Product Specification

产品规格

型号 Model: DFDLFR60130

标称容量 Nominal Capacity：46Ah

拟制 Registered	审核 Checked	批准 Approved

公司名称：广西宁福新能源科技有限公司

公司地址：广西省南宁市青秀区伶俐镇工业园

目录 Catalog

1. 修订履历 Modified List

产品变更履历表 Product Modified Record List				
版本 Edition	变更内容 Modified content	编制 Registered	批准 Approved	生效日期 Effective date
A/0	初版发行 Original Release			2022.03.14

2. 术语定义 Terms & Definition

术语 Terms	定义 Definition
室温 Room Temperature	25℃±2℃
电芯 Cell	将化学能与电能进行相互转换的基本单元装置，通常包括电极、隔膜、电解质、外壳和端子，并被设计成可充电。 A basic unit for converting chemical energy to electrical energy, usually consisting of electrode,separator,electrolyte,housing, and terminal, and designed to be rechargeable.
电芯温度 Cell Temperature	电芯表面温度。 The surface temperature of the cell.
额定容量 Rated Capacity	室温下完全充电的蓄电芯以 1/3C（A）电流放电，达到终止电压时所放出的容量（Ah）。 It's the capacity when cells are discharged to end of voltage with 1/3C at 25℃±2℃.
充电倍率 Charge Rate (C-Rate)	电芯在规定的时间内放出其额定容量时所需要的电流值，它在数据值上等于电芯额定容量的倍数，通常以字母 C 表示。 The current value that the cell need to discharge its rated capacity in a stated time, which equal to a multiple of the rated capacity of the cell on the data value, usually expressed with the letter "C".
循环寿命 Cycle Life	二次电池在反复充放电的过程中，容量会逐渐下降。当容量降到额定容量的 80%时，充放电的次数称为循环寿命。 With the repeated charging and discharging, the cell's capacity will gradually decline. Usually when the capacity of the cell reaches 80% of the rated capacity, the number of charge-discharge cycles is called cycle life.
开路电压 Open Circuit Voltage(OCV)	开路电压是指外电路没有电流流过时电芯两极之间的电位差。 Open-circuit voltage is the difference of electrical potential between two terminals of a device when disconnected from any circuit.
工作电压 Operating Voltage	工作电压又称放电电压或负荷电压，是指有电流通过外电路时，电芯两极之间的电位差。工作电压总是低于开路电压，因为电流流过电芯内部时，必须克服极化电阻和欧姆内阻所造成的阻力。 Operating voltage, also known as the discharge voltage or load voltage, it is defined as the potential difference between the cell terminals when the current transmits through the external circuit. Working voltage is always lower than the open circuit voltage, because when the current transmits through the cell internal, the polarization resistance and ohmic resistance must be overcome.

可恢复容量 Restore Capacity	电芯储存后，按照本规格书第 5.2.1 和 5.3.1 条所列的标准充放电条件所测得的容量，取值分别按照本规格书第 5.2.1 和 5.3.1 条给出的充放电标准，分别选取 3 次测量的平均值。 After storage,the capacity tested according to the standard charge and discharge conditions listed in section 5.2.1 and 5.3.1, the average value of 3 measured values were selected as restore capacity.
荷电保持能力 Charge Retention Capability	电芯在一定温度下，储存一定时间后，放电所获得的容量与额定容量之比的百分数。 The percentage of the discharge capacity and rated capacity after the cell stored in a certain time and under normal temperature condition.
容量恢复能力 Capacity Recovery Capability	电芯在一定温度下，储存一定时间后再行充电，其后放电容量与额定容量之比的百分数。 The percentage of the discharge capacity and rated capacity with recharging after the cell stored in a certain time and under normal temperature.
标准充电 Standard Charging	本规格书第 5.2.1 条所述的充电模式。 Charge mode described in section 5.2.1.
标准放电 Standard Discharging	本规格书第 5.3.1 条所述的放电模式。 Discharge mode described in section 5.3.1.
荷电状态 State of Charge (SOC)	电芯剩余电量百分比，也是电芯一个重要的参数，只有准确估算电芯 SOC 才能有效提高电芯利用效率、保证电芯的使用寿命和安全。 The percentage of remaining energy. Only with estimating the cell SOC accurately can improve the utilization efficiency of the cell,and ensure the cell life and safety.
测量单位 Units of Measurement	“V”（Volt）伏特，电压单位 “V” (Volt),Unit of voltage
	“A”（Ampere）安培，电流单位 “A” (Ampere),Unit of current
	“Ah”（Ampere-Hour）安培-小时，电荷单位 “Ah” (Ampere-Hour),Unit of electric charge
	“Wh”（Watt-Hour）瓦特-小时，能量单位 “Wh” (Watt-Hour),Unit of energy
	“mΩ”（MilliOhm）毫欧姆，电阻单位 “mΩ” (MilliOhm),Unit of resistance
	“℃”（degree Celsius）摄氏度，温度单位 “℃”(degree Celsius),Unit of temperature

	“mm”（millimeter）毫米，长度单位 “mm” (millimeter),Unit of length
	“s”（second）秒，时间单位 “s” (second),Unit of time
	“Hz”（Hertz）赫兹，频率单位 “Hz”(Hertz),Unit of frequency

3. 适用范围 Scope

本产品规格书描述了广西宁福新能源科技有限公司提供的型号为 DFDLFR60130-46Ah 锂离子动力电芯的产品性能指标。

This product specification describes the performance indicators of DFDLFR60130-46Ah lithium-ion power cells which is provided by Guangxi Ningfu New Energy Technology Co. LTD..

4. 产品类型 Product Type

4.1 种类：磷酸铁锂电芯

Type:Lithium iron phosphate cell

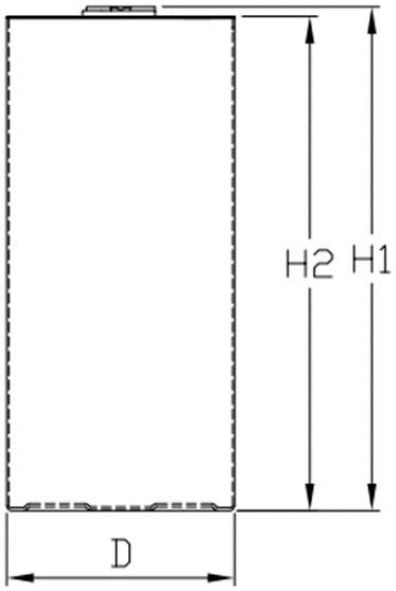
4.2 型号：DFDLFR60130（46Ah）

Model: DFDLFR60130(46Ah)

4.3 外观尺寸 Dimensions

电芯外观不得有变形及裂纹，表面平整、干燥、无外伤、无污物等，且标志清晰。

The appearance of the cell should not be deformed or cracked,the surface should be flat, dry,non-traumatic, non-dirty,and the mark should be clear.



项目 Item	描述 Description	尺寸 Dimensions
H1	高度 1 Hight1	131.0±0.5mm
H2	高度 2 Hight2	128.5±0.5mm
D	直径 Total Hight	60.2± 0.3 mm

5. 产品规格 Specification

5.1 技术参数 Technical Parameters

No.	项目 Item	规格要求 Specification Requirements
1	额定容量 Nominal Capacity	46.0Ah RT@1/3C Discharge 46.0Ah RT@1C Discharge
2	标称电压 Standard Voltage	3.20V RT@1/3C Discharge
3	标准充电 Standard Charge	1/3C CC to 3.65V,3.65V CV to 0.05C
4	标准放电 Standard Discharge	1/3C CC to 2.0V
5	充电截止电压 Charging Cut-off Voltage	3.65V
6	放电截止电压 Discharging Cut-off Voltage	2.0V（T＞0℃） 2.0V（T≤0℃）
7	最大持续充电电流 Max Charge Continuous Current	0.8C（36.8A）
8	最大持续放电电流 Max Discharge Continuous Current	1C（46A）
9	电芯内阻 Internal Resistance	≤1.0mΩ
10	电芯重量 Weight	820±20g（含 PET 膜）
11	能量密度 Energy Density	≥180Wh/kg,≥410Wh/L RT@1/3C Discharge
12	工作环境温度 Operating Temperature	充电 Charge：-20℃~ 55℃ 放电 Discharge：-30℃~55℃
13	储存环境要求 Storage Requirements	温度 Temperature：-40℃~ 60℃ 湿度 Humidity：≤75%RH

5.2 充电模式 Charging Model

序号 NO.	参数 Parameter	规格 Values	备注 Remarks
5.2.1	标准充电模式 Standard Charging Model	1/3C	室温下，以 1/3C 恒流持续充电至单体电芯电压 3.65V，然后在 3.65V 下恒压持续充电直至电流降至 0.05C。 At 25℃±2℃， charged to 3.65V at a constant current of 1/3C, and then,changed continuously with constant voltage of 3.65V until the current to 0.05C.
5.2.2	标准充电温度 Standard Charging Temperature	25℃±2℃	电芯温度 Cell Temperature
5.2.3	绝对充电温度 Absolute Charging Temperature	-20℃ ~55℃	无论电芯处在何种充电模式，一旦发现电芯温度超过绝对充电温度范围，即停止充电。 No matter what the charging model is,once the temperature of the cell is above the absolute charging temperature, charging should be stopped.
5.2.4	绝对充电电压 Absolute Charging Voltage	最大 3.65V Maximum 3.65V	无论电芯处在何种充电模式包括脉冲充电状态，一旦发现电芯电压超过绝对充电电压范围，即停止充电。 No matter what the charging model is,including pulse charging, once the voltage of the cell is above the absolute charging voltage,charging should be stopped.

5.2.5 其他充电条件（模式）C-Rate Other charge Condition (C-Rate)

电芯温度/℃ Cell Temperature/℃		-20℃	-10℃	0℃	5℃	10℃	15℃	20℃	25℃	45℃	50℃	55℃
SOC	0%~＜80%	0.07C	0.1C	0.2C	0.3C	0.5C	0.6C	0.8C	0.8C	0.5C	0.5C	0.3C
SOC	＞80%	0.07C	0.07C	0.1C	0.2C	0.2C	0.2C	0.2C	0.2C	0.2C	0.2C	0.2C

5.3 放电模式 Discharging Model

序号 NO.	参数 Parameter	规格 Values	备注 Remarks
5.3.1	标准放电模式 Standard Discharging Model	1/3C	室温下，以 1/3C 恒流持续放电至 2.0V 。 At room temperature,discharged to 2.0V at a constant current of 1/3C.
5.3.2	最大脉冲放电电流 Maximum Pulse	3C	电芯温度低于 55℃，且最长放电时间为 30s。 The maximum discharge time can last 30s with cell temperature

	Discharging Current		below 55℃
5.3.3	标准放电温度 Standard Discharging Temperature	25℃±2℃	电芯温度。 Cell Temperature.
5.3.4	绝对放电温度 Absolute Discharging Temperature	-30℃ ~55℃	无论电芯处在何种放电模式，一旦发现电芯温度超过绝对放电温度范围即停止放电。 No matter what the discharging model is, once the temperature of the cell is above the absolute discharging temperature, discharging should be stopped.

5.3.5 其他放电条件 Other Discharge model (D-Rate)

电芯温度 Cell Temperature		-30℃	-25℃	-20℃	-10℃	0℃	5℃	15℃	25℃	45℃	50℃	55℃
SOC	0%-100%	0.5C	0.5C	1C	1C	1C	1C	1C	1C	1C	1C	1C

6. 常规性能 General Performance

No.	测试项目 Item	测试方法 Test Method	判定标准 Decision Criteria
1	室温循环 Cycle Life	在 25℃±2℃环境下先用 0.5C 恒流充电至 3.65V，再恒压 3.65V 充电至电流 0.05C，搁置 30 分钟，再用 0.5C 电流放电至 2.0V；又搁置 30 分钟，重复以上步骤，直到放电容量是额定容量的 80%。 At 25℃±2℃environment,using 0.5C constant current charged to 3.65V, then constant voltage charge to current declines to 0.05C,rest 30min,constant current 0.5C discharge to 2.0V,rest 30min.Repeat above steps till discharging capacity lower than 80% of the rated capacity of the cells.	≥2000Cycles
2	低温放电 Low Temperature Discharge	在 25℃±2℃下，以 5.2.1 方式充满电，然后在-20℃±2℃下搁置 8 小时或以上，以 1C 放电至 2.0V。 The cell was charged by 5.2.1 at 25℃±2℃， then at - 20℃±2℃ environment,shelved for 8 hours or more than, then discharged to 2.0V by 1C.	放电时间≥42min Discharge time≥42min
3	高温放电 High Temperature Discharge	在 25℃±2℃下，以 5.2.1 方式充满电，然后在 55℃±2℃下搁置 5 小时或以上，以 1C 放电至 2.0V。 The cell was charged by 5.2.1 at 25℃±2℃,then resting at 55℃ ±2℃ for 5 hours or more than,then discharged to 2.0V by 1C.	放电时间≥57min Discharge time≥57min

4	倍率放电 Multiplying Discharge	在 25℃±2℃下，以 5.2.1 方式充满电，搁置 30min，然后以 1C 放电至 2.0V。 The cell was charged by 5.2.1 at 25℃±2℃, rest 30min,then discharged to 2.0V by 1C.	放电时间≥57min Discharge time≥57min

7. 存储性能 Storage Performance

No.	测试项目 Item	测试方法 Test Method	判定标准 Decision criteria
1	室温存储 Room Temperature Storage	在 25℃±2℃环境下，以 5.2.1 方式充满电，电芯搁置 28 天，然后以 1C 放电至 2.0V，记录放电时间 T1；以 5.2.1 方式充满电，搁置 30min，然后以 1C 放电至 2.0V，记录放电时间 T2。 The cell was charged by 5.2.1 at 25℃±2℃, shelved for 28 days at 25℃±2℃,and then discharged to 2.0V with 1C, recording the discharging time T1 ;Charged by 5.2.1 at 25℃±2℃, rest 30min, and then discharged to 2.0V with 1C, recording the discharging time T2.	放电时间 T1≥57min; 放电时间 T2≥58.2min; Discharge time T1≥57min; Discharge time T2≥58.2min.
2	高温存储 High Temperature Storage	在 25℃±2℃环境下以 5.2.1 方式充满电，放置于 55℃±2℃的恒温箱中搁置 7 天，取出电芯在室温下搁置 5h 后，以 1C 放电至 2.0V，记录放电时间 T1；以 5.2.1 方式充满电，搁置 30min，然后以 1C 放电至 2.0V，记录放电时间 T2。 The cell was charged by 5.2.1 at 25℃±2℃,placed in the thermostat at 55℃±2℃ for 7 days. Take out the cell and hold for 5 hours at 25℃±2℃,discharged to 2.0V with1C, recording the discharging time T1;Charged by 5.2.1 at 25℃±2℃, rest 30min, and then discharged to 2.0V with 0.5C, recording the discharging time T2.	放电时间 T1≥57min; 放电时间 T2≥58.2min. Discharge time T1≥57min; Discharge time T2≥58.2min.

8. 安全性能 Safety Performance

No.	测试项目 Item	测试方法 Test Method	判定标准 Decision Criteria
1	过放电 Over Discharge	在 25℃±2℃下，以 5.2.1 方式充满电，然后以 1C 电流放电 90 分钟，在 25℃±2℃观察 1h。 The cell was charged by 5.2.1 at 25℃±2℃，then discharged for	不爆炸、不起火 No explosion，no fire

		90min by 1C current. Observe for 1 hour at 25℃±2℃.	
2	过充电 Over Charge	在 25℃±2℃下，以 5.2.1 方式充满电，然后以 1/3C 电流充电至规定充电截止电压的 1.1 倍或充电 115%SOC 停止充电；观察 1h。。 The cell was charged by 5.2.1 at 25℃±2℃, charge it with 1/3C current to 1.1 times the prescribed charging termination voltage or 115% SOC to stop charging. Observe for 1 hour.	不爆炸、不起火 No explosion， no fire
3	短路 Short Circuit	电芯充满电后，正负极经外部短路 10min，外部线路电阻＜5mΩ；观察 1h。 When the cell was fully charged, the positive and negative poles are short-circuited for 10 minutes and the external line resistance is less than 5 mΩ. Observe for 1 hour.	不爆炸、不起火 No explosion， no fire
4	加热 Heating	将满电电芯放置温度箱中，温度箱按照 5℃/min 的速率由室温升至 130℃，并维持 30 分钟后停止加热；观察 1h。 The full cell was placed in the temperature box. The temperature box rises from room temperature to 130℃ at the rate of 5℃/min and maintains for 30 minutes. Observe for 1 hour.	不爆炸、不起火 No explosion， no fire
5	挤压 Crushing	将电池以 5.2.1 方式充满电； 挤压方向：垂直电芯表面； 挤压板形式：半径 75mm 的半圆柱体； 挤压速度：≤2mm/s； 挤压程度：直到电芯变形量达到 15%或挤压力达到 100KN 或电压达到 0V 后停止挤压，保持 10 分钟，观察 1h。 Charge the cell to 100% SOC as per section 5.2.1; Extrusion Direction: Vertical Core Surface; Style of extrusion plate： 75mm half cylinder; Extrusion speed: ≤2mm/s; Extrusion degree: until the cell deformation reaches 15% or the extrusion force reaches 100KN or the voltage to 0V,stop extrusion and maintains for 10min. Observe for 1 hour.	不爆炸、不起火 No explosion， no fire
6	温度循环 Temperature Cycle	以 5.2.1 方式充满电，将单体电芯放入温度箱中，按照如下温度循环 5 次： 1. 60 分钟内，以 13/12℃/min 速度，将温度降至-40℃±2℃	不爆炸、不起火 No explosion， no fire

		保持 90 分钟； 2.60 分钟内，以 13/12℃/min 速度，将温度升至 25℃±2℃； 3. 90 分钟内，以 2/3℃/min 速度，将温度升至 85℃±2℃，并保温 110 分钟； 4.70 分钟内，以 6/7℃/min 速度，将温度降至 25℃±2℃； 测试结束后，观察 1h。 The cell was charged as per section 5.2.1,put the cell in the thermostat,according to the following temperature: 1. Reduce the ambient temperature to -40℃±2℃ with 13/12℃/min rate in 60min,then store the cell for 90min; 2. Heating the ambient temperature to 25℃±2℃ with 13/12℃/min speed in 60min; 3. Heating the ambient temperature to 85℃±2℃ with 2/3℃/min speed in 90min, then store the cell for 110min; 4. Reduce the ambient temperature to 25℃±2℃with 6/7℃/min speed in 70min; Repeat above steps for five cycles. After the test ,observe for 1 hour.	

9. 标准测试条件 Standard Test Conditions

9.1 测试仪器、仪表 Testing Instruments

- 电压测量装置：准确度不低于 0.5 级；

Voltmeter measuring device: accuracy is not less than 0.5 grade;

- 电流测量装置：准确度不低于 0.5 级；

Current measuring device: accuracy is not less than 0.5 grade;

- 温度测量装置：准确度在±0.5℃；

Temperature measuring device:accuracy is ±0.5℃；

- 时间测量装置：准确度为± 0.1%；

Time measuring device: accuracy is ±0.1%;

- 尺寸测量装置：准确度为± 0.1%；

Size measuring device： accuracy is ±0.1%;

- 重量测量装置：准确度为± 0.1%。

Weight measuring device: accuracy is ± 0.1%.

9.2 除非另有规定外，所有测试均在温度为 25℃±2℃、相对湿度 15%~90%，大气压力 86KPa ~ 106KPa 环境下进行。

Unless otherwise specified,all tests are conducted at temperatures ranging from 20℃ to 30℃ degrees Celsius,relative humidity from 15% to 90%,atmospheric pressure from 86 Kpa to 106 Kpa. Proceed in the environment.

9.3 用于测试的电芯必须是新交货的电芯，最迟是在一个月前交货，除非另有规定。

Cells for tested must be newly delivered cells,delivered by one month at the latest,unless otherwise specified.

10. 运输 Transport

10.1 电芯运输荷电状态为 30~60%（电芯电压 3.25~ 3.31V)，电芯包装成箱进行运输，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。

The state of charge of cell transportation is 30%~60% （cell voltage is 3.25~3.31V). Cells are packed in boxes for transportation. Violent vibration,shock or extrusion should be prevented during transportation,sunshine and rain should not be inverted.

10.2 在装卸过程中，产品应轻搬轻放，严防摔掷、翻滚、重压。

In the process of loading and unloading,the products should be handled lightly by handled lightly. Throwing,rolling and heavy pressure should be strictly prevented.

11. 贮存条件 Storage Conditions

电芯贮存荷电状态为 30% ~60%（电芯电压 3.25~ 3.31V)，电芯贮存环境温度要求为-40℃~60℃（推荐最佳为 0℃~ 35℃)，清洁、干燥、通风的室内，应避免与腐蚀性物质接触，应不受阳光直射，应远离火源及热源。

Storage charge status of cells is 30%~60% （cell voltage is 3.25~3.31V). Storage environment temperature of cells should be at - 40℃~60℃（0℃~35℃ recommended). Clean,dry and ventilated rooms should avoid contact with corrosive substances,should not be exposed to direct sunlight,and should be far away from fire and heat sources.

12. 电芯使用时警告事项及注意事项 Warnings and Precautions for Cell Use

为避免电芯发生泄漏、发热、燃烧、爆炸等危险，请注意：

In order to avoid the dangers of leakage,heated,combustion and explosion of cells,please pay attention to:

- 严禁将电芯浸入液体中，贮存不用时，应放置于阴凉干燥的环境中；

It is strictly forbidden to immerse cells in liquids. When not in use,cells should be stored in a cool and dry environment;

- 禁止将电芯置于高温热源旁，如火、加热器等；

It is forbidden to place cells near high-temperature heat sources,such as fires,heaters,etc.

- 充电时请选用锂离子电芯专用充电器；

When charging,please choose a special charger for lithium-ion cells;

- 严禁颠倒正负极使用电芯；

It is strictly forbidden to use cells by reversing the positive and negative electrodes;

- 禁止用金属直接连接电芯正负极使电芯短路；

It is forbidden to connect the positive and negative electrodes of cells directly with metals to make them short-circuit;

- 禁止敲击或抛掷、踩踏和弯折电芯；

Striking or throwing,trampling and bending cells are prohibited;

- 禁止用钉子或其它利器刺穿电芯；

It is forbidden to pierce the cell with nails or other sharp tools;

- 禁止在高温下使用电芯；

Cells are prohibited at high temperatures;

- 禁止在强静电和强磁场的地方使用电芯；

It is forbidden to use cells in places with strong static and magnetic fields;

- 如果电芯发生泄露，电解液进入眼睛，请不要揉擦，应用清水冲洗眼睛，并立即送医治疗；

If the cell leaks and the electrolyte enter the eyes,please don't rub it. Rinse your eyes with clean water and send to the hospital immediately;

- 如果电芯发出异味、发热、变色、变形或使用、贮存、充电过程中出现任何异常，立即将电芯从装置或充电器中移开并停用；

If there is any abnormality in the process of odor,heat，discoloration,deformation or use,storage and charging,remove the cell from the device or charger immediately and stop using it;

- 防止电芯包装内产生短路，引线与电芯之间要有足够的绝缘层以保证绝对安全。外壳内不得有任何短路发生，以防止冒烟或着火；

To prevent short circuit in cell packaging,there should be enough insulation between lead and cell to ensure absolute safety. No short circuit shall occur in the enclosure to prevent smoke or fire;

- 严禁拆卸电芯，更换电芯时应由电芯供应商或设备供应商完成，用户不得自行更换；

Disassembly of cells is strictly prohibited. Replacement of cells should be completed by cell suppliers or equipment suppliers. Users are not allowed to replace cells by themselves;

- 禁止使用已损坏的电芯；

Using damaged cells is prohibited;

- 禁止和不同型号，不同品牌的电芯混用；

It is forbidden to mix cells of different models and brands;

- 禁止新旧电芯，不同材料的电芯混用。

It is forbidden to mix old and new cells with cells of different materials.

13. 产品责任 Product Liability

敬请客户在电芯使用前仔细阅读产品规格书，并严格按照产品规格书及所附的注意条款来使用电芯。对没有按本规格书规定操作而导致的意外，广西宁福新能源科技有限公司将不承担责任。

- Please read the product specifications carefully before using the cells,and use the cells in strict accordance with the product specifications and the attached terms of attention. Guangxi Ningfu New Energy Technology Co. LTD will not be liable for any accidents caused by the failure to operate in accordance with this specification.

14. 修订声明 Amendment Statement

因广西宁福新能源科技有限公司不断地改善产品质量、特性的需要，广西宁福新能源科技有限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。

Due to need of continuous improvement of product quality and characteristics of Guangxi Ningfu New Energy Technology Co. LTD. Which has the right to revise product specifications and maintenance characteristics without prior notice to users.

15. 其它事项 Other

本规格书中未提及的事项，须经双方协商确定，广西宁福新能源科技有限公司保留对此规格书中所述内容的最终解释权。

The matters not mentioned in this specification shall be determined through consultation by two parties. Guangxi Ningfu New Energy Technology Co. LTD reserving the right of final interpretation of the contents mentioned in this specification.