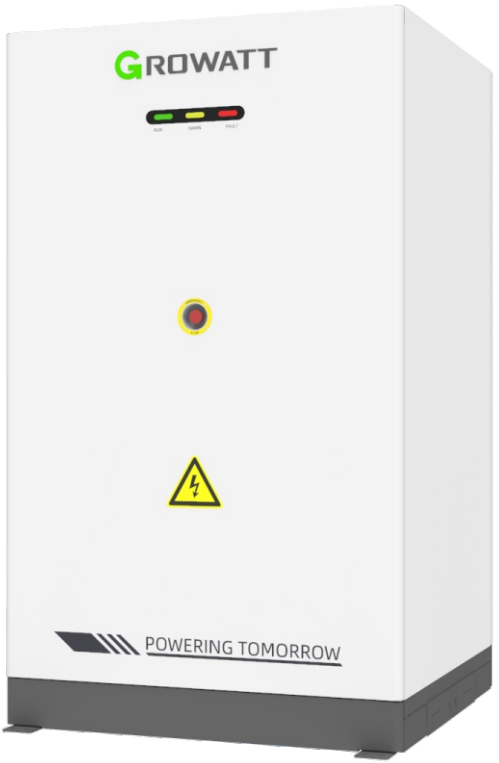


ACE 209H-2H Smart Energy Storage Battery Cabinet User Manual

Table of Contents

1 About this manual

1.1 Overview

This document describes the ACE 209H-2H Smart Energy Storage Battery Cabinet (hereafter referred to as the Battery Cabinet) in terms of the installation, electrical connections and troubleshooting, etc. Prior to operating the battery cabinet, read through this manual and familiarize yourself with all safety precautions and the features of the product.

1.2 Applicable product

ACE 209H-2H Smart Energy Storage Battery Cabinet

1.3 Intended audience

This manual is intended for personnel who transport, install and operate this battery cabinet. Only qualified personnel are allowed to perform operations on the equipment. Qualified personnel should:

- Have fundamental electronic, electrical wiring and mechanical expertise and be familiar with electrical and mechanical schematics.
- Have knowledge of the construction and operating principle of the battery cabinet and other devices connected to it in the ESS system.
- Have received training in the installation and commissioning of electrical devices.
- Have received training in how to deal with the dangers and risks associated with installing, commissioning or operating the electrical devices.
- Be familiar with all locally applicable standards and codes.
- Be familiar with all contents specified in this manual.

Unauthorized personnel are not allowed to perform any operations on the battery cabinet, and should keep a safe distance from the equipment to avoid accidents.

1.4 Symbol conventions

The following safety symbols are used throughout this document to denote important safety information. Familiarize yourself with the symbols and their meaning before installing or operating this instrument.

Symbol	Description
 DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

 **NOTICE**	NOTICE is used to address practices not related to personal injury.
 **Information**	Information that you must read and know to ensure optimal system operation.

1.5 Intended use

Please read this manual carefully before transporting and installing the product. This manual and other documents must be stored in a convenient place and be available at all times for installation, operation and maintenance personnel. No part of this document may be reproduced, stored in a retrieval system or transmitted, in any form or by any means without the prior written permission of Shenzhen Growatt New Energy Co., Ltd. (hereinafter referred to as Growatt). Growatt reserves the right to make changes to the material at any time and without notice in order to keep the document accurate and up-to-date. For possible changes in this manual, Growatt accepts no responsibility to inform users. If questions arise during installation, you can contact Growatt Support.

1.6 Abbreviations

Full name	Shortened form
ACE 209H-2H Smart Energy Storage Battery Cabinet	ACE Battery Cabinet
Energy management system	EMS
Battery pack	PACK
Battery management system	BMS

2 Safety precautions

All safety instructions specified in this manual must be strictly observed at all times. In order to avoid potential personal injury and property damage during installation or operation, and to extend the service life of the battery cabinet, please be sure to read the safety instructions carefully.

2.1 General safety

When installing, operating and maintaining the equipment, read this manual first and follow all safety precautions marked on the equipment and specified in the manual.

The "NOTICE", "CAUTION", "WARNING" and "DANGER" statements in this manual do not cover all the safety precautions, but are only supplements to the safety precautions. Growatt shall not be liable for any consequences due to violation of general safety requirements or safety standards for the design, production and usage of the equipment.

This equipment should be used in an environment that meets the design specifications, otherwise it may cause equipment failure. The consequential equipment malfunction, component damage, personal injuries, property damage, and other problems are beyond the scope of warranty. Observe local laws, regulations and codes when installing, operating and maintaining the equipment. The safety precautions in this manual are only supplements to local laws, regulations and codes.

Growatt shall not be held liable for the consequences of any of the following events:

1) Failure to meet the installation and operation environment requirements listed in applicable international, national and regional standards.
2) Operations beyond the conditions specified in this manual.
3) Disassemble or alter the product, or modify the software code without authorization.
4) Failure to follow the operating instructions and safety warnings on the product and in the documentation.
5) Damage due to force majeure, such as earthquakes, fires, windstorms, floods, mudslides, etc.
6) Damage caused during transportation and installation by the user.
7) Damage caused during storage as the storage conditions do not meet the requirements
8) Damage to the hardware or data of the equipment due to customer negligence, improper operation or intentional damage.
9) Damage to the system caused by third parties or the customer, including damage caused by failure to follow the requirements when relocating, installing, adjusting, or altering the battery cabinet, or removing identification markings.
10) Defects, failures or damages resulted from behaviors, events, negligence or accidents beyond the reasonable control of the seller, including power outages or electrical failures, theft, war, riots, civil commotion, terrorism, willful or malicious damage.

DANGER	High voltages are present in the equipment. Malpractice may lead to electric shocks or fires that could result in serious personal injury, severe property damage, or even death. Please observe the following operation instructions:

- Observe the operating procedure and safety precautions specified in this manual and other related documents.
- Observe the safety labels, warnings and precautions on the equipment.
- Observe the requirements specified in this manual. Choose the correct tools and use them properly.
- Observe the safety regulations regarding the power plant, such as implementing the operation ticket and work ticket system.
- Keep persons other than those operating the equipment away from the equipment. Take protection and isolation measures for the equipment in operation, such as installing temporary warning signs or fences.
- Do not scrawl, damage or block any safety labels, warnings and protective measures on the equipment. Promptly replace the labels that have worn out.
- Do not perform operations such as installation, wiring, maintenance and replacement with power on.
- Do not clean electrical components inside the equipment with water.
- Check the equipment for damage such as holes, dents, or other signs of possible internal damage.
- Check that the pre-installed cables are securely connected.
- Check that the internal components of the equipment are not displaced. It is not allowed to alter the equipment structure or change the installation sequence without authorization.
- Do not power on the device without completing the installation or without carrying out after-installation by a professional technician.
- Measure the voltage at the contact point before coming into contact with any conductor surface or terminal. Ensure that the PE cable of the equipment or parts to be serviced is reliably connected and that there is no risk of electric shocks.
- If liquid is found inside the equipment, press the emergency stop switch immediately and notify the site manager.
- Do not open the cabinet door while the system is running.
- Wear arc flash protective clothing upon initial power-up, or when operating the main circuit with electricity on.

 **NOTICE**	• Do not perform operations such as arc welding, drilling, cutting on the equipment, which will damage the sealing and electromagnetic interference shielding performance, or damage the internal components and cables. Metal shavings produced during operation might cause a short circuit, leading to malfunction or device damage. • Do not touch the equipment in operation to avoid burns as it generates high temperature on the enclosure. • In case that a fault that might cause personal injury or device damage is detected during operation, stop the operation immediately, report the issue to the person in charge and take effective protection measures. • Evacuate from the site immediately once the fire alarm horn/strobe is triggered. • During operation or maintenance, close and lock the cabinet door if the operation personnel need to leave temporarily.
 **Information**	• When performing operations such as transportation, transferring, installation, wiring and maintenance, comply with the requirements listed in locally applicable laws, regulations and relevant standards. • The materials and tools prepared by the user must comply with requirements listed in locally applicable laws, regulations and relevant standards. • Ensure that you have obtained approval from local electricity department before operating the system in the on-grid mode. • Before installing, operating, or maintaining the equipment, clean the water, ice, snow, or other debris on top of the cabinet before opening the door to prevent foreign objects from falling into the cabinet.
	• Reverse engineering, decompiling, disassembly, adaption, implantation or other derivative operations on the equipment software are strictly prohibited. Do not study the internal implementation logic of the equipment, obtain the source code of the equipment software, violate intellectual property rights in any manner, or disclose the results of any performance tests of the equipment software. • It is recommended that users prepare a camera to record the detailed process of installation, operation and maintenance of the equipment.

2.2 Personnel safety

- Only qualified personnel are allowed to operate the equipment, including transporting, transferring, installation, wiring and maintenance. Wear equipment that meets local safety requirements.
- Operators must have knowledge of the energy storage system through relevant training and examination.

	For specific personnel requirements, please refer to local regulations and industry standards. • Do not wear conductive objects, such as watches, bracelets, bangles, rings and necklaces when installing, operating and maintaining the equipment to avoid electric shocks. • When performing operations such as transportation, transferring, installation, wiring and maintenance, comply with the requirements listed in locally applicable laws, regulations and relevant standards. • Familiarize yourself with the structure and working principle of the entire battery cabinet and operate the equipment following instructions specified in this manual.

2.3 Manual management

The product manual is an integral and important part of the product, containing important information of the product, including transportation and installation. Be sure to read this manual carefully before performing operations on the product.

- Please strictly observe instructions specified in this manual when transporting, installing or performing other operations on the product; otherwise, it may lead to device damage, personal injury or death, or property damage.
- This manual should be kept in a safe place to ensure that it is readily accessible to transportation, installation and operation personnel.

2.4 Electrical safety

Cable routing requirements

- Avoid improper operations, such as dropping cables directly from a vehicle.
- Do not route cables near the air intake and exhaust vents of the equipment.
- Bind the cables of the same type. For different types of cables, keep a distance of 30 mm and ensure that they are not entangled or overlapped.
- Upon completion of cable connections or when cable connection is paused for a short period, seal the cable holes with sealing putty at once to prevent small animals from entering.
- The cable insulation layer might deteriorate or be damaged in the high-temperature environment. Reserve a distance of at least 30 mm between the cables and the heat-generating components or areas.
- When selecting cables, follow local laws and regulations.
- Ensure that the slots and holes for routing cables are free from sharp edges.
- The positions where cables are routed through pipes or cable holes should be protected to prevent the cables from being damaged by sharp edges or burrs.
- Cables used in the energy storage system should be securely connected, insulated and of the appropriate specification.
- Secure the cables with cable supports and cable clips. Ensure that cables in the backfill area are in close contact with the ground to prevent cable deformation or damage during backfilling.
- When the temperature is too low, violent impact and vibrations may cause damage to the plastic cable sheathing.

The following requirements should be met to ensure construction safety:

-All cables can only be laid and installed when the temperature above 0°C. Handle cables with caution, especially when working in a low-temperature environment.

-If stored at environments below 0°C, the cable must be stored at room temperature for more than 24 hours before they are laid out.

Grounding requirements

- Do not damage the grounding conductor.
- It is prohibited to operate the equipment in the absence of a properly installed grounding conductor.

- When installing the equipment that requires grounding, the PE cable shall be installed first; when removing the equipment, the PE cable shall be removed last.
- Ensure that the equipment is permanently connected to the protective ground. Before operations, check the electrical connection to ensure that the equipment is properly connected.
- Ensure that the equipment grounding impedance meets local electrical standards.

O&M requirements

- Before connecting or removing cables, disconnect the corresponding switches.
- Attach warning signs to prevent accidental connection near the switches/circuit breakers that have been turned off.
- Check if the equipment is energized using a voltage tester. Ensure that the equipment has been completely powered off.
- If live objects exist nearby, please shield or wrap them using insulated boards or tapes.
- Connect the circuit to be serviced and the grounding circuit using a PE cable reliably before conducting O&M.
- Remove the PE cable between the serviced circuit and the grounding circuit after the O&M is completed.

Arc flash protection requirements

 **DANGER**	To avoid personal injury or death and equipment damage, operate this product strictly complying with instructions specified in this manual. Improper operations may result in the risk of electric arcs, fires, explosions, or other risks. Growatt accepts no liability for arcs, fires, explosions, etc., caused by failure to comply with safety labels or instructions described in the product manual. Improper operations as described below may cause electric arcs, fires, explosions and other hazards inside the equipment. Please be aware that accidents must be handled by qualified professionals. Improper handling of the accident may cause a wider range of malfunctions or accidents. Plug or unplug the high-voltage fuses on the AC side with power on. • Touch the uninsulated cable terminals which might be energized. • Come into contact with components that might be energized, such as the copper bar, terminals or other components inside the equipment. • Loose power cable connection. • Accessories such as screws have accidentally fallen into the power module. • Incorrect operations performed by untrained and unqualified operators.

 **DANGER**	• Inspect the operating area to check for the risk of electrical arcs before operating the equipment. If the risk of electrical arc exists, please meet the following requirements: • Operators must have received relevant safety trainings. • If possible, figure out the areas where electric shocks are likely to occur. • Wear compliant protective clothing before working in areas where there are potential electric shocks.

ESD requirements

 **Information**	Static electricity generated by the human body can damage static-sensitive components on single boards, such as large-scale integrated circuits (LSIs). • Wear ESD gloves before touching the equipment and handling boards. • When holding a board, hold the edge without touching any components. Do not touch the components with bare hands. • Pack the boards with ESD packaging materials before storage or transportation.

2.5 Storage requirements

General requirements

- Keep relevant proof of compliance with product storage requirements, such as temperature and humidity log data, photos of the storage environment and inspection reports.
- It is not recommended to store battery packs and the battery cabinet for extended periods. The irreversible capacity loss of the lithium battery is generally 3% to 10% when it has been stored for 12 months at the recommended storage temperature.
- Store the equipment in a clean, dry place and protect it against dust and moisture. Do not expose the equipment to rain or standing water on the ground.
- The ambient air must not contain corrosive or flammable gases.
- The equipment must not be placed tilted or upside down.
- If the equipment excluding battery packs has been stored for over two years, it should be inspected and tested by professionals before being put into use.

Battery cabinet storage requirements (excluding battery packs, etc.)

- Do not remove the package if it is to be stored for a long period.
- Do not stack the equipment during storage.
- The ground surface should be flat (for long-term or temporary storage).
- Close the cabinet door tightly.
- Temperature of storage environment: -40℃~+60℃; humidity: 5% RH~95% RH.

Conditions for determining battery pack overdue storage

Generally, it is not recommended to store battery packs for an extended period. You are advised to use them immediately.

Storage temperature requirement	Storage voltage requirement (U)	Charge interval	Note
0℃~40℃	54V≤U (Charge the single battery PACK if its voltage is less than 54V)	3 months	1. Within the charge interval: no action required; 2. Reach the charge interval: charge the battery; The storage duration should not exceed the warranty period.

1. If the storage duration of the battery PACK or the cabinet is longer than the permitted period, report the issue to the person in charge.
2. Dispose of the bulging PACK regardless of the storage duration.
3. The storage duration starts from the latest charge time labeled on the battery package. If a battery is qualified after charge, update the latest charge time and the next charge time (which is latest charge time + 3 months) on the label. The storage duration should not exceed the warranty period.

2.6 Installation environment requirements

Observe the following requirements when selecting the site:

- The installation layout of the battery cabinet must meet the fire separation distance or firewall requirements stipulated in local standards.
- Do not place the equipment in an environment with flammable or explosive gases or smoke, and it is prohibited to perform any operations in such environments.
- Do not install, use or operate the equipment and cables installed outdoors (including but not limited to, moving the equipment, operating equipment and cables, plugging and unplugging connectors from signal ports connected to outdoor devices, working at heights, performing outdoor installation) under severe weather conditions such as thunder, lightning, rain, snow, and Level 6 or stronger wind.
- Take protective measures such as installing fences or walls around the battery cabinet and set up the safety warning sign to prevent unauthorized people from entering when the equipment is running, which might cause personal injury or property loss.
- When the equipment is operating, do not block the vents and cooling system to prevent fires caused by high temperature.

- Keep the equipment far away from liquids. Do not install it in areas prone to condensation, such as under the water pipes or the air exhausts, or areas prone to water leakage, such as under the air conditioner vents, ventilation vents or the cable routing window of the equipment room to prevent equipment malfunctions or short circuits caused by liquid penetration.
- Ensure that the installation site is far away from fire sources. Do not place flammable or explosive materials around the equipment.
- If the equipment is installed in a site with heavy vegetation, in addition to routine weeding, the ground underneath the equipment needs to be hardened to prevent overgrown weeds.

2.7 Handling and transportation requirements

 **DANGER**	Load and unload batteries in accordance with locally applicable laws, regulations and industry standards. Load and unload batteries with caution; otherwise, it might lead to short circuits or damage to the battery packs, e.g. electrolyte leakage, crack, explosions or fires.

Departure conditions

- If the battery pack has been collided or dropped, or there is smoke or fire, please handle the issue following the emergency handling instructions; otherwise, transportation is prohibited.
- Check the battery cabinet before transportation. Ensure that the cabinet is intact and the cabinet door is securely closed. Make sure the cabinet is free from any foreign objects, and there is no smoke or burning smell; otherwise, transportation is prohibited.

	Exercise caution and take moisture-proof measures when loading, unloading and transporting the product.

Transport process requirements

- It is not allowed to transport the equipment by railway or air.
- For maritime transportation, the transportation process shall comply with UN 38.3 and UN 3480.
- For land transportation, the transportation process shall comply with UN 38.3 and UN 3480.
- Comply with the requirements of the transport regulatory authorities in the counties of departure, route and destination.
- Comply with the international rules on the transportation of dangerous goods and the requirements of the transportation regulatory authorities of the relevant countries.
- Monitor the whole transportation process.
- Vehicles for land transportation need to meet the load-bearing requirements: a single battery cabinet (including battery packs, etc.) weighs about 2500 ± 100 kg.

- Speed limits for land transportation: 80km/h on flat roads, 60km/h on rough roads. In case that the speed limits conflict, the local traffic regulations prevail.
- Do not stack the equipment when landing them at the harbor or transporting them by sea.

The battery should be protected against the following events during transportation:
- Falling into the water;
- Drops or mechanical impacts;
- Being placed upside down or tilted.

	If any of the above situations occurs, please follow the emergency handling instructions.

2.8 Mechanical safety

Safety instructions concerning drilling holes outside the cabinet:
- Select the suitable drilling positions to avoid short circuits or other risks.
- Wear safety gear such as goggles and protective gloves when drilling holes.
- When drilling holes, cover the equipment to prevent shavings from falling into the equipment, and clean the shavings in time after drilling.

2.9 Maintenance and replacement

 **NOTICE**	Before pulling components from the cabinet, ensure that other objects have been secured. • Two or more persons are required to be on site when maintaining the battery cabinet. • During equipment maintenance, cover the energized objects nearby with insulating material. • Do not open the cabinet door in bad weather such as rain, snow, thunder, dust, fog, etc. • Prevent any object from touching the fan in operation (e.g., fingers, components, screws, or tools) until the fan is powered off and stops spinning. • Do not power on the equipment until all faults have been cleared. • When inspecting the system with electricity, pay attention to the hazard warning signs on the equipment and avoid standing by the cabinet door. • Wait 15 minutes after powering off the equipment other than battery packs to ensure that the equipment has been discharged to the safe level before operation. • Attach the “Do not switch on” warning sign near the switches/circuit breakers that need be turned off for maintenance.

 NOTICE	• After the power components of the battery cabinet are replaced or the wiring is changed, it is necessary to manually start the wiring detection and topology identification to avoid abnormal system operation. • After completing the maintenance and replacement operations, lock the cabinet door in time, secure the safety rope and keep the key properly.

2.10 Emergency handling instructions

In the event of a hazardous incident on site, including but not limited to the following events, please ensure the safety of onsite personnel first and contact our service engineers.

Gas exhaust

- On-site personal protection: Do not face the exhaust vents directly.
- Post-disaster product maintenance: Contact our service engineers for evaluation.

Extinguishing agent release or fire

 DANGER	**Suggestions for on-site O&M personnel:** 1) In the event of a fire, evacuate from the building or equipment area, press the fire alarm, call the fire emergency service immediately. Notify professional firefighters, and provide them with relevant product information including, but not limited to: battery pack type, battery cabinet capacity, and battery pack location and distribution. 2) Do not enter the affected the building or equipment area. Do not open the battery cabinet door. Isolate and supervise the site. Keep irrelevant people from approaching the area. 3) After calling the fire emergency service, power off the system (e.g., by pressing the emergency stop switch, auxiliary power supply, etc.), ensuring your own safety. 4) After the professional firefighters arrive, provide them with relevant product information, including but not limited to: battery pack type, battery cabinet capacity, battery pack location and distribution, and the user manual. 5) After the professional firefighters confirm that the fire is extinguished, handle the site by professionals following the requirements of local regulations. Do not open the battery cabinet door without permission. 6) Post-disaster product maintenance: contact our service engineers for evaluation.

 **DANGER**	**Suggestions for professional firefighters:** 1) Please refer to the information provided by the O&M personnel for product information, including but not limited to: battery pack type, capacity of the battery cabinet, battery pack location and distribution, and the user manual. 2) It is prohibited to open the battery cabinet door until it is confirmed safe by professionals. 3) Follow local fire suppression regulations.

3 Product introduction

3.1 Product specifications

The Growatt's ACE battery cabinet is suitable for commercial and industrial scenarios. The typical application scenario of the battery cabinet is shown in Fig3-1 below.

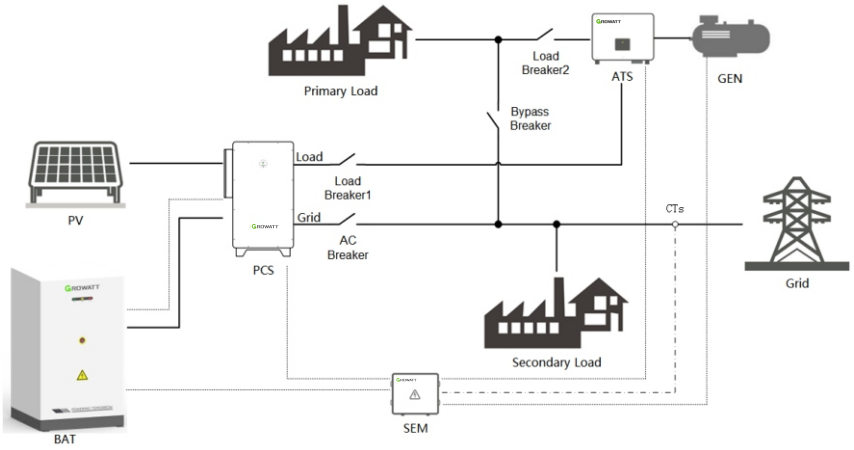


Figure 3-1 Commercial Energy Storage System Application Diagram

Table 3-1 Specifications:

Product model	ACE 209H-2H
Number of battery modules	13
Nominal energy	209.6 kWh
Nominal voltage	748.8 V
Operating voltage range	655.2~854.1V
Nominal capacity	280 Ah
DOD	90%
Maximum charge/discharge current	140 A
Dimensions (W/H/D)	1200*2040*1385 mm
Weight	<2400 kg
Operating temperature	-25°C ~ +55°C (derating >45°C)
Altitude	3000 m (>2000 m, de-rating)
Cooling method	Intelligent air cooling
IP rating	IP55
Relative humidity	5 to 95%
Fire suppression system	Aerosol
Communication interface	RS485

3.2 Model description

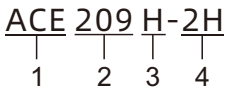


Table 3-2 Model designation:

Label	Meaning	Description
1	Product series	ACE: Outdoor energy storage cabinet
2	Energy level	209: Nominal energy is 209 kWh
3	Voltage	H stands for high pressure
4	Back-up power	2H stands for power consumption of 0.5C/2h

3.3 Functions and features

1) Easy installation and deployment:
   Pre-installed battery components before delivery, facilitating installation and deployment of the battery cabinet;
2) Simple O&M:
   With connection to the cloud platform, the ESS supports remote data monitoring, remote upgrade, remote troubleshooting analysis, parameter settings and intelligent balancing.
3) Flexible expansion:
   Modular design enables easy scalability and future expansion, adapting to your needs and minimizing disruption of the faulty module;
4) Advanced safety:
   Four-layer safety protection: intelligent internal short circuit detection, active arc fault detection, insulation fault warning and real-time leakage current monitoring. Various temperature sensors enable real-time detection of system exceptions, rapid alarms, and emergency shutdown;
5) Refined management:
   Distributed temperature control that maintains system temperature difference below 8℃, thus prolonging the service life of the battery.

3.4 Appearance

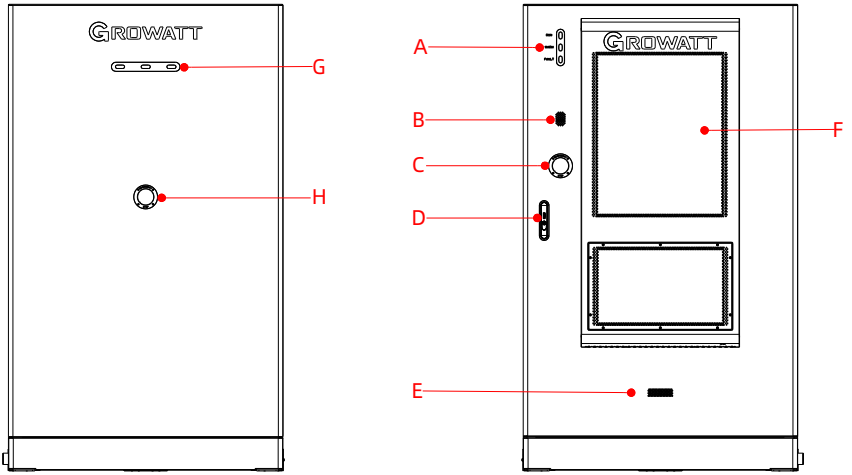


Figure 3-2 Appearance

The figure is for demonstration purposes only. The actual product appearance prevails.

Table 3-3 Components:

Position	Module	Description
A/G	LED indicator	Indicates the operating status of the energy storage system Green: running normally; yellow: alarm; red: fault
B	Hydrogen exhaust vent	Exhausts hydrogen
C/H	Emergency stop switch	Emergency power off
D	Lock	Safety gear
E	Hydrogen exhaust air inlet	Air inlet
F	Air conditioner	Energy storage system temperature control device

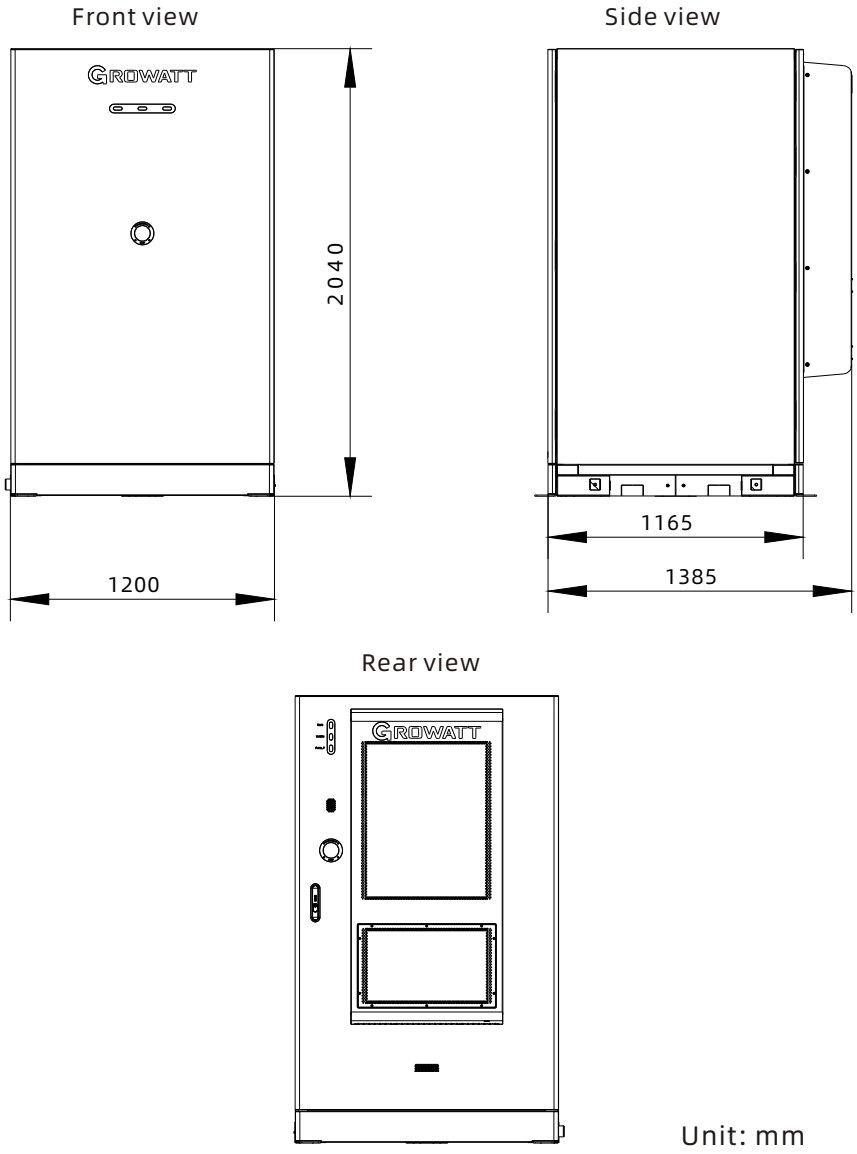


Figure 3-3 External dimensions of the battery cabinet

3.5 Intra-cabinet description

3.5.1 Component layout

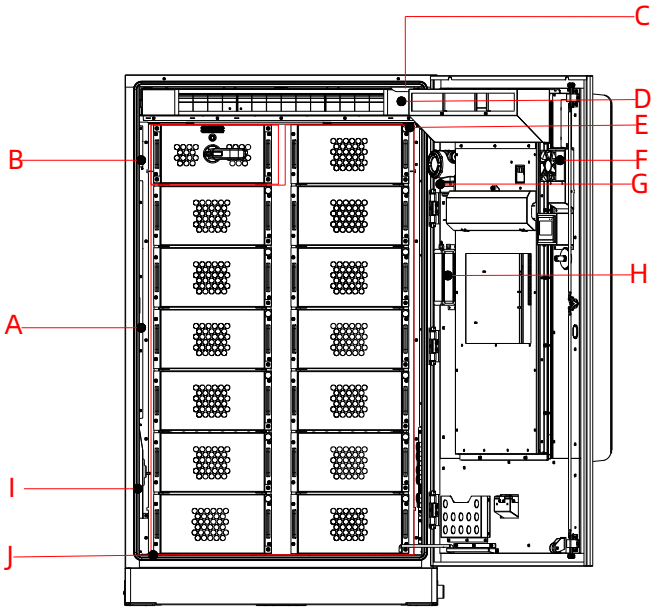


Figure 3-4 Intra-cabinet components

Table 3-4 Intra-cabinet components:

Position	Module	Description
A	Battery PACK	Energy storage device
B	High voltage box	Battery charge/discharge control device
C	Smoke sensor	For smoke detection
D	Temperature sensor	For temperature detection
E	Access control sensor	Monitor the opening and closing status of the cabinet door
F	Hydrogen exhaust fan	Used to exhaust combustible gases in the cabinet
G	Combustible gas detection sensor	Used to detect combustible gases in the cabinet
H	Aerosol	For fire extinguishing
I	PCS transfer connector	For connecting the PCS and the high voltage box
J	Water leak sensor	For water leakage detection

3.5.2 Distribution box

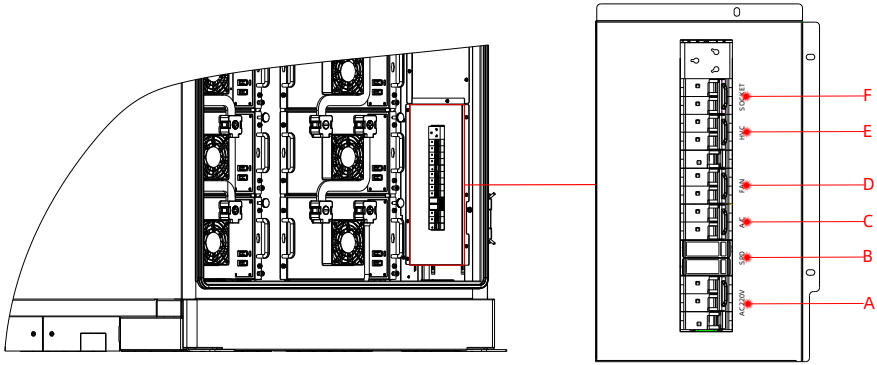


Figure 3-5 Distribution box internal view

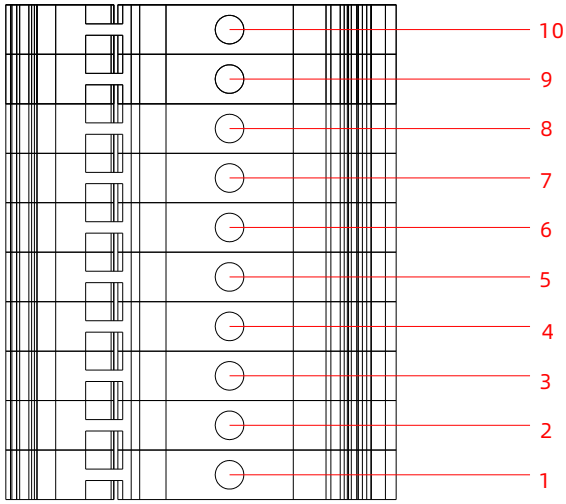


Figure 3-6 Terminal block in the distribution box

Table 3-5 Component configuration:

Position	Designation	Description
A	AC220V	220V AC power input terminal
B	SPD	SPD (Surge Protective Device) input control terminal
C	A/C	A/C power supply input terminal
D	FAN	Power supply terminals for the fans of the battery cabinet and PACKs
E	HVC	High voltage box HVC power supply input terminal
F	SOCKET	AC socket (GB) (reserved)

Table 3-6 Terminal block:

Connected module	Left	NO.	Right	Connected module
Connected to PCS-COM1	485A-BAT	1	/	/
		2	/	/
	485B-BAT	3	/	/
		4	/	/
Grounding	PE	5	/	/
		6	/	/
Connected to HVC-SEM	485-1A	7	/	/
		8	/	/
	485-1B	9	/	/
		10	/	/

3.5.3 High voltage box

Figure 3-7 Internal high voltage box panel description

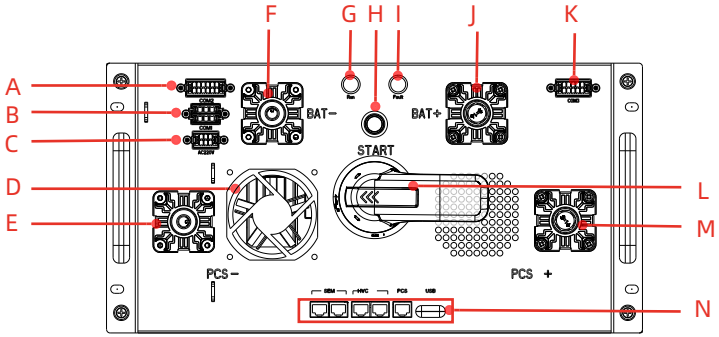


Figure 3-7 High voltage box panel

Table 3-7 Component configuration:

Position	Module	Description
A	COM2 communication terminal	Connecting to panel indicators, tripping control board and emergency stop switch, etc.
B	COM1 communication terminal	Connecting to the RS485 communication port and the 24V power supply port of the EM (Environmental Monitor) board.
C	AC power supply port	Auxiliary AC 220V power input
D	Cooling fan (optional)	Optional, for heat dissipation inside the high voltage box

Position	Module	Description
E	PCS-power output terminal	Connecting to the negative battery terminal of the PCS
F	BAT- power terminal	Connecting to the negative terminal of the battery cluster
G	Running indicator	Indicates the operating status of the energy storage system
H	Start button	To power on the energy storage system
I	Warning indicator	Raise warnings when exceptions occur in the energy storage system
J	BAT+ power terminal	Connecting the positive battery terminal of the battery cluster
K	COM3 communication terminal	Connecting to the communication port of the BM board and the 24V power supply port of the BM
L	Switch-disconnector	Connect/disconnect the DC power of the battery cabinet
M	PCS+ power output terminal	Connecting to the positive battery terminal of the PCS
N	CM COM common wiring terminals	Connecting to communication terminals of PCS, SEM

Table 3-8 PIN definitions of COM1, COM2, and COM3 of the high voltage box:

COM1		COM2		COM3	
A1	SB2-1_V-	A2	COM	A1	FAN1_24V+
B1	S9_V+	B2	STOP	B1	FAN2_24V-
A1	EM-FAN_V-	A4	/	A2	FAN1_GND
B1	EM-FAN_V+A5	B4	RED	B2	FAN2_GND
A2	EM_485B	A5	GREEN	A3	BM_GND
B2	EM_485A	B5	YELLOW	B3	EM_24V+
A3	EM_GND	A6	GND	A5	GND_H
B3	EM_24V+	B6	+5V	B5	GND_L

3.5.4 Battery PACK

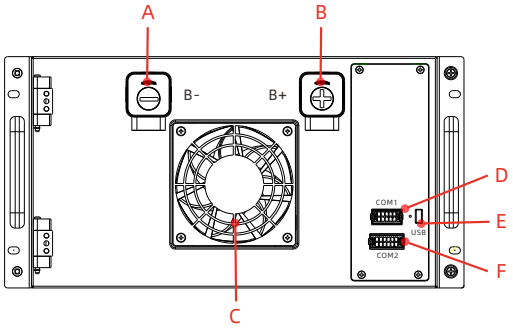


Figure 3-8 Battery PACK panel

Table 3-9 Component configuration:

Position	Component	Description
A	Negative battery PACK terminal (black)	Negative battery PACK connector
B	Positive battery PACK terminal (orange)	Positive battery PACK connector
C	Cooling Fan	For battery heat dissipation
D	COM1 communication terminal	For communication between battery PACKs, and between the battery PACK and the high voltage box.
E	USB port	For BM upgrade with the USB flash drive
F	COM2 communication terminal	For communication between battery PACKs, and between the battery PACK and the high voltage box.

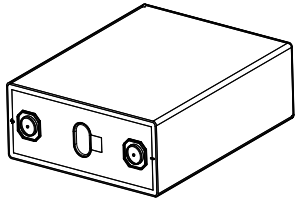
Table 3-10 Communication terminals between battery PACKs:

COM1		COM2	
A1	FAN1_24V+	A1	FAN1_24V+
B1	FAN2_24V-	B1	FAN2_24V-
A2	FAN1_GND	A2	FAN1_GND
B2	FAN2_GND	B2	FAN2_GND
A3	BM_GND	A3	BM_GND
B3	BM_24V+	B3	BM_24V+
A4	BM_TX/RX	B4	BM_TX/RX
A5	GND.S	A5	GND.S
A6	CAN_H	A6	CAN_H
B6	CAN_L	B6	CAN_L

3.5.5 Battery cabinet

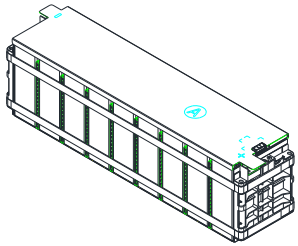
Battery cell

Table 3-11 Cell parameters:

Battery cell	Item	Parameters
	Dimensions (D*W*H)	173.7*71.7*205.1mm
	Model	LF280K
	Weight	5.34 kg
	Rated capacity	280 Ah
	Rated energy	896 Wh
	Rated voltage	3.2 V
	Voltage range	2.5V~3.65V

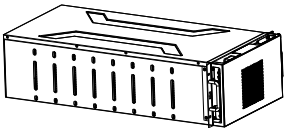
Battery module

Table 3-12 Module parameters:

Battery module	Item	Parameters
	Model	GRTM118P280JLB
	Series and parallel configuration	9S1P
	Dimensions	759.7*180*215.5mm
	Weight	51±4 kg
	Nominal voltage	28.8V
	Operating voltage range	22.5V~32.85V
	Charge cutoff voltage	32.85V
	Discharge cutoff voltage	22.5V
	Nominal capacity	280Ah

Battery PACK

Table 3-13 Battery PACK parameters:

Battery PACK	Item	Parameters
	Model	ACE 16.1H-2H-E1
	Dimensions	430*225*850 mm
	Weight	≤134 kg
	Battery type	Lithium iron phosphate (LFP)
	Number of battery cells	18
	Nominal capacity	280 Ah
	Nominal energy	16.1 kWh
	Nominal voltage	57.6 V
	Operating voltage range	50.4~65.7 V

Battery cabinet

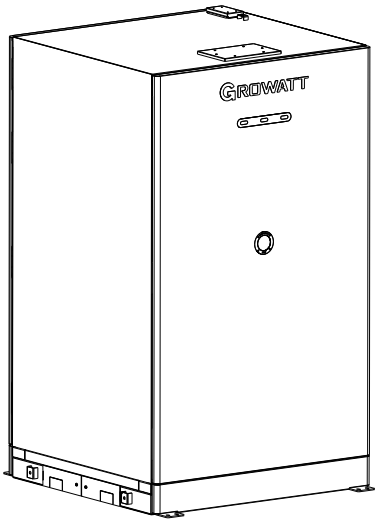


Figure 3-9 Energy Storage Battery Cabinet

Table 3-14 Battery cabinet parameters:

	Items	Parameters
Battery cabinet	Dimensions (W/H/D in mm)	1200*2040*1385 mm
	Weight	<2400 kg
	Nominal energy	209.6 kWh
	Nominal voltage	748.8 V
	Operating voltage range	655.2 V~854.1 V
	Nominal capacity	280Ah
	DOD	90%
	Operating temperature	-25°C ~ +55°C (>45°C, derating)
	altitude	3000 m (>2000 m, derating)
	Cooling method	Intelligent air cooling
	IP rating	IP55
	Relative humidity	5~95% (non-condensing)
	Fire extinguishing system	Aerosol
	Communication interface	RS485

3.5.6 Smoke sensor

Figure 3-10 Photoelectric smoke sensor

Table 3-15 Smoke sensor parameters:

Items	Parameters
Power supply voltage	24V
Operating temperature	-20℃~+60℃
Operating humidity	5 to 95% (non-condensing)

3.5.7 Temperature sensor

Figure 3-11 Temperature sensor

Table 3-16 Temperature sensor parameters:

Items	Parameters
Power supply voltage	9V~33V
Storage temperature	-30°C~120°C
operating temperature	-20°C~90°C
Operating humidity	0% to 95% RH (non-condensing and ice-free)

3.5.8 Access control sensor

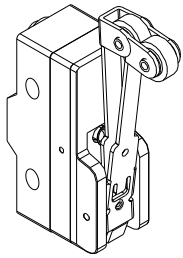


Figure 3-12 Access control sensor

Table 3-17 Access control sensor parameters:

Items	Parameters
IP rating	IP 52
Rated voltage	DC 24 V
Operating rate	20 times/minute
Operating speed	0.1mm/s~0.5mm/s
Ambient temperature	-5℃~+40℃
Relative humidity	The relative humidity shall not exceed 50% at a maximum temperature of +40°C. Higher relative humidity is permitted at lower temperatures.
Altitude	≤2000m

3.5.9 Combustible gas sensor

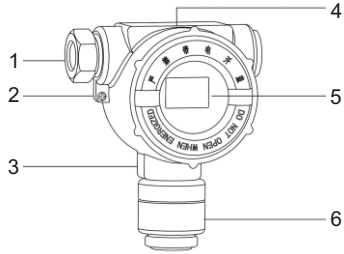


Figure 3-13 Combustible gas sensor

Table 3-18 Combustible gas sensor parameters:

Items	Parameters
Detection range	3-100% LEL
Power supply	18~28V DC
Power consumption	≤ 2.5W
Output signal	Rs485
Dimensions (H*W*D)	157*133*79mm

3.5.10 Water leak sensor

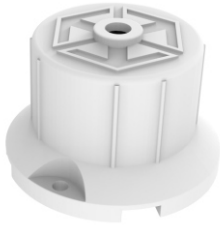


Figure 3-14 Water leak sensor

Table 3-19 Water leak sensor parameters:

Items	Parameters
Model	Isolated Water Leak Detector
Operating power	DC 24V
operating temperature	-20℃~ 60℃
Operating humidity	0% RH~100% RH
waterproof rating	IP 68
Dimensions	48*48*30 mm

3.5.11 Aerosol

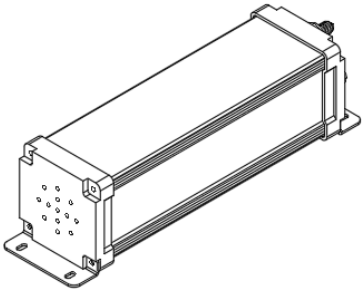


Figure 3-15 Aerosol

Table 3-20 Aerosol technical parameters:

Items	Parameters
Operating temperature range	-30℃ ~ + 70℃
Relative humidity of the ambient environment	≤ 95% RH
Shell surface temperature	≤ 200°C
Start-up method	Hot start
Hot start temperature	≥ 170±10°C

3.5.12 Hydrogen exhaust fan

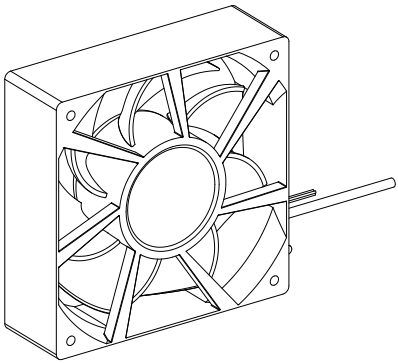


Figure 3-16 Hydrogen exhaust fan

Table 3-21 Hydrogen exhaust fan specifications:

Items	Parameters
Rated voltage	24 V
Operating voltage	12.0 V-27.6 V
Start-up voltage	DC 12.0V (25°C)
Safe current	1.05A
Speed	6300 ± 10% rpm
Operating temperature	-10℃~70℃
Operating humidity	5%~90% RH

3.5.13 Air conditioner

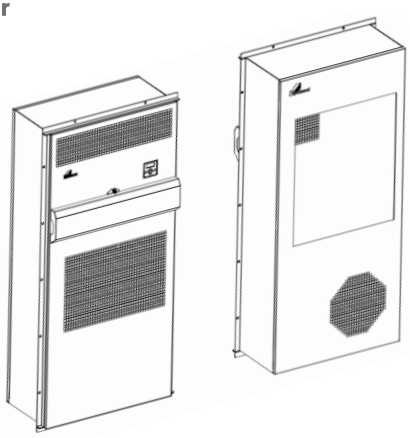


Figure 3-17 Air conditioner

Table 3-22 Air conditioner parameters:

Items	Parameters
Dimensions (W*D*H)	620*300*1350 mm
Weight	88 kg
Operating temperature range	-40 ℃~55 ℃
IP rating	IP 55
Cooling capacity	5000 W
Noise level	65 dB
Cooling input power consumption	1850 W
Cooling input current	8.5 A
Power supply range	AC 220V±15%V, 50 Hz
Maximum current	17.0 A

4 Inspection upon delivery

4.1 Scope of delivery

Table 4-1 Packing list of the ACE battery cabinet

NO.	Item	Quantity (pcs)
1	Battery cabinet	1
2	User manual	1
3	Quick Guide	1
4	Site wiring and infrastructure drawin	1
5	Certificate of Conformity	1

4.2 Nameplate

Users can identify the device by the nameplate. Information on the nameplate includes the model of the equipment, the serial number, the main technical parameters and the place of manufacturing.

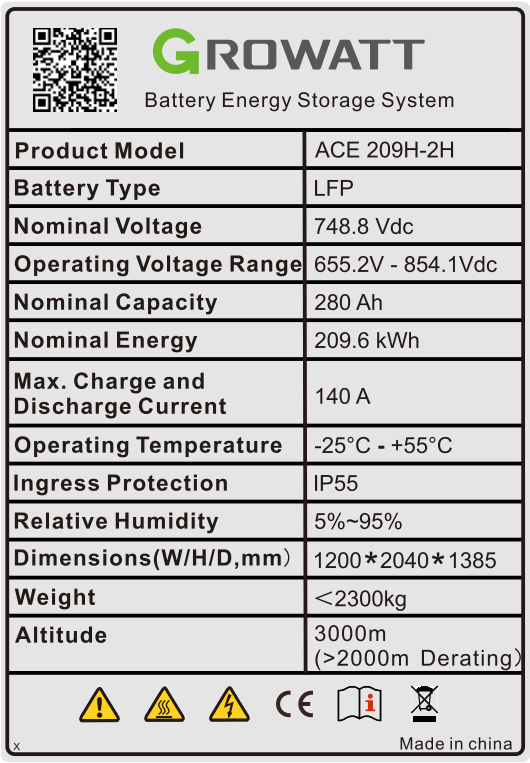


Figure 4-1 Nameplate of the ACE Battery Cabinet

 **WARNING**	The nameplate contains important parameters related to the equipment, which should be protected during operations including transportation, installation, maintenance, and repairs. Destruction or removal is strictly prohibited!

4.3 Check the package

The battery cabinet has been carefully inspected and securely packed before leaving the factory. Nevertheless, there is still a chance that the equipment may be bumped or even damaged during transportation.
Upon receipt of the equipment, check the completeness and integrity of the package. Please carefully check the following items:

- Check that all components are delivered against the "Scope of delivery".
- Confirm that the model of the battery cabinet received is consistent with the one you ordered.
- Carefully inspect the battery cabinet for any damage during transportation. If you find any problems or have any questions, please contact the shipping company or Growatt in time.

 **WARNING**	Only the battery cabinet that is intact and undamaged can be installed and commissioned. Please verify the following things before installation: • The battery cabinet is intact and without any damage. • All equipment in the battery cabinet is intact and undamaged.

5 Installation

5.1 Pre-installation preparation

Note:

- The tools shown below are for reference only. The actual tools prevail.
- Other tools not mentioned in the list might be needed due to different on-site conditions. In this case, please prepare the tools required for installation by yourself.

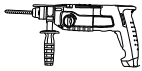
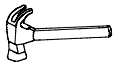
Installation environment

Max.+50 ℃

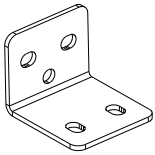
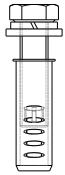
Min.-25℃

RH+5%~+95%

Installation tool

 Socket wrench	 Screwdriver	 Impact drill
Drill bit	 Claw hammer	 Forklift

Installation accessories

Anchor bracket and expansion bolt	
	

5.2 Pre-installation inspection

5.2.1 Inspect the outer packaging

Before unpacking the unit, inspect the outer packaging for any visible damage such as holes, cracks or other signs of possible internal damage and check the device model. If any packaging anomaly is found or if the received model is inconsistent with the one you ordered, do not unpack it and contact your dealer as soon as possible.

	Note: It is recommended to remove the outer packaging of the cabinet within 24 hours before installing it.

WARNING	If the height of the cabinet exceeds 2 m, take protective measures for working at heights when removing the outer packaging.

5.2.2 Check the deliverables

After unpacking the equipment, please check that the deliverables are complete and intact, and free from any obvious damage.

5.3 Foundation requirements

Unit: mm

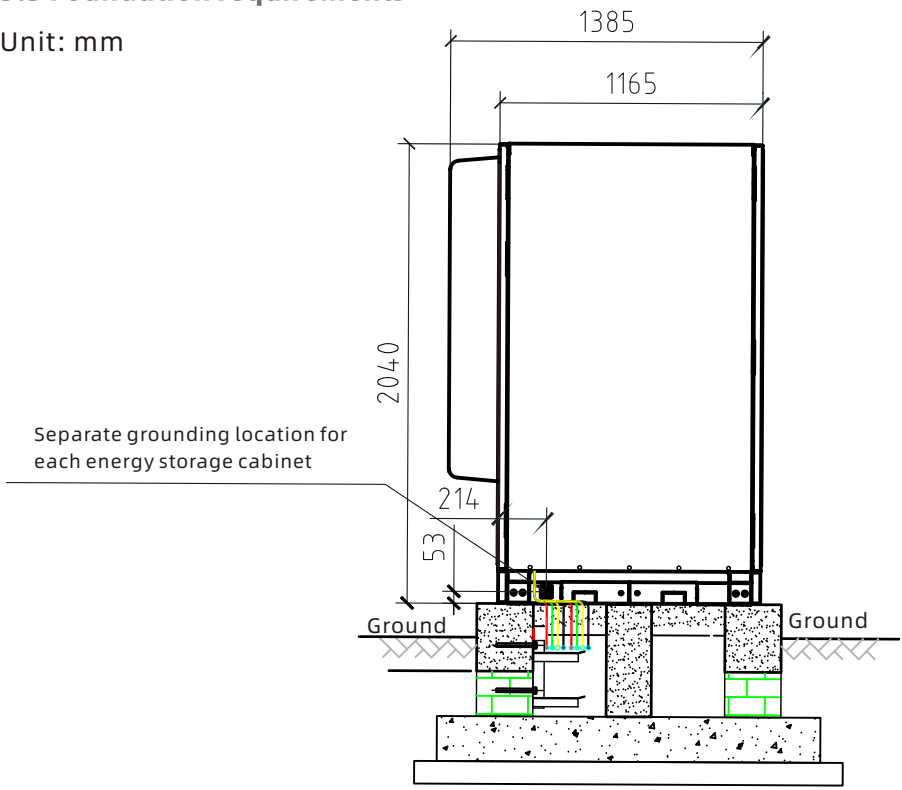


Figure 5-1 Foundation construction

Note:

1. Consider local hydrological conditions over the years for the foundation design.
2. The recommended minimum height of the foundation is 800 mm.
3. The entire battery cabinet should be installed on a concrete foundation.
4. Ensure that the upper surface of the entire foundation is on the same level (not more than 5 mm).
5. Each battery cabinet weighs about 2400 kg.
6. After positioning the battery cabinet onto the pier properly, secure each cabinet with eight M12*120 expansion bolts.
7. Reserve the cable conduits. Determine the specifications and quantity of the conduits based on the models and quantity of the cables.
8. Reserve the grounding flat steel when designing the foundation, which is used for connection to the ground point of the base after the cabinet installation is complete.
9. Before the excavation for the proposed foundation is commenced, conduct soil compacting and foundation reinforcement treatment.
10. The mounting pier should be made of concrete and its load-bearing capacity should not be less than 2000kg/m2.
11. Set up the grounding conductor and grounding pole following the conventional grounding network construction of transformer station. The grounding resistance should be less than 4 Ω. It is recommended to use the 50 * 4 mm galvanized flat steel bar to form the grounding network. Determine the length based on the on-site conditions. Pre-bury the galvanized flat steel bar along the cable trench.
12. General detection should be carried out before the foundation construction. Conduct the slope or deep foundation pit support according to the field conditions and geological survey when excavating the foundation to ensure construction safety.
13. Refer to the electrical drawings for those unnoted pre-buried elements, grounding and pre-buried pipes. Construct the foundation strictly following the electrical diagrams and related drawings provided by the manufacturer to avoid secondary excavation.
14. Ensure that the foundation surface is level using a level. A drainage slope of 1% should be designed for the cable trenches at the bottom of the foundation. Direct the drainage pipe towards the rainwater well. Pre-bury the PE drainage pipe according to the location of the rainwater well.
15. Once the excavation commences, do not pile loads within 5 m of the edge of the pit to avoid landslides.
16. All cable brackets must be reliably connected to the grounding network with in the cable trenches.

5.4 Forklift requirements

- Before using a forklift, make sure that it meets the load-bearing requirements, which should be greater than or equal to 3 t;
- Recommended tyne length: ≥1.2m; width 80cm~160cm; and thickness 25cm~70cm.

Remove the decorative panels on the front and rear sides of the base to expose the positions for forklifting.

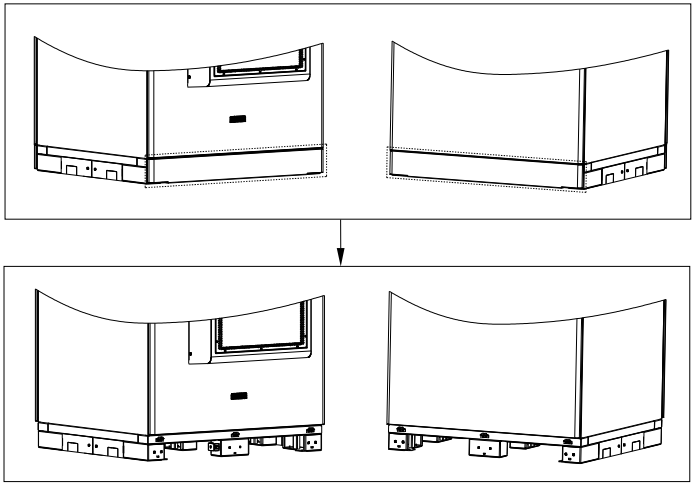


Figure 5-2 Remove the decorative panels

When using a forklift to move the equipment, place the forks under the equipment as far as possible to over 95% of the length of the forks.

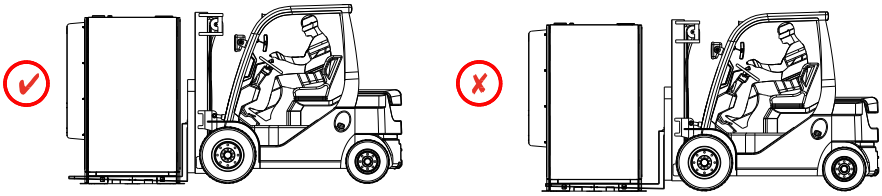


Figure 5-3 Transport the battery cabinet with a forklift

After moving the equipment to the mounting location using a forklift, re-install the decorative panels.

5.5 Install the battery cabinet

5.5.1 Install a single ACE battery cabinet and the base

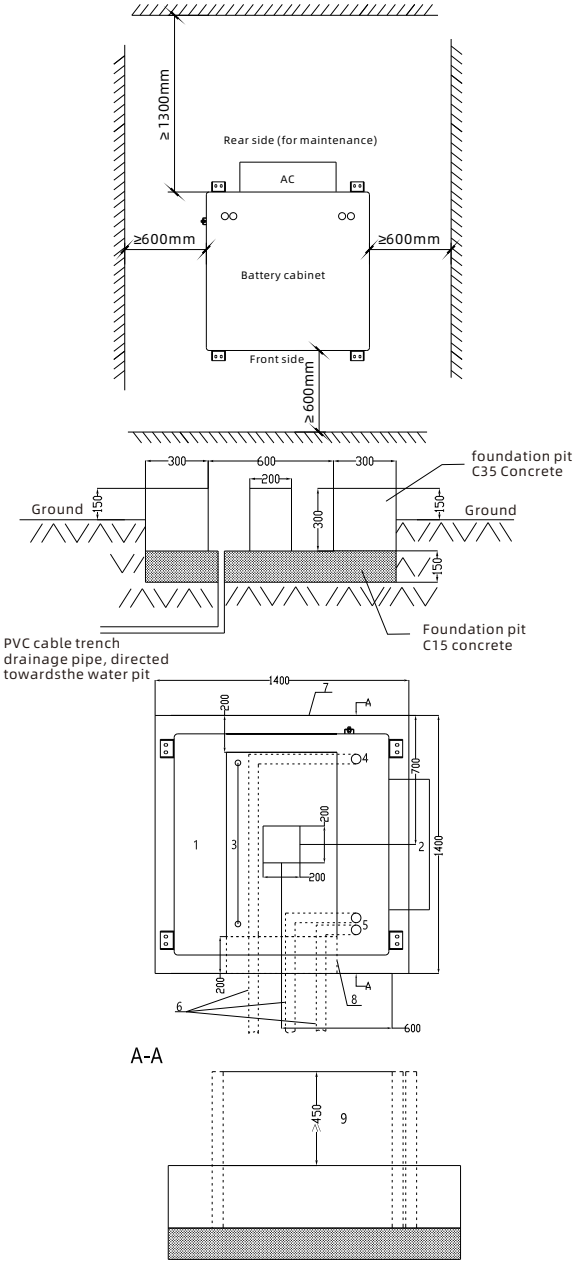


Figure 5-4 Single cabinet installation Table 5-1 Position description:

Table 5-1 Position description:

No.	Description	No.	Description
1	Front side of the cabinet	6	Pre-buried the PVC pipe with a diameter of 50 mm
2	Rear side of the cabinet	7	Apply waterproof paint to the entire surface of the foundation, citapercled with the black/ yellow hazard
3	Drainage pipe, diameter: 30 mm	8	Dotted line area, the cable outlet side to be sealed with cement after pre-burying the pipes
4	Auxiliary control circuit cable routing hole	9	For reserving cables with a length of over 450 mm
5	AC input/output cable routing holes		

5.5.2 Install three ACE battery cabinets connected in parallel

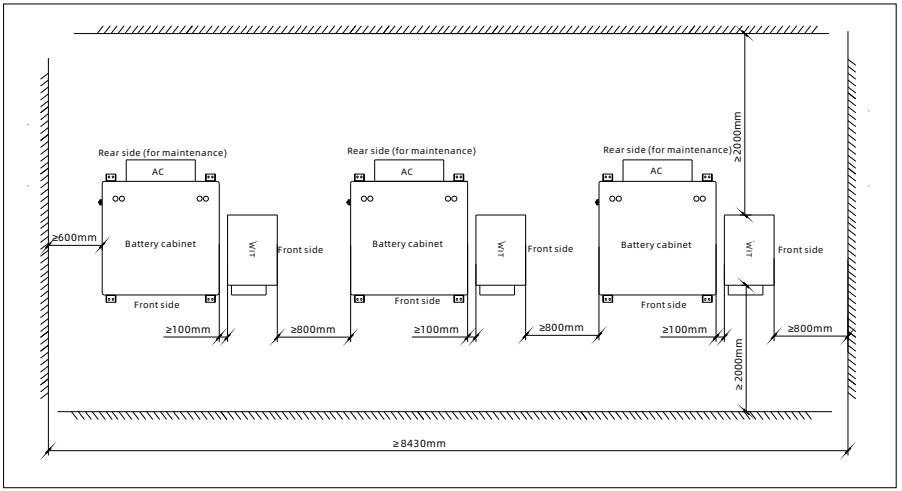


Figure 5-5 Clearance requirements

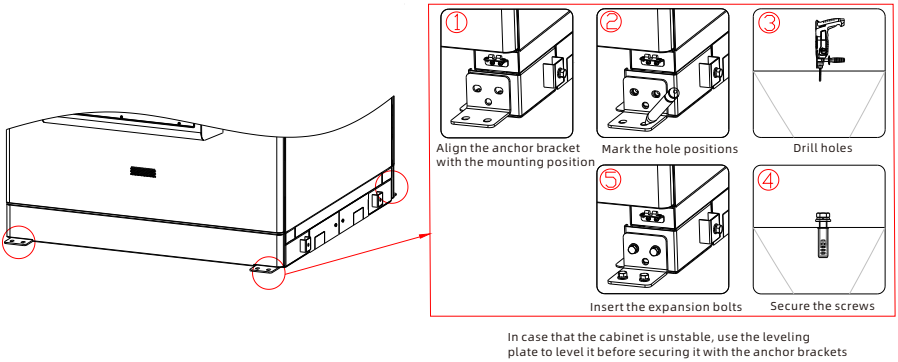
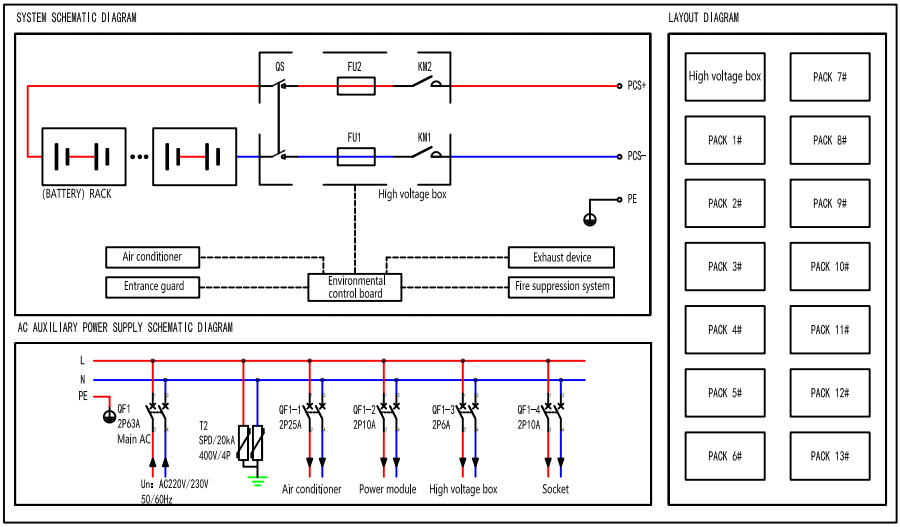


Figure 5-6 Secure the battery cabinet

Note: In case that the cabinet is unstable, use the leveling plate to level it before securing it with the anchor brackets

Electrical connections 6

6.1 Electrical schematic



Precautions

Symbol	Description
DANGER	Danger • Before connecting cables, make sure that all switches of the energy storage system are in the "OFF" position. Otherwise the high voltage of the energy storage system may cause electric shocks. • Measure the voltage at the point of contact before touching any conductor surface or terminal, and confirm that the equipment or parts to be serviced are reliably grounded to prevent electric shocks.
WARNING	Warning • Damage to the equipment due to incorrect wiring is beyond the scope of warranty. • Only professional electrical technicians are allowed to carry out electrical connections. • Wear personal protective equipment when connecting cables.
	Note • Cable colors involved in all electrical schematics in this section are for reference only. Select cables following local standards.

6.2 Internal wiring diagram

6.2.1 Internal wiring of the battery cluster

Step 1 Measure the voltage of the positive and negative terminals of each battery PACK (50.4V~65.7V) with a multimeter.

Step 2 Install the copper bars between the battery PACK and the high voltage box, and between two PACKs.

Step 3 Install the power cables between the bottom battery PACKs.

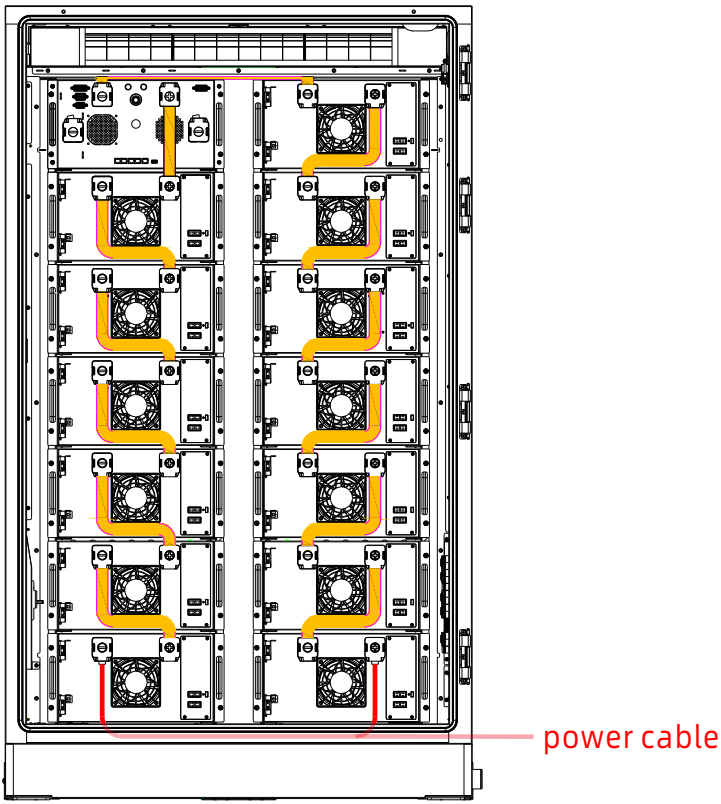


Figure 6-1 Install the copper bars and power cables

Step 4 Check the connection of the communication and power cables between the battery PACK and the high voltage box, and between two PACKs (pre-installed before delivery).

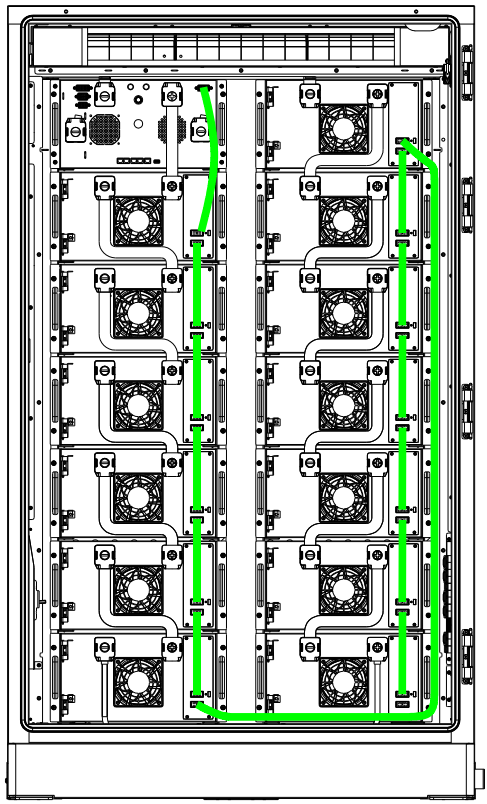


Figure 6-2 Wiring of the power and communication cables

6.3 Cable connections

Precautions:

- Pay attention to the polarity when installing the battery. It is strictly prohibited to short the positive and negative terminals of a single battery or battery string, otherwise the battery might be short-circuited.
- Do not smoke or use open flame near the battery.
- Firefighting facilities that are compliant with requirements, such as fire sand, CO2 fire extinguishers, etc. must be available on site.
- Use dedicated protective gear and insulated tools to avoid electric shock injury or short circuit failure.
- Tighten the fastening screws of the copper bars or cables to the torque specified in the document. Periodically check whether they are tightened, check for rust, corrosion, or any other foreign materials, if any, clean them up. Loose connection can lead to excessive voltage drop, and even cause the battery to be burnt due to high temperature caused by the high current.

6.3.1 Prepare the cables

Note: Determine the cable diameter in accordance with local cable standards.

Cable name	Type	Connecting from	Connecting to	Source
PE cable	Single core outdoor copper wire	Battery cabinet	Main grounding bar in the distribution panel	Prepared by users
DC power cable	Single core copper wire	Battery cabinet	PCS	Delivered with the package
AC auxiliary power supply cable	Two-core (L, N) copper wire	Battery cabinet	PCS	Delivered with the package
Communication cable connecting PCS and battery	CAT 5E shielded network cable	Battery cabinet	PCS	Delivered with the package
Communication cable connecting PCS and SEM	CAT 5E shielded network cable	Battery cabinet	SEM communication box	Prepared by users
Communication cable connecting battery and SEM	CAT 5E shielded network cable	Battery cabinet	SEM communication box	Prepared by users

6.3.2 Install the PE cables

- **Note:** The equipment grounding impedance should meet the requirements of local electrical standards.

Intra-cabinet PE cable

Step 1 Open the battery cabinet door.

Step 2 Connect the PE cable through the hole at the bottom to the main grounding bar.

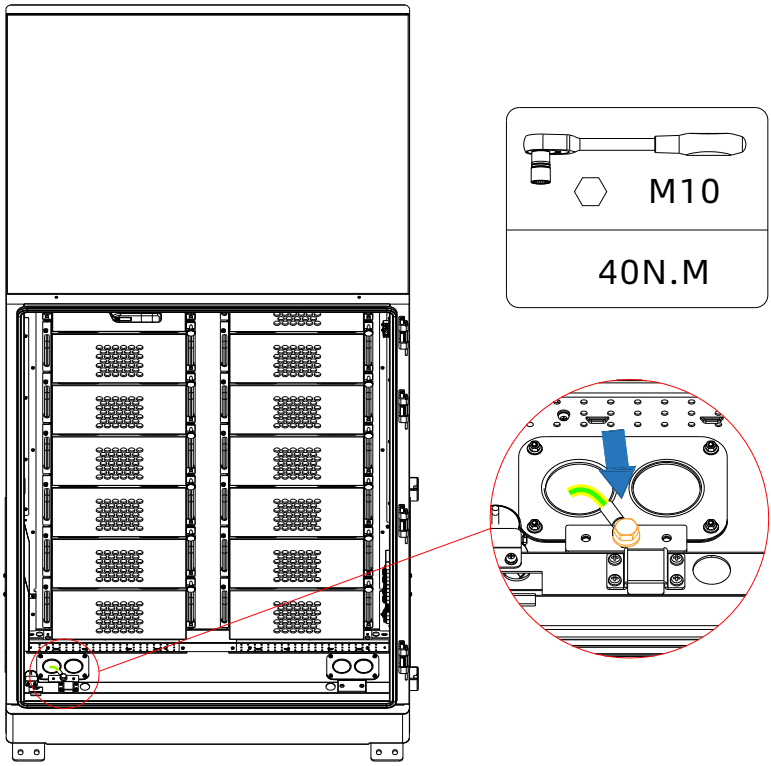


Figure 6-3 Connect the PE cable

Table 6-1 Grounding requirements:

Cable name	Type	Cable specifications	Quantity	Wiring terminal
PE cable	Single-core outdoor copper cable	25mm²~50mm²	1	OT/DT terminals

External grounding

Step 1 Users need to prepare the hot dipped galvanized flat steel (recommendation: ≥40 x 4 mm) or cable (recommendation: ≥25mm²).

Step 2 Connect the grounding flat steel or cable.

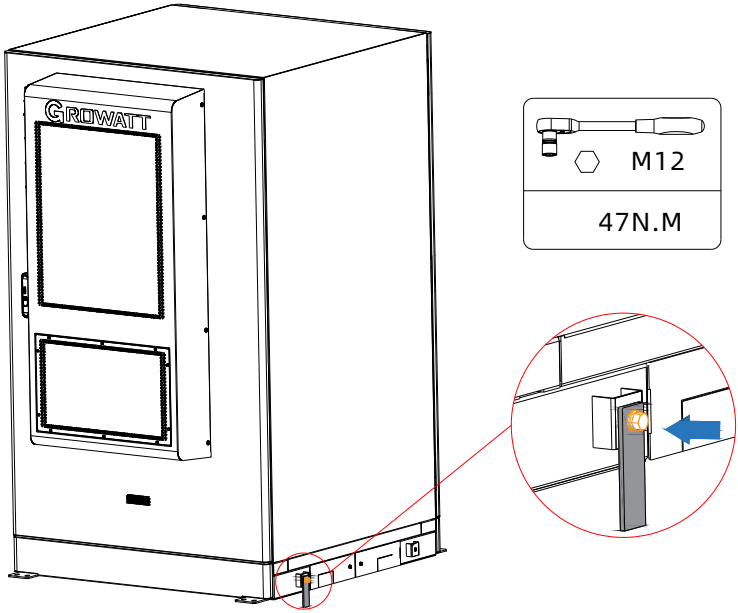


Figure 6-4 Connect the grounding flat steel

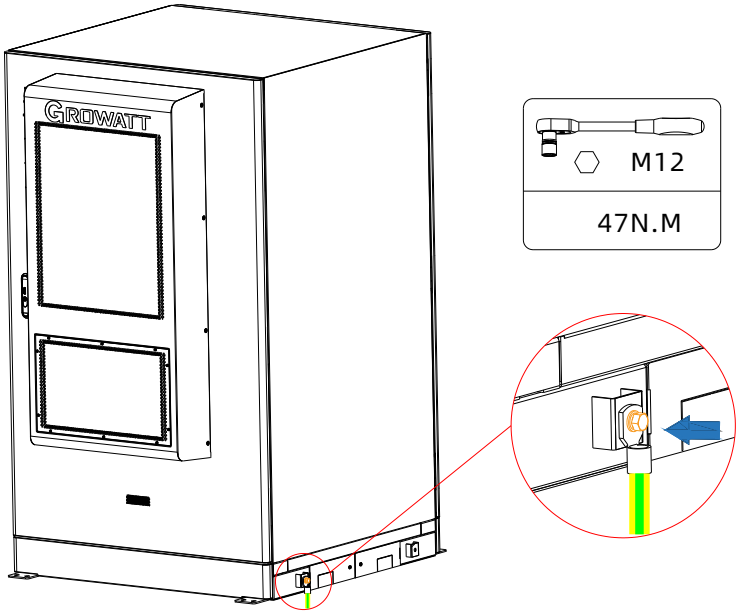


Figure 6-5 Connect the PE cable

6.3.3 Install the DC power cables

Procedure

Step 1 Remove the cover from the DC distribution area.

Step 2 Connect the DC cables through the holes at the bottom to the PCS+ and PCS- terminals.

Step 3 Re-install the cover.

Torque to tighten the bolt: 35 N·m

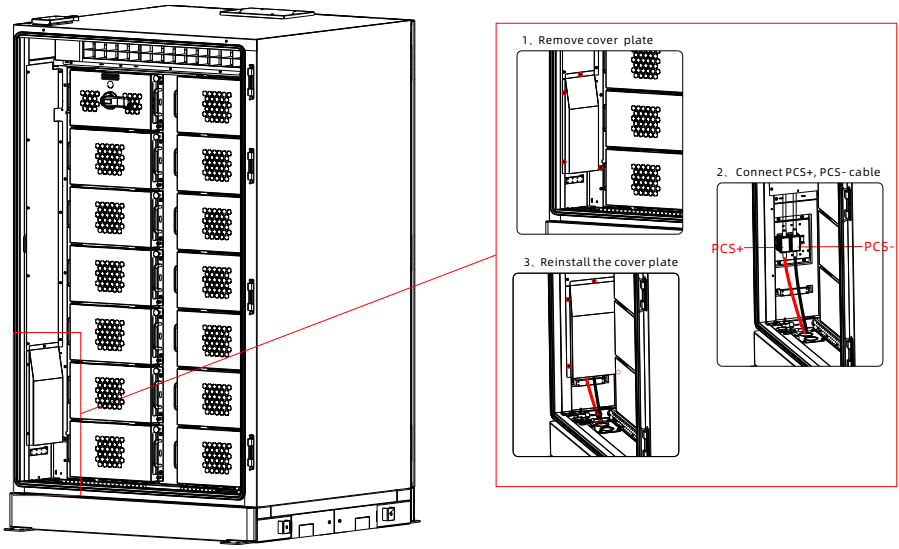


Figure 6-6 Connect the DC cables

Table 6-2 DC power cables:

No.	Cable label	Cable specifications	Quantity	Connection terminal
1	PCS+	UL10269/ 1 AWG/Red cable	1	PCS+
2	PCS-	UL10269/1 AWG/Black cable	1	PCS-

6.3.4 Install the AC auxiliary power cables

Procedure

Step 1 Remove the cover from the AC distribution area.

Step 2 Connect the AC cables through the hole at the bottom to the QF1 terminal on the miniature circuit breaker.

Step 3 Re-install the cover.

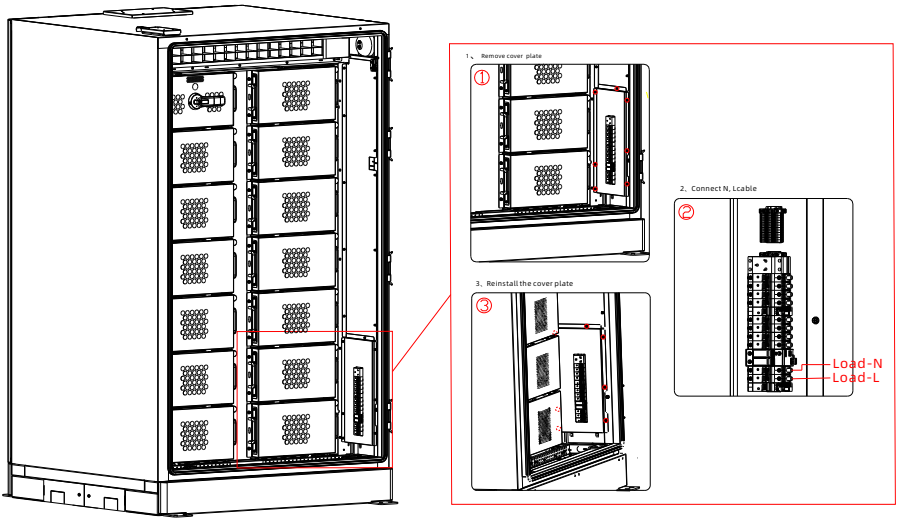


Figure 6-7 Connect the AC cables

Table 6-1 AC auxiliary power cable requirements:

No.	Cable label	Cable specifications	Quantity	Connection terminal
1	QF1-N	UL1015/10AWG/blue cable and blade terminal	1	N
2	QF1-L	UL1015/10AWG/red cable and blade terminal	1	L

6.3.5 Install the communication cables

Procedure

Step 1 Remove the cover from the AC distribution area.

Step 2 Connect the communication cables from the PCS through the hole at the bottom to PIN 7 and PIN 9 on the terminal block.

Step 3 Connect the communication cable between the battery and SEM to PIN 1 and 3 on the terminal block; connect the one between the PCS and SEM through the hole at the bottom to PIN 8 and PIN 10.

Step 4 Re-install the cover.

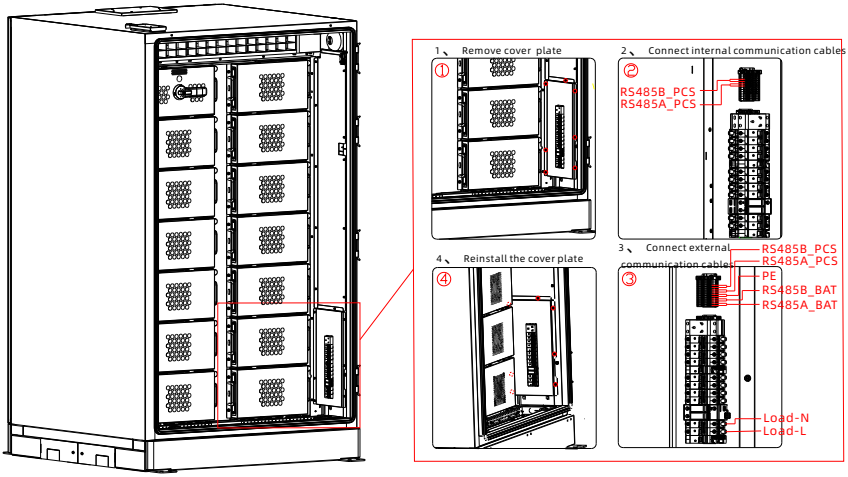


Figure 6-8 Connect the communication cables

Step 5 Install the communication cable between the battery cabinet and the PCS (the cable has been pre-connected at the top of the battery cabinet).

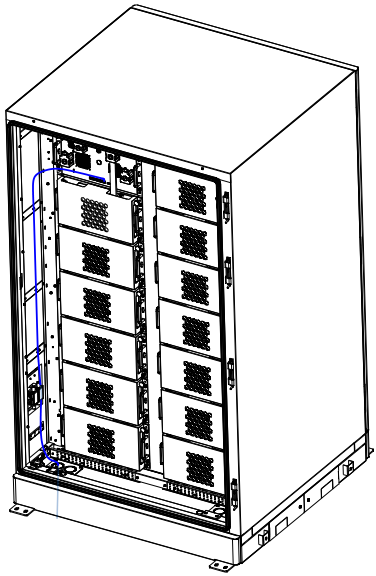


Figure 6-9 Connect the communication cable

Table 6-1 Communication cable requirements:

No.	Function	Cable specifications	Quantity	Connection terminal
1	PCS communication cable	UL20276/2P*22AWG/ with shielded layer	1	PIN 7 and 9
2	Communication between Battery and SEM	CAT 5E shielded network cable	1	PIN 1 and 3
3	Communication between PCS and SEM	CAT 5E shielded network cable	1	PIN 8 and 10
4	Communication between Battery Cabinet and PCS	CAT 5E shielded network cable	1	/

Note: Connect the shielding layer of the communication cable to PIN 5 and PIN 6.

6.4 Seal the cable routing holes

Upon completion of cable connections, seal the cable holes using the sealing mud supplied with the battery cabinet package.

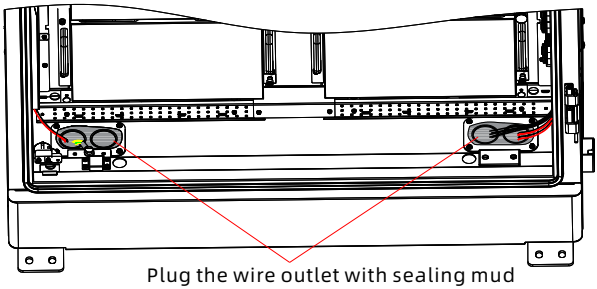


Figure 6-10 Seal the cable holes

Power on/off the system 7

7.1 Check before power-on

7.1.1 Routine check

No.	Checking item	Acceptance criteria
1	Equipment appearance	The equipment is intact, free from damage, rust or paint loss. If any paint loss is found, please re-paint the spotted area. Equipment labels are clear and damaged labels should be replaced in time.
2	Cable appearance	The cable sheath is properly wrapped with no visible damage. The cable conduits are intact.
3	Cable connection	Cables are connected at the designate positions. Wiring terminals are prepared as required and connected reliably. Labels on both end of each cable is clear and facing toward the same direction.
4	Cable routing	Electrical cables and extra low voltage cables are routed separately. The cables are neat and tidy. Cable tie joints are evenly cut without burs. Leave the cable slack at bending points to avoid stress. Cables are routed neatly without twists or crossovers in the cabinets.
5	Battery pack copper bar	The copper bar is not deformed, and the plastic dip coating is not damaged.
6	Switch	The switch of the distribution cabinet is OFF. The switch of the high voltage box is OFF

7.1.2 Battery cabinet installation inspection

Cabinet inspection

No.	Checking item	Acceptance criteria
1	Installation	Installation complies with the design requirements. The cabinet is level and each door opens properly.
2	Appearance	The surface of the cabinet is free from cracks, dents and scratches. If the paint flakes off, re-paint the spotted area.
3	Cabinet grounding	Each cabinet has at least two grounding points, and is grounded reliably. The resistance of a bond shall be less than or equal to 4Ω.
4	Label	Labels are correct, clear and complete.

Intra-cabinet inspection

No.	Checking item	Acceptance criteria
1	Copper bar	The copper bar is not deformed, and there are no foreign objects on the copper bar.
2	Cable	The bolts for securing the cables have been tightened and no loose cable connections.
3	Cable routing hole sealing	The cable routing holes are sealed.
4	PACK	All PACKs are intact.
5	Foreign object	Foreign objects, e.g. tools and installation leftovers are removed from the cabinet,.
6	Distribution area baffle	The distribution area baffle is free from cracks, dents, scratches, openings and looseness.
7	SPD	The SPD indicator is green.
8	Subcomponents (EM, environmental sensors, aerosol, air conditioner, fans, etc.)	All subcomponents are intact.
9	Cabinet grounding	The grounding conductor is reliably connected to the cabinet's grounding terminal board or copper bar.

7.2 Power-on procedure

Step 1 Test the voltage between BAT+ and BAT- with a multimeter. The value should be within the range of 655.2 - 854.1V.
Step 2 Turn on the load switch-disconnector of the high voltage box.
Step 3 Turn on the switches of HVC, air-conditioner, fan, etc. in turn, and turn on the auxiliary AC power supply.
Step 4 Turn on the main breaker of the auxiliary power supply in the AC distribution box, and the AC distribution panel will be powered on (AC 220V).
Step 5 Turn on the AC side distribution circuit breaker of the PCS.

NOTICE	**Note:** Before turning on the internal switch of the auxiliary power supply in the battery cabinet, check if the AC auxiliary power supply voltage is within the permitted range (220V + 10%).

With the operations completed, the system will be powered on and you can check if the system is running properly.

7.3 Power-off procedure

Step 1 Turn off the AC side distribution circuit breaker of the PCS.
Step 2 Turn off the main breaker of the auxiliary power supply in the AC distribution box.
Step 3 Turn off the switches of the HVC, air conditioner, fan, and other components in turn.
Step 4 Turn off the load switch-disconnector of the high voltage box.

With the operations completed, the system will be powered off.
Troubleshooting

8 Troubleshooting

8.1 Overview

System maintenance is important in the daily operation of ACE energy storage system (ESS). The ACE storage battery system operates in outdoor environments. The diverse geographic conditions can cause damage to components and system aging, thus affecting the normal operation of the ACE energy storage system. Regular system maintenance can improve the performance of the ESS, extend the service life, extend the period of safe and smooth operation, and ensure optimal availability of the equipment.

8.2 Safety precautions

1. System maintenance operations should be carried out by professionals. Non-professionals are not allowed to dismantle and install the equipment to avoid safety accidents;
2. Before carrying out maintenance work, make sure that the external power supply is disconnected and that the internal battery PACKs have been discharged to the safe level;
3. During rainy days, or when the air humidity is greater than 90%, do not open the battery cabinet door, so as to avoid moisture penetration. Maintenance work should be carried out on sunny days and in a dry environment;
4. When replacing the electronic components of the equipment, it is necessary to replace the device with a new unit from the same manufacturer and of the same model; if other types are to be used, you should confirm with relevant personnel in advance, and only replace the device after obtaining permission.
5. After maintenance work is completed, check that no tools have been left inside the cabinet, such as screws, nuts, screwdrivers, and other metal tools. Otherwise, the equipment may be damaged;

8.3 Node fault information

Node	Fault	Troubleshooting
Node 1	Battery cabinet CAN communication abnormal	1. Power off the equipment and disconnect the external power supply; 2. Check for loose connection of the communication cable; 3. If the problem persists, please contact the maintenance personnel.
Node 2	Battery cluster CAN communication abnormal	1. Power off the equipment and disconnect the external power supply; 2. Check for loose connection of the communication cable; 3. If the problem persists, please contact the maintenance personnel.

Node	Fault	Troubleshooting
Node 3	PCS communication timeout	1. Power off the equipment and disconnect the external power supply; 2. Check for loose connection of the communication cable between the PCS and the high voltage box; 3. If the problem persists, please contact the maintenance personnel.
Node 4	Environmental controller communication abnormal	1. Power off the equipment and disconnect the external power supply; 2. Check for loose connection of the communication cable between the EM and the high voltage box; 3. If the problem persists, please contact the maintenance personnel.
Node 5	SEM communication abnormal	1. Power off the equipment and disconnect the external power supply; 2. Check for loose connection of the communication cable between the SEM and the high voltage box; 3. If the problem persists, please contact the maintenance personnel.
Node 6	Combustible gas sensor communication abnormal	1. Power off the equipment and disconnect the external power supply; 2. Check for loose connection of the communication cable between this sensor and the EM; 3. If the problem persists, please contact the maintenance personnel.

8.4 Other fault information

Fault	Troubleshooting
SOC too low	a) Check the system SOC. b) If the problem persists, please contact the maintenance personnel.
SOH too low	a) Check the system SOH. b) If the problem persists, please contact the maintenance personnel.
Insulation alarm	a) Check the connection of the PE insulated cables. b) If any cable is loosely connected or disconnected, re-connect the cable properly. c) If the problem persists, please contact the maintenance personnel.
Insulation protection	a) Check the connection of the PE insulated cables. b) If any cable is loosely connected or disconnected, re-connect the cable properly. c) If the problem persists, please contact the maintenance personnel.

Contact us 9

If you have technical problems concerning our products, please contact your installer or Growatt Service. To provide you with the necessary support, please have the following information ready:

1> The model and capacity of the battery cabinet
2> The serial number of the battery cabinet
3> The installation location of the battery cabinet
4> The LED display of the battery cabinet

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