RePower 瑞能

PACK EOL Test Equipment Technical Specification

Version:
V1.0-20250506

Model: EOL-PACK-EPT1000V

Party A: _____

Representative (seal):

Party B: _____

Representative (seal):

Contract Number: _____

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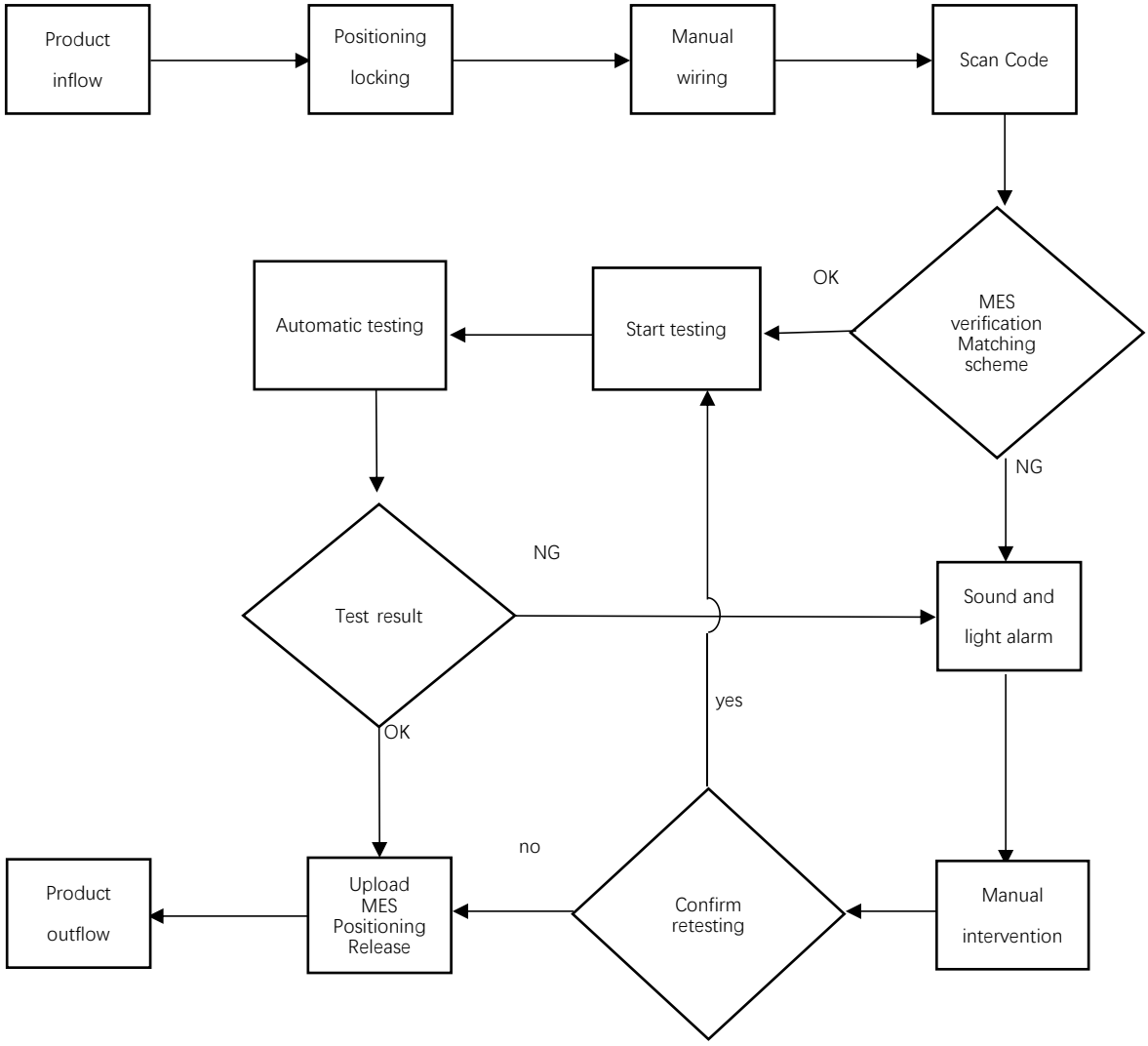
1、 Introduction

1.1 System Overview

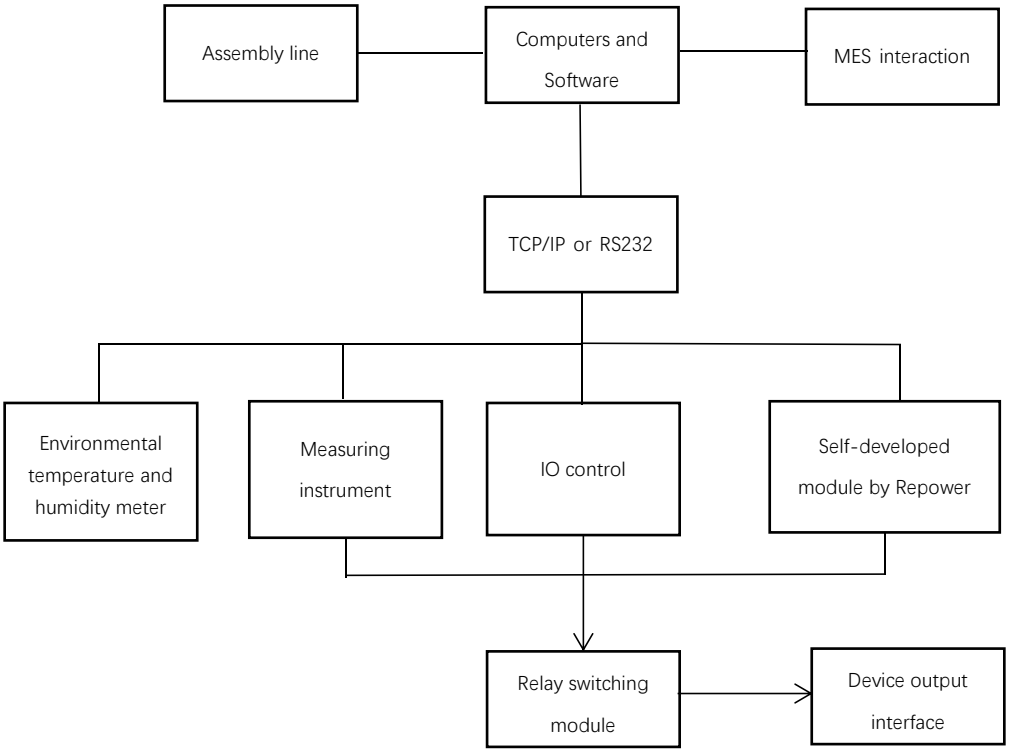
The EOL testing system is mainly used for offline testing and quality control of battery modules or packs for electric vehicles, buses, container energy storage, household energy storage, and mobile energy storage. A comprehensive and intelligent testing platform developed to integrate automatic testing, data recording integration analysis, production efficiency, and other aspects of lithium battery offline, providing a complete static testing solution for power battery modules or PACK; The unique features include safe, fast, and efficient, customized test data output format, linkage testing with charging and discharging testing equipment, seamless integration with factory MES, and simple software operation interface.

1.2 Basic testing process

Note: The action process is for reference only and does not represent the scope of supply.



1.3 Equipment topology diagram



二、Main components of the equipment

2.1 Main Equipment Configuration

Number	Unit Name	Brand	Specification/Model	Number	Unit
1	Insulation Withstand Voltage Tester	Ainuo	BTS837	1	Pcs
2	Multimeter	Gwinstek	GDM-9061	1	Pcs
3	AC Internal Resistance Tester	Hantek	HBT4564A/H	1	Pcs
4	BMS Power Supply	Customized	Supplier-defined compatible models	1	Pcs
5	CAN Card	Customized	Supplier-defined compatible models	1	Pcs
6	Computer	Dell	CPU-I5 or above/16GB RAM/1TB HDD	1	Pcs
7	Monitor	Dell	21.5 inch	1	Pcs
8	Temperature and Humidity Meter	Renke	RS-WS-ETH	1	Pcs
9	Barcode Scanner	Customized	Supplier-defined compatible models	1	Pcs

10	High Voltage Measurement Unit	RePower	RP-EOL-HVUnit	1	Pcs
11	Programmable Resistor Unit	RePower	RP-HPRES-CK-01	1	Pcs
12	LOW Voltage Signal Unit	RePower	RP-PACK-LVUnit	1	Pcs
13	PWM Unit	RePower	RP-GD-4CH-PWM	1	Pcs
14	Equipotential Switching Board	RePower	RP-EC-Relay	1	Pcs
15	IO Module	RePower	RP-EIO-128CH	1	Pcs
16	Control Software	RePower	RP-EOL-S/W	1	Pcs
17	Cabinet	RePower	EOLCabinet	1	Pcs
18	Equipment Harness	RePower	EOL-PACK-SBX	1	Pcs
19	Test Harness	RePower	EOL-PACK-CSX	1	Pcs
20	Master Resistor Box	RePower	RP-Master-01	1	Pcs
21	Wire-cable hut	RePower	EOL-PACK-ZJH	1	Pcs

Note: If Party A has requirements for the appearance and color of the equipment, Party A must provide a standard color card sample or color card number (except for electroplated parts and stainless steel). If there is no color requirement, the default color provided by Party B shall be followed.

2.2 Special Material List

Number	Unit Name	Brand	Specification/Model	quantity	unit
1	Connector	\	Blue battery docking connector	2	set
2	Battery pack	\	Blueprint battery pack (used during debugging)	1	set

Note: As the special materials are bound to the product to be tested, Party A or the final user of the equipment should purchase them themselves, and Party B is responsible for wiring.

2.3 Scope of Supply Description

Number	Item	Line integration party or demand party	Testing equipment party
1	Online Equipment Frame	V	
2	Docking Fixture (High/Low Voltage Plugs)	V	
3	Needle Bed Fixing Mechanism & Mobile Servo	V	
4	Probe	V	
5	RFID & Automatic Scanning	V	
6	Safety Light Curtain	V	
7	Test Instruments		V
8	Industrial Control Computer (Mouse/Keyboard/Monitor)		V
9	Test Software		V
10	Test Equipment MES Integration		V

Note: The boundary of the equipment supply scope is shown in the table above. During acceptance, the supply scope of the testing equipment shall be used as the boundary point for separate acceptance.

2.4 Explanation of the responsible party

Number	project	Line integration party or demand party	Testing equipment party
1	Connector skewed and misaligned, poor docking, and product scratches	V	
2	Mechanism malfunction, servo positioning	V	
3	Insufficient instrument accuracy, circuit failure in test cabinet		V
4	Test results uploaded, testing machine MES interaction		V

3、 Applicable product specifications

3.1 Compatible product specifications

Number	Product Name	Nominal voltage	Communication protocol (This function requires configuring the corresponding communication conversion module)
1	A-type battery blueprint	1000V	CAN/CANFD
2	B-type battery blueprint	1000V	CAN/CANFD

Note: The product models that need to be installed and adjusted on site are listed in the table above. If the equipment has met the acceptance conditions, Party A or the final user of the equipment is still unable to provide the blue products in the table above to Party B for debugging work, the acceptance conditions required by the business shall prevail.

4、 Technical parameters

4.1 Basic Equipment Parameters

序号	Item	Technical parameter
1	Equipment size	≤850*800*1980mm（W*D*H）
2	Number of device channels	1 channel
3	Operation mode	Manual wiring, Software automatic testing, can test up to one product simultaneously
4	Internal communication	LAN/RS232
5	Product communication	CAN/CANFD(based on configuration list)
6	Input voltage	AC220V±10%，50/60Hz or AC110V±10%，50/60Hz
7	Input power	≤2kW
8	Protection rating	IP32
9	Cooling method	Air-cooled
10	Security level	Complies with EN60950 and GB4943 requirements
12	Equipment working environment temperature	0℃～45℃
13	Device storage temperature	-10℃～70℃
14	Maximum relative humidity during equipment operation	30%～70%（RH non condensing）

4.2 Equipment functional parameters

Number	Unit Name	Brand	Model	Specification parameters
1	Insulation Withstand Voltage Tester	Ainuo	BTS837	1) AC Withstand Voltage (ACW): 5kV/100mA 2) DC Withstand Voltage (DCW): 6kV/10mA 3) Insulation Resistance (IR): 6kV/50GΩ 4) Ground Impedance: 32A/600mΩ
2	Multimeter	Gwinstek	GDM-9061	1) Resolution: 6½ 2) Voltage Range: 1000VDC 3) Resistance Range: 100MΩ
3	AC Internal Resistance Tester	Hantek	HBT4564A/H	1) Voltage Range: 1300VDC 2) Resistance Range: 3600Ω
4	High Voltage Measurement Unit	RePower	RP-EOL-HVUnit	1) Modular design with effective electrical isolation for high-voltage test circuits 2) All outputs fused for short-circuit/overload protection 3) Relay cards support quick replacement and channel expansion
5	Programmable Resistor Unit	RePower	RP-HPRES-CK-01	1) Insulation simulation switching 2) Switching Resistance: 5KΩ～10MΩ; Accuracy: ±3% 3) Resolution: 5KΩ

6	LOW Voltage Signal Unit	RePower	RP-PACK-LVUnit	1) Specific Temperature Simulation Output (Default: 25℃) 2) High Voltage Interlock Simulation, Dry Contact Output 3) BMS Power Supply Switching, Activation/Ignition Enable Signal Output 4) CAN Termination Resistance Measurement, CAN-to-Ground Voltage Measurement (Requires Additional Instruments) 5) Charging Hardware Handshake Signals (CC, CC2-1, CC2-2)
7	PWM Unit	RePower	RP-GD-4CH-PWM	1) 4-Channel PWM Signal Output 2) Voltage Amplitude: -15V～15V (Range Depends on External Power Supply Voltage) 3) Adjustable Duty Cycle: 0%～100%, Accuracy: ±2% 4) Adjustable Frequency: 1～100kHz, Accuracy: ±0.02%
8	Equipotential Switching Board	RePower	RP-EC-Relay	1) 2-Channel Equipotential Measurement, Modular Design 2) High Voltage Isolation Design to Prevent Backflow
9	IO Module	RePower	RP-EIO-128CH	1) Digital Output Module with High Voltage Isolation Technology (Anti-Breakdown) 2) High-Speed MCU Chip for Rapid Response 3) TCP/IP Communication Protocol for Secure & Stable Connectivity

10	Master Resistor Box	RePower	RP-Master-01	1) Insulation Resistance: 50MΩ, 200MΩ, 700MΩ 2) DC Withstand Resistance: 1MΩ, 4MΩ 3) AC Withstand Resistance: 500kΩ, 1MΩ 4) External, Manual Wiring, Automatic Inspection by Host Software
11	Control Software	RePower	RP-EOL-S/W	1) RePower EOL Testing Software 2) Supports Local Data Export, MES Data Upload Service, etc. 3) Supports Rapid Recipe Switching for Different Products Under Test 4)Two test product debugging services are provided by default

4.3 System testing items

Number	Test items	Function Description	Testing instruments
1	Fixture fixed-point	Test fixture to battery module fixed point	Manual
2	Pack-Total Voltage Measurement	Read BMS cell voltages via CAN and sum to get total voltage V1; compare V1 and BMS-measured total voltage V2 with actual measured total voltage to verify if values and accuracy are within normal range.	Multimeter
3	Program Burning	Program burning and verification for battery pack system (customer-provided burning tool software).	CAN Card
4	CAN Communication Test	Read battery pack initialization information via CAN communication.	CAN Card
5	Termination Resistance Test	Use multimeter resistance mode to check if each CAN line has 120Ω/60Ω resistors (direct measurement, no parallel testing).	Multimeter
6	Ambient Temperature Comparison	Compare BMS-detected temperature with ambient temperature (or use ambient temperature as functional reference).	Temperature & Humidity Meter
7	BMS Insulation Alarm Test	Apply ≤500Ω/V resistance between total positive/negative terminals and casing to trigger BMS insulation alarm. Apply ≤100Ω/V resistance between total positive/negative terminals and casing to trigger BMS insulation alarm.	High-Power Resistor Programming Unit
8	PWM Signal Testing	Test signals like charge lock, fast-charge activation, fan control, and ignition signals using different PWM frequencies.	PWM Generator
9	ACIR Test	Measure AC internal resistance of the battery pack.	Internal Resistance Tester

10	Ground Continuity Test	Check continuity of Pack grounding line.	Insulation Withstand Voltage Tester
11	Equipotential Test	Measure resistance between Pack equipotential points.	Insulation Withstand Voltage Tester
12	High Voltage Interlock Test	After connecting all battery pack connectors, check BMS status and continuity of interlock lines. Disconnect one interlock line and verify if BMS status indicates failure (NG).	CAN Card
13	Charging Communication Test	Connect to charging CAN via CAN card, send messages, and validate if responses are received.	CAN Card
14	Vehicle Communication Function	Connect to vehicle charging CAN via CAN card, send messages, and validate if responses are received.	CAN Card
15	Insulation Resistance Test	Disable insulation monitoring function, use insulation tester to measure insulation resistance between total positive/negative terminals, charging terminals, and chassis (ground).	Insulation Withstand Voltage Tester
16	Single Cell Voltage Difference Test	Detect maximum and minimum string voltages of the battery pack via BMS. Calculate the difference between the maximum and minimum values.	CAN Card
17	Single Cell Temperature Difference Test	Detect maximum and minimum temperatures from battery pack temperature sensors via BMS. Calculate the difference between the maximum and minimum values.	CAN Card
18	Test data upload	Upload test data to the MES system.	\

Note: The EOL testing system is a customized equipment, and the equipment configuration and function shall be based on meeting the testing items specified in the table above. Any additional items shall be evaluated and confirmed by Party B. Additional items shall not be used as acceptance criteria for this agreement.

4.4 Standard functional requirements

4.4.1 General Hardware Functions

1) The equipment is equipped with insurance and an external AC switch, which has anti leakage and human protection functions;
2) The equipment is equipped with a bus emergency stop switch and hardware emergency stop function;
3) All high and low voltage relays in the equipment configuration are set to normally open by default to prevent unexpected situations;
4) The wiring harness of the device connected to the positive and negative terminals of the battery, as well as the box, is equipped with fuses to prevent accidental situations;
5) Module/Pack safety, voltage, temperature, faults, and other abnormalities, equipment stops testing and sound and light alarms;
6) The temperature of the module/pack testing environment is extremely abnormal, and the equipment stops testing with an audible and visual alarm;

4.4.2 General software functions

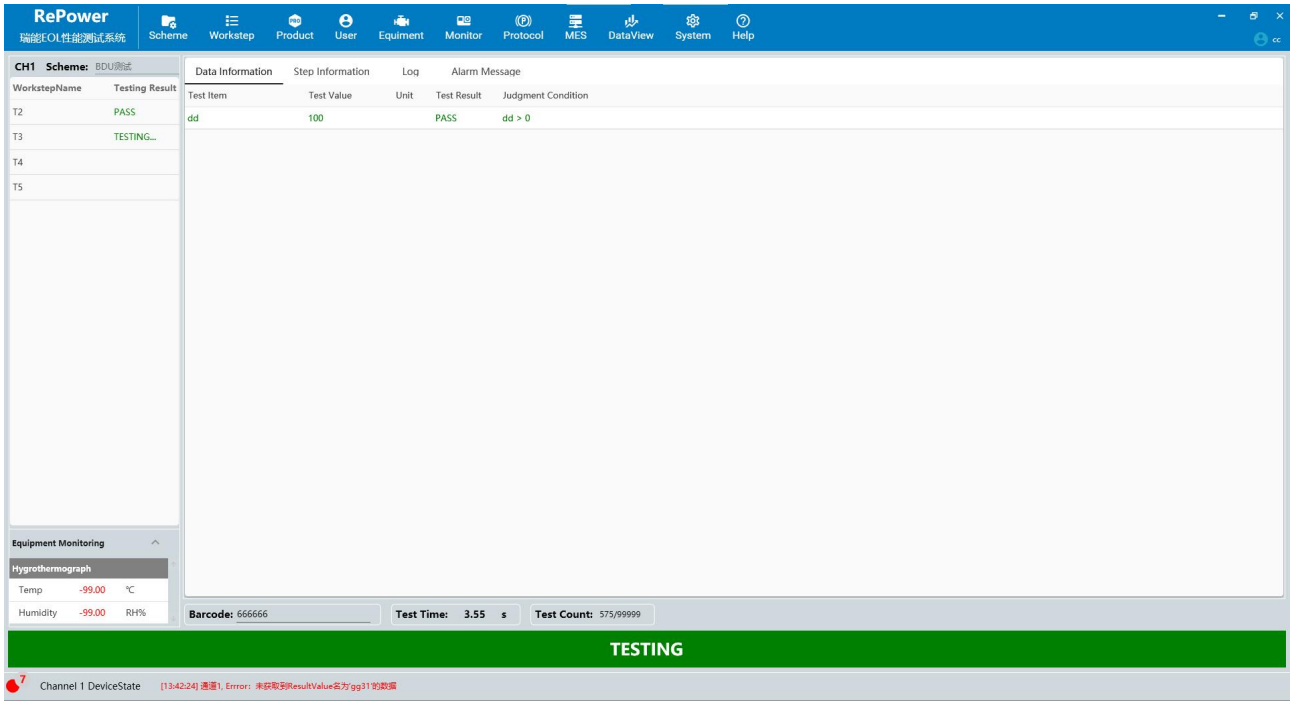
1) Provide four modes: automatic, manual, debugging, and automatic idle operation (without the need for materials and equipment to operate in a safe state). Switching between operating modes requires different permissions;
2) Provide reasonable production control strategies and propose reasonable handling measures for various situations that can be encountered in production;
3) Provide comprehensive fault diagnosis functions. When equipment testing malfunctions, the control panel can indicate the type and location of the fault, and provide specific handling methods if necessary;
4) Collect and display production information, such as current output, planned output, process optimization rate, etc;
5) Can accurately identify and distinguish the barcodes of modules, and save their respective data according to the barcodes;

5、 System diagram

5.1 Equipment appearance rendering

（Subject to the physical product）

5.2 Software interface



6、 Equipment pre acceptance and final acceptance standards

If Party B completes the debugging and trial operation for 30 days without any abnormal problems, it can enter the acceptance process and execute according to the relevant provisions of the technical agreement.

The acceptance shall be carried out by designated engineering and technical personnel from both parties, who shall jointly sign the acceptance report.

Acceptance mainly involves the acceptance of various functions, technical indicators, and appearance of the equipment.

If due to the reasons of Party A, if Party A does not have the production conditions, does not have corresponding products for Party B to debug, or is unable to provide installation and debugging conditions, Party A still does not notify installation within 30 days from the date of equipment delivery, or does not notify debugging within 30 days from the date of installation completion, it shall be deemed that the product acceptance is qualified.

7、 Installation, debugging, and training

Unless otherwise requested in writing, Party A shall be responsible for receiving; And prepare relevant electricity, gas, and other equipment input terminals.

The second party is responsible for delivering the goods to the location designated by the first party, the first party assists in transporting the machines to the installation site, and the second party carries out the installation and debugging of the equipment.

The first party shall provide the second party with raw materials that can meet the requirements for debugging the machine, including the prototype battery to be tested, BMS communication protocol, DBC files, UDS unlocking algorithm, testing process requirements documents, etc.

After installation, both parties shall conduct small-scale trial production of their equipment. Only after the small-scale trial production is qualified and approved by Party B can it be put into formal mass production.

The second party shall provide free training to the relevant personnel of the first party, including the normal use, maintenance, fault analysis and troubleshooting, operation safety, and emergency handling procedures of the equipment. The first party must arrange for technical leaders, engineers, operators and other personnel who may use the equipment to be present and cooperate with the training, and sign and confirm on the "Equipment Training Attendance Form" provided by the second party.

8、 Quality assurance and after-sales service

The warranty period for the equipment is one year, during which Party B is responsible for free maintenance and repair of the equipment (excluding vulnerable parts). The second party guarantees to respond by phone within 2 hours and submit a solution within 4 hours after receiving the equipment failure notice from the demand side; If necessary, rush to the buyer's site for maintenance within 48 hours.

After the warranty period expires, Party B shall still be responsible for repairing and maintaining the equipment, but shall only charge reasonable working hours and related travel expenses. For the replacement and purchase of equipment related accessories, Party B shall only charge the cost of accessories.

The second party will provide timely after-sales service by providing 24-hour technical support personnel on duty telephone.

9、 Confidentiality clause

The first party shall strictly keep confidential any trade secrets of the seller that they become aware of as a result of the performance of this agreement, including but not limited to equipment technical parameters, configuration standards, equipment prices, product specifications, etc. Without the written consent of Party B, no information known during the cooperation shall be disclosed to any third party. If Party A violates the provisions of this agreement and leaks Party B's trade secrets, Party A shall compensate Party B for its direct losses. This clause shall remain valid for five years after the termination of this agreement.

10、 Other matters and agreements

This agreement shall be authorized, signed and stamped by both Party A and Party B, and shall come into effect simultaneously with the signing of the business contract.

This agreement, as an appendix to the business contract, is made in duplicate, with Party A holding one copy and Party B holding one copy. Any matters not covered in this agreement shall be resolved through consultation between both parties.