

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
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产品交付规格书

Product Specification

Prismatic LFP Cells

方形铝壳锂离子电池

产品名称 Product: A41-V2.1

编制 Drafted by	产品设计审核 Product Design Checked by	品质审核 Quality Checked by	销售审核 Sales Checked by	批准 Approved by

客户接受栏 Customer Recipient
公司名称 Company Name:
批准 Approved by:
日期 Date:

2025 年 2 月 Feb, 2025

惠州亿纬锂能股份有限公司 EVE Power Co., Ltd

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
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客户要求 Customer's Requirement

要求客户写出他们的需求信息并提前与 EVE 沟通。如果客户有一些特别的应用或者操作条件不同于此文件中所描述的, EVE 可以根据客户的特别要求进行产品的设计和生产。

Customers are requested to write out their requirement information and communicate with EVE in advanced. If the customer has some special applications or operating conditions different from those described in this document, EVE can design and manufacture the product according to the customer's special requirements.

序号 No.	特殊要求 Special Requirements	标准 Standard
1		
2		
3		
4		
5		
6		
7		
8		

客 户 代 码: _____ 签 字: _____ 日 期: _____
Customer Code Sign Date

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
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变更履历 Change History

版本 Version	日期 Date	内容描述 Description	编制 Draft by
A	2025.02.25	1、修订重量、更新功率表 2、部门代码更新	张啸飞

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
-----------------	----------	---------------------------	----------------------	---------------	---

目录 Content

变更履历 Change History	- 3 -
目录 Content.....	- 4 -
术语定义 Term Define	- 6 -
1. 基本信息 Basic Information.....	- 7 -
1.1. 使用范围 Scope.....	- 7 -
1.2. 产品类型 Cell Classification and Model.....	- 7 -
2. 电池规格参数 Cell Specification.....	- 7 -
2.1. 基本性能 Nominal Specification.....	- 7 -
2.2. 电性能指标 Electrical Specification	- 8 -
2.3. 安全与可靠性 Safety and Reliability Specification.....	- 12 -
2.4. 电池图纸 Cell Drawing.....	- 13 -
2.5. 外观 Appearance.....	- 13 -
3. 试验条件 Testing Conditions	- 13 -
3.1. 环境条件 Environmental Conditions.....	- 13 -
3.2. 测试设备 Measurement Instrument.....	- 13 -
4. 测试方法 Testing Methods.....	- 13 -
4.1. 测试夹具安装 Testing Fixture Installation.....	- 13 -
4.2. 电池测试温度采集 Temperature Monitor.....	- 14 -
4.3. 尺寸 Dimension	- 14 -
4.4. 重量 Weight.....	- 15 -
4.5. 标准充电 Standard Charge	- 15 -
4.6. 标准放电 Standard Discharge	- 15 -
4.7. SOC 调节方式 SOC Adjust Method	- 15 -
4.8. 初始 ACR Initial ACR.....	- 15 -
4.9. 初始容量和能量 Initial Capacity and Energy.....	- 16 -
4.10. 初始 DCR Initial DCR.....	- 16 -
4.11. 月自放电 Monthly Self Discharge	- 16 -
4.12. 倍率放电容量 Rate Discharge Capacity	- 17 -
4.13. 低温放电容量 -20°C Discharge Capacity	- 17 -
4.14. 高温放电容量 55°C Discharge Capacity	- 17 -
4.15. 室温荷电保持与容量恢复性能 25°C Capacity Retention and Recovery Capability.....	- 18 -
4.16. 高温荷电保持与容量恢复性能 55°C Capacity Retention and Recovery Capability.....	- 18 -

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
4.17.	19min 快充循环	19min Fast Charging(FC) Cycle Life at 25°C.....	- 18 -		
4.18.	安全与可靠性	Safety and Reliability Performance.....	- 19 -		
5.	BMS 使用参数建议	Recommended BMS Design Parameters	- 20 -		
5.1.	SOC~OCV 表		- 20 -		
5.2.	充电建议	Charge Recommend 单位 unit: C-Rate.....	- 20 -		
6.	电池安全操作限制	Safety Limits	- 21 -		
6.1.	电压限制	Voltage Limits	- 21 -		
6.2.	温度限制	Temperature Limits	- 21 -		
7.	电池操作说明及注意事项	Cell Operation Instruction and Precautions.....	- 22 -		
7.1.	产品寿命终止管理	Product End-life Management.....	- 22 -		
7.2.	长期存储	Long-term Storage	- 22 -		
7.3.	运输	Transportation	- 23 -		
7.4.	操作说明	Operation Precautions	- 23 -		
7.5.	免责声明	Disclaimer	- 24 -		
8.	其它	Other	- 24 -		
9.	联系方式	Contact Information	- 25 -		
附录 A	Appendix A: Cell Dimension Diagram	电芯尺寸图	- 26 -		

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
-----------------	----------	---------------------------	----------------------	---------------	---

术语定义 Term Define

术语 Terms	定义 Definition
电池单体 Cell	直接将化学能和电能的基本单元装置，包括电极、隔膜、电解质、外壳和端子，并被设计成可充电。 A basic unit device that directly combines chemical and electrical energy, including electrodes, separator, electrolytes, can and terminals, and is designed to be rechargeable.
最小容量 Nominal Capacity	电池在规定试验条件和试验方法下测得的放电容量 The discharge capacity tested with specified test method.
最小能量 Nominal Energy	电池在规定试验条件和试验方法下测得的放电能量 The discharge energy tested with specified test method.
开路电压 (OCV) Open circuit voltage	没有接入任何负载和电路时测得的电池的电压，缩写用 OCV 表示。 The voltage of the cell measured when unloaded or circuit is connected. The abbreviation is expressed by OCV.
DCR	工作条件下电池的电压变化与相应的电流变化之比，缩写用 DCR 表示。 The ratio of the voltage changes of the cell to the corresponding current change under working conditions, the abbreviation is DCR.
标准充电 Standard Charge	本规格书第 4.5 条所述的充电模式。 The charge mode described in 4.5 of this specification.
标准放电 Standard Discharge	本规格书第 4.6 条所述的放电模式。 The discharge mode described in 4.6 of this specification.
环境温度 Environment temperature	电池所处的周围环境温度。 Surrounding environmental temperature where the cell is located.
电芯表面温度 Cell surface temperature	由温度传感器测量的电池大面或侧面中心的温度。 Temperature measure by the temperature sensor installed at the center of cell surface.
新电池状态 Fresh cell	是指电池自产品的制造日期算起 3 个月以内的状态。 It refers to the cell within 3 months from the date of manufacture of the product.
荷电状态 (SOC) State of charge	在无负载的情况下，以安培小时或者以瓦特小时为单位计量的电池容量状态与额定容量的比值，缩写用 SOC 表示。如：若将容量为 560 Ah 的状态视为 100% SOC，则容量为 0 Ah 时，SOC 为 0%。 Under unloaded conditions, the ratio of the cell capacity state to the rated capacity measured in ampere-hours or watt-hours. The abbreviation is expressed by SOC. For example, if the capacity is 560Ah as 100% SOC, when the capacity is 0Ah, the SOC is 0%.
循环 Cycle	电池按规定的充放标准充放一次为一个循环。循环包括短时的正常充电或者再生充电和放电过程的组合，在充电过程中有时只有正常充电而无再生充电的情况。放电可以由一些部分放电组合在一起形成。 The cell is charged and discharged in a cycle according to the prescribed charging and discharging standards. The cycle includes short-term normal charging or regenerative charging combination with discharging processes. In the charging process, sometimes there is only normal charging and no re-regenerative charging. The discharge can be formed by combining some partial discharges.
测量单位 The unit of measurement	电压单位 Voltage: 伏特 “V” (Volt) 电流单位 Current: 安培 “A” (Ampere) 容量单位 Capacity: 安培-小时 “Ah” (Ampere-Hour) 能量单位 Energy: 瓦特-小时 “Wh” (Watt-Hour) 电阻单位 Resistance: 欧姆 “Ω” (Ohm), 毫欧姆 “mΩ” (Milliohm) 温度单位 Temperature: 摄氏度 “°C” (degree Celsius) 长度单位 length: 毫米 “mm” (millimeter) 时间单位 Time: 秒 “s” (second) 频率单位 Frequency: 赫兹 “Hz” (Hertz) 功率单位 Power: 瓦特 “W” (Watt)

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
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1. 基本信息 Basic Information

1.1. 使用范围 Scope

本标准描述了湖北亿纬动力有限公司生产的方形铝壳磷酸铁锂电池的产品类型、基本性能、测试方法和注意事项。

This standard describes the product types, basic performance, test methods and precautions of square aluminum shell lithium iron phosphate batteries manufactured by EVE Power Co., Ltd.

1.2. 产品类型 Cell Classification and Model

1.2.1 产品类型 Cell Classification 方形铝壳锂离子电池 Prismatic LFP Cell with Aluminum Shell

1.2.2 产品名称 Cell Model A41-V2.1

2. 电池规格参数 Cell Specification

2.1. 基本性能 Nominal Specification

序号 No.	项目 Item	产品规格 Specification	备注 Remark
2.1.1	标称容量 Standard Capacity	116 Ah	1/3C, 2.5~3.65V, 25±2°C
2.1.2	标称能量 Standard Energy	373.5 Wh	1/3C, 2.5~3.65V, 25±2°C
2.1.3	标称电压 Standard Voltage	3.22 V	1/3C, 25±2°C
2.1.4	工作电压 Operation Voltage Range	2.5~3.65V	0°C<T≤60°C
		2.0~3.65V	-30°C≤T≤0°C
2.1.5	标准充电电流 Standard Charge Current	1/3C	25°C
2.1.6	标准放电电流 Standard Discharge Current	1/3C	25°C
2.1.7	最大持续充电电流 Maximum Continuous Charge Current	3C	25°C~45°C
2.1.8	最大脉冲放电电流 Maximum Pulse Discharge Current	10C	5s, 25°C
2.1.9	初始 ACR Initial ACR	≤ 0.35 mΩ	Shipping SOC, AC, 1kHz

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
2.1.10	初始 DCR Initial DCR	$\leq 0.8 \text{ m}\Omega$		50%SOC, 2C, 10s, 25°C	
2.1.11	出货 SOC 状态 Shipping SOC Status	15%~25%SOC		/	
2.1.12	月自放电 Monthly Self Discharge	$\leq 3\%$		25°C, 50%SOC, 90days	
2.1.13	电池重量 Cell Weight	1985 g $\pm$ 30 g		包含蓝膜 With Insulation Film	
2.1.14	电池尺寸 Cell Dimension (含蓝膜 With Insulation Film)	高度 H Height(H)	119.0 $\pm$ 0.5 mm	包含极柱 With Terminal	
		高度 h Height(h)	116.8 $\pm$ 0.5 mm	不包含极柱 Without Terminal	
		宽度 (H) Length	148.6 $\pm$ 0.5mm		
		厚度 (T) Thickness	52.3 $\pm$ 0.3mm	/	
2.1.15	工作温度 Operation Temperature	充电 Charge	-20~55°C	充电工作温度	
		放电 Discharge	-30~60°C	放电工作温度	
2.1.16	存储温度 Storage Temperature	-40~60°C		/	

备注：电池性能测试选用新电池状态进行。Note: Testing the cell using the fresh cell.

2.2. 性能指标 Electrical Specification

2.2.1 不同温度的放电容量特性

温度	-20°C	-10°C	0°C	10°C	25°C	45°C	55°C
容量保持率	80%	85%	90%	95%	100%	100%	100%
能量保持率	70%	80%	85%	92%	100%	100%	100%

2.2.2 不同温度的充电容量特性

温度	0°C	10°C	25°C	45°C
容量保持率	90%	95%	100%	100%
能量保持率	85%	90%	100%	100%

2.2.3 不同倍率放电容量特性

倍率	1/3C	0.5C	1C	2C
容量保持率	100%	99%	98%	98%

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
能量保持率	100%	98%	96%	95%	

2.2.4 不同倍率充电容量特性

倍率	1/3C	0.5C	1C	2C
容量保持率	100%	99%	98%	97%
能量保持率	100%	99%	98%	97%

2.2.5 放电峰值功率特性

10s 峰值放电功率/W								
SoC/T	5%	10%	20%	30%	40%	50%	70%	95%
-30°C	122	144	197	424	431	437	540	669
-20°C	143	219	390	548	603	789	921	987
-15°C	162	411	586	713	784	921	1075	1151
-10°C	221	603	781	877	965	1053	1228	1316
0°C	251	658	976	1096	1206	1316	1535	1645
10°C	398	731	1252	1413	1559	1706	1998	2144
15°C	506	804	1445	1633	1803	1974	2315	2485
20°C	697	1040	1637	1852	2047	2242	2632	2827
25°C	1125	1697	2015	2289	2415	2485	2797	2924
35°C	1251	2012	2355	2485	2485	2485	2884	2942
45°C	1566	2485	2485	2485	2485	2485	3088	3127

30s 峰值放电功率/W								
SoC/T	5%	10%	20%	30%	40%	50%	70%	95%
-30°C	97	115	158	339	345	350	432	535
-20°C	114	175	312	439	482	632	737	789
-15°C	130	329	468	570	627	737	860	921
-10°C	177	482	625	702	772	842	982	1053
0°C	200	526	781	877	965	1053	1228	1316
10°C	318	585	1002	1131	1248	1365	1598	1715
15°C	405	643	1156	1306	1442	1579	1852	1988
20°C	558	832	1310	1481	1637	1793	2105	2261
25°C	900	1357	1612	1831	1932	1988	2238	2339
35°C	1001	1610	1884	1988	1988	1988	2307	2353
45°C	1253	1988	1988	1988	1988	1988	2470	2502

60s 峰值放电功率/W								
SoC/T	5%	10%	20%	30%	40%	50%	70%	95%
-30°C	85	101	138	266	301	306	378	468
-20°C	100	154	273	384	422	553	645	691

产品名称 Product	A41-V2.1	文件编号 Specification No.			JMRI-A41-V2.1-D06-01			版本 Version	A
-15℃	113	288	410	499	549	645	752	806	
-10℃	155	422	473	614	675	737	860	921	
0℃	175	461	683	768	844	921	1075	1151	
10℃	278	512	877	989	1092	1194	1399	1501	
15℃	354	563	1011	1143	1262	1382	1620	1740	
20℃	488	728	1146	1296	1433	1569	1842	1979	
25℃	788	1188	1410	1602	1690	1740	1958	2047	
35℃	876	1408	1649	1740	1740	1740	2019	2059	
45℃	1096	1740	1740	1740	1740	1740	2161	2189	

2.2.6 充电峰值功率特性

10s 峰值充电功率/W								
SoC/T	5%	20%	50%	60%	70%	80%	90%	95%
-30°C	25	18	14	14	13	12	10	7
-20°C	184	161	115	100	84	69	31	23
-15°C	276	242	173	150	127	104	53	39
-10°C	368	322	230	200	179	174	126	94
0°C	972	673	529	473	409	378	274	204
10°C	1270	926	734	662	569	530	383	286
15°C	1548	1140	909	826	755	700	487	364
20°C	1943	1463	1191	1098	1060	1032	662	494
25°C	2656	2025	1731	1651	1472	1428	1034	771
35°C	2997	2301	1962	1877	1699	1653	1198	895
45°C	3156	2653	2251	2161	1974	1929	1401	1047

30s 峰值充电功率/W								
SoC/T	5%	20%	50%	60%	70%	80%	90%	95%
-30°C	21	15	12	12	11	10	7	4
-20°C	147	129	92	80	68	55	24	18
-15°C	221	193	138	120	101	83	42	31
-10°C	295	258	184	160	143	139	101	75
0°C	748	538	424	378	327	302	219	163
10°C	1016	740	587	530	455	424	307	229
15°C	1238	912	727	661	604	560	390	291
20°C	1554	1170	953	879	848	826	530	395
25°C	2125	1620	1385	1320	1177	1143	827	617
35°C	2398	1841	1570	1502	1359	1322	958	716
45°C	2525	2122	1800	1729	1580	1544	1121	837

60s 峰值充电功率/W								
SoC/T	5%	20%	50%	60%	70%	80%	90%	95%
-30°C	19	14	11	10	10	8	5	3
-20°C	94	113	81	70	59	48	21	16
-15°C	193	169	121	105	89	73	37	27

产品名称 Product	A41-V2.1		文件编号 Specification No.		JMRI-A41-V2.1-D06-01			版本 Version	A
-10℃	258	226	161	140	125	122	88	66	
0℃	680	471	371	331	286	265	192	143	
10℃	889	648	514	464	398	371	268	200	
15℃	1083	798	636	579	529	490	341	255	
20℃	1360	1024	834	769	742	723	464	346	
25℃	1769	1418	1212	1155	1030	1000	724	540	
35℃	2098	1611	1373	1314	1190	1157	838	626	
45℃	2209	1857	1575	1513	1382	1351	981	733	

2.2.7 寿命特性

序号	项目		标准
1	循环 (小中检)	25°C, FC/1C, SOC:0-100%, 2.5~3.65V	容量保持率≥90%@1000 次; DCR 增长≤10% 容量保持率≥80%@2500 次; DCR 增长≤20% 容量保持率≥70%@3500 次; DCR 增长≤40%
2		45°C, FC/1C, SOC:0-100%, 2.5~3.65V	容量保持率≥90%@500 次; DCR 增长≤10% 容量保持率≥80%@1200 次; DCR 增长≤20% 容量保持率≥70%@1800 次; DCR 增长≤40%
3	膨胀力循环 (大中检、 小中检)	25°C, FC/1C, SOC:0-100%, 2.5~3.65V	/
4	日历寿命	25°C, SOC: 60%; 时间: 300d	30d 容量保持率≥97%, 30d 容量恢复率≥98%, 30d DCR 增长≤5%; 150d 容量保持率≥94%, 150d 容量恢复率≥95%, 150d DCR 增长≤10%; 300d 容量保持率≥92%, 300d 容量恢复率≥94%, 300d DCR 增长≤20%;
5		25°C, SOC: 100%; 时间: 300d	30d 容量保持率≥97% 30d 容量恢复率≥98% 30d DCR 增长≤5% 150d 容量保持率≥94% 150d 容量恢复率≥95% 150d DCR 增长≤10% 300d 容量保持率≥92% 300d 容量恢复率≥94%

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
				300d DCR 增长 $\leq$ 20%	
6		45°C, SOC: 100%; 时间: 300d		30d 容量保持率 $\geq$ 95% 30d 容量恢复率 $\geq$ 96% 30d DCR 增长 $\leq$ 10% 150d 容量保持率 $\geq$ 92% 150d 容量恢复率 $\geq$ 93% 150d DCR 增长 $\leq$ 15% 300d 容量保持率 $\geq$ 89% 300d 容量恢复率 $\geq$ 91% 300d DCR 增长 $\leq$ 30%	
7		55°C, SOC: 100%; 时间: 300d		30d 容量保持率 $\geq$ 94% 30d 容量恢复率 $\geq$ 95% 30d DCR 增长 $\leq$ 15% 150d 容量保持率 $\geq$ 89% 150d 容量恢复率 $\geq$ 90% 150d DCR 增长 $\leq$ 25% 300d 容量保持率 $\geq$ 83% 300d 容量恢复率 $\geq$ 85% 300d DCR 增长 $\leq$ 40%	

备注：电池性能测试选用新电池状态进行。Note: Testing the cell using the fresh cell.

2.3. 安全与可靠性 Safety and Reliability Specification

序号 No.	项目 Items	产品规格 Specification	测试条件 Test Condition
2.3.1	过放电 Over Discharge	不起火、不爆炸 No fire, No explosion	GB 38031-2020
2.3.2	过充电 Over Charge	不起火、不爆炸 No fire, No explosion	GB 38031-2020
2.3.3	外部短路 External Short Circuit	不起火、不爆炸 No fire, No explosion	GB 38031-2020
2.3.4	加热 Heating	不起火、不爆炸 No fire, No explosion	GB 38031-2020
2.3.5	温度循环 Temperature Cycling	不起火、不爆炸 No fire, No explosion	GB 38031-2020
2.3.6	挤压 Crush	不起火、不爆炸 No fire, No explosion	GB 38031-2020
2.3.7	针刺 Acupuncture	不起火、不爆炸 No fire, No explosion	GB 38031-2020

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
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备注：外部短路测试需要带夹具进行测试，进行其他测试或者参考其他标准测试前需与 EVE 确认具体测试流程和注意事项。

Note: External short circuit test needs to be carried out with fixture. Before carrying out other tests or referring to other standard tests, it is necessary to confirm the specific test process and precautions with EVE.

备注：电池性能测试选用新电池状态进行。Note: Testing the cell using the fresh cell.

2.4. 电池图纸 Cell Drawing

见附录。 See Appendix.

2.5. 外观 Appearance

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

The cell should have none of obvious scratches, cracks, rust stains, discoloration, or electrolyte leakage, which may adversely affect commercial value of the cell.

3. 试验条件 Testing Conditions

3.1. 环境条件 Environmental Conditions

除另有规定外，试验应在温度为 $25 \pm 5^\circ\text{C}$ ，相对湿度 15%~90%，大气压力为 86 kPa~106 kPa 的环境中进行。本规格书所提到的室温，是指 $25 \pm 2^\circ\text{C}$ 。

Unless otherwise specified, the test should be carried out in an environment with a temperature of $25^\circ\text{C} \pm 5^\circ\text{C}$, a relative humidity of 15%-90% RH, and an atmospheric pressure of 86 kPa to 106 kPa. The ambient temperature mentioned in this specification refers to $25^\circ\text{C} \pm 2^\circ\text{C}$.

3.2. 测试设备 Measurement Instrument

试验装置应符合下列要求：The accuracy of measuring device should meet the following requirements:

- A. 电压测量装置 Voltage measuring device: $\pm 0.05\%$;
- B. 电流测量装置 Current measuring device: $\pm 0.05\%$;
- C. 温度测量装置 Temperature measuring device: $\pm 1^\circ\text{C}$;
- D. 尺寸测量装置 Dimension measuring device: $\pm 0.01\text{mm}$;
- E. 重量测量装置 Weight measuring device: $\pm 0.01\text{g}$.

4. 测试方法 Testing Methods

4.1. 测试夹具安装 Testing Fixture Installation

将包覆有蓝膜（材质：PET，厚度 0.1mm）和顶贴片（材质：PC，厚度 0.3mm）的电池（15%~20%SOC）置于夹具中间，每个螺栓初始预紧力为 $300\text{kgf} \pm 20\text{kgf}$ ，如图 1 和图 2。

Place the cell (~20%~30%SOC) covered with blue film (material: PET, thickness 0.1mm) and top film (material: PC, thickness 0.5mm) in the middle of the clamp, and the initial compression force is $(300 \text{ kgf} \pm 20\text{kgf})$ as shown in

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
-----------------	----------	---------------------------	----------------------	---------------	---

Figure 1 and Figure 2.



图1 电池包膜示意图 Schematic diagram of cell coating

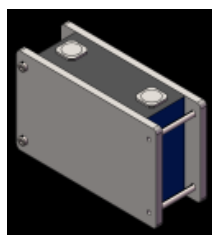


图 2 电池上夹具图 Side view of cell shaft

4.2. 电池测试温度采集 Temperature Monitor

如果没有特殊要求，电池测试时将按照如下描述进行温度采集。对电池表面进行温度采集时，建议温度采集点布置在 NTC 位置（温度点 T1）、正极端子（温度点 T2）、负极端子（温度点 T3），如下图。

If there are no special requirements, the temperature sensor will be pasted during test as below. When collecting temperature on the cell surface, the temperature collection point in the NTC (temperature point T1), positive terminal (temperature point T2), and negative terminal (temperature point T3) as shown in the following figure.

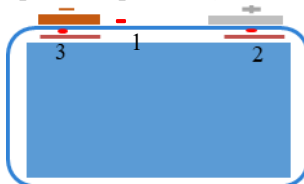


图 3 电池温度采集点示意图 Cell temperature monitoring diagram

4.3. 尺寸 Dimension

试验设备：自动包膜机

Testing Instrument: Automatic wrapping machine

试验方法：

Testing Method:

a) 使用包膜机自动测试出货态电池高度，厚度和宽度；

Use the CMM test device test the diameter and height respectively;

b) 测试条件：300kgf±20kgf 下测试。

Test conditions: 300kgf±20kgf.

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
-----------------	----------	---------------------------	----------------------	---------------	---

4.4. 重量 Weight

试验设备：电子秤

试验方法：使用电子秤测量电池的重量。

Test Instrument: Electronic scale

Test Method: Use the electronic scale to measure the weight of the cell. Record the weight value.

4.5. 标准充电 Standard Charge

标准充电是在环境温度 $25\pm 2^{\circ}\text{C}$ 的条件下，对电池以 $1/3C$ 的电流恒流充电至 3.65V，然后在 3.65V 下转恒压充电，直至充电电流小于等于 $0.05C$ 。搁置 30min。

At $25\pm 2^{\circ}\text{C}$, charged with constant current $1/3C$ to 3.65V, then continue charged with constant voltage until the current reach to $0.05C$, rest 30min.

4.6. 标准放电 Standard Discharge

标准放电是在环境温度 $25\pm 2^{\circ}\text{C}$ 的条件下，电池以 $1/3C$ 的电流恒流放电至 2.5V。搁置 30min。

At $25\pm 2^{\circ}\text{C}$, discharged with constant current $1/3C$ to 2.5V, rest 30min.

4.7. SOC 调节方式 SOC Adjust Method

如果没有特殊要求，SOC 将按照如下方式进行调节。在环境温度 $25\pm 2^{\circ}\text{C}$ 的条件下，电池以 $1/3C$ 恒流放电至 2.5V，搁置 30min。按照标准充电方式和标准放电方式重复 3 次。记录第三次放电容量，标记为 C_0 。

调节 SOC：按照标准充电方式充满电，以 $1/3C_0$ 的电流恒流放电至目标电量，

目标电量 = $(1 - \text{目标 SOC}) * C_0$ ，搁置 60min。

If there are no special requirements, the SOC will be adjusted as follows. At $25\pm 2^{\circ}\text{C}$, the cell was discharged with $1/3C$ to 2.5V. Repeat 3 times according to standard charge mode and standard discharge mode. Record the third discharge capacities, recorded as C_0 .

Adjust SOC: charging with standard charge mode, discharge with $1/3C_0$ to target SOC, rest 60min.

Target SOC = $(1 - \text{Target SOC}) * C_0$

4.8. 初始 ACR Initial ACR

在 $(25\pm 2)^{\circ}\text{C}$ 下，将电池用频率为 1KHz 的电压内阻测试仪的正、负极分别接触电池的正、负极，读取电池的交流内阻读数。

At $25\pm 2^{\circ}\text{C}$, connecting the cell's positive and negative terminal with the Voltage Internal Resistance Tester, which the 1kHz frequency.

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
-----------------	----------	---------------------------	----------------------	---------------	---

4.9. 初始容量和能量 Initial Capacity and Energy

在 $(25 \pm 2)^\circ\text{C}$ 下, 电池初始容量和能量测试按照下列方法进行:

电池标准放电后, 使用标准充电和标准放电进行 3 次充放电循环, 以第 3 次放电的值作为结果, 分别计算初始容量和初始能量。

The initial discharge capacity and energy are tested according to the follow step.

Cell is discharged with standard discharge, then cycled with standard charge and standard discharge model until 3 cycles, calculate the average of the 3rd cycle discharge capacity and energy. The calculated value is recorded as the initial discharge capacity and energy.

4.10. 初始 DCR Initial DCR

在 $(25 \pm 2)^\circ\text{C}$ 下, 使用标准充电和标准放电进行 3 次充放电循环, 按照 SOC 调节方式将电池调节至 50%SOC, 记录搁置末期第 60min 的电压 V_1 。1C 恒流放电 10s。记录第 10s 放电末期的电压 V_2 。采样间隔为 0.1s。

计算 DCR: $\text{DCR} = (V_1 - V_2) / 1\text{C m}\Omega$ 。

At $25 \pm 2^\circ\text{C}$, adjust the cell to 50%SOC, according to the SOC adjust method. Record the voltage as V_1 at the end of 60min rest. Then, discharge the cell with 1C for 10s, record the voltage as V_2 at the end of 10s discharge. The sampling interval was 0.1s during the 10s discharge.

Calculate DCR: $\text{DCR} = (V_1 - V_2) / 1\text{C m}\Omega$.

4.11. 月自放电 Monthly Self Discharge

- ① SOC 调节: 按照 4.7 章节 SOC 调节方式将电池 SOC 调节至 50%SOC。
- ② 容量测试: 在 $(25 \pm 2)^\circ\text{C}$ 下, $1/3\text{C}$ 恒流放电至 2.5V, 搁置 30min, 记录放电容量 C_{m0} 。
- ③ SOC 调节: 在 $(25 \pm 2)^\circ\text{C}$ 下, 按照标准充电方式充满电, 以 $1/3C_0$ 的电流恒流放电 50% C_0 的容量。
- ④ 储存: 在 $(25 \pm 2)^\circ\text{C}$ 下, 搁置 30 天。
- ⑤ 容量测试: 在 $(25 \pm 2)^\circ\text{C}$ 下, $1/3\text{C}$ 恒流放电至 2.5V, 搁置 30min, 记录放电容量 C_{m+i} ($i=1、2、3$, 第一次存储记录为 C_{m+1} , 第 i 次存储记录为 C_{m+i})。
- ⑥ 重复步骤③至⑤, 一共 3 次,

月自放电计算: $1 - (C_{m+i}/C_{m+(i-1)})$ 为第 i 个月的自放电

- ① SOC adjust: Adjust SOC to 50%SOC, according to the chapter 4.7.
- ② Capacity test: At $25 \pm 2^\circ\text{C}$, $1/3\text{C}$ discharge to 2.5V, rest 30min, record the discharge capacity as C_m .
- ③ SOC adjust: At $25 \pm 2^\circ\text{C}$, full charged cell (charge with standard charge mode) discharged with $1/3C_0$, cutoff by 50% C_0 .
- ④ Storage: At $25 \pm 2^\circ\text{C}$, storage 30 days.
- ⑤ Capacity test: At $25 \pm 2^\circ\text{C}$, $1/3\text{C}$ discharge to 2.5V, rest 30min, record the discharge capacity as C_{m+i} ($i=1, 2, 3$, the 1st storage record as C_{m+1} , the i time recorded as C_{m+i}).

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
-----------------	----------	---------------------------	----------------------	---------------	---

⑥ Repeat step ③ to step ⑤, the total repeat is 3 times.

Calculate monthly self discharge: $1 - (C_{m+i}/C_{m+(i-1)})$, is the i monthly self discharge.

4.12. 倍率放电容量 Rate Discharge Capacity

在 $(25 \pm 2)^\circ\text{C}$ 下, 电池按照标准充电后, 再按照进行标准放电, 循环三次, 记录第三圈放电容量 C_{10} .

标准充电后, 1C 放电至 2.5V, 搁置 30min, 记录放电容量为 C_{20} .

标准充电后, 2C 放电至 2.5V, 搁置 30min, 记录放电容量为 C_{30} .

计算倍率放电容量比值: C_3/C_2

At $25 \pm 2^\circ\text{C}$, cell discharged with standard discharge mode, charged with standard charge mode. Then standard discharged, record the discharge capacity as C_1 .

Standard charged the cell, 1C discharge to 2.5V, rest 30min, record the discharge capacity as C_2 .

Standard charged the cell, 2C discharge to 2.5V, rest 30min, record the discharge capacity as C_3 .

Calculate rate discharge capacity ratio: C_3/C_2

4.13. 低温放电容量 -20°C Discharge Capacity

在 $(25 \pm 2)^\circ\text{C}$ 下, 电池进行标准充电, 再进行标准放电, 循环三次, 记录放电容量为 C_4 , 再将电池进行标准充电。

在 $(-20 \pm 2)^\circ\text{C}$ 下, 将电池搁置 8h。使用 1/3C 放电至 2.0V, 搁置 30min, 记录放电容量为 C_{50} 。

计算低温放电容量比值: C_5/C_4

At $25 \pm 2^\circ\text{C}$, cell discharged with standard discharge mode, charged with standard charge mode, record the discharge capacity as C_4 . Charged with standard charged.

At $-20 \pm 2^\circ\text{C}$, rest 8h. Then discharge to 2.0V with 1/3C, rest 30min, record the discharge capacity as C_5 .

Calculate -20°C discharge capacity ratio: C_5/C_4

4.14. 高温放电容量 55°C Discharge Capacity

在 $(25 \pm 2)^\circ\text{C}$ 下, 电池进行标准充电, 再进行标准放电, 循环三次, 记录放电容量为 C_6 , 再将电池进行标准充电。

在 $(55 \pm 2)^\circ\text{C}$ 下, 将电池搁置 4h。使用 1/3C 放电至 2.5V, 搁置 30min, 记录放电容量为 C_{70} 。

计算低温放电容量比值: C_7/C_6

At $25 \pm 2^\circ\text{C}$, cell discharged with standard discharge mode, charged with standard charge mode, record the discharge capacity as C_6 . Charged with standard charged.

At $55 \pm 2^\circ\text{C}$, rest 4h. Then discharge to 2.5V with 1/3C, rest 30min, record the discharge capacity as C_7 .

Calculate 55°C discharge capacity ratio: C_7/C_6

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
-----------------	----------	---------------------------	----------------------	---------------	---

4.15. 室温荷电保持与容量恢复性能 25°C Capacity Retention and Recovery Capability

在 $(25 \pm 2)^\circ\text{C}$ 下, 电池进行标准充电, 再进行标准放电, 循环三次, 记录放电容量为 C_8 , 再将电池进行标准充电。

在 $(25 \pm 2)^\circ\text{C}$ 下, 将电池搁置 30 days。

使用 1/3C 放电至 2.5V, 搁置 30min, 记录放电容量为剩余容量 C_9 。

使用标准充电和标准放电进行 3 次充放电循环, 以第 3 次放电作为结果, 记录为恢复容量 C_{10} 。

计算容量保持率: C_9/C_8

计算容量恢复率: C_{10}/C_8

At $25 \pm 2^\circ\text{C}$, cell discharged with standard discharge mode, charged with standard charge mode, record the discharge capacity as C_8 . Charged with standard charged.

At $25 \pm 2^\circ\text{C}$, rest 30 days. Then discharge to 2.5V with 1/3C, rest 30min, record the discharge capacity as C_9 .

Cycled with standard charge and standard discharge model until 3 cycles, calculate the average of the 3 cycle discharge capacity, recorded as C_{10} .

Calculate capacity retention: C_9/C_8

Calculate capacity recovery: C_{10}/C_8

4.16. 高温荷电保持与容量恢复性能 55°C Capacity Retention and Recovery Capability

在 $(25 \pm 2)^\circ\text{C}$ 下, 电池进行标准充电, 再进行标准放电, 循环三次, 记录放电容量为 C_{11} , 再将电池进行标准充电。

在 $(55 \pm 2)^\circ\text{C}$ 下, 将电池搁置 30 days。

在 $(25 \pm 2)^\circ\text{C}$ 下, 使用 1/3C 放电至 2.5V, 搁置 30min, 记录放电容量为剩余容量 C_{12} 。

使用标准充电和标准放电进行 3 次充放电循环, 以第 3 次放电作为结果, 记录为恢复容量 C_{13} 。

计算容量保持率: C_{12}/C_{11}

计算容量恢复率: C_{13}/C_{11}

At $25 \pm 2^\circ\text{C}$, cell discharged with standard discharge mode, charged with standard charge mode, record the discharge capacity as C_{11} . Charged with standard charged.

At $55 \pm 2^\circ\text{C}$, rest 30 days. At $25 \pm 2^\circ\text{C}$, discharge to 2.5V with 1/3C, rest 30min, record the discharge capacity as C_{12} .

Cycled with standard charge and standard discharge model until 3 cycles, calculate the average of the 3 cycle discharge capacity, recorded as C_{13} .

Calculate capacity retention: C_{12}/C_{11}

Calculate capacity recovery: C_{13}/C_{11}

4.17. 19min 快充循环 19min Fast Charging(FC) Cycle Life at 25°C

① 初始性能测试:

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
-----------------	----------	---------------------------	----------------------	---------------	---

初始容量：按照初始容量和能量的测试方法（4.9）进行初始容量测试

初始 DCR：按照初始 DCR 的测试方法（4.10）测试 DCR。

② 循环：

充电：在 $(25 \pm 2)^\circ\text{C}$ 下，使用 19min 快充工步充电，SOC 区间为 10%SOC~80%SOC，搁置 60min。

放电：在 $(25 \pm 2)^\circ\text{C}$ 下，1C 恒流恒流放电至 2.5V，搁置 30min。

循环：100cycles。

每 100 圈进行初始性能测试，记录容量和 DCR，计算放电容量保持率和 DCR 增长率。

① Initial performance test:

Initial capacity: testing the cell with the initial capacity and energy test method (4.9), obtain the capacity.

Initial DCR: testing the cell with the initial DCT test method (4.10), obtain the DCR.

② Cycle:

Charge: At $25 \pm 2^\circ\text{C}$, charge with 20min FC step from 10%SOC to 80%SOC, rest 60min.

Discharge: At $25 \pm 2^\circ\text{C}$, 1C constant current discharge to 2.5V, rest 30min.

Cycle: 100cycles. After every 100cycles, testing the initial performance test, record the capacity and DCR, calculate the capacity retention and DCR increase ratio.

4.18. 安全与可靠性 Safety and Reliability Performance

所有测试均参考国家标准 GB38031-2020 和国际标准 UN38.3 标准进行测试。外部短路测试需要使用到的夹具示意图如下所示。

All tests are carried out with reference to the national standard GB38031-2020 and UN38.3 standards. The fixture diagram for external short-circuit test is shown below.

序号 No.	项目 Items	测试方法 Test Method
1	过放电 Over Discharge	GB 38031-2020
2	过充电 Over Charge	GB 38031-2020
3	外部短路 External Short Circuit	GB 38031-2020
4	加热 Heating	GB 38031-2020
5	温度循环 Temperature Cycling	GB 38031-2020
6	挤压 Crush	GB 38031-2020
7	针刺 Acupuncture	GB 38031-2020

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
-----------------	----------	---------------------------	----------------------	---------------	---

5. BMS 使用参数建议 Recommended BMS Design Parameters

以下数据为电池参考性能数据，仅供 BMS 设计时参考使用，实际使用以双方约定的使用方式和条件为准。

The following is the cell performance data for reference only during the BMS design. The actual use is subject to the usage mode and conditions agreed by both parties.

5.1. SOC~OCV 表

	SOC	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%
25°C	OCV	3.184	3.205	3.253	3.285	3.288	3.290	3.322	3.329	3.330	3.333	3.334

5.2. 充电建议 Charge Recommend 单位 unit: C-Rate

SOC	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%	99%	100%
-30°C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-20°C	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.03	0.03	0.02	0.02	0.02	0.02	0.02
-10°C	0.33	0.33	0.33	0.20	0.20	0.20	0.20	0.10	0.05	0.05	0.05	0.05	0.02	0.02
0°C	0.40	0.40	0.50	0.50	0.40	0.33	0.33	0.20	0.20	0.15	0.06	0.05	0.05	0.05
5°C	0.60	0.60	0.70	0.70	0.40	0.40	0.40	0.33	0.20	0.20	0.20	0.15	0.08	0.08
10°C	0.80	0.80	1.00	1.00	1.00	0.80	0.60	0.60	0.40	0.33	0.20	0.15	0.08	0.08
20°C	1.00	1.00	1.00	2.00	1.80	1.80	1.80	1.50	1.30	1.00	0.50	0.33	0.25	0.20
25°C	1.00	1.00	1.00	2.50	2.40	2.40	2.40	2.30	2.10	1.65	1.00	0.50	0.33	0.20
35°C	1.00	1.00	1.00	2.50	2.40	2.40	2.20	2.20	2.00	1.50	1.00	0.50	0.33	0.20
40°C	1.00	1.00	1.00	2.50	2.40	2.40	2.20	2.20	2.00	1.50	1.00	0.50	0.33	0.20
45°C	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.33	0.20
50°C	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.20
55°C	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
-----------------	----------	---------------------------	----------------------	---------------	---

6. 电池安全操作限制 Safety Limits

6.1. 电压限制 Voltage Limits

项目 Items	类别 Category	数值 Value	备注 Remark
充电电压 Charging Voltage	一级 Primary-level	3.67 V	BMS 系统报警 BMS alarm
	二级 Secondary-level	3.70 V	降低电池充电电流或者功率 Reduce cell charge current or power
	三级 Three-level	3.80 V	切断电流，强制使电池停止工作 Cut off the current and force the cell to stop working
放电电压 Discharging Voltage	一级 Primary-level	2.4V (T>0°C) 1.97 V (T≤0°C)	BMS alarm BMS 系统报警
	二级 Secondary-level	2.3 V (T>0°C) 1.95 V (T≤0°C)	降低电池放电电流或者功率 Reduce cell discharge current or power
	三级 Three-level	2.1 V (T>0°C) 1.9 V (T≤0°C)	切断电流，强制使电池停止工作 Cut off the current and force the cell to stop working

6.2. 温度限制 Temperature Limits

项目 Items	数值 Value	备注 Remark
推荐操作温度范围 Recommended Operating Temperature Range	10°C~45°C	推荐使用电池的温度范围。 Recommended cell usage temperature range.
最高操作温度 Maximum operating temperature	60°C	如果电池使用温度超过操作温度范围，功率需要降为 0。 If the cell surface temperature exceeds the operating temperature range, the power needs to be reduced to 0.
最低操作温度 Minimum operating temperature	-40°C	
最高安全温度 Maximum safety temperature	65°C	如果电池使用温度超过最高安全温度或最低安全温度，将会造成电池不可逆的永久性损坏，用户使用时不得超过安全温度范围。 If the cell surface temperature exceeds the safety temperature range, it will cause irreversible and permanent damage to the cell. The user should not use it exceed the safety temperature range.
最低安全温度 Minimum safety temperature	-35°C	

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
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7. 电池操作说明及注意事项 Cell Operation Instruction and Precautions

7.1. 产品寿命终止管理 Product End-life Management

电池使用期限是有限的，客户应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。内阻及容量的测量方法和计算方法需要客户和湖北亿纬动力有限公司共同讨论和双方同意。当使用中电池的内阻超过这个电池最初内阻的 150%或容量小于标称容量的 60%（25℃）或与客户达成一致的电池寿命末期，应停止使用电池。违反该项要求，免除湖北亿纬动力有限公司依据产品销售协议以及本规格书所应承担的产品质量保证责任。

The cell life is limited. Customers should establish an effective tracking system to monitor and record the internal resistance and capacity of each cell during its life. The measurement method and calculation method of internal resistance and capacity need to be discussed and agreed between the customer and EVE Power Co., Ltd. When the internal resistance of the cell in use exceeds 150% of the initial internal resistance of the cell or the capacity is less than 60% of the nominal capacity (25℃) or the end of cell life which both customer and EVE agree on is coming, the cell should not to be operated. Violation of this requirement will exempt EVE Power Co., Ltd. from its responsibility for product quality assurance in accordance with the product sales agreement and this specification.

7.2. 长期存储 Long-term Storage

电池进行充电后，需尽快使用，避免因自放电而造成可用容量损失。若需要存储，则电池需要在干燥、通风、无腐蚀性气体影响的库房，低 SOC 态下进行存储。推荐的存储条件为：15%~25% SOC，0~25℃，≤60% RH。

电池若在库房长期放置未使用，需定期进行补充电。电池补充电周期参考如下：

After charging the cell, it should be used as soon as possible to avoid loss of available capacity due to self discharge. If storage is required, the cell needs to be stored in a dry, ventilated, and non corrosive gas free warehouse under low SOC conditions. The recommended storage conditions are: 15%~25% SOC, 0-25 °C, ≤ 60% RH.

If the cell is not used for a long time in the warehouse, it need to be recharged periodically. The recharge cell cycle reference is as follows:

电池补充电周期 Cell Recharge Cycle		
实际存储温度 Actual Storage Temperature	补充电周期 Recharge Periodically	补充电方式 Recharge Method
0≤T≤25℃	6 个月 6 months	标准充放电1次后调整至存储SOC Cycle with standard charge and discharge current, then switch to storage SOC

备注：对电池最后一次实际充放电日期或补电日期需进行记录

Note: Record the date of the last actual charge and discharge or recharge of the cell.

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
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7.3. 运输 Transportation

产品的运输应在 15%~25% SOC 下包装成箱进行。在运输过程中应防止剧烈振动、冲击或挤压、避免日晒雨淋。适用于汽车、火车、轮船、飞机等交通工具运输。

Cell for shipping should be packed in boxes with the SOC of 15%~25%. The severe vibration, impact, extrusion, sun and rain should be prevented during shipping. Applicable methods of transportation include truck, train, ship, airplane, etc.

7.4. 操作说明 Operation Precautions

- 禁止反向充电。正确连接电池的正负极，严禁反向充电。
- 禁止过放电。在电池正常使用过程中，为防止过放电，电池应定期充电，将电压维持在 2.5V 以上。
- 严禁将电池浸入水中，保存不用时，应放置于阴凉干燥的环境中。
- 禁止将电池放在热高温源旁边，如火、加热器等使用和留置。
- 充电时请选用锂离子电池专用充电器。
- 在使用过程中，严禁将电池正负极颠倒。
- 禁止将电池丢于火或给电池加热。
- 禁止用金属直接导通电池正负极。
- 禁止将电池与金属，如发夹、项链等一起运输或贮存。
- 禁止敲击或抛掷、踩踏和弯折电池等。
- 禁止直接焊接电池。
- 禁止用钉子或其它利器刺穿电池。
- 不要使用处于极热环境中的电池，如阳光直射或热天的车内。
- 禁止在强静电和强磁场的地方使用。
- 如果电池漏液，电解液溅入到皮肤、眼睛、口、鼻等部位，应立即用大量清水冲洗，并马上送医治疗，否则会对人体造成严重伤害。
- 如果电池出现异味、发热、变色、变形或使用、贮存、充电过程中出现任何异常时不得使用。
- It is forbidden to inversely charge. Correctly connect the positive and negative poles of the cell, and reverse charging is strictly prohibited.
- It is forbidden to over-discharge. During the normal use of the cell, in order to prevent over-discharge, the cell should be charged regularly to maintain the voltage above 2.5 V.
- It is strictly forbidden to immerse the cell in water. When it is not in use, it should be placed in a cool and dry environment.
- It is forbidden to use and leave the cell next to heat and high temperature sources, such as fire, heater, etc.
- Please use a special charger for lithium-ion batteries when charging.
- During usage, it is strictly prohibited to reverse the positive and negative terminals of the cell.

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
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- Do not throw the cell in the fire or heater.
- It is forbidden to use metal to directly connect the positive and negative terminals of the cell to short-circuit.
- It is forbidden to transport or store the cell with metal, such as hairpins, necklaces, etc.
- It is forbidden to knock or throw, step on, or bend the cell.
- It is forbidden to directly solder the cell.
- It is forbidden to directly pierce the cell with nails or other sharp objects.
- It is forbidden to use or place the cell under high temperature (under hot sunlight), such as in a car under direct sunlight or in a hot day.
- It is forbidden to use it in places with strong static electricity and strong magnetic fields.
- If the cell leaks and the electrolyte splashes on the skin, clothes, eyes, mouth, nose, etc., immediately wash the affected area with running water and send to a doctor for treatment immediately, otherwise it will cause serious harm to the human body.
- If the cell emits peculiar smell, heat, discoloration, deformation, or any abnormality during use, storage, or charging, stop using it.

7.5. 免责声明 Disclaimer

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，并对湖北亿纬动力有限公司的声誉造成影响的，湖北亿纬动力有限公司将会追究产品需求单位的责任。根据对湖北亿纬动力有限公司造成的影响程度，产品需求单位需向湖北亿纬动力有限公司提供赔偿。

If the product demanding party does not use the provisions in this manual, which causes social impact and affects the reputation of EVE Power Co., Ltd., EVE Power will pursue the responsibility of the product demanding party. According to the degree of impact on EVE Power, the product demand party must provide compensation to EVE Power.

8. 其它 Other

本规格书受中华人民共和国法律管辖，但不包括其冲突规范。因本规格书或者履行过程引发的争议应由双方友好协商解决，协商不成，任何一方均可向湖北亿纬动力有限公司所在地人民法院提起诉讼。

本规格书为中英互译版本，如中文与英文约定内容有歧义，以中文内容为准。

本规格书自双方签字盖章之日起生效，有效期至：年 月 日。一式两份，具有同等法律效力。

本规格书未尽事宜，由双方另行签订补充协议，补充协议与本规格书具有同等法律效力。非经双方签署书面的文件，本规格书的任何条款不得被修改或者变更。

These specifications shall be governed by the laws of the People's Republic of China, excluding its conflict specifications. Any dispute arising from this specification document or the performance process shall be settled by both sides through friendly negotiation. If no agreement can be reached through negotiation, either side may file a lawsuit with the people's court where EVE Power Co., Ltd. is located.

产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
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This specification is a Chinese English translation version. In case of any ambiguity between the Chinese and English agreed terms, the Chinese content shall prevail.

This specification shall come into force upon being signed and sealed by both parties and shall be valid until .
In duplicate, both copies shall have the same legal effect.

For matters not covered in this specification, both parties shall separately sign a supplementary agreement which shall have the same legal effect as this specification document. No provision of this specification shall be modified or altered without a written document signed by both parties.

9. 联系方式 Contact Information

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产品名称 Product	A41-V2.1	文件编号 Specification No.	JMRI-A41-V2.1-D06-01	版本 Version	A
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附录 A Appendix A: Cell Dimension Diagram 电芯尺寸图

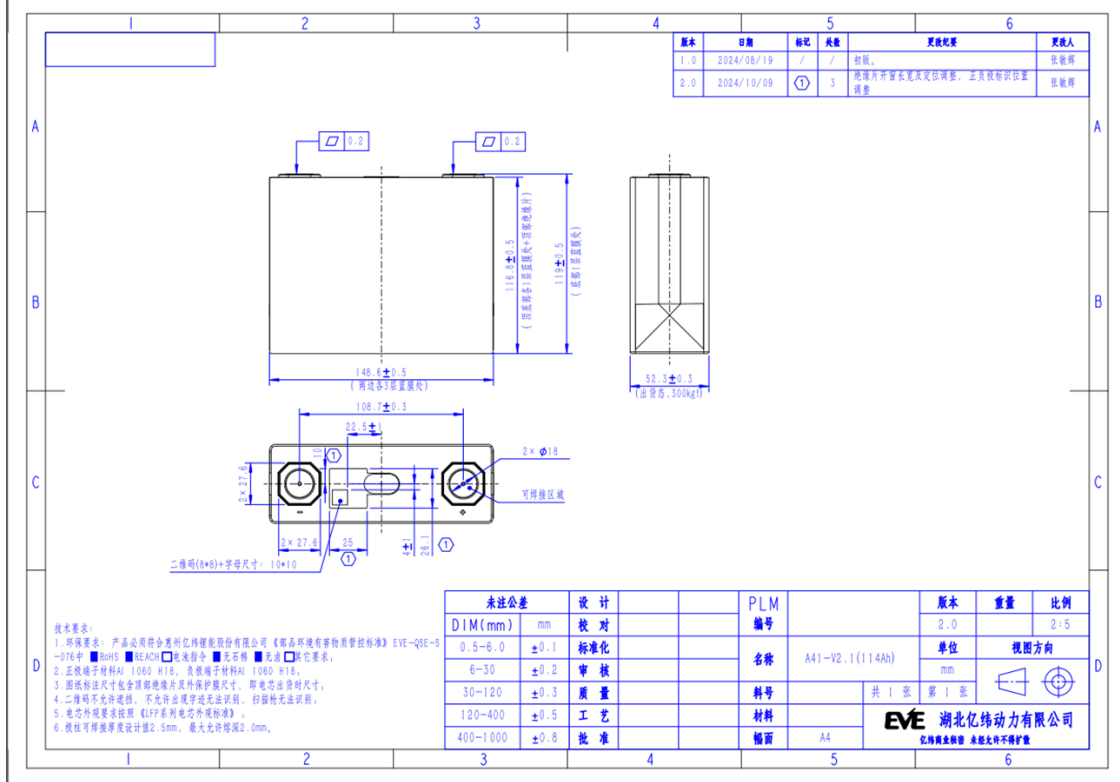


图4 电芯尺寸图 Cell Dimension Diagram