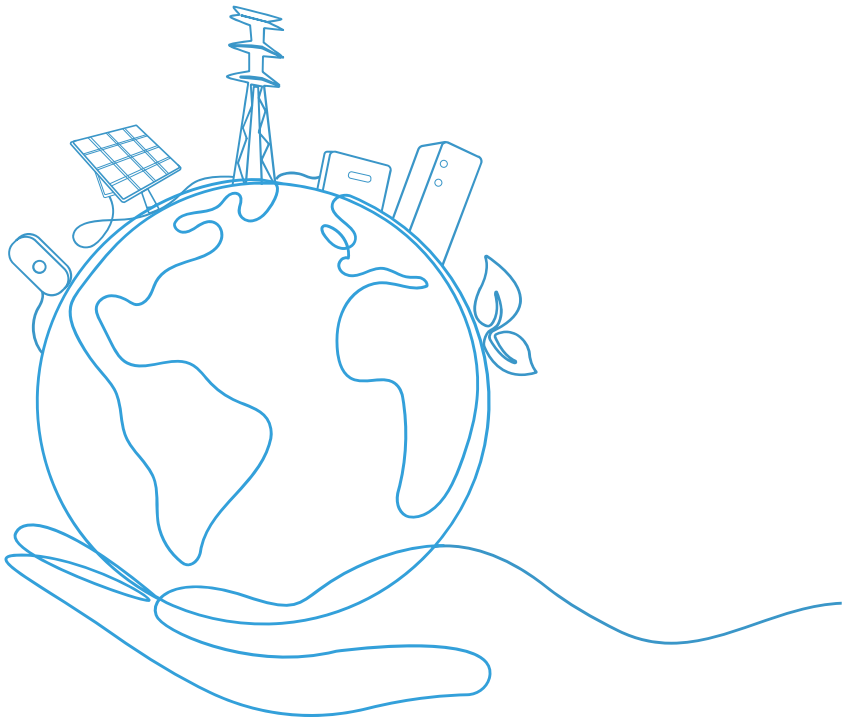
User Manual

Commercial & Industrial Energy Storage System
125 kW/261 kWh

v4.0 2025-09



LIVOLTEK

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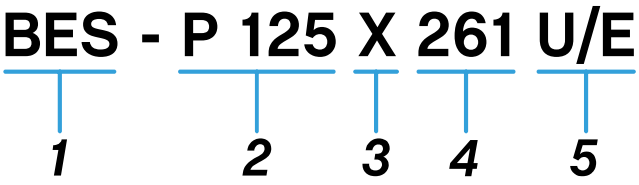
About the Manual

Validity

This manual is valid for the following products:

- BES-P75X261E
- BES-P100X261E
- BES-P110X261E
- BES-P125X261E
- BES-P75X261U
- BES-P100X261U
- BES-P110X261U
- BES-P125X261U
- BES-P135X261U

Model Description



No.	Item	Description
1	**Product Name**	Battery Energy System.
2	**Power**	Rated power of the PCS. Value range: 75 (75 kW), 100 (100 kW), 110 (110 kW) and 125 (125 kW).
3	**Cabinet Series**	X series Commercial & Industrial Battery System.
4	**Battery Capacity**	The battery capacity is 261 kWh.
5	**Standard**	U: Conforms to the American Standard. E: Conforms to the European Standard.

Target Group

This document is intended for qualified persons and operators. Only qualified persons are allowed to perform the activities marked in this document with a warning symbol and the caption "Qualified person". Tasks that do not require any particular qualification are not marked and can also be performed by operators. Qualified persons must have the following skills:

- Have basic knowledge and installation skills of the product.
- Training to deal with risks associated with installing, repairing, and using electrical devices, PCS, and batteries.
- Training in the installation and commissioning of electrical devices and installations.
- Knowledge of all applicable laws, regulations, standards, and directives.
- Knowledge of and compliance with this document and all safety information.
- Successful participation in a training course on commissioning the device with the Livoltek manufacturer.

Levels of Warning Messages

The following levels of warning messages may occur when handling the product.

DANGER	
	Indicates risk of Electric Shock which will result in death or serious injury if not avoided.
WARNING	
	Indicates a situation of moderate potential hazard that could result in death or serious injury if not avoided.
CAUTION	
	Indicates a low level of potential hazard that, if not avoided, could result in moderate or minor injury to personnel.
NOTE	
	Emphasis and additions to the content may also provide tips for optimizing the use of the product.

Release Note

Version	Version Update Record	Date
1.0	Initial release.	2025-03-25
2.0	Updated the template of user manual and modified structure of battery packs and PDU in the cabinet.	2025-05-25
3.0	• Upgraded Product appearance by changing the original black and gray color combination to a single solid color; • Reduced the height of the product; • Upgraded the internal structure, three-in-one integrated PCS, BMS and high-voltage box; • Cancelled the gas detector; • Put the humidifier inside the cabinet; • Integrated local controller on ARM board; • Upgraded the liquid cooling unit; • Upgraded system diagram, for details, please refer to "2.6 System Architecture"; • Added the description of work modes, for details, please refer to "2.7 Work Mode"; • Added clearance requirements of parallel connections, for details, please refer to "4.1.5 Clearance Requirements for Multiple Cabinets"; • Added MSD installation instructions, for details, please refer to "7.4 MSD Installation"; • Upgraded the procedures of communication cables connections, and added PIN description and parallel connection, for details, please refer to "7.5 Communication Connection";	2025-09-01
4.0	Updated the technical data.	2025-09-17

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1 Safety

1.1 Safety Precaution

This equipment should be used in an environment that meets the design specifications, otherwise it may cause equipment failure, and the resulting abnormal equipment function or damage to parts, personal safety accidents, property damage, etc. Which are not covered by the equipment quality warranty. Local laws, regulations and codes should be observed when installing, operating and maintaining the equipment. The safety precautions in this manual are only supplementary to local laws, regulations, and codes. The Company shall not be liable in the event of any of the following occurrences.

- The installation and use environment exceed the provisions in the relevant international, national and regional standards.
- Do not operate under the conditions of use described in this manual.
- Unauthorized disassembly, alteration of products or modification of software code.
- Failure to follow the operating instructions and safety warnings in the product and documentation.
- Damage to equipment caused by abnormal natural circumstances (force majeure, such as earthquakes, fires, windstorms, floods, mudslides, etc.).
- Damage caused by the customer's failure to follow shipping and installation requirements.
- Damage caused by storage conditions that do not meet the requirements of the product documentation.
- Damage to the hardware or data of the device due to customer negligence, incorrect operation or intentional damage.
- Damage to the system caused by a third party or the customer, including damage caused by relocating and installing the system in a manner that does not comply with the requirements of this manual, as well as adjusting, altering, or removing identifying marks in a manner that does not comply with the requirements of this manual.
- Defects, failures or damages caused by acts, events, negligence or accidents beyond Seller's reasonable control, including power outages or electrical failures, theft, war, riots, civil commotion, terrorism, willful or malicious damage.

DANGER

The equipment is subject to high voltages, and unregulated operation may cause electric shock or fire, resulting in death, serious personal injury, or severe property damage. Please follow the operating sequence and safety precautions given in this manual and other related documents to standardize the operation.

- Check that the device's pre-installed cable connections are tight. Check the device for damage, such as holes, dents or other signs of possible internal damage. Check that the internal parts of the equipment are not displaced. Any unauthorized alteration of the equipment's structure, installation order, etc. is prohibited.
- Do not use water to clean electrical parts inside the equipment. If liquid is found inside the equipment, press the emergency stop switch immediately and notify the site manager.
- Do not carry out installation, wiring, maintenance and replacement operations with electricity. Measure the voltage at the point of contact before touching any conductor surface or terminal, and make sure that the protective earth wire of the equipment or parts to be serviced is reliably grounded and that there is no danger of electric shock.
- Do not approach the equipment except for the person who will operate it. Do not energize the equipment without completing the installation or without confirmation from a qualified person. Ensure that at least two persons are present when power is first applied or when the main circuit is energized.

NOTE

- Users in the transportation, handling, installation, wiring and maintenance of the process of operating behavior and operating tools, must meet the country, region, laws and regulations and relevant standards.
- When installing, operating, or maintaining, it is necessary to clean the top of the cabinet of any standing water, ice, snow, or other debris before opening the cabinet door to avoid debris falling into the cabinet.
- Reverse engineering, decompiling, disassembling, adapting, implanting or other derivative operations on the device software is prohibited, as well as researching the internal implementation of the device, obtaining the source code of the device software, stealing intellectual property rights, etc., In any way, or disclosing the results of any device software performance tests.

1.2 Battery Safety

NOTE

We are not responsible for damage to the batteries supplied by us caused by the following reasons:

- Failure to charge and accept the battery in time due to the customer, resulting in overdue storage, loss of capacity or irreversible damage.
- Mechanical damage from dropping, liquid leakage, rupture, etc. caused by improper handling or failure to connect the battery as required.
- The customer or a third party may change the usage of the battery without informing us. This includes, but is not limited to, connecting additional loads to the battery, mixing it with other brands of batteries, mixing it with batteries of different rated capacities, etc.
- Due to the field equipment operating environment or external power parameters can not meet the environmental requirements of normal operation, the battery caused by direct damage. Including the actual operating temperature of the battery is too high or too low, poor power grid conditions and frequent power outages.
- Customers do not correctly set the battery operation and management parameters or improper maintenance caused by frequent over-discharge of the battery, the customer site expansion or long-term failure to fully charge.
- The customer has not properly maintained the battery in accordance with the operation manual of the supporting equipment, including but not limited to: not regularly checking whether the battery terminal screws are tightened.
- Batteries are lost by theft.
- Batteries that have exceeded the warranty period.

DANGER

- Do not expose the battery to high temperatures or around heat generating equipment, such as sunlight, fire, transformers, heaters, etc. Overheating of the battery may cause fire or explosion.
- It is prohibited to disassemble, modify or damage the battery (e.g., inserting foreign objects, immersing in water or other liquids, etc.), which may cause the battery to leak, overheat, catch fire or explode.
- Battery thermal runaway generates flammable gases, as well as harmful gases such as CO and HF. The accumulation of flammable gases after thermal runaway of the battery poses a risk of deflagration and explosion, which may cause personal injury and property damage.
- When installing and maintaining the battery, it is necessary to wrap the exposed cable terminals on the battery with insulating tape. At the same time, avoid foreign objects (e.g. conductive objects, screws, liquids, etc.) from entering the interior of the battery and causing a short circuit.

WARNING

- Batteries must be stored in a separate warehouse, and stored in the outer packaging, avoiding mixed storage with other materials, avoiding open storage, and avoiding stacking batteries too high. The site must be equipped with fire-fighting facilities that meet the requirements, such as fire sand and fire extinguishers.
- Batteries should be protected from impact. When handling the battery, it should be carried in the direction required by the battery, and inverted and tilted are prohibited.
- Please use the battery within the temperature range specified in this manual. When the ambient temperature of the battery is lower than the lower limit of the operating temperature, charging is prohibited to avoid internal short-circuiting of the battery due to crystallization that occurs with low temperature charging.
- Please dispose of used batteries in accordance with local laws and regulations, and do not dispose of batteries as household waste.
- If it has been more than 8 months since the battery was last charged, the battery needs to be recharged. Failure to recharge the battery as required may affect the performance and service life of the battery.

Battery Abnormal Handling Measures

DANGER

- When an electrolyte leak occurs or there is an unusual odor, avoid contact with the leaking liquid or gas. Non-professionals should stay away and contact a professional immediately to handle the situation.
- Electrolyte is corrosive and contact may cause skin irritation and chemical burns. If contact with battery electrolyte occurs, the contact area needs to be washed immediately with plenty of water and soap and medical help sought immediately.
- After dropping the battery (no matter with or without package), it is forbidden to continue to use it. If there is no obvious deformation or damage in appearance and there is no obvious odor, smoke or fire, transfer the battery to an open and safe place for 1h under the premise of ensuring safety, and contact our service engineer.
- When there is obvious odor, breakage, smoke or fire after the battery falls, evacuate people immediately and call the police in time. By professional personnel in the protection of safety, the use of fire fighting facilities to extinguish the fire.

1.3 Installation Safety

WARNING

- The bottom board must be removed for fork transportation without wooden crate bottom bracket. Lifting and lowering should be carried gently and put down gently, avoiding impact or vibration.
- The center of gravity of the box should fall in the middle of the two forks of the forklift during transportation. It is prohibited to carry the box for long distance or invert or tilt it.
- When transporting the equipment, the operator's view may be blocked due to the large size of the equipment, so it is necessary to arrange for auxiliary personnel to assist in the completion of the task.
- In order to ensure the safety of drilling holes outside the body of the equipment, a suitable location should be selected before drilling to ensure that it will not cause short circuits and other effects. During the drilling process, the equipment should be covered to prevent debris from falling into the equipment, and the debris should be cleaned up in time after drilling.
- When carrying equipment by hand, you should be prepared to bear the weight and should wear protective gloves, anti-smash shoes and other safety gear.
- The equipment must be moved carefully during handling to avoid impact or dropping. Avoid scratching the surface of the equipment, damaging parts or cables.

1.4 Electrical Safety

1.4.1 Cabling Requirements

- Please choose cables that meet the requirements of local laws and regulations. Cables of the same type should be tied together, and cables of different types should be laid separately, and it is prohibited to twist or cross lay each other.
- When wiring is completed or you leave for a short period of time during the wiring process, you need to immediately seal the cable opening and close the cabinet door to avoid small animals from entering.
- The cables used in the energy storage system shall be firmly connected, well insulated, and in accordance with the specifications. The location of the cable through the pipe or over the hole, must be protected to avoid the cable by sharp edges, burrs and other damage.
- Cable wiring is completed, you need to use the cable bracket and cable clamps for reliable fixing, backfill the soil area of the cable to ensure that the ground is closely adhered to, to prevent backfilling soil, cable deformation or damage caused by force.
- Cables used in high temperature environments may cause the insulation to deteriorate and break, the distance between the cable and the periphery of the heat generating device or heat source area is at least 30mm.

- In order to ensure construction safety, all cables should be laid and installed above 0°C. When handling cables, especially when constructing in low-temperature environments, they should be gently held and placed.

1.4.2 Grounding Requirements

- Tampering with the grounding conductor is prohibited. The grounding body of the equipment should be permanently connected to the protective grounding grid. Before operating the equipment, check the electrical connections of the equipment to ensure that it is reliably grounded.
- Do not operate equipment without a grounding conductor. When installing equipment that requires grounding, install the protective earth conductor first; when removing equipment, remove the protective earth conductor last.

1.4.3 Inspection Requirements

- Before connecting or removing cables, disconnect the protective switch of the corresponding circuit.
- Use a multimeter of the corresponding voltage level to verify that it is not energized and to ensure that the equipment has been completely de-energized.
- If there is an electrically charged body nearby, cover or wrap it with an insulating board or tape.
- Use a grounding wire to reliably connect the circuit to be serviced to the grounding circuit before performing O&M.

NOTE

- Before connecting the cables, make sure that the cable labels are correctly labeled before connecting them.
- If the unit has multiple inputs, disconnect all inputs to the unit and wait until the unit is completely powered down before operating the unit.
- After completing the inspection, remove the grounding wire between the inspection circuit and the grounding circuit.

1.5 Maintenance and Replacement Danger

WARNING

- It is prohibited to open the cabinet door in rain, snow, lightning, dust, fog, etc.
- Before parts are removed from the cabinet, make sure that other parts on the cabinet are not loose.
- During equipment maintenance, nearby energized parts should be covered with insulating material.
- Prohibit any object from touching the operating fan (e.g., fingers, parts, screws, etc.) until the fan is powered off and stops rotating.
- Do not power up the unit before troubleshooting.
- When inspecting the system with electricity, pay attention to the hazard warning signs on the equipment and avoid standing at the cabinet door.
- Equipment other than battery packs must wait 15 minutes after powering down to ensure that the equipment is unpowered before operating the equipment.
- Manual wiring inspection is required to avoid abnormal system operation after power components of the energy storage system are replaced or wiring is changed.
- After completing the operation related to maintenance and replacement, lock the cabinet door in time and keep the key properly.

1.6 Symbols on the Label

Item	Description
	Follow the instruction in this manual for service and replacement.
	RCM mark of conformity.
	RoHS Mark.
	CE Mark.
	Complies with the requirements of the applicable UKCA guidelines.
	Complies with the requirements of the applicable UKNI guidelines.
	**Warning:** General warning sign
	**Caution:** Risk of Electric Shock Disconnect all incoming power and turn off the product before working on it.
	Do not short circuit the battery.
	**Caution:** Risk of Electric Shock Hazardous voltage is still present 5 minutes after all power sources have been disconnected. Wait for at least 5 minutes before maintenance to prevent electric shock.
	**WEEE Mark.** All electrical and electronic products should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities. The correct disposal of your old appliance will help prevent potential negative consequences for the environment and human health. For more detailed information about disposal of your old appliance, please contact your city office, waste disposal service or the shop where you purchased the product.

2 Product Overview

BES-X series energy storage system integrates high performance PCS, BMS, high-capacity battery modules, smart EMS, and advanced liquid cooling unit and fire protection mechanism in one cabinet. A high-density modular design minimizes space requirements, improves ease of transport, and simplifies installation and maintenance, ensuring maximum efficiency from deployment to operation.

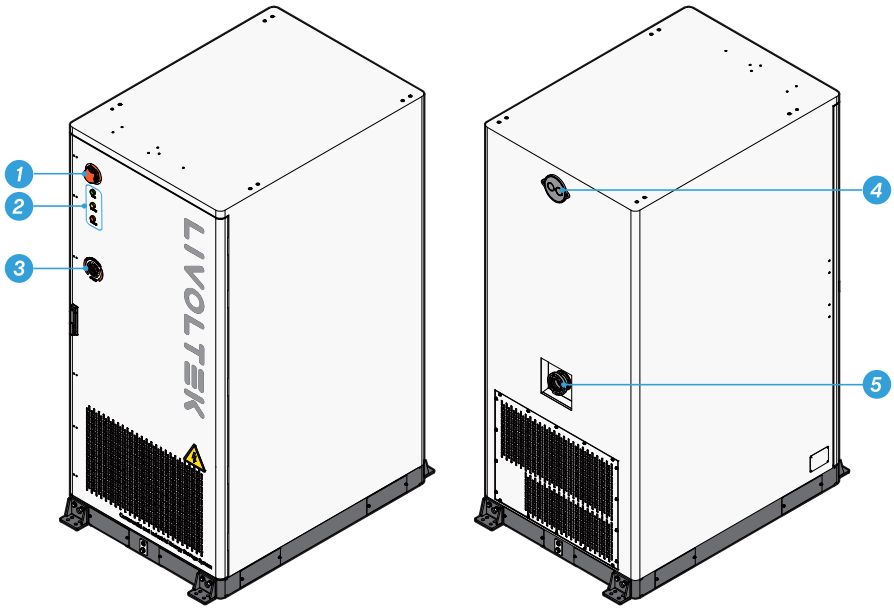
Table 2-1 Configuration List

Model	Quantity of Battery packs (BHF-B166314)	PCS	Quantity of HVAC	Note
BES-P75X261E	5	PCS-75KG1	1	**PCS:** Supports electrical energy conversion between the grid and the rechargeable battery and controls the charging and discharging of the battery. Also used in the control center of the energy storage system, short-circuit, leakage current detection, high-precision current acquisition, auxiliary power supply and so on. **HVAC:** Provides a favorable operating temperature environment for the energy storage cabinet.
BES-P100X261E	5	PCS-100KG1	1	
BES-P110X261E	5	PCS-110KG1	1	
BES-P125X261E	5	PCS-125KG1	1	
BES-P75X261U	5	PCS-75KMG1	1	
BES-P100X261U	5	PCS-100KMG1	1	
BES-P110X261U	5	PCS-110KMG1	1	
BES-P125X261U	5	PCS-125KMG1	1	
BES-P135X261U	5	PCS-135KMG1	1	

2.1 Performance and Features

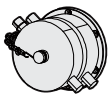
- Integrated design, space-saving, integrated LFP battery, PCS, energy management monitoring system, power distribution system, environmental control system, fire control system, can only be temperature control, comprehensive control of the system's operating status and risks;
- Configuration of rack-type modular PCS, support for multiple parallel connection, good scalability; according to the system capacity requirements of micro-grid and other scenarios to select the number of PCS modules and the total battery power, the typical configuration is: 125 kW/261 kWh.
- With protection class IP55, and C3, C5 (optional), it can perfectly cope with all types of weather outdoors;
- Built-in smoke sensing, temperature sensing, gas sensing, fire extinguishing system, real-time monitoring of the state of the electric cabinet, to ensure the safety of product operation;
- Intelligent temperature control with 8000+ long cycles to maintain optimal operation;
- Artificial intelligence self-diagnostics and remote OTA, unit-level fine monitoring and diagnostics.

2.2 Appearance



Front View Back View

Figure 2-1 Appearance

No.	Item	Description
1	**Sound and light alarm**	Simultaneously emits sound and light alarm signals.
2	**Indicators**	To display status information of all processess running on the system.
3	**Emergency stop button**	To shut down the system in emergency circumstances.
4	**Explosion relief valve**	To prevent explosions of system or equiment due to excessive internal pressure.
5	**Fire hose coupling**	Connect to the interface of the water supply system. European Standard:  American Standard: 

2.3 Product Sizes

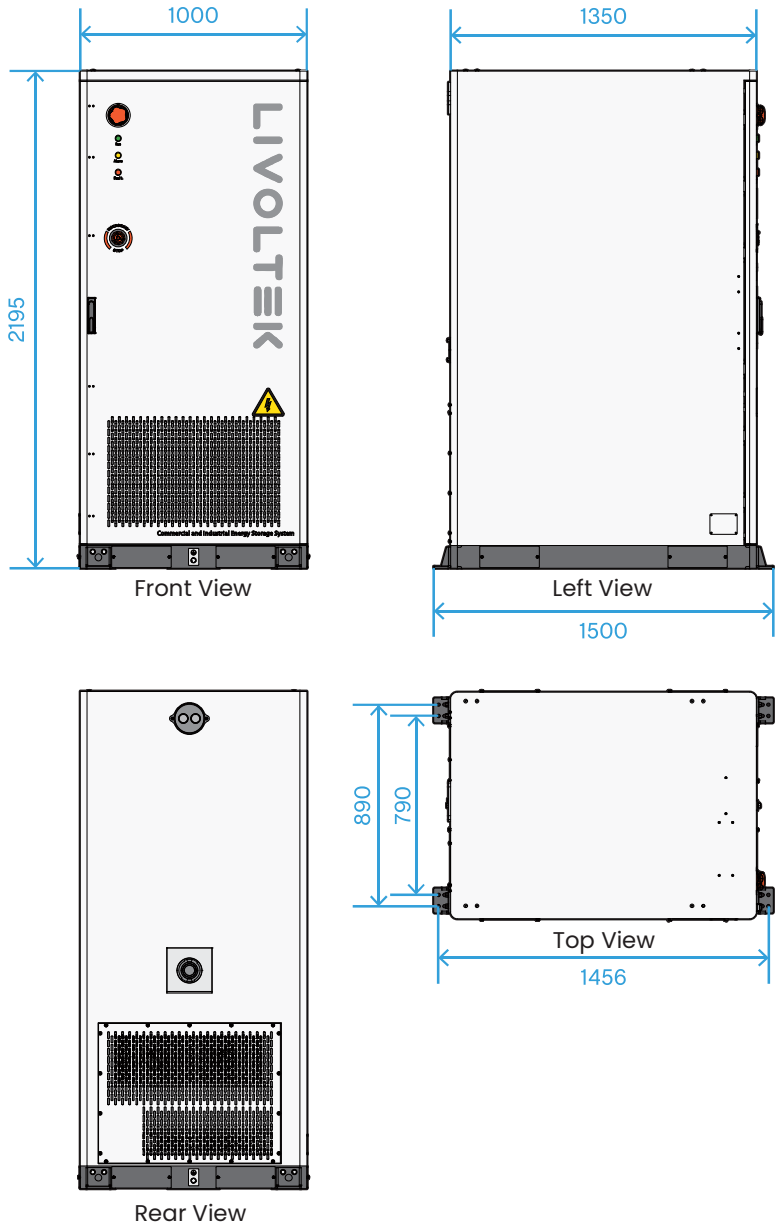


Figure 2-2 Product Size (Dimensions in mm)

2.4 Cabinet Internal Structure

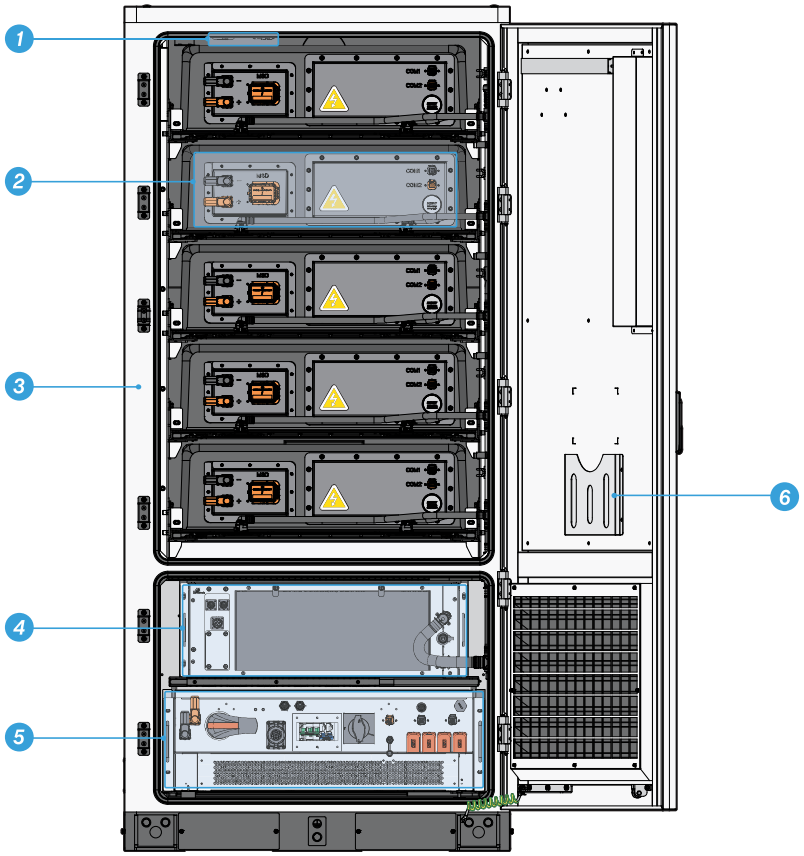


Figure 2-3 Cabinet Internal Structure

No.	Item	No.	Item
1	Smoke/Temperature detector	4	HVAC
2	Battery pack × 5	5	PCS
3	Dehumidifier	6	File box

2.4.1 Battery System

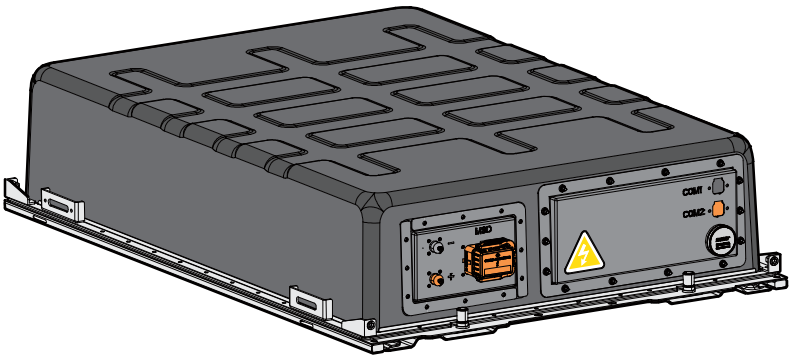


Figure 2-4 Appearance of Battery Pack

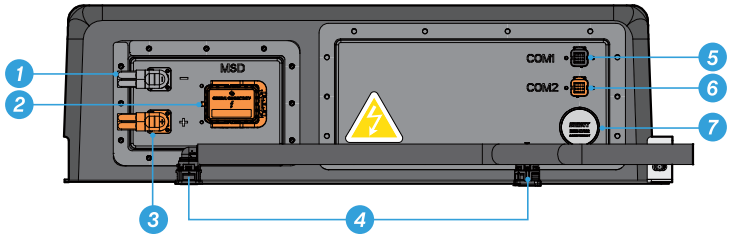


Figure 2-5 Terminals of Battery Pack

No.	Item	Description
1	**Negative terminal**	To connect to negative power cable
2	**MSD plug**	To protect personnel and device safety during maintenance
3	**Positive terminal**	To connect to positive power cable
4	**Coolant inlet and outlet**	To inject and drain the coolant
5	**COM 1 port**	To connect to BMS or other battery packs for communication
6	**COM 2 port**	To connect to BMS or other battery packs for communication
7	**Vent valve**	For airtightness testing

2.4.2 PCS

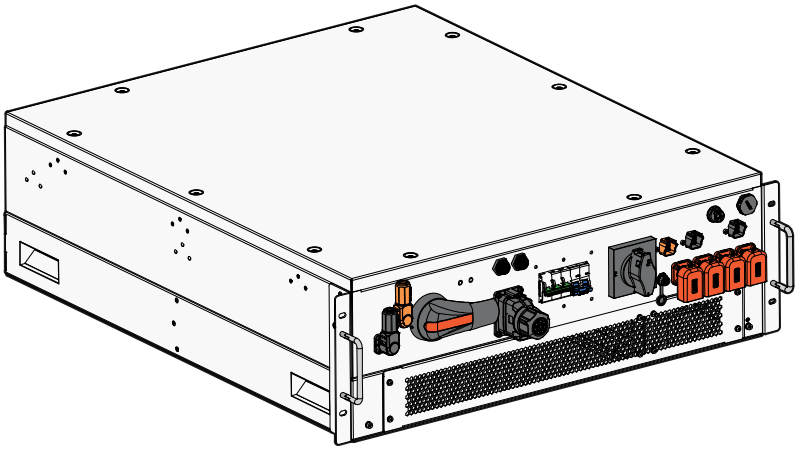


Figure 2-6 Appearance of PCS

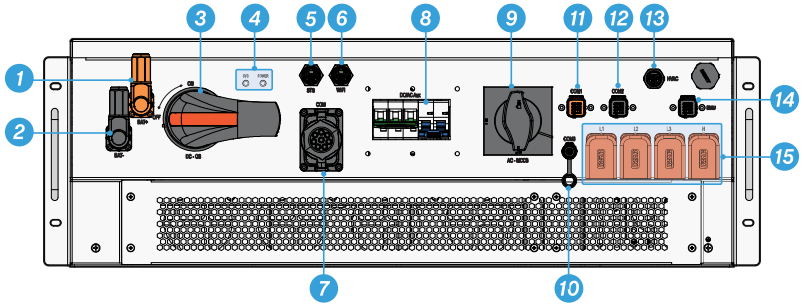


Figure 2-7 Terminals of PCS

No.	Item	Description
1	**Battery positive port**	To connect to the battery pack's positive terminal
2	**Battery negative port**	To connect to the battery pack's negative terminal
3	**Battery switch**	Disconnect the battery circuit if needed
4	**Indicators**	Display the status of the PCS
5	**STS port**	Communication terminal
6	**USB port**	USB terminal
7	**COM port**	Communication terminal
8	**DC breaker**	Cutting off DC/AC auxiliary power
9	**AC breaker**	Cutting off AC auxiliary power

No.	Item	Description
10	**COM3 port**	Communication terminal
11	**COM1 port**	Communication terminal
12	**COM2 port**	Communication terminal
13	**HVAC COM port**	To connect to HVAC
14	**BMU COM port**	To connect to BMU
15	**Grid terminals**	Grid connection terminal

2.4.3 HVAC

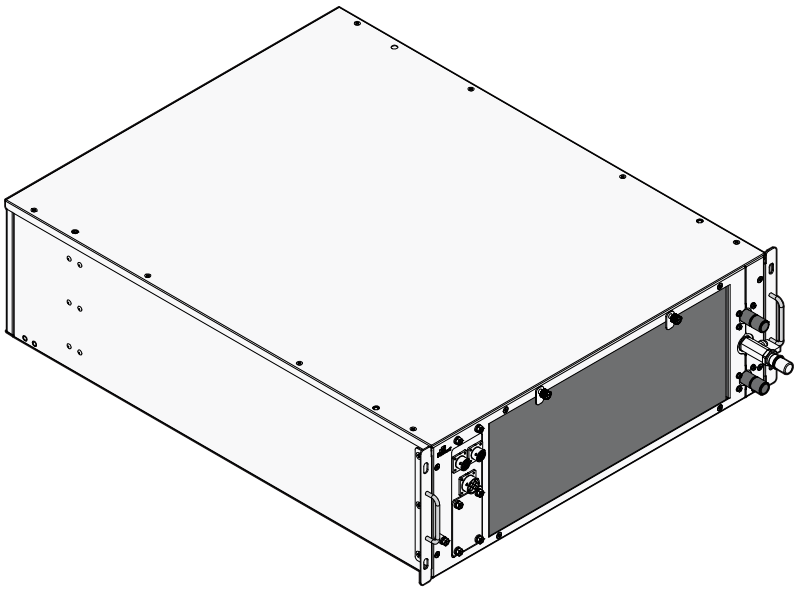


Figure 2-8 Appearance of HVAC

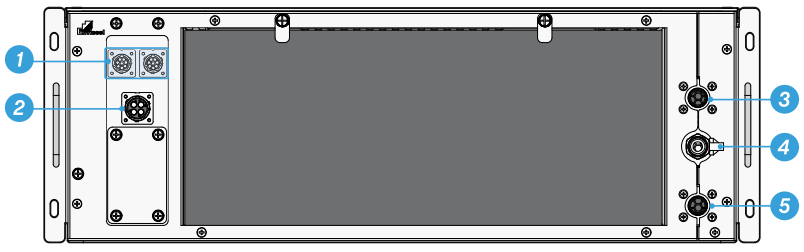


Figure 2-9 Terminals of HVAC

No.	Item	Description
1	**COM port & Debug port**	To communicate with LC and to debug the unit
2	**Power port**	To supply power for the unit
3	**Coolant inlet**	/
4	**Filler & drainage port**	To inject and drain the coolant into and from the unit
5	**Coolant outlet**	/

2.4.4 Environmental Monitoring System

The energy storage system is equipped with comprehensive environmental monitoring and fire suppression systems, including devices like smoke detectors, temperature sensors, water sensors, and fire extinguishers. These components collectively ensure full control over the system's operational status and immediate response to environmental anomalies.

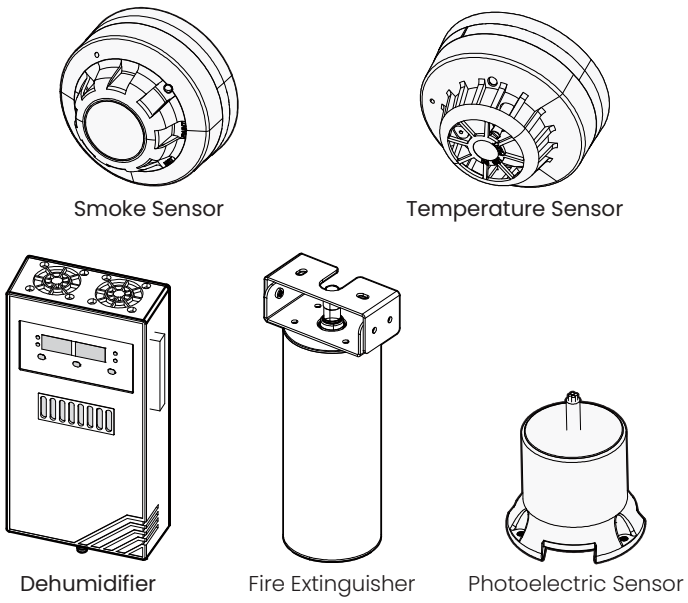


Figure 2-10 Appearance of Parts of Environment Monitoring System

2.5 Application Scenarios

- Commercial & Industrial PV and Storage Application Scenario

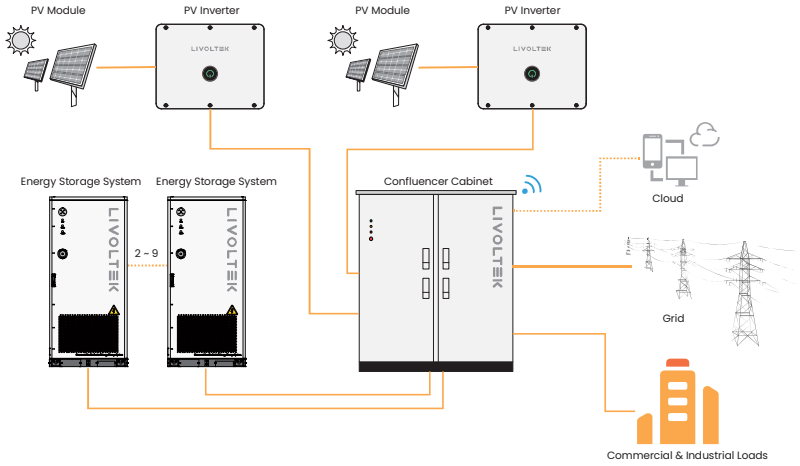


Figure 2-11 C&I PV and Storage Application Scenario

- Commercial & Industrial Storage Application Scenario

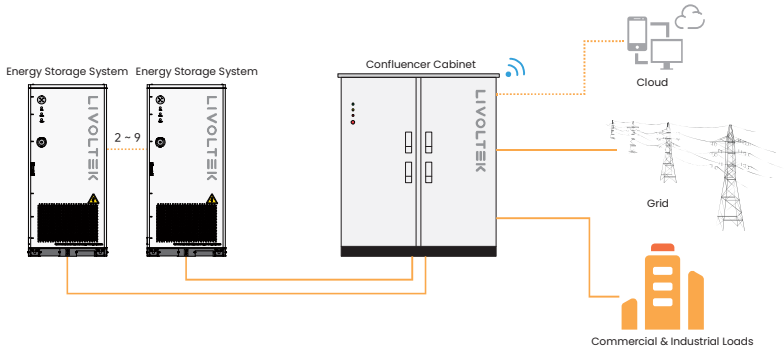


Figure 2-12 C&I Storage Application Scenario

NOTE

In the scenario of parallel operation, please refer to the combiner cabinet manual for guidance.

2.6 System Architecture

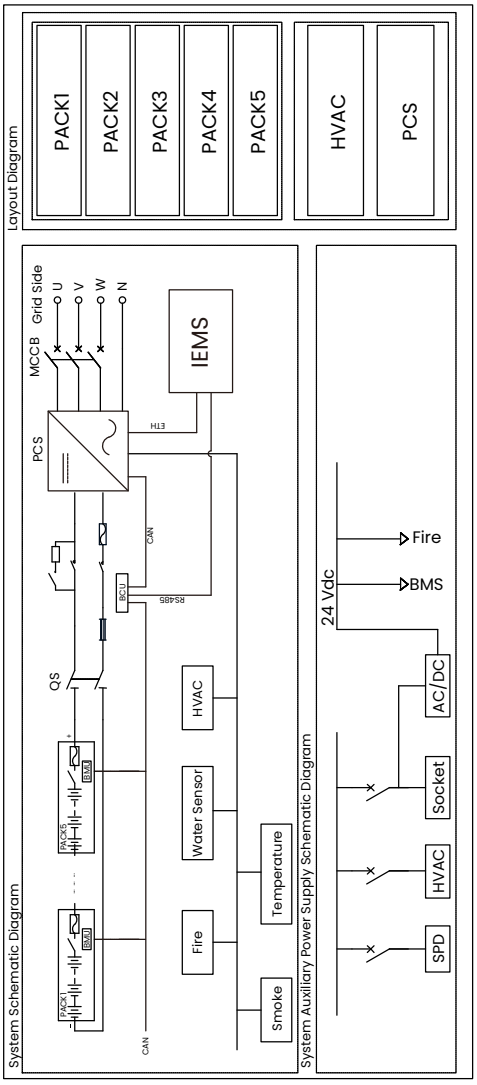


Figure 2-13 Circuit Diagram

NOTE

Figure for the system program with parallel off-grid, different projects with different configurations, the line is slightly different, the actual shipping attached drawings shall prevail.

2.7 Work Mode

The work modes of the energy storage system for common application scenarios:

- **Peak Shaving and Valley Filling**: During off-peak hours as per time-of-use tariffs, the energy storage cabinet automatically initiates charging and remains on standby once fully charged. Conversely, during peak hours, it discharges automatically, capitalizing on tariff differentials for arbitrage, thereby enhancing the economic efficiency of the solar storage and charging system.
- **PV (Photovoltaic) and Storage Integration**: The system dynamically monitors local load demand, giving priority to using photovoltaic-generated power for self-consumption, with excess energy stored. In instances where photovoltaic output is inadequate to meet the immediate local load requirements, the stored energy in the battery is then utilized as a primary supplement.
- **Anti-Reverse Current**: For application scenarios where reverse power flow into the grid is not allowed: During the ESS charging period: If PV systems are present, the edge EMS coordinates PV generation to prioritize supplying the load. Excess energy is used to charge the energy storage system. If the ESS and load cannot absorb the excess energy, PV generation is limited to prevent reverse power flow into the grid. During the ESS discharging period: If the load cannot absorb both PV generation and the energy discharged from the ESS, the edge EMS limits PV generation and reduces the storage discharge power to avoid reverse power flow from PV or storage into the grid.
- **Off-Grid Power Supply**: In off-grid scenarios, the ESS provides stable voltage and frequency support for the local grid to ensure reliable power supply. This application scenario supports the addition of AC/DC PV systems to extend the off-grid power supply duration.
- **Backup Power Supply**: Grid Normal: The ESS operates in grid-connected mode, implementing peak shaving, dynamic capacity expansion, anti-backflow, and demand management to achieve grid-connected benefits. Grid Abnormal: The ESS switches to off-grid mode, outputting stable voltage and frequency to provide reliable power supply to regional loads, addressing power interruptions or emergencies.

3 Transportation and Storage

3.1 Transportation

- For better protection of the equipment, transportation with packaging is recommended;
- Transportation of equipment should be carried out in accordance with the marking requirements on the packaging to prevent personal injury and equipment damage;
- Energy storage batteries are not recommended for railroad transportation and air transportation. Speed limit requirements for land transportation: 80 km/h on flat roads, 60 km/h on rugged roads, in case of conflict, please refer to local traffic regulations.

3.1.1 Forklift

- When using a forklift to move to ensure that the forklift has enough load capacity, and pay attention to the center of gravity of the equipment needs to fall between the feet of the forklift to prevent personal injury and equipment damage;
- Recommended fork knife length ≥1.3 m, width 80 cm ~ 160 cm, thickness 25 mm ~ 60 mm.

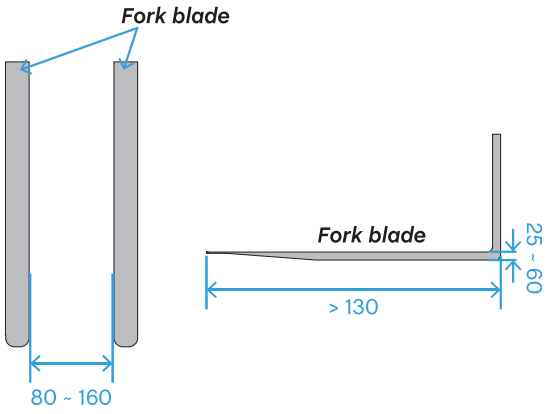


Figure 3-1 Fork Blade (Dimensions in cm)

- Forklifts with batteries need to have a load capacity of ≥3 t; forklifts without batteries need to have a load capacity of ≥1.5 t;
- Before moving the device, please pay attention to the center of gravity position of the load, and fully secure the load on the forklift by securing measures, such as ropes or bindings. In addition, please designate a person to supervise for safety concerns during transportation.

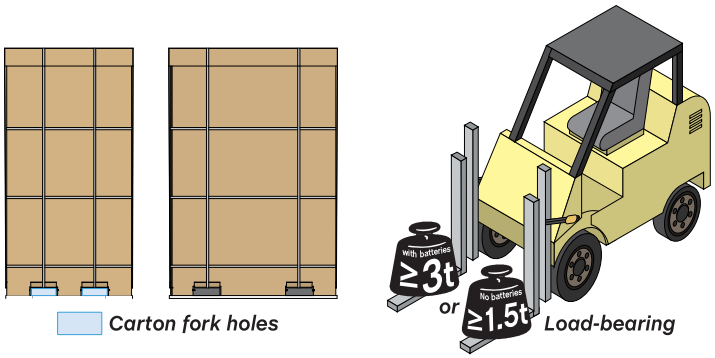


Figure 3-2 Carton Fork Holes and Load-bearing

- Before unpacking, please accurately insert the fork blade into the fork holes on the carton when moving the device.

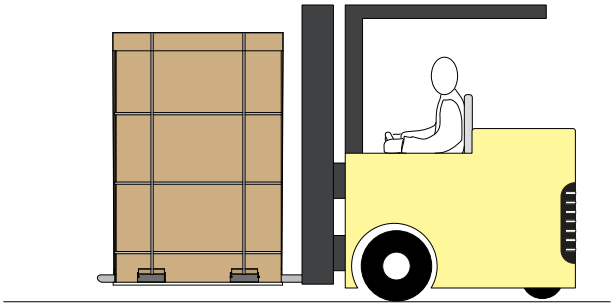


Figure 3-3 Transporting the Carton

3.1.2 Hoisting

A hoist operator with good operational skills and safety awareness, who must be trained and certified, shall be operated according to the local laws and regulations.

- After unpacking, the following requirements must be met when working with cranes and lifting ropes: crane hoisting capacity ≥ 5 t, hoisting operating radius ≥2 m.
- Before hoisting, please check:
  - Lifting tools are complete, tested and fully secured.
  - The device door is closed and locked to avoid accidental opening.
  - The lifting rope's quality must meet standards, and it shall be fully secured, to avoid falling and fraying.
- Do not hoist outdoors in rain, snow, wind and other bad weather.
- It is recommended to hoist devices in sequence and to ensure that the hoist moves in the same direction.

3.2 Storage

3.2.1 Product Packaging

In order to keep the product in a better state of protection during transportation, it is packed in specific wooden crates.

Table 3-1 Packaging Parameters

Parameters	Clarification
Model number	Product Model.
Sizes	The external dimensions of the fully packaged product, including all protective materials (e.g., foam, pallet, or carton).
Weights	The gross weight of the product, including the inverter cabinet, internal components, and all packaging materials.
Markings	Symbols, icons, or text printed on the packaging to ensure safe transportation and storage. Face up, careful placement, center of gravity, etc.

3.2.2 Product Storage

The product shall not be stored in an exposed outdoor location if the product is not immediately transported or installed for use in a storage location that complies with the following conditions:

Table 3-2 Requirements for Product Storage Conditions

Parameters	Request
Storage temperature (without battery) [°C]	-25 ~ +60
Storage temperature (with battery) [°C]	10 ~ 30
Storage relative humidity	<95% (no condensation)
Altitude [m]	<4000

NOTE

Long-term storage of batteries is not recommended. There will be capacity loss in long term storage of lithium batteries, the general irreversible capacity loss of lithium batteries is 3% ~ 10% after 12 months of storage at the recommended storage temperature. Battery packs should be stored and shipped for a total of no more than 6 months (counting time from shipment). Beyond 6 months a recharge and SOC calibration is required, at a minimum to 50% SOC. failure to recharge as required may affect the performance and service life of the battery.

4 Installation Preparations

4.1 Installation Site Condition

4.1.1 Environment

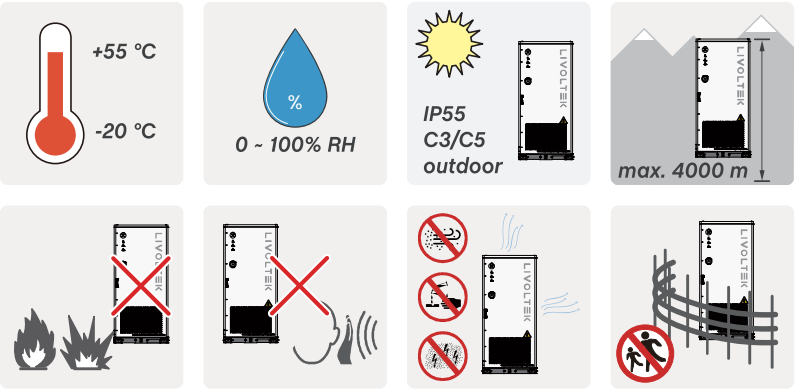
The layout of the energy storage system installation must meet the fire distance or fire wall requirements specified in local standards, including but not limited to NFPA 855 Standard for theInstallation of Stationary Energy Storage Systems. Code Requirements. The energy storage system is only applicable to outdoor scenarios and requires an outdoor arrangement and does not support indoor arrangements. The general requirements for siting are as follows:

- The level of the installation location should be above the highest historical water level in the area. The distance to airports, buried waste disposal sites, river banks or dams should be ≥2 km.
- Select a well-ventilated area. Do not block the ventilation openings and heat dissipation system while the equipment is in operation to prevent fire from high temperatures. Installation space is sufficient to ensure that the surrounding equipment will not be affected by the heat generated by the product; install in a location that ensures sufficient space for external wiring. Equipment with convenient transportation conditions and reliable fire suppression systems.
- Keep the installation location away from sources of ignition and do not place flammable or explosive materials around the equipment. If the equipment is installed in a place with lush vegetation, in addition to routine weeding, the ground underneath the equipment needs to be hardened to prevent overgrowth of weeds.
- Do not install the energy storage system outdoors in salt-affected areas to prevent equipment corrosion and fire. Salt-hazardous areas are defined as areas within 2 km from the coast or affected by sea breezes.
- The energy storage system must be equipped with protective measures such as fences and walls, and safety warning signs must be erected for isolation to avoid entry of unauthorized personnel during the operation of the equipment, which may result in personal injury or property damage.
- The equipment is installed in an area away from liquids, and should not be installed below water pipes, air outlets and other locations that are prone to condensation; it should not be installed below air conditioning outlets, vents, server room outlet windows and other locations that are prone to water leakage, to prevent liquids from entering the interior and causing short circuits in the equipment.

4.1.2 Location Requirements

Re-siting is recommended when the site cannot be safely spaced to meet relevant state standards. Site selection should avoid scenarios not recommended by industry standards and regulations, including, but not limited to, the following lots, areas, and places:

- Strong vibrations, strong noise sources and strong electromagnetic field interference areas.
- Places that generate or have dust, fumes, harmful gases, corrosive gases, etc.
- Places where corrosive, flammable and explosive substances are produced or stored. Within the range of blasting hazards.
- Places where underground facilities are already in place. Densely populated places, high-rise buildings, underground buildings.
- Undesirable geologic conditions such as rubbery and weak soils, ground prone to waterlogging and subsidence.
- Within the boundaries of a mining trap (stagger) area. Areas that could be inundated by a dam or levee failure.
- Earthquake faults and seismic zones with a defense intensity higher than nine degrees. Sections with direct hazards such as mudslides, landslides, quicksand and caves.
- Important sanitary protection areas for water supply sources.
- Historic Monuments and Sites Conservation Area.



If there is no more suitable site, it is recommended to install a firewall of not less than 3h fire resistance for safety protection, while considering the space requirements for equipment transportation, installation and maintenance. It is recommended to refer to T/CEC 373-2020: the length and height of the fireproof wall should exceed the outer contour of the energy storage cabinet by 1 m each.

4.1.3 Installation Foundation Requirements

According to the product size in advance to select the equipment installation location, good positioning and fixing; recommended foundation as shown below.

- Type of foundation material:
  - Non-combustible materials such as solid bricks or concrete;
  - Steel.
- The foundation's bearing capacity shall exceed 5 t. Otherwise, a retest is required.
- The bottom of the foundation pit must be strengthened and filled. The surface of the foundation shall be solid, flat and level (horizontal error ≤3 mm, tilt angle ≤5°). Sunken or tilted foundation is not acceptable.
- Referring to the weight of the product, the selected mounting location needs to have sufficient load-bearing strength;
- Reliable grounding point, ensure that the grounding resistance is less than 4 Ω
- The foundation drawing is only for reference. Operators shall recheck and revise it according to the environment, geological conditions, seismic requirements, etc. of the installation site.
- A qualified drainage facility, of which the drainage capacity meets the requirements of the heaviest rain records in local history,shall be established according to the local geological conditions and municipal drainage standards.

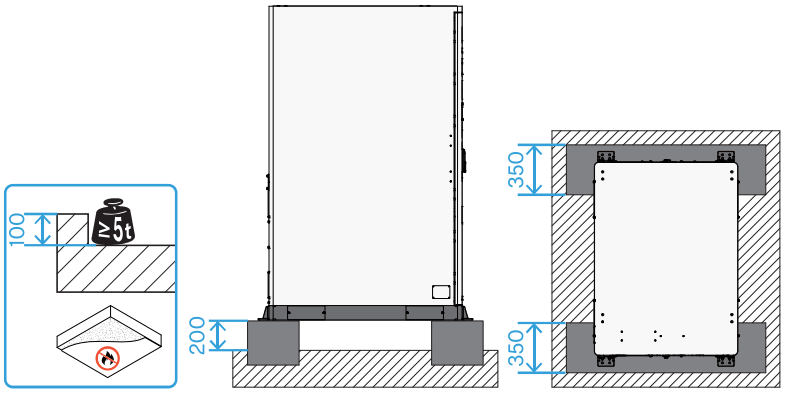


Figure 4-1 Foundation Requirements (Dimensions in mm)

4.1.4 Angle and Space Requirements

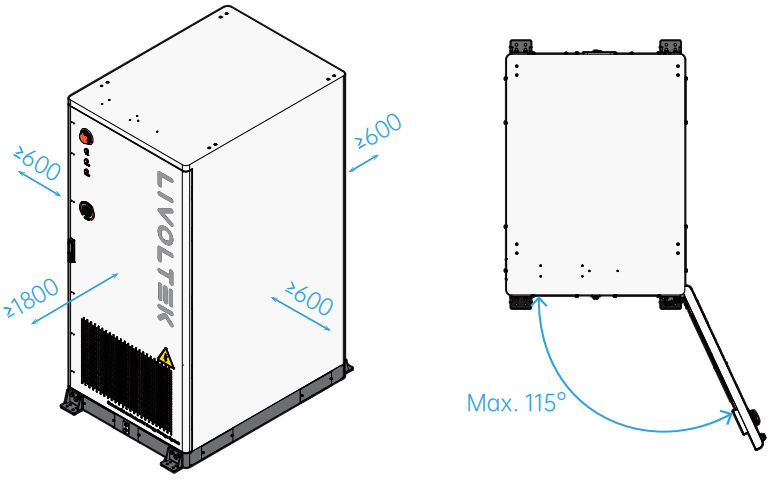


Figure 4-2 Angle and Space Requirements (Dimensions in mm)

4.1.5 Clearance Requirements for Multiple Cabinets

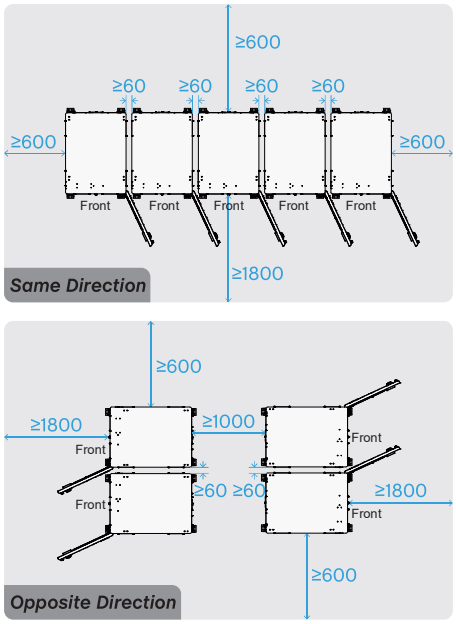
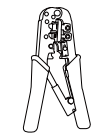
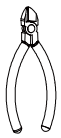


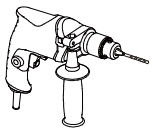
Figure 4-3 Clearance Requirements for Multiple Cabinets (Dimensions in mm)

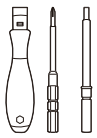
4.2 Tools Preparations

4.2.1 Tools Requirements


Wire crimper


Diagonal pilers


Pneumatic drill


Cross screwdriver
Straight screwdriver

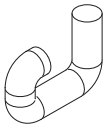

Torque wrench


Multimeter

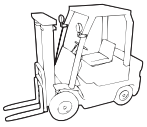

Level


Pencil


Knife


Tube for wrapping

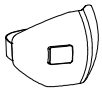

Crane


Forklift


Safety helmet


Safety boots


Safety gloves


Anti-dust mask


Safety goggles

4.2.2 Additional Required Materials

According to the power of the product, cable specifications provided in Table below. Cable diameter selection should be in line with local cable standards. Factors affecting cable selection include: rated current, cable type, laying method, ambient temperature and maximum acceptable line loss.

Table 4-1 Cable Size Comparison Table

Capacity	125 kW
AC Cable [mm²]	≥ 3 × 70
N Cable [mm²]	≥ 70
PE Cable [mm²]	≥ 50

NOTE

- The above cables are not included in the scope of delivery and should be prepared separately.
- The installation scheme of the ESS must conform to the applicable standards or regulations in the country/region where the project is located.
- Failing to follow the relevant installation requirements in this manual may result in equipment or system failure, and the damage caused therefrom will not be covered by warranty.

5 Unpacking and Inspection

5.1 Unpacking

- The equipment undergoes 100% testing and inspection before shipping from the manufacturing facility. However, transport damage may still occur. Before unpacking the rechargeable battery, please verify that the model and outer packing materials for damage, such as holes and cracks.
- Due to the cabinet height exceeding 2 m, please take necessary precautions for working at heights when removing the outer packaging.
- When unpacking, please handle all packaging materials properly for future storage or relocation of this equipment.
- After unpacking, please check if the equipment is intact and if all accessories are complete. If there is any damage or missing accessories, please contact your dealer immediately for assistance.

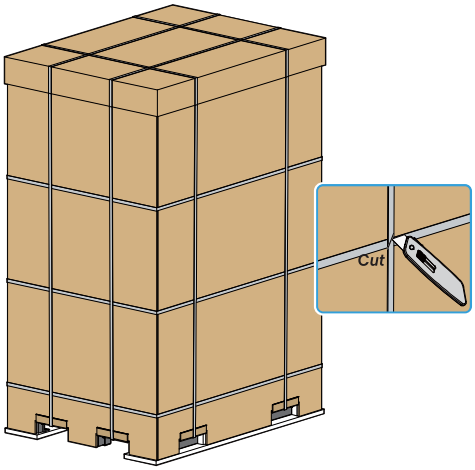


Figure 5-1 Unpacking the Carton

5.2 Scope of Delivery

- Before installing the product, please inspect it for any signs of damage. If you detect any evidence of damage, retain the evidence and promptly contact Hangzhou Livoltek Power Co., Ltd.
- If you confirm that the product is in good condition, please proceed to check against the delivery list to verify the completeness of all components.

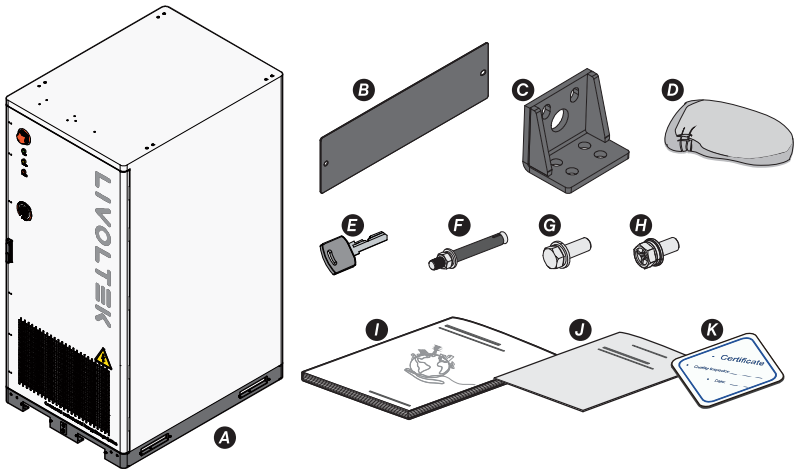


Figure 5-2 Scope of Delivery

Table 5-1 Components Included in Scope of Delivery

Item	Description	Quantity
A	Cabinet	1 pc
B	Cover plate	8 pcs
C	Angle support	4 pcs
D	Fireproofing mudsesiccant	2 pcs
E	Key	2 pcs
F	M12 × 120 expansion bolt	8 pcs
G	M12 × 35 combination screw	8 pcs
H	M5 × 10 combination screw	16 pcs
I	User Manual	1 pc
J	Factory inspection report	1 pc
K	Certification of Conformity	1 pc

5.3 Product Handling Requirements

⚠ QUALIFIED PERSON

NOTE

Before relocating the cabinet through a forklift truck, make sure you have secured the cabinet properly without any risks of tipping over.

- Transport by forklift truck

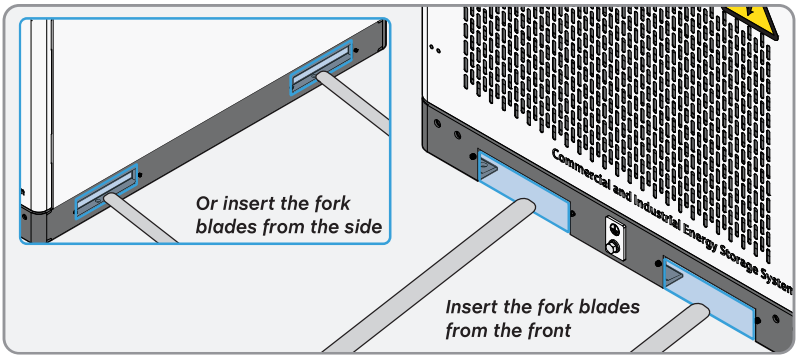


Figure 5-3 Lifting the Device by Forklift

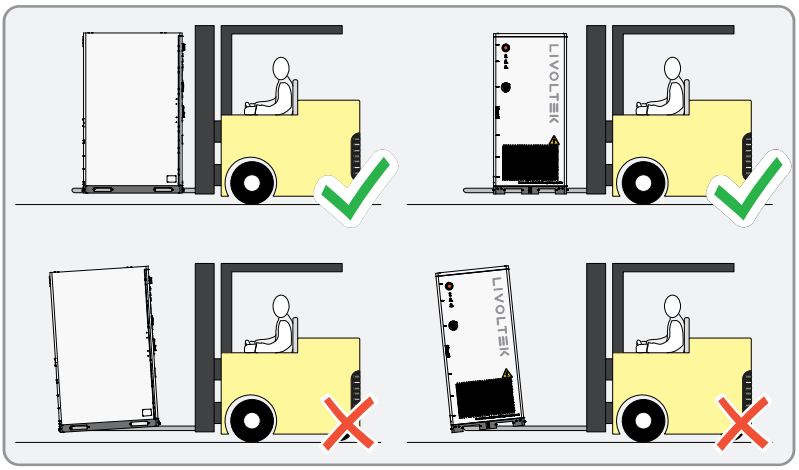


Figure 5-4 Lifting Requirements

- Construct by hoisting ready-built components into place

Step 1: Put four angle supports C at the right position on the top of cabinet, and secure them with two M12 × 35 combination screws G each, confirm that they are firmly attached on the top of device.

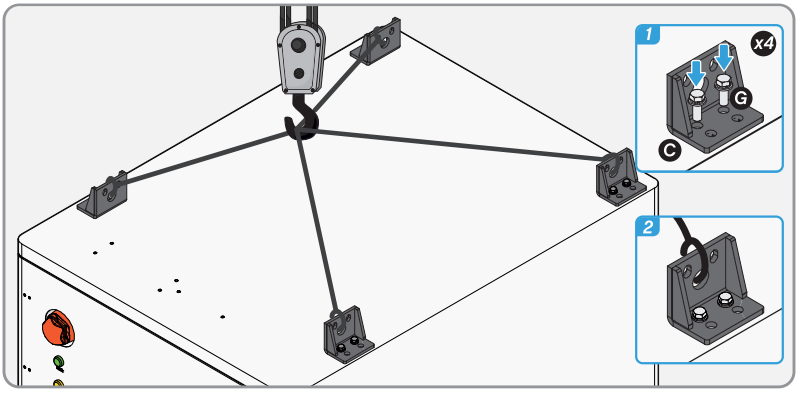


Figure 5-5 Lifting the Device by Crane

Step 2: After sitting the cabinet on the right position, remove four angle supports for further usage.

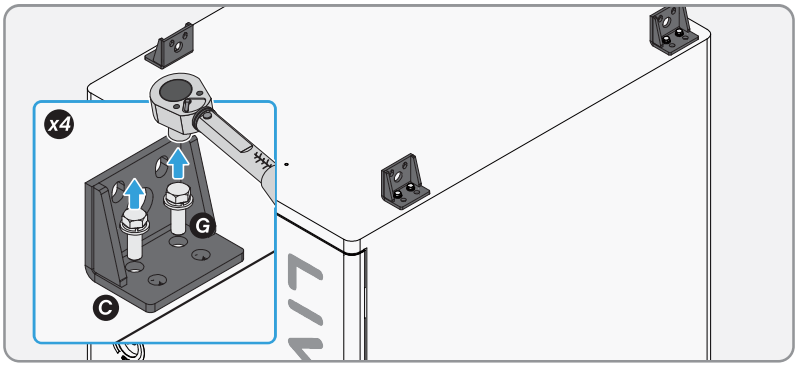


Figure 5-6 Removing Angle Supports

6 Mechanical Mounting

⚠ QUALIFIED PERSON

After making sure that there is no abnormality in the product and all accessories are complete, you can refer to the following suggestions for mechanical installation:

Step 1: Sitting the cabinet on the right position, then align the installation holes of the angle support C to those of the cabinet.

Step 2: Draw holes on the foundation surface.

Step 3: Drill holes (Ø 13 mm) with reference to the hole distances.

Step 4: Nail expansion bolts (M12 × 120) F into the drilled holes, remove the nuts on the expansion bolts, and position the equipment on the foundation with a forklift truck so that the equipment fixing holes are aligned with the pre-buried expansion bolts on the foundation, and tighten the nuts.

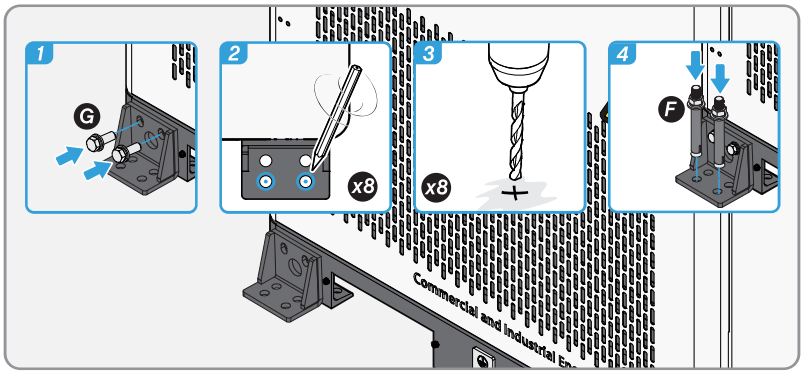


Figure 6-1 Securing the Cabinet

Step 5: Attach the cover plate, and then secure it. Follow the instruction to install altogether 4 cover plates B at the front and rear sides of the cabinet bottom.

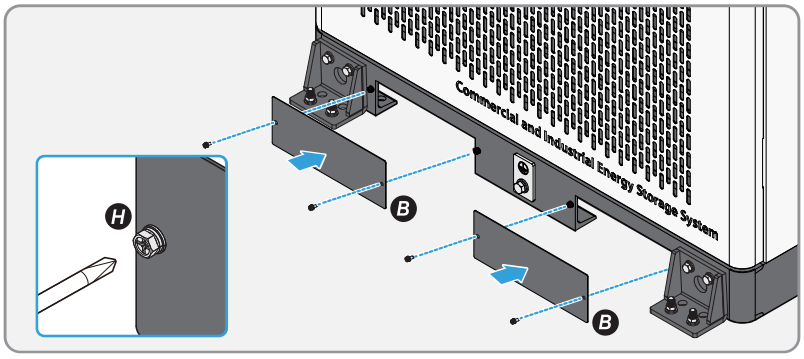


Figure 6-2 Securing the Plates

7 Electrical Connection

⚠ QUALIFIED PERSON

DANGER

When performing an electrical installation, refer to the following recommendations for electrical installation:

1. Check that all switches in the equipment are disconnected before wiring to ensure that the equipment is not energized;
2. Disconnect the grid switch before wiring and make sure the cable is not energized;
3. To determine the correct phase sequence of the cable, you can add yellow, green, red and black different colors of insulation sheath or marking to distinguish, to prevent phase sequence error;
4. Cable terminals and copper row connections need to be compressed, screws to choose the right length, so as not to affect the insulation and tightening;
5. Lay communication and power cables as separately as possible, and ensure that the cable insulation is not damaged during the laying process;
6. The grounding cable must be reliably connected to the grounding copper row, and the cross-sectional area of the cable must meet the design requirements;
7. All AC cables should be connected to the appropriate phase sequence after entering the device through the access holes on the bottom of the device;
8. After the wiring is completed, use fireproof mud to seal the wiring leaks to prevent external insects and rodents from entering and damaging the equipment or cables.

7.1 Torque

In order to prevent the terminals from loosening under force and causing poor contact resulting in increased contact resistance and heat generation, etc., make sure that the bolts used to fasten the terminals meet the torque requirements.

Table 7-1 Torque

Screw Size	Torque (N × m)
M4	1.8 ~ 2.4
M5	4 ~ 4.8
M6	7 ~ 8
M8	22 ~ 29
M10	44 ~ 58
M12	76 ~ 102
M14	121 ~ 162
M16	189 ~ 252

7.2 Grounding Connection

Step 1: Remove the combination screw from the ground terminal. Strip the outer jacket of the PE cable to the appropriate length. Cut a length of heat shrink tubing, thread it through the stripped cable, and install the ring terminal.

Step 2: To crimp the terminals, pull the heat shrink tubing over the crimp area and heat it with a heat gun.

Step 3: Align the OT terminal of the PE cable with the ground terminal and bolt it in place.

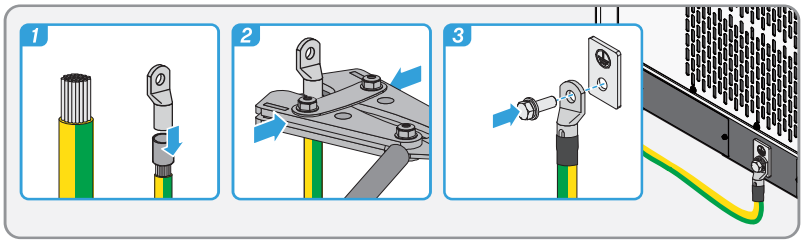


Figure 7-1 PE Cable Connection

7.3 Grid Connection

Step 1: Use the key Ⓔ for the cabinet door to unlock the front door at the left side.

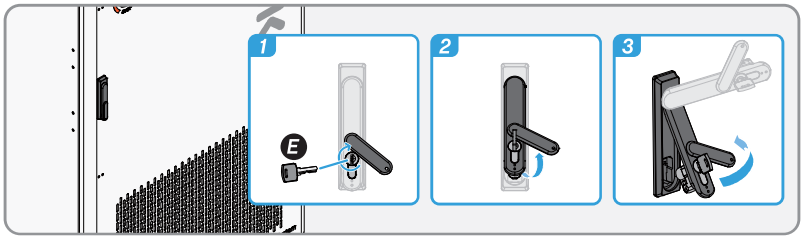


Figure 7-2 Opening the Door

Step 2: Cut a few pieces of heat shrink tubing, thread it through the stripped wires, and install the OT terminals. Then crimp the OT terminals.

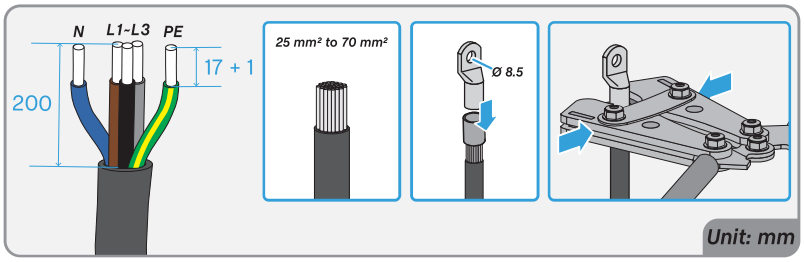


Figure 7-3 Crimping the Cables

NOTE

The inlet and outlet of the energy storage system is lower inlet and outlet, after opening the baffle, the A/B/C/N copper rows at the lower end of the switch reserve an openings for customers' wiring, or according to the customer's requirements for the size of the openings.

Step 3: Connect the AC cable to the device.

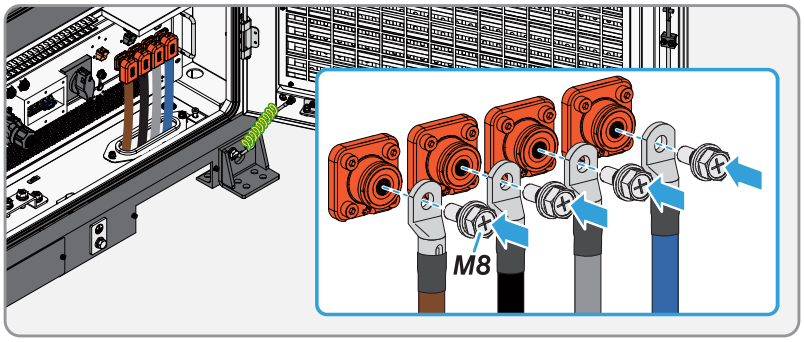


Figure 7-4 Attaching to the Terminals

WARNING

- When using copper core cables or copper-clad aluminum cables, use copper terminal blocks.
- When aluminum alloy cables are used, use copper-aluminum transition terminals or aluminum terminals with copper-aluminum transition spacers.
- At least one large flat washer is required on one side of the screw to ensure a tight and reliable connection.

Step 4: Thread the grid cable through the cable threading hole at the right side of the bottom of cabinet.

Step 5: Align the PE wire to the earth bar, and then secure them. And the equipment ground impedance meets the requirements of national standard and the local electrical standards.

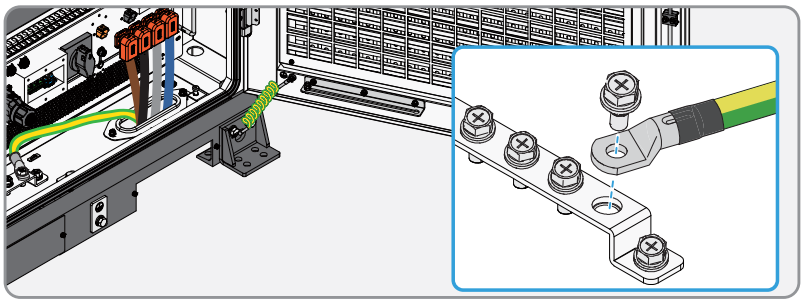


Figure 7-5 Connecting PE Wire

7.4 MSD Installation

Step 1: Make sure that both the AC circuit breaker and the PCS DC load switch are disconnected.

Step 2: Ensure that all circuit breakers on the downstream grid side are disconnected.

Step 3: Ensure that the installation environment is clean and dry and equipped with the necessary anti-static measures. Check the integrity of the MSD components to ensure that there is no damage or missing components.

Step 4: Open the MSD lever and insert the MSD into the MSD socket position, ensuring that it is securely fitted.

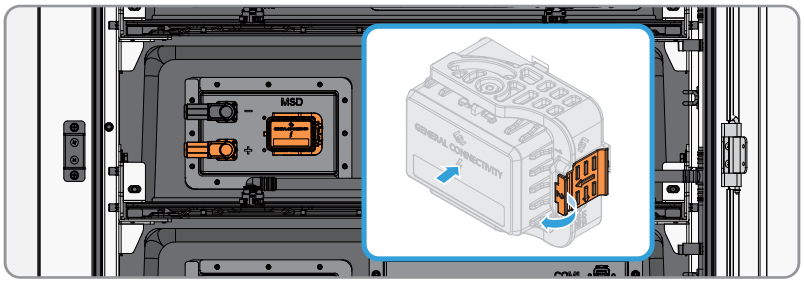


Figure 7-6 Installing MSD

Step 5: Close the MSD lever and lock the safety latch. Ensure that the MSD is securely mounted without any looseness or displacement.

Step 6: Repeat the above steps to complete the installation of the other MSDs.

7.5 Communication Connection

7.5.1 COM Port Introduction

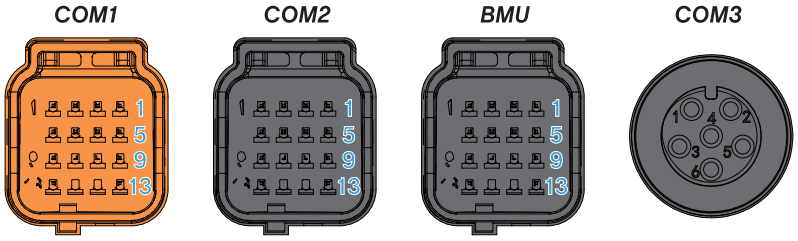


Figure 7-7 COM Ports Introduction

Table 7-2 COM Ports Introduction

PIN	COM1	COM2	BMU	COM3
1	DO6_1	24V+	CAN2H	24V+

PIN	COM1	COM2	BMU	COM3
2	DO6_2	24V-	/	24V-
3	DI6	485A3	CAN2L	DI8
4	DI6GND	485B3	/	DI8GND
5	24V+	DI9	CAN2G	485A4
6	24V-	DI9GND	/	485B4
7	DI3	24V+	HSS4	/
8	DI3GND	F	/	/
9	24V+	DO4_1	24V+	/
10	24V-	DO4_2	/	/
11	DI4	DO7_1	24V-	/
12	DI4GND	DO8_1	/	/
13	DO5_1	DO9_1	/	/
14	DO5_2	24V+	/	/
15	DI5	/	/	/
16	DI5GND	/	/	/

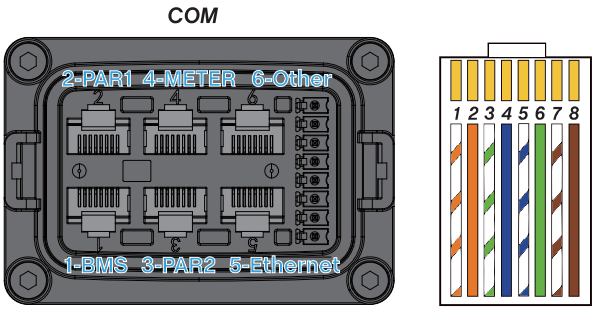


Figure 7-8 COM Port Introduction

Table 7-3 COM Port Introduction

PIN	BMS	PAR1	PAR2	METER	Ethernet	Other
1	BAT_CAN_H	/	/	METER_485A	ETH_TX+	RES_485A
2	BAT_CAN_L	/	/	METER_485B	ETH_TX-	RES_485B
3	/	WIFI_485A	WIFI_485A	/	ETH_RX+	STS_485A
4	/	WIFI_485B	WIFI_485B	/	/	STS_485B
5	/	CAN_H3	CAN_H3	/	/	/
6	/	CAN_L3	CAN_L3	/	ETH_RX-	/

PIN	BMS	PAR1	PAR2	METER	Ethernet	Other
7	/	SYNC	SYNC	/	/	/
8	/	GND_ISO	GND_ISO	/	/	/

Table 7-4 8-PIN Terminal Introduction

PIN	DI/DO	
1	DO2_KEY1	GEN_DO
2	DO2_KEY2	
3	Remote_2	GEN_DI
4	GND_ISO	
5	GND_ISO	Remote shutdown_DI
6	Remote_1	
7	DO1_KEY1	Smart load_DO
8	DO1_KEY2	

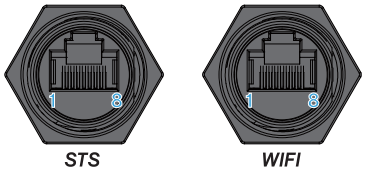


Figure 7-9 STS and WIFI Port Introduction

Table 7-5 STS and WIFI Port Introduction

PIN	STS	WIFI
1	ZC	GND
2	GND	
3	OS	RS485A
4	GND2	
5	GTRL1	RS485A
6	PGND	
7	GTRL2	+5V

NOTE

For detailed functions, please refer to the PCS User manual.

7.5.2 Connection Procedures

Step 1: When installing external communication cables, it is essential to segregate them

from power cables to minimize interference.

Step 2: The recommended minimum distance between communication lines and power cables is 300 mm. Where the communication line must cross a power cable, endeavor to ensure the angle of intersection is 90° between the two cable types. This helps to mitigate electromagnetic interference from the power cable affecting the communication line. Ideally, the communication line should run as close to the ground surface as feasible, utilizing supports like cable trays or metal conduits. If such supports are unavailable, secure the cables with basic fixtures to maintain their position.

Step 3: Complete all wiring, close the door and secure the cover.

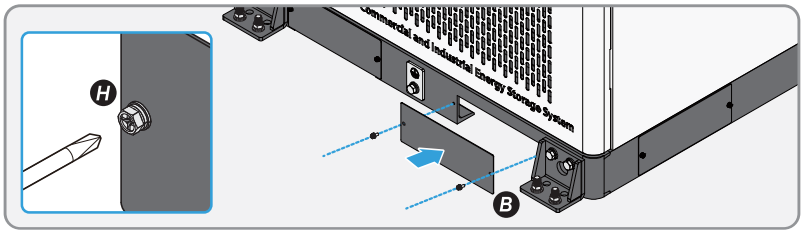


Figure 7-10 Securing Plate on the Right Side of the Bottom

7.5.3 Parallel Connection

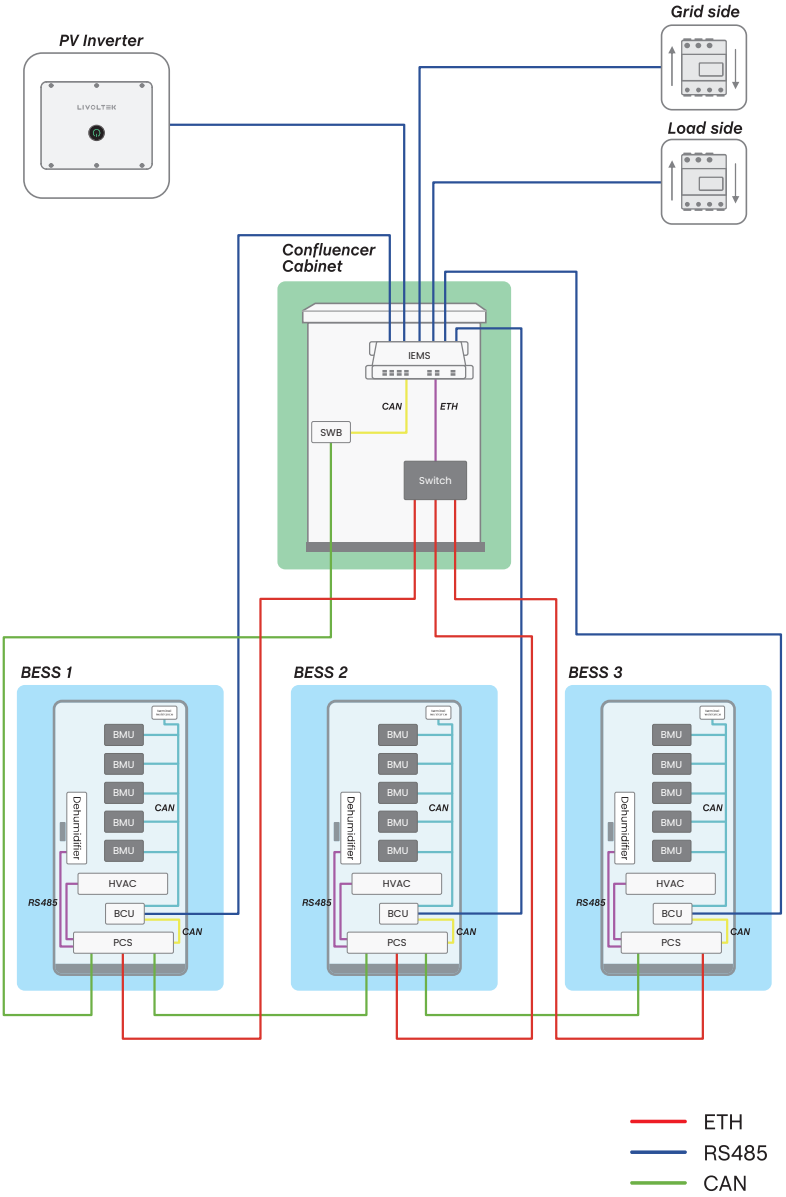


Figure 7-11 Parallel Connection Communication Architecture Diagram

8 Operation

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8.1 Power On

8.1.1 Pre-opening Check

WARNING

- Please pay attention to battery voltage range.
- The battery cannot be started if the battery voltage range is exceeded to avoid damage to the equipment.

Before running the product, please make sure that the product has been installed in accordance with the specifications, and carry out a comprehensive and detailed inspection of the machine to ensure that all indicators are in line with the requirements before starting the machine.

1. **Appearance Check:**
   - *a.* Appearance of the equipment is intact, no damage, no rust and no paint loss. If there is any paint loss, please carry out the paint refinishing operation;
   - *b.* Equipment labels are clearly visible and damaged labels should be replaced promptly.
2. **Grounding Check:** the box has a grounding point, and grounding is secure; the box grounding conductor is reliably connected to the box grounding copper row.
3. **Cable Check:**
   - *a.* The cable protection layer is well wrapped with no visible damage;
   - *b.* The terminals are made in accordance with specifications, and the connection is firm and reliable;
   - *c.* Each cable is clearly labeled at both ends, and the alignment meets the principle of separation of strong and weak power, leaving a margin at the turn, and shall not be strained;
   - *d.* Cable mounting bolts have been tightened, cable pulling without loosening; cable crossing hole blocking has been completed.
4. **Copper Row Inspection:** no obvious cracks or deformation of copper rows, fastening of screws at the lap joints, no misalignment of scribed markings, no debris on the copper rows.
5. **Component Check**: the circuit breakers are all in the open position; the lightning protector indicator mark is green.

8.1.2 Switch On

The product switch on and operating procedure is as follows:

1. Use a multimeter to confirm that the grid voltage is within the pre-determined range;
2. Close the battery high voltage control box DC load switch;
3. Close all auxiliary power switches on the system;
4. Close the main AC circuit breaker.

NOTE

Make sure you have locked door well after normally powering on the system.

8.1.3 Trial Operation

After the equipment's electrical structure installation is complete and startup conditions are met, to ensure the reliable and stable operation of the energy storage system, initial commissioning must be conducted by professional electrical engineers and technicians. Configure the operation mode and relevant parameters in accordance with project specifications:

1. Set the device control mode to **Manual Mode** and set the active power to 5%;
2. Observe the parameters of PCS and battery during operation, and stop the machine in time for testing if there is any abnormality;
3. Runs for 0.5 hours;
4. Set the active power to -5%, at which point the battery is charged at 5% of the system's rated power.
5. Observe the parameters of PCS and battery during operation, and stop the machine in time for testing if there is any abnormality;
6. Runs for 0.5 hours;
7. After completing the one-hour test run without any abnormality, turn off the system in the **Switch** interface;
8. According to the project background and demand, you can choose the local manual power control mode or automatic peak shaving mode to put into operation formally, and then click **System Power On** in the system interface.

8.2 Power Off

When the product needs daily maintenance, the shutdown operation is required. The normal shutdown operation of the product is as follows:

1. Operating the APP/WEB and the battery stops charging and discharging;
2. Disconnect the battery high voltage control box DC load switch;
3. Breaks the main AC circuit breaker;
4. Disconnect all auxiliary power switches of the system, and the unit completes shutdown.

8.3 Emergency Stop

When the product is malfunctioning or a critical situation requires emergency shutdown, you can perform the following emergency shutdown operations:

1. Press the emergency power-off button **EPO**;

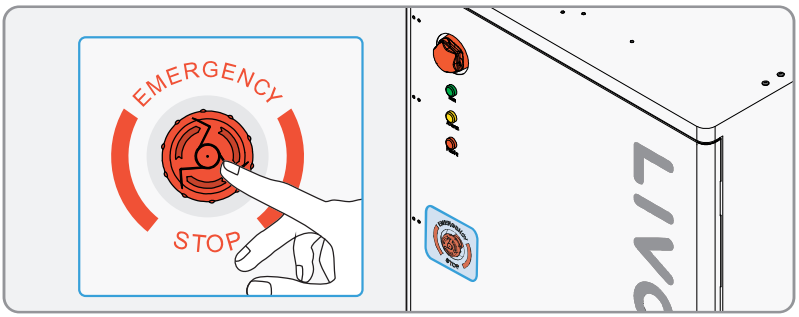


Figure 8-1 Emergency Stop

2. Break out all auxiliary power switches of the system;
3. Reset the EPO button after determining that the fault or hazard is cleared and operation is required.

9 Troubleshooting and Maintenance

9.1 Troubleshooting

Alarm levels are defined as follows:

- **Failure:** The device fails and the system stops operating (charging / discharging).
- **Alarm:** The device's output power decreases or part of its function fails due to external factors, but it does not affect the system's charging and discharging functions.

Table 9-1 Troubleshooting List

Fault/Alarm	Components	Cause and Solutions
Rainstorm Malfunctions	Battery	***Cause:*** Flooding of energy storage cabinets. ***1*** Check for water buildup inside the cabinet; ***2*** Verify that the outdoor cabinet is not leaking and that the equipment inside the cabinet is intact.
Fire-fighting Malfunctions	Battery	***Cause:*** Battery overheating or fire. ***1*** Immediately press the EPO button and move away from the energy storage cabinet; ***2*** Observe continuously for 30 minutes from a safe distance. If there is smoke or fire, call the fire alarm; if neither is abnormal, manually clear this activity alarm and contact the manufacturer.
Lightning protector Warning	Electric silo	***Cause:*** Failure of a lightning protector. ***1*** Check for loose lightning arrester signal wire connections; ***2*** Check for discoloration of the lightning protector indicator; ***3*** Replacement of AC lightning arresters.
Compactors Warning	Refrigeration	***Cause:*** Loose wiring; Compressor damage. ***1*** Disconnect the power distribution switch and open the air conditioner junction box to check for loose wiring; ***2*** Observe the appearance of the compressor for visible damage and a burning smell, if so, contact the manufacturer.
Grid overvoltage/ undervoltage malfunctions	Grid/oil engine	***Cause:*** Abnormal grid voltage. ***1*** Check for abnormal grid voltage.
Grid overfrequency/ underfrequency malfunctions	Grid/oil engine	***Cause:*** Abnormal grid voltage. ***1*** Check for abnormal grid voltage.
Crypto-protection malfunctions	Grid/oil engine	***Cause:*** Abnormal grid voltage. ***1*** Check for abnormal grid voltage.

Fault/Alarm	Components	Cause and Solutions
High / Low Voltage Ride Through warning	Grid/oil engine	***Cause:*** Abnormal grid voltage. ***1*** Check for abnormal grid voltage.
Grid voltage imbalance malfunctions	Grid/oil engine	***Cause:*** Abnormal grid voltage. ***1*** Check for abnormal grid voltage.
Misphasing of the grid malfunctions	Grid/Diesel	***Cause:*** Wrong phase sequence in the grid. ***1*** Counterbalance any two of the three ABC cables.
DC voltage high/low malfunctions	Batteries	***Cause:*** Abnormal battery voltage. ***1*** Check for abnormal DC input voltage.
Busbar overvoltage malfunctions	Energy storage converter	***Cause:*** Load imbalance; software anomaly. ***1*** Check for loose or abnormal DC wiring; ***2*** Contact Manufacturer.
Busbar halfvoltage unbalance malfunctions	Energy storage converter	***Cause:*** Load imbalance; software anomaly. ***1*** Check for abnormal loads; ***2*** Contact Manufacturer.
Overheating and derating warning	Energy storage converter	***Cause:*** High internal temperature. ***1*** Check the electrical bin inlet and outlet for blockages; ***2*** Check the internal fan for proper operation; ***3*** Contact Manufacturer.
Power Tube Over Temperature malfunctions	Energy storage converter	***Cause:*** High internal temperature. ***1*** Check the electrical bin inlet and outlet for blockages; ***2*** Check the internal fan for proper operation; ***3*** Contact Manufacturer.
Balance bridge over-temperature malfunctions	Energy storage converter	***Cause:*** High internal temperature. ***1*** Check the electrical bin inlet and outlet for blockages; ***2*** Check the internal fan for proper operation; ***3*** Contact Manufacturer.
DC overcurrent malfunctions	Energy storage converter	***Cause:*** DC Current Excess. ***1*** Check for short circuits or broken lines on the DC side; ***2*** Replace the energy storage converter module or contact the manufacturer.
Balanced Bridge Overcurrent malfunctions	Energy storage converter	***Cause:*** Internal current overrun. ***1*** Check for off-grid load overload; ***2*** Replace the energy storage converter module or contact the manufacturer.
Output overload/ overcurrent malfunctions	Energy storage converter	***Cause:*** AC side power/current excess. ***1*** Check that the grid voltage is normal; ***2*** Check for short circuits or broken lines on the DC side; ***3*** Check for off-grid load overload; ***4*** Replace the energy storage converter module or contact the manufacturer.

Fault/Alarm	Components	Cause and Solutions
Current limit on a wave-by-wave basis Malfunctions	Energy storage converter	***Cause:*** AC side current excess. ***1*** Check that the grid voltage is normal; ***2*** Check for off-grid load overload; ***3*** Replace the energy storage converter module or contact the manufacturer.
Communications blackout Malfunctions	Local Controller for Energy Storage Converters	***Cause:*** Communications blackout. ***1*** Check whether the communication network cable between modules is loose and abnormal; ***2*** Check whether the local controller communication network cable is loose and abnormal.
Parallel/Synchronous malfunctions	Energy storage converter	***Cause:*** Parallel/Synchronized Signal Interrupt. ***1*** Check the parallel cable for looseness or abnormality; ***2*** Check that the parallel setting is not abnormal; ***3*** Hardware circuitry is damaged.
Relay open/short malfunctions	Energy storage converter	***Cause:*** Internal relay abnormality; software anomaly. ***1*** Replacement of energy storage converter modules. ***2*** Contact factory to replace internal boards.
Leakage current malfunctions	Energy storage converter	***Cause:*** Excess leakage current; software anomaly. ***1*** Check the leakage current hall for loose or abnormal wiring; ***2*** Check that the ground wire is not disconnected.
Abnormal insulation impedance malfunctions	Energy storage converters/ batteries	***Cause:*** Low insulation to ground; software anomaly. ***1*** Check the AC and DC cables for breakage or short circuit to ground; ***2*** Check for broken battery wiring or a short to ground.
Loss of modules warning	Energy storage converter	***Cause:*** Module-to-screen communication interruption. ***1*** Check whether the communication network cable between modules is loose and abnormal.
Low DC voltage warning	Energy storage converter	***Cause:*** Battery not turned on. ***1*** Check if the battery is on.

WARNING

The above alarms and faults are common alarms or faults, if any faults other than those in table occur, please contact the manufacturer directly.

9.2 Routine Maintenance

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9.2.1 Safety Precautions

Affected by ambient temperature, humidity, dust, vibration and aging of internal components of the inverter, the system may have some potential problems during operation. In order to enable the energy storage system to operate in a long-term and stable manner, it is necessary to arrange regular inspections by maintenance personnel, so that problems can be found and dealt with in a timely manner. Quarterly maintenance is recommended for systems installed in areas with severe sand and dust, high salt spray or heavy industrial parks, and semi-annual maintenance is recommended for energy storage systems in areas with favorable climatic environments.

DANGER

- Before replacing the battery pack, remove the MSD plug, and power off the system to avoid the risk of electric shock.
- Do not use a wet cloth to clean the copper busbar or other conductive parts.
- Do not use water or any solvents to clean the battery.

WARNING

- Maintenance of the battery must not be performed while the battery is live. Operations such as torque verification and tightening of screws must be done after the battery is powered off. These operations can only be carried out after explaining the risks to the customer, obtaining written consent, and implementing effective preventive measures.
- Only qualified person can perform the maintenance for the device.
- Only use the spare parts and accessories approved by Livoltek for maintenance.

CAUTION

Operation and Maintenance Safety Requirements:

- Before connecting or disconnecting cables, ensure that the protection switch for the corresponding circuit is turned off.
- Use a voltage tester rated for the corresponding voltage level to check for live power, ensuring the equipment is completely powered off.
- If there are live components nearby, use insulating boards or insulating tape to cover or wrap them.
- After securely connecting the maintenance circuit to the main grounding circuit with a grounding wire, proceed with operation and maintenance.
- After completing the maintenance, remove the grounding wire between the maintenance circuit and the main grounding circuit.

NOTE

- We recommend not opening the door during rainy or high-humidity weather, such as when the relative humidity is consistently above 80%.
- If the door must be opened during rainy weather, the cabinet should be shielded to prevent water from entering and damaging the internal modules.
- Additionally, when opening the cabinet door in high-humidity conditions for more than 0.5 hours, manual forced dehumidification must be performed in both off-grid and grid-connected scenarios to prevent equipment failure or network collapse.

9.2.2 Equipment Maintenance

Table 9-2 Maintenance List of Cabinet

Item	Check Notes	Reference Standard
Cabinet	• Check the appearance of the whole machine. • Checking the vents. • Checking the condition of door locks.	• No visible coating flaking, scratching or rusting. • No visible signs of water leakage. • No dust buildup in vents. • No damage to door locks.
Refrigeration	• Check for noise and vibration. • sweep the filters.	• Compressor rotation is normal, no jamming, strange noise. • Filter surfaces are clean and not clogged.
Energy storage converter	• Check for noise and vibration. • Check the front panel vents. • Checking the contact surface of the copper row at the rear end.	• Front panel vent surfaces are clean and free of clogs. • No corrosion and discoloration of copper rows and contact surfaces, no dust accumulation.
Electronic	• Inspection of lightning protectors. • Check cable copper contact surface.	• Lightning protector normal. • No loose screw socket connecting wires coming off. • No corrosion and discoloration of copper rows and contact surfaces, no dust accumulation.
Battery pack	• Check for noise and vibration. • Check cable copper contact surface.	• Battery pack fan rotates without jerks or rattles. • Front panel vent surfaces are clean and free of clogs. • No loose screw socket connecting wires coming off. • No corrosion and discoloration of copper rows and contact surfaces, no dust accumulation.

10 Disposing of the Device

Please dispose of the rechargeable battery or accessories in accordance with the disposal regulations for electronic waste which is applied at the installation site.

NOTE

- The expenses for dispose of the wasted or damaged battery packs incurred shall be borne by the user.

11 Technical Specifications

- Battery

Item	BES-P125X261E	BES-P125X261U
Nominal Voltage [V]	832	
Operating Voltage Range [V]	702 ~ 936	702 ~ 936
Battery Type	LFP	
Rated Capacity [Ah]	314	
Battery Pack	1P52S, 166.4 V, 314 Ah, 52.2 kWh	
Number of Packs	5	
System Composition	1P260S	
Total Energy [kWh]	261.2	
Nominal Power [kW]	125	
Max. Power [kW]	137.5	
Rated Charge/Discharge Current [A]	157/157	
Max. Charge/Discharge Current [A]	200.9/200.9	
Max. Depth of Discharge	100% DOD	
Recommended Depth of Discharge	90% DOD	
Operating Temperature [°C]	-20 ~ +55	

- On Grid

Item	BES-P125X261E	BES-P125X261U
Rated Power [kW]	125	
Max. Output Power [kW]	137.5	
Max. Output Apparent Power [kVA]	137.5	
Rated AC Current [A]	180.4	150.4
Max. AC Current [A]	198.5	165.4
Rated Grid Voltage [V]	3L/N/PE, 3L/PE, 220/380, 230/400	3L/N/PE, 3L/PE, 277/480
Grid Voltage Range [V]	340 ~ 460	408 ~ 528
Grid Frequency [Hz]	50/60, (±5)	
Total Harmonic Distortion of Current THDi	<3% (rated power)	
Power Factor	-1 ~ 1	
Charge/Discharge Conversion Time [ms]	≤20	

- Off Grid

Item	BES-P125X261E	BES-P125X261U
Rated Power [kW]	125	
Max. Output Power [kW]	137.5	
Max. Output Power (1 min) [kW]	143.75	172.5
Max. Output Power (10 s) [kW]	151.6	180
Rated Output Voltage [V]	3L/N/PE, 3L/PE, 220/380, 230/400	3L/N/PE, 3L/PE, 277/480
Voltage Accuracy	±1%	
Frequency Accuracy	±0.1%	
Total Harmonic Distortion of Voltage THDv	±2% (resistive full load)	
Dynamic Voltage Transient Range [V]	≤10% (under resistive/balanced load conditions, when the load increases from 20% to 100% or decreases from 100% to 20%)	

- General

Item	BES-P125X261E	BES-P125X261U
System Efficiency	90%	
Operating Temperature [°C]	-20 ~ +55 (>40 derating)	
Operating Humidity	5% ~ 95%	
Operating Altitude [m]	<4000 (>2000 derating)	
System Life (Design life) [years]	>15	
Communication Interfaces	CAN/RS485/Ethernet/WiFi/4G	
Number of Parallel Devices	On Grid: 10 Off Grid: 10	
Cooling Method	Battery: Liquid cooling PCS: Forced Air Cooling	
Ingress Protection	IP55	
Anti-corrosion Level	C3/C5 optional	
Fire Fighting Methods	Aerosol (passive fire protection + active suppression)	
Topology	Non-isolated	
Noise [dB]	<75	
Electrical Protection Class	Class I	
Dimensions (W × H × D) [mm]	1000 × 2195 × 1350	
Weight [kg]	2350	
Certificates	IEC 61000, IEC 62619, IEC 63056, IEC 62477, IEC 62933, RoHS, UN38.3	

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