥90%额定充电容量	3C CC to 3.95V 温升≤15℃	

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3.2.2 放电性能

项目	参数		性能指标		条件
放电性能	典型温度与放电能力		-30℃	≥75%	搁置 12h, 标准放电电流下放电容量相对于标称容量
			-20℃	≥85%	
			0℃	≥90%	
			25℃	≥100%	
			45℃	≥100%	
			60℃	≥95%	
	放电温度区间		-40℃~70℃		无论何时电池温度超过此温度, 应停止工作
	倍率放电能力	标准放电电流	0.5C	≥100%	25℃, 标准充放电下相对容量
		最大持续放电电流	3C	≥90%	25℃, 标准充放电下相对容量
		最大脉冲放电电流 (长时间)	10C	30s	25℃ < 电池表面温度 < 60℃, SOC > 50%
		最大脉冲放电电流 (短时间)	20C	3s	25℃ < 电池表面温度 < 60℃, 且电池 SOC > 50%

3.2.3 存储性能

项目	子项目	参数	性能指标		条件
存储性能	短期	超高温存储	保持率	≥90%	25℃下核容, 75℃下存储 3 天, 100%SOC
			恢复率	≥98%	
		高温存储	保持率	≥90%	25℃下核容, 45℃下存储 7 天, 100%SOC
			恢复率	≥98%	
		低温存储	保持率	≥95%	25℃下核容, -20℃下存储 7 天, 100%SOC
			恢复率	≥98%	
	长期	高温存储	保持率	≥90%	25℃下核容, 35℃下存储 90 天, 40%SOC
			恢复率	≥98%	
		常温存储	恢复率	≥98% (28d ≥ 99%)	25±5℃下存储 180 天, 40%SOC

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3.2.4 寿命

项目	参数	性能指标 (次)	条件	备注
寿命	高温循环	≥ 2000	45℃, 0.5C, 容量保持率至 70%	具体取决于使用工况
	常温循环	≥ 5000	25℃, 0.5C, 容量保持率至 70%	
	倍率循环	≥ 1500	25℃, 2C 不恒压, 容量保持率至 70%	
	常温过放特性循环	≥ 100	25℃, 0.5C, 0~3.95V, 容量保持率至 95%	

3.3 安全性能

下述试验应在有强制排风条件及防爆措施的装置内进行, 在实验前所有电池都按规定 4.1.2 标准充电方式充电, 并搁置 12h 后, 再进行以下试验。

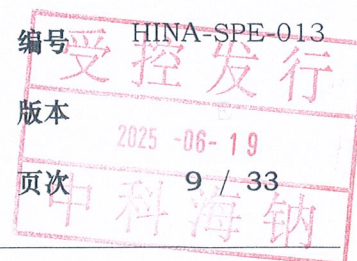
项目	测试方法	检验标准
过放电	GB 38031 8.1.2	电池应不起火、不爆炸
过充电	GB 38031 8.1.3	电池应不起火、不爆炸
外部短路测试	GB 38031 8.1.4	电池应不起火、不爆炸
加热测试	GB 38031 8.1.5	电池应不起火、不爆炸
挤压测试	GB 38031 8.1.7	电池应不起火、不爆炸
重物冲击测试	UL 1642-14	电池应不起火、不爆炸

3.4 环境适应性

项目	测试方法	检验标准及说明
跌落测试	GB/T 31485 6.2.5	电池应不漏液、不起火、不爆炸
机械冲击测试	UL1642-15	在运输和操作中遭受冲击时, 不应引起着火, 爆炸或泄漏
振动测试	UL1642-16	在运输途中遭受振动时, 不应引起泄漏、着火或爆炸
温度循环测试	UL1642-18	反复暴露在高低温中, 不应引起着火或爆炸
低气压测试	UL1642-19	在运输途中, 处于飞行器货舱中不应引起着火或爆炸

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4. 测试方法

4.1 标准测试条件

4.1.1 温度与湿度

若无特别要求，此规格书上的产品测试，条件均为温度 $25 \pm 2^\circ\text{C}$ ；湿度： $65 \pm 20\%\text{RH}$ 。

4.1.2 标准充电方式

“标准充电”即在环境温度为 $25 \pm 2^\circ\text{C}$ 的条件下，先以恒定电流 0.5C 充电至 3.95V ，再以 3.95V 恒压充电至电流小于 0.05C 。

4.1.3 标准放电方式

“标准放电”即在环境温度为 $25 \pm 2^\circ\text{C}$ 的条件下，以恒定电流 0.5C 放电至 2.0V 。

4.2 电性能测试

4.2.1 充电性能

4.2.1.1 温度与充电性能

电池按标准放电方式放电结束后，将电池放入环境试验箱内并按规定设定电池表面温度值且保持 6h ，然后分别按“标准充电”“快速充电”“脉冲充电”的倍率和时间进行充电。

4.2.1.2 倍率

电池按标准放电方式放电结束后，将电池放入环境试验箱内设定 25°C 并保持 6h ，然后电池分别以 $2\text{C}/3\text{C}$ 恒流充电至 3.95V 。

4.2.2 放电性能

4.2.2.1 典型温度与放电能力

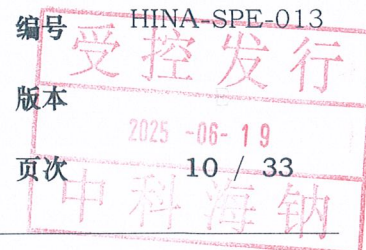
电池按标准充电方式充电结束后，将电池放入环境试验箱内按性能指标规定的温度设定并在该温度下保持 12h ，然后以 0.5C 放电至 2.0V 。

4.2.2.2 倍率放电能力

电池按标准充电方式充电结束后，将电池放入环境试验箱内并设定为 25°C 且保持该温度 4h ，再以 3.2.2 表格列出的倍率及时间放电至电压达到 2.0V 。

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4.2.3 存储性能

4.2.3.1 短期

a) 超高温存储

电池按标准充电方式充电，搁置 30min，将电池放入环境试验箱内并设定为 75℃且保持该温度 3 天，将电池取出放入 4.4.1 规定环境下 6h，将电池按标准放电方式放电。

b) 高温存储

电池按标准充电方式充电，搁置 30min，将电池放入环境试验箱内并设定为 45℃且保持该温度 7 天，将电池取出放入 4.4.1 规定环境下 6h，将电池按标准放电方式放电。

c) 低温存储

电池按标准充电方式充电，搁置 30min，将电池放入环境试验箱内并设定为 -20℃且保持该温度 7 天，将电池取出放入 4.4.1 规定环境下 6h，将电池按标准放电方式放电。

4.2.3.2 长期

a) 高温存储

电池按标准充电方式充电，以 0.5C 放电 72min，搁置 30min，将电池放入环境试验箱内并设定为 35℃且保持该温度 90 天，将电池取出放入 4.4.1 规定环境下 6h，先将电池按标准放电方式放电，搁置 30min，然后将电池按标准充电方式进行充电，最后将电池按标准放电方式放电。

b) 常温存储

电池按标准充电方式充电，以 0.5C 放电 72min，搁置 30min，将电池放入 25±5℃环境内并且保持该温度 180 天，并每 30 天采集电池一次电池 OCV 及 ACR，将电池取出放入 4.4.1 规定环境下 6h，先将电池按标准放电方式放电，搁置 30min，然后将电池按标准充电方式进行充电，最后将电池按标准放电方式放电。

4.2.4 寿命

4.2.4.1 高温循环

- 将电池放入 45±2℃的环境试验箱搁置 4h;
- 将电池在 45±2℃下以 0.5C 恒流充电至 3.95V，恒压 3.95V 充电至电流小于 0.05C，并搁置 30min;
- 将电池在 45±2℃下以 0.5C 恒流放电至 2.0V 并搁置 30min;
- 重复工步 b~c 直到容量低于初始容量的 70%。

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4.2.4.2 常温循环

- a) 将电池放入 $25 \pm 2^\circ\text{C}$ 的环境试验箱搁置 4h;
- b) 将电池在 $25 \pm 2^\circ\text{C}$ 下以 0.5C 恒流充电至 3.95V, 恒压 3.95V 充电至电流小于 0.05C, 并搁置 30min;
- c) 将电池在 $25 \pm 2^\circ\text{C}$ 下以 0.5C 恒流放电至 2.0V 并搁置 30min;
- d) 重复工步 b~c 直到容量衰减为初始容量 70%。

4.2.4.3 倍率循环

- a) 将电池放入 $25 \pm 2^\circ\text{C}$ 的环境试验箱搁置 4h;
- b) 将电池在 $25 \pm 2^\circ\text{C}$ 下以 2C 恒流充电至 3.95V, 并搁置 30min;
- c) 将电池在 $25 \pm 2^\circ\text{C}$ 下以 2C 恒流放电至 2.0V 并搁置 30min;
- d) 重复工步 b~c 直到容量衰减为初始容量的 70%。

4.2.4.4 过放特性循环

- a) 将电池放入 $25 \pm 2^\circ\text{C}$ 的环境试验箱搁置 4h;
- b) 将电池在 $25 \pm 2^\circ\text{C}$ 下以 0.5 恒流充电至 3.95V, 恒压 3.95V 充电至电流小于 0.05C, 并搁置 30min;
- c) 将电池在 $25 \pm 2^\circ\text{C}$ 下以 0.5C 恒流放电至 0V 并搁置 30min;
- d) 重复工步 b~c 共计 100 次。

4.2.5 安全测试

4.2.5.1 过放电

电池以 1C 电流放电, 直至放电时间到达 90min, 观察 1h。

4.2.5.2 过充电

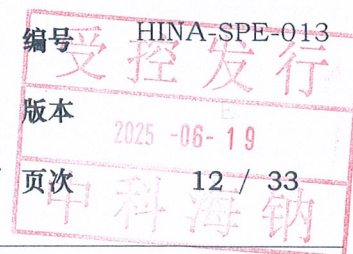
电池按标准充电制式充电结束后, 对电池以 1C 恒流充电至 4.345V 或 115% SOC 后停止充电, 观察 1h。

4.2.5.3 外部短路测试

将电池正极端子和负极端子经外部短路 10min(外部线路电阻 $<5\text{m}\Omega$), 观察 1h。

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4.2.5.4 加热测试

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

4.2.5.5 挤压测试

电池放在挤压设备的两个挤压面之间，圆柱电池芯轴平行于挤压平面，以 $\leq 2\text{mm/s}$ 的挤压速度，逐渐增加压力至电压达到 0V 或变形量达到 15% 或挤压力达到 100kN 或 1000 倍电池重量，保持压力 10min，观察 1h。

4.2.5.6 重物冲击测试

将电池放在冲击台上，将一个 $\phi 15.8\text{mm}$ 的钢柱置放电池中心，钢柱的纵轴平行于平面，让重量 9.1kg 重锤自 610mm 高度自由落下，冲击电池，电池允许发生变形。

4.2.6 环境适应性

4.2.6.1 跌落测试

电池按标准充电制式充电结束后，将电池样品的正负极端子向下由高度为 1.5m 的位置自由跌落到水泥地面上，观察 1h。

4.2.6.2 机械冲击测试

电池按照平面的刚性安装方式固定在测试设备上。每个单体电池均应承受 3 个等加速度的冲击。每个电池沿三个相互垂直的方向承受冲击，除非电池只有两个对称轴。每次冲击的方向通常应直于单体电池的表面。加速度要求：初始 3ms 内最小平均加速度应达到 75g (g 代表重力加速度)，峰值加速度介于 125~175g 之间。测试温度为 $25 \pm 5^\circ\text{C}$ 。

4.2.6.3 振动试验

电池应经受振幅为 0.8mm 振动，振动频率在 10~55Hz 范围内以 1Hz/min 的速率变化，并在 90~100min 内循环一次。电池沿 3 个相互垂直的方向振动。对于只有两个对称轴的电池，电池应沿垂直于每个轴的方向测试。

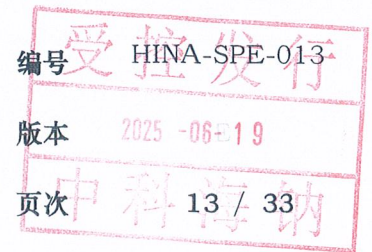
4.2.6.4 温度循环测试

电池放于温度试验箱内并承受以下循环：

- a) 30min 内升温至 $70 \pm 3^\circ\text{C}$ ，保温 4h；
- b) 30min 内降温至 $20 \pm 2^\circ\text{C}$ ，保温 2h；
- c) 30min 内降温至 $-40 \pm 3^\circ\text{C}$ ，保温 4h；

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- d) 30min 内升温至 $20 \pm 2^\circ\text{C}$;
- e) 再重复上述循环 9 次;
- f) 10 次循环后, 电池在 $20 \pm 5^\circ\text{C}$ 的室温下放置 7 天待检。

4.2.6.5 低气压测试

样品电池在绝对压力为 11.6kPa、温度为 $20 \pm 5^\circ\text{C}$ 条件下贮存 6h。

5.说明及注意事项

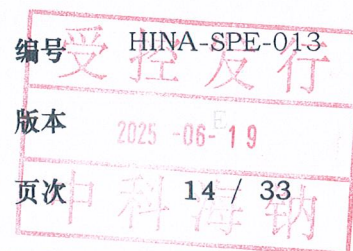
5.1 电池使用说明

5.1.1 温度梯度充电方案

最大充电倍率 C	SOC	温度梯度							
		$-20^\circ\text{C} \sim -10^\circ\text{C}$	$-10^\circ\text{C} \sim 0^\circ\text{C}$	$0^\circ\text{C} \sim 10^\circ\text{C}$	$10^\circ\text{C} \sim 20^\circ\text{C}$	$20^\circ\text{C} \sim 45^\circ\text{C}$	$45^\circ\text{C} \sim 55^\circ\text{C}$	$55^\circ\text{C} \sim 70^\circ\text{C}$	$70^\circ\text{C} \sim 85^\circ\text{C}$
	100%	/	/	0.05	0.05	0.05	0.05	0	0
	90%	/	/	0.10	0.75	0.50	0.50	0.20	0.1
	80%	/	/	0.30	0.75	3.00	1.00	0.50	0.1
	70%	/	0.20	0.30	0.75	3.00	1.00	0.50	0.1
	60%	0.10	0.20	0.30	0.75	3.00	1.00	0.50	0.1
	50%	0.10	0.20	0.30	0.75	3.00	1.00	0.50	0.1
	40%	0.10	0.20	0.30	0.75	3.00	1.00	0.50	0.1
	30%	0.10	0.20	0.30	0.75	3.00	1.00	0.50	0.1
20%	0.10	0.20	0.30	0.75	3.00	1.00	0.50	0.50	0.1
10%	0.10	0.20	0.30	0.75	0.75	0.50	0.50	0.50	0.1
0%	0.10	0.20	0.30	0.50	0.50	0.50	0.50	0.50	0.1

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5.1.2 温度梯度放电方案

最大放电倍率 C	SOC	温度梯度							
		-40℃~-30℃	-30℃~-10℃	-10℃~-10℃	10℃~20℃	20℃~45℃	45℃~55℃	55℃~70℃	70℃~85℃
	100%	2.00	3.00	3.00	3.00	3.00	1.00	0.50	0.2
	90%	2.00	3.00	3.00	3.00	3.00	1.00	0.50	0.2
	80%	2.00	3.00	3.00	3.00	3.00	1.00	0.50	0.2
	70%	2.00	3.00	3.00	3.00	3.00	1.00	0.50	0.2
	60%	2.00	2.00	3.00	3.00	3.00	1.00	0.50	0.2
	50%	1.00	2.00	2.00	3.00	3.00	1.00	0.50	0.2
	40%	1.00	1.00	2.00	2.00	3.00	1.00	0.50	0.2
	30%	0.50	1.00	1.00	2.00	3.00	1.00	0.50	0.2
	20%	0.50	0.50	0.50	1.00	2.00	1.00	0.50	0.2
	10%	0.20	0.20	0.50	0.50	0.75	0.50	0.50	0.2

5.1.3 运输

电池运输荷电状态为 30~50%SOC，电池包装成箱进行运输，在运输过程中应防止剧烈振动、冲击或挤压，防止日晒雨淋，不得倒置。

在装卸过程中，产品应轻搬轻放，严防摔掷、翻滚、重压。

5.1.4 存储

长期储存的电池超过 6 个月须置于干燥、通风处，储存荷电状态为 20~50%SOC，且每 6 个月对电池进行一次充放电循环。

5.2 安全守则

滥用钠离子充电电池可能会造成电池的损害或人身伤害,在使用钠离子电池以前，请仔细阅读以下的安全守则：

注释 1：如果客户需要将电池在该文件之外的条件下操作应用，请先咨询公司相关事宜。

注释 2：在该文件说明的条件之外使用该电池而产生的事故，公司不承担任何责任。

5.2.1 电池防范措施

a) 不要将电池投入火中或加热。

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- b) 不要将电池短路，过充。
- c) 不要使电池承受过重的机械冲击。
- d) 不要将电池浸入海水或水中，或者使其吸湿。
- e) 不要颠倒电池的正负极。
- f) 不要拆卸或修整电池。
- g) 不要使电池受到明显的损害或变形。
- h) 不要直接接触泄漏的电池。
- i) 将电池放置在远离儿童的地方。
- j) 不要针刺，锤打或踩踏电池。
- k) 不要撞击或投掷电池。

6.修订声明

因不断地改善产品质量、特性的需要，本公司有权对产品规格书及维护特性进行修订，修订后将不预先通知用户。

7.其他事项

本规格书中未提及的事项，须经本公司确认，本公司保留对此规格书中所述内容的最终解释权。

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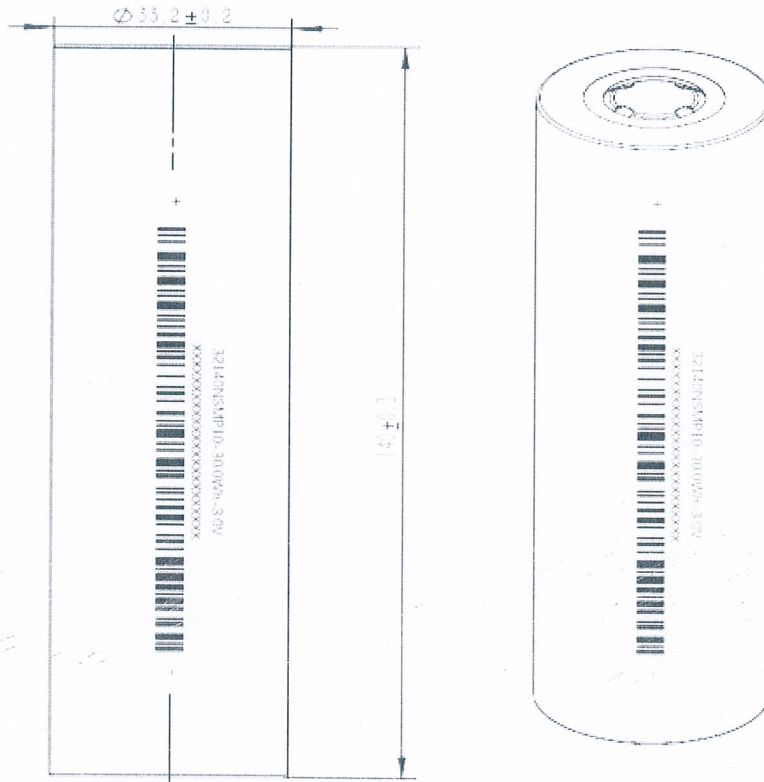
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8.附录

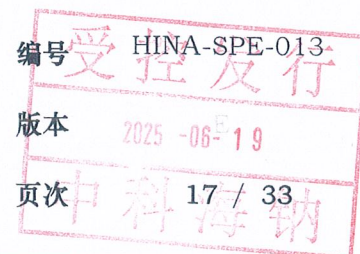
8.1 电池外观及尺寸

电池表面喷码为:32140NSMP10 (对应产品型号 NaCR32140-MP10)。

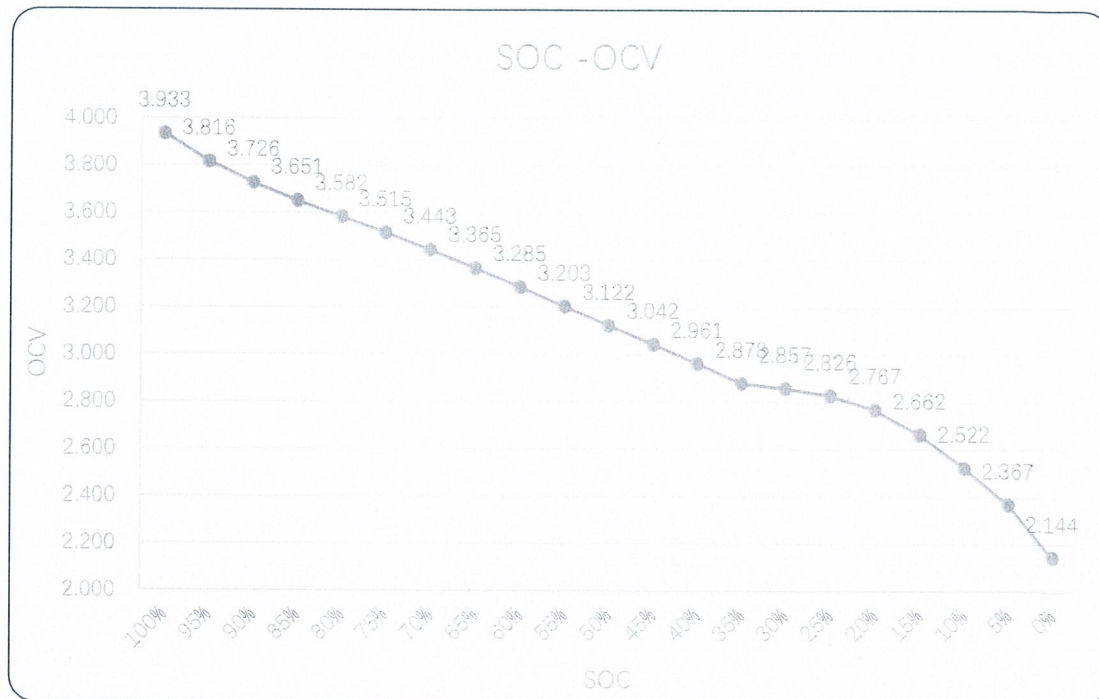


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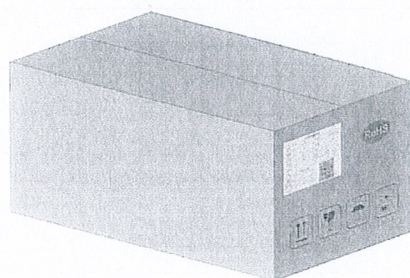
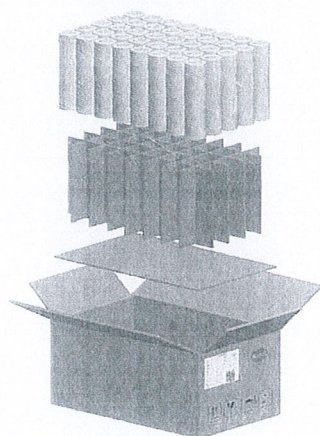


8.2 SOC-OCV



8.3 包装方式

每箱装入 40pcs 电池, 箱体外部张贴 RoHS 标识及成品电池标识卡, 如图所示。外箱标签印刷产品型号: NaCR32140-MP10, 内部电池喷码: 32140NSMP10。



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Product Specification



Cylindrical Na-Ion Battery Specification

Model: NaCR32140-MP10

Nominal Capacity: 10.0 Ah

Documentarian: Donglin Fang

Reviewer: Kai Cao/Xiaomin Wei

Approver: Wei Chen

Distribution Department: Battery Technology Research Institute

Effective Date: 2025-06-19

HiNa Battery Technology Co., Ltd

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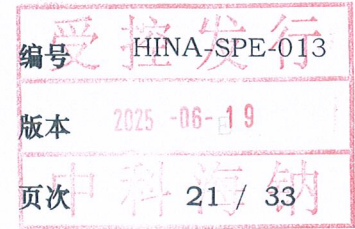
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Product Change History Form

Versions	Changes	Date of change	Documentarian	Reviewer	Approver
A	First edition	2023-06-20	Donglin Fang	Xiaomin Wei	Wei Chen
B	1. Modify the battery weight to $265\pm 5\text{g}$. 2. Modify the low-temperature charging cut-off voltage: 3.65V when $-10^{\circ}\text{C}\leq T\leq 0^{\circ}\text{C}$, and 3.5V when $-20^{\circ}\text{C}\leq T\leq -10^{\circ}\text{C}$.	2023-12-15	Donglin Fang	Xiaomin Wei	Wei Chen
C	1. Pulse discharge, conditions: battery surface temperature between 25°C and 60°C , and $\text{SOC} > 50\%$. Specification: support 15C for 3s→support 20C for 3s. 2. 25°C cycle test, conditions: 25°C , 0.5C, 2.0-3.95V, capacity retention rate $\geq 70\%$. Specification: cycle life ≥ 3000 cycles→ ≥ 5000 cycles. 3. Cell weight, specification: $265\pm 5\text{g}\rightarrow 266\pm 4\text{g}$.	2025-04-09	Tingyuan Huang	Xiaomin Wei	Wei Chen
D	1. Add battery body inkjet code 32140NSMP10 and an equivalence explanation for the product model.	2025-06-06	Tingyuan Huang	Xiaomin Wei	Wei Chen
E	1. Add English version.	2025-06-19	Tingyuan Huang	Kai Cao/Xiaomin Wei	Wei Chen

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1. Scope of Application

This product specification describes the product performance indicators of NaCR32140-MP10 Na-ion battery.

This product mainly refers to the following standards for performance index evaluation:

GB 38031 *Safety requirements for power batteries for electric vehicles*

GB/T 31486 *Electrical performance requirements and test methods for electric vehicles with power batteries*

GB/T 31484 *The cycle life requirements and the test method evaluation for the performance indicators for electric vehicles with power batteries*

GB/T 31485—2015 *Safety requirements and test methods for electric vehicles with power batteries*

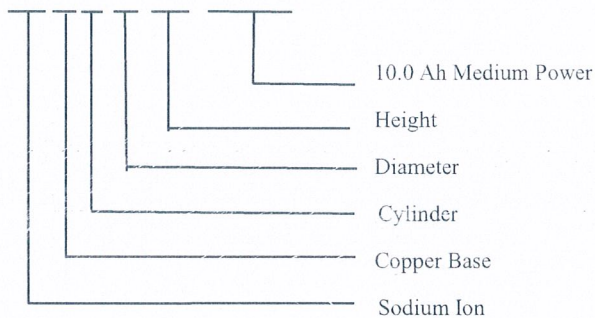
UL 1642

2. Product Type

2.1 Product Name: Cylindrical Na-Ion Battery

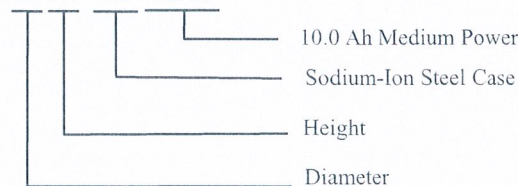
2.2 Model: Na C R 32140-MP10

Model: Na C R 32 140 - MP10



2.3 Battery body inkjet code: 32140NSMP10 (Equivalent Identification for Product Model)

Battery body inkjet: 32 140 NS MP10



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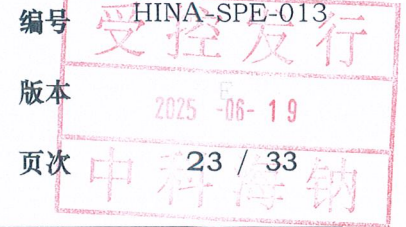
3. Battery Parameters

3.1 Basic Parameters

NO.	Content	Standards		Remarks
1	Nominal capacity @3.95V~2.0V	10.0	Ah	0.5C discharge @ 25°C
2	Nominal voltage	3.0	V	/
3	AC internal resistance	≤ 3	mΩ	AC 1kHz, 3.2V
4	DC internal resistance	≤ 10	mΩ	2C 30s, 3.2V
5	Battery weight	266±4	g	/
6	Battery dimension	Diameter: Φ33.2 ± 0.2 Height: 140 ± 0.3	mm	Format dimension
7	Charge cut-off voltage	3.95 3.65 3.50	V	0°C < T -10°C ≤ T ≤ 0°C -20°C ≤ T < -10°C
8	Charge cut-off current	500 (0.05C) 1000 (0.1C)	mA	T > 0°C T ≤ 0°C
9	Discharge cut-off voltage	2.0	V	Could discharge to 0V
10	Standard continuous charge current	5000	mA	0.5C
11	Maximum continuous charge current	30000	mA	3C CC to 3.95V, Charge capacity > 90%, Temperature rise < 20°C
12	Standard continuous discharge current	5000	mA	0.5C
13	Maximum continuous discharge current	30000	mA	3C CC to 2V, Discharge capacity > 90%, Temperature rise < 20°C
14	Energy density	≥ 110	Wh/kg	/

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3.2 Electrical Performance Parameters

3.2.1 Charge Performance

Projects	Subprojects	Battery surface temperature	Standard charge	Fast charge	Pulse charge
Charge performance	Temperature and charge performance	> 70°C	Charge is not allowed		
		45 ~ 70°C	0.5C	2C	Charge is not allowed
		30 ~ 45°C	0.5C	3C	5C and battery SOC ≤ 40%, time < 8 min
		15 ~ 30°C	0.5C	1C	3C and battery SOC ≤ 50%, time < 15 min
		0 ~ 15°C	0.33C	0.5C	Charge is not allowed
		-10 ~ 0°C	0.2C (3.65V) 70% SOC	Charge is not allowed	
		-20 ~ -10°C	0.1C(3.5V) 60% SOC	Charge is not allowed	
	Subprojects	Battery surface temperature	Product specifications	Conditions	
	Rate performance	25±2°C	Charge capacity ≥ 95% nominal charge capacity	2C CC to 3.95V Temperature rise ≤ 8°C	
		25±2°C	Charge capacity ≥ 90% nominal charge capacity	3C CC to 3.95V Temperature rise ≤ 15°C	

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3.2.2 Discharge Performance

Projects	Parameters		Performance indicators		Conditions
Discharge performance	Typical temperature and discharge capability		-30°C	≥ 75%	Rest for 12h, the discharge capacity is relative to the nominal capacity under the standard discharge current
			-20°C	≥ 85%	
			0°C	≥ 90%	
			25°C	≥ 100%	
			45°C	≥ 100%	
			60°C	≥ 95%	
	Discharge temperature range		-40°C ~ 70°C		Whenever the battery temperature exceeds this temperature, it should stop working
	Rate discharge capability	Standard discharge current	0.5C	≥ 100%	25°C, relative capacity at standard charge and discharge
		Maximum continuous discharge current	3C	≥ 90%	25°C, relative capacity at standard charge and discharge
		Maximum pulse discharge current (long time)	10C	30s	25°C < battery surface temperature < 60°C, SOC > 50%
		Maximum pulse discharge current (short time)	20C	3s	25°C < battery surface temperature < 60°C, and battery SOC > 50%

3.2.3 Calendar Performance

Projects	Subprojects	Parameters	Performance indicators		Conditions
Calendar performance	Short term	Ultra-high temperature storage	Retention rate	≥ 90%	Initial discharge per 4.1.3, rest for 30 min, Initial charge per 4.1.2 at 25°C. Store at 75°C for 3 days, 100% SOC
			Recovery rate	≥ 98%	
		High-temperature storage	Retention rate	≥ 90%	Initial discharge per 4.1.3, rest for 30 min, Initial charge per 4.1.2 at 25°C. Store at 45°C for 7 days, 100% SOC
			Recovery rate	≥ 98%	
		Low-temperature storage	Retention rate	≥ 95%	Initial discharge per 4.1.3, rest for 30 min, Initial charge per 4.1.2 at 25°C. Store at -20°C for 7 days, 100% SOC
			Recovery rate	≥ 98%	
	Long term	High-temperature storage	Retention rate	≥ 90%	Store at 35°C for 90 days, 40% SOC
			Recovery rate	≥ 98%	
		Room-temperature storage	Retention rate	≥ 98% (28 d ≥ 99%)	Store at 25±5°C for 180 days, 40% SOC

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3.2.4 Cycle Life

Projects	Parameters	Performance indicators (cycles)	Conditions	Remarks
Cycle life	High-temperature cycle	≥ 2000	45°C, 0.5C, capacity retention rate $\geq 70\%$	Specifically depending on the operating conditions.
	Room-temperature cycle	≥ 5000	25°C, 0.5C, capacity retention rate $\geq 70\%$	
	Rate cycle	≥ 1500	25°C, 2C non-constant voltage, capacity retention rate $\geq 70\%$	
	Room-temperature over discharge characteristic cycle	≥ 100	25°C, 0.5C, 0 ~ 3.95V, capacity retention rate $\geq 95\%$	

3.3 Safety Performance

The following tests should be carried out in a device with forced exhaust conditions and explosion-proof measures, and all batteries should be charged according to the standard charge method of 4.1.2 before the experiment. Rest for 12 h, then carry out the following tests.

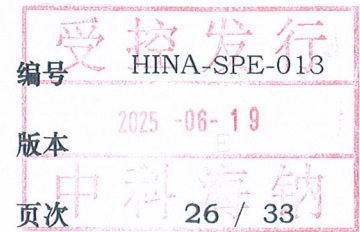
Projects	Test methods	Inspection standards
Over discharge	GB 38031 8.1.2	The battery should not fire or explode
Over charge	GB 38031 8.1.3	The battery should not fire or explode
External short-circuit test	GB 38031 8.1.4	The battery should not fire or explode
Heating test	GB 38031 8.1.5	The battery should not fire or explode
Crush test	GB 38031 8.1.7	The battery should not fire or explode
Heavy impact test	UL 1642-14	The battery should not fire or explode

3.4 Environmental Adaptability

Projects	Test methods	Inspection standards and instructions
Drop test	GB/T 31485 6.2.5	The battery should not leak, fire or explode
Mechanical impact test	UL1642-15	When subjected to impact during transportation and operation, it should not cause fire, explosion or leakage
Vibration test	UL1642-16	When subjected to vibration during transportation, it should not cause leakage, fire or explosion
Temperature cycle test	UL1642-18	Repeated exposure to high and low temperatures should not cause fire or explosion
Low atmospheric pressure test	UL1642-19	During transportation, being in the cargo hold of the aircraft should not cause fire or explosion

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4. Test Methods

4.1 Standard Test Conditions

4.1.1 Temperature and Humidity

If there are no special requirements, the product test conditions on this specification are temperature $25\pm 2^{\circ}\text{C}$; Humidity: $65\pm 20\%$ RH.

4.1.2 Standard Charge Method

"Standard charge" means that under the condition that the ambient temperature is $25\pm 2^{\circ}\text{C}$, it is first charged at a constant current 0.5C to 3.95V, and then charged at 3.95V constant voltage to the current to less than 0.05C.

4.1.3 Standard Discharge Method

"Standard discharge" means that under the condition that the ambient temperature is $25\pm 2^{\circ}\text{C}$, the constant current is 0.5C to discharge to 2.0V.

4.2 Electrical Performance Tests

4.2.1 Charge Performance

4.2.1.1 Temperature and Charge Performance

After the battery is discharged according to the standard discharge method, the battery is placed in the environment test chamber and the surface temperature value of the battery is set according to the regulations and maintained for 6 h, and then charges according to the rate and time of 'Standard Charge', 'Fast Charge' and 'Pulse Charge'.

4.2.1.2 Rate

After the battery is discharged according to the standard discharge method, the battery is placed in the environment test chamber to set at 25°C and kept 6 h, and then the battery is charged to 3.95V at 2C/3C constant current respectively.

4.2.2 Discharge Performance

4.2.2.1 Typical Temperature and Discharge Capability

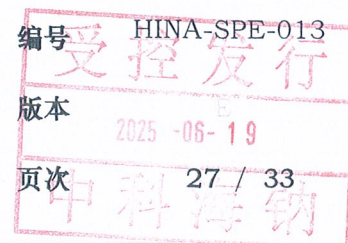
After charged according to the standard charge method, the battery is placed in the environment test chamber to set the temperature specified by the performance index and kept it at the temperature for 12 h, and then discharge to 2.0V at 0.5C.

4.2.2.2 Rate Discharge Capability

After charged according to the standard charge method, the battery is placed in the environmental test chamber and set to 25°C and maintained at this temperature for 4 h, then discharge to a voltage of 2.0V at the rate and time listed in Table 3.2.2.

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4.2.3 Calendar Performance

4.2.3.1 Short Term

a) Ultra-high Temperature Storage

The battery is charged according to the standard charge method, rest for 30 min, put the battery into the environmental test chamber and set it to 75 °C and keep the temperature for 3 days, take out the battery and put it in the environment specified in 4.4.1 for 6 h, and discharge the battery according to the standard discharge mode.

b) High-temperature Storage

The battery is charged according to the standard charge method, rest for 30 min, put the battery into the environmental test chamber and set it to 45 °C and keep the temperature for 7 days, take out the battery and put it in the environment specified in 4.4.1 for 6 h, and discharge the battery according to the standard discharge mode.

c) Low-temperature Storage

The battery is charged according to the standard charge method, rest for 30 min, put the battery into the environmental test chamber and set it to -20 °C and keep the temperature for 7 days, take out the battery and put it in the environment specified in 4.4.1 for 6 h, and discharge the battery according to the standard discharge mode.

4.2.3.2 Long Term

a) High-temperature Storage

The battery is charged according to the standard charge method, discharged at 0.5C for 72 min, rest for 30 min, put the battery into the environment test chamber and set it to 35°C and keep the temperature for 90 days, take out the battery and put it in the environment specified in 4.4.1 for 6 h, first discharge the battery according to the standard discharge mode, rest for 30 min, then charge the battery according to the standard charge method, and finally discharge the battery according to the standard discharge method.

b) Room-temperature Storage

The battery is charged according to the standard charge method, discharged at 0.5C for 72 min, rest for 30 min, put the battery into a 25±5°C environment and keep the temperature for 180 days, and collect the battery OCV and ACR every 30 days, take out the battery and put it in the environment specified in 4.4.1 for 6 h, first discharge the battery according to the standard discharge mode, rest for 30 min, then charge the battery according to the standard charge method, and finally discharge the battery according to the standard discharge method.

4.2.4 Cycle Life

4.2.4.1 High-temperature Cycle

- Put the battery into an environmental test chamber at 45±2°C and rest for 4 h;
- Charge the battery at 45±2°C at 0.5C constant current to 3.95V, constant voltage 3.95V to a current less than 0.05C and rest for 30 min;
- Discharge the battery to 2.0V at 0.5C constant current at 45±2°C and rest for 30 min;
- Repeat steps b~c until the capacity is less than 70% of the initial capacity.

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4.2.4.2 Room-temperature Cycle

- Put the battery into an environmental test chamber at $25\pm 2^{\circ}\text{C}$ and rest for 4 h;
- Charge the battery at $25\pm 2^{\circ}\text{C}$ at 0.5C constant current to 3.95V, constant voltage 3.95V to a current less than 0.05C and rest for 30 min;
- Discharge the battery to 2.0V at 0.5C constant current at $25\pm 2^{\circ}\text{C}$ and rest for 30 min;
- Repeat steps b~c until the capacity decays to 70% of the initial capacity.

4.2.4.3 Rate Cycle

- Put the battery into an environmental test chamber at $25\pm 2^{\circ}\text{C}$ and rest for 4 h;
- Charge the battery at $25\pm 2^{\circ}\text{C}$ at 2C constant current to 3.95V, and rest for 30 min;
- Discharge the battery to 2.0V at 2C constant current at $25\pm 2^{\circ}\text{C}$ and rest for 30 min;
- Repeat steps b~c until the capacity decays to 70% of the initial capacity.

4.2.4.4 Over-discharge Characteristic Cycle

- Put the battery into an environmental test chamber at $25\pm 2^{\circ}\text{C}$ and rest for 4 h;
- Charge the battery at $25\pm 2^{\circ}\text{C}$ at 0.5C constant current to 3.95V, constant voltage 3.95V to a current less than 0.05C, and rest for 30 min;
- Discharge the battery to 0V at 0.5C constant current at $25\pm 2^{\circ}\text{C}$ and rest for 30 min;
- Repeat steps b~c for a total of 100 times.

4.2.5 Safety Test

4.2.5.1 Over Discharge

The battery is discharged at a current of 1C until the discharge time reaches 90 min, and observes for 1 h.

4.2.5.2 Over Charge

After the battery is charged according to the standard charge standard, the battery is charged to 4.345V or 115% SOC at a constant current of 1C and then stops charge and observes for 1 h.

4.2.5.3 External Short-circuit Test

The positive and negative terminals of the battery are short-circuited externally for 10 min (external line resistance $< 5\text{m}\Omega$) and observes for 1 h.

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4.2.5.4 Heating Test

Put the battery in an electric blower drying chamber, and the temperature is raised from room temperature to $130 \pm 2^\circ\text{C}$ at a rate of $5 \pm 2^\circ\text{C}/\text{min}$ and held for 30 min before stopping heating and observing for 1 h.

4.2.5.5 Crush Test

The battery is placed between the two extrusion surfaces of the extrusion equipment, the cylindrical battery mandrel is parallel to the extrusion plane, and the pressure is gradually increased to the voltage reaches 0V or the deformation reaches 15% or the extrusion force reaches 100 kN or 1000 times the battery weight at an extrusion speed of $\leq 2 \text{ mm/s}$, and the pressure is maintained for 10 min, observes for 1 h.

4.2.5.6 Heavy Impact Test

Put the battery on the impact table, place a $\phi 15.8 \text{ mm}$ steel column in the center of the battery, the longitudinal axis of the steel column is parallel to the plane, let the 9.1 kg hammer fall freely from the height of 610 mm, impact the battery. The battery is allowed to deform.

4.2.6 Environmental Adaptability

4.2.6.1 Drop Test

After the battery is charged according to the standard charge system, the positive and negative terminals of the battery sample are held downwards and freely dropped to the concrete floor from a height of 1.5 m and observes for 1 h.

4.2.6.2 Mechanical Impact Test

The battery is fixed to the test equipment in a flat rigid mounting manner. Each single cell should withstand 3 equal accelerations. Each cell bears the impact in three directions perpendicular to each other, unless the battery has only two axes of symmetry. The direction of each impact should usually be straight to the surface of the monomer battery. Acceleration requirements: The minimum average acceleration within the initial 3 ms should reach 75g (g-local gravitational acceleration), and the peak acceleration should be between 125-175g. The test temperature is $25 \pm 5^\circ\text{C}$.

4.2.6.3 Vibration Test

The battery should be subjected to an amplitude of 0.8 mm vibration, and the vibration frequency should change at a rate of 1 Hz/min in the range of 10-55 Hz, and cycle once within 90-100 min. The battery vibrates in 3 directions perpendicular to each other. For cells with only two axes of symmetry, the cells should be tested in a direction perpendicular to each axis.

4.2.6.4 Temperature Cycle Test

The battery is placed in a temperature chamber and subjected to the following cycles:

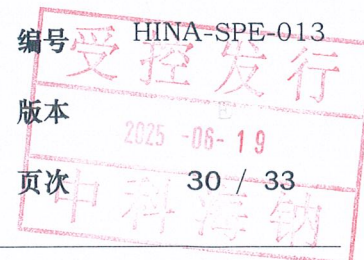
- Heat up to $70 \pm 3^\circ\text{C}$ within 30 min, keep warm for 4 h;
- Cool down to $20 \pm 2^\circ\text{C}$ within 30 min and keep warm for 2 h;
- Cool down to $-40 \pm 3^\circ\text{C}$ within 30 min and keep warm for 4 h;
- Rise the temperature to $20 \pm 2^\circ\text{C}$ within 30 min;
- Repeat the cycle 9 more times;
- After 10 cycles, the battery is left at room temperature of $20 \pm 5^\circ\text{C}$ for 7 days to be tested.

4.2.6.5 Low Atmospheric Pressure Test

The sample cells are stored for 6 h at an absolute pressure of 11.6 kPa and a temperature of $20 \pm 5^\circ\text{C}$.

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5. Instructions and Cautions

5.1 Battery Instructions

5.1.1 Temperature Charge Current Scheme

Maximum charge rate C	SOC	Charge Current Map							
		-20℃ ~ -10℃	-10℃ ~ 0℃	0℃ ~ 10℃	10℃ ~ 20℃	20℃ ~ 45℃	45℃ ~ 55℃	55℃ ~ 70℃	70℃ ~ 85℃
	100%	/	/	0.05	0.05	0.05	0.05	/	/
	90%	/	/	0.10	0.75	0.50	0.50	0.20	0.1
	80%	/	/	0.30	0.75	3.00	1.00	0.50	0.1
	70%	/	0.20	0.30	0.75	3.00	1.00	0.50	0.1
	60%	0.10	0.20	0.30	0.75	3.00	1.00	0.50	0.1
	50%	0.10	0.20	0.30	0.75	3.00	1.00	0.50	0.1
	40%	0.10	0.20	0.30	0.75	3.00	1.00	0.50	0.1
	30%	0.10	0.20	0.30	0.75	3.00	1.00	0.50	0.1
	20%	0.10	0.20	0.30	0.75	3.00	1.00	0.50	0.1
	10%	0.10	0.20	0.30	0.75	0.75	0.50	0.50	0.1
	0%	0.10	0.20	0.30	0.50	0.50	0.50	0.50	0.1

5.1.2 Temperature Discharge Current Scheme

Maximum discharge rate C	SOC	Discharge Current Map							
		-40℃ ~ -30℃	-30℃ ~ -10℃	-10℃ ~ 10℃	10℃ ~ 20℃	20℃ ~ 45℃	45℃ ~ 55℃	55℃ ~ 70℃	70℃ ~ 85℃
	100%	2.00	3.00	3.00	3.00	3.00	1.00	0.50	0.2
	90%	2.00	3.00	3.00	3.00	3.00	1.00	0.50	0.2
	80%	2.00	3.00	3.00	3.00	3.00	1.00	0.50	0.2
	70%	2.00	3.00	3.00	3.00	3.00	1.00	0.50	0.2
	60%	2.00	2.00	3.00	3.00	3.00	1.00	0.50	0.2
	50%	1.00	2.00	2.00	3.00	3.00	1.00	0.50	0.2
	40%	1.00	1.00	2.00	2.00	3.00	1.00	0.50	0.2
	30%	0.50	1.00	1.00	2.00	3.00	1.00	0.50	0.2
	20%	0.50	0.50	0.50	1.00	2.00	1.00	0.50	0.2
	10%	0.20	0.20	0.50	0.50	0.75	0.50	0.50	0.2

5.1.3 Transport

Battery transportation state of charge is 30% ~ 50% SOC, and the battery is packed into a box for transportation, in the process of transportation, should prevent severe vibration, impact, extrusion, sun, rain, and must not be inverted.

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In the process of loading and unloading, the product should be handled lightly to prevent falling, tumbling and heavy pressure.

5.1.4 Storage

Long-term storage of batteries for more than 6 months must be placed in a dry, ventilated place, storage state of charge of 20% ~ 50% SOC, and every 6 months to carry out a charge and discharge cycle of the battery.

5.2 Safety Rules

Abuse of Na-ion rechargeable batteries may cause battery damage or personal injury, please read the following safety rules carefully before using Na-ion batteries:

Note 1: If the customer needs to operate the battery under conditions beyond this document, please contact HiNa Battery Company.

Note 2: HiNa Battery Company will not be responsible for trouble caused by using cells beyond the specified range of this file.

5.2.1 Battery Precautions

- a) Do not throw the battery into fire or heat.
- b) Do not short-circuit and overcharge the battery.
- c) Do not subject the battery to excessive mechanical impact.
- d) Do not immerse the battery in water or seawater, or make it moisture-absorbing.
- e) Do not reverse the positive and negative terminals of the battery.
- f) Do not disassemble or repair the battery.
- g) Do not cause visible damage or deformation to the battery.
- h) Do not direct contact with leaking batteries.
- i) Keep the battery away from children.
- j) Do not pierce, hammer or step on the battery.
- k) Do not hit or throw the battery.

6. Revision Statement

Due to the continuous improvement of product quality and characteristics, the company has the right to revise the product specifications and maintenance characteristics, and the user will not be notified in advance after revision.

7. Other Notes

The matters that are not mentioned in this specification must be confirmed by the company, and the company reserves the right of final interpretation of the contents stated in this specification.

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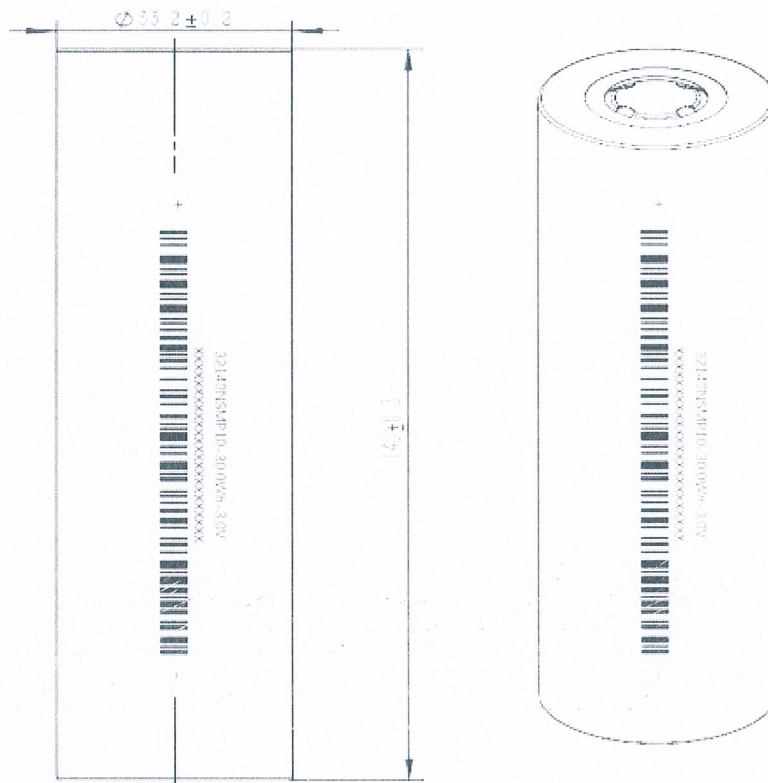
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8. Appendix

8.1 Battery Dimension

The inkjet code on the battery surface is 32140NSMP10 (corresponding to the product model NaCR32140-MP10).

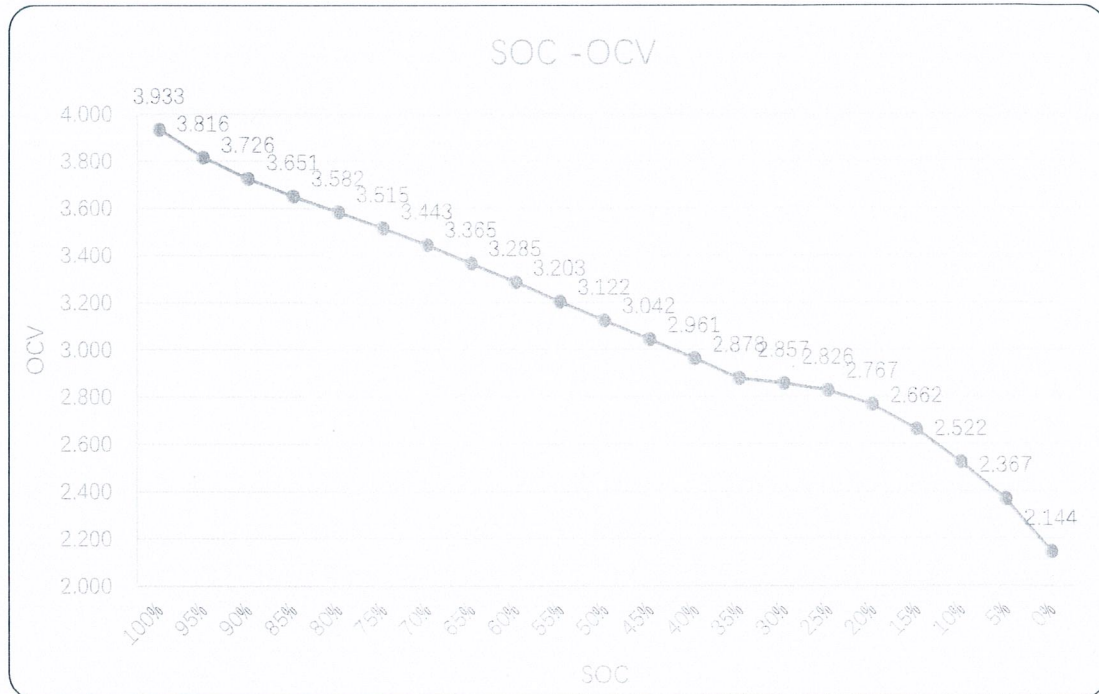


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8.2 SOC-OCV



8.3 Packaging Method

Each box is loaded with 40pcs batteries, and the RoHS logo and finished battery identification card are posted on the outside of the box, as shown in the figure. The product model printed on the outer carton label is NaCR32140-MP10, and the inkjet code on the internal battery is 32140NSMP10.

