

LUNA2000-4472 Series Smart String ESS

User Manual

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About This Document

Purpose

This document describes the Smart String Energy Storage System (also referred to as ESS) in terms of safety information, components, transportation and storage requirements, site requirements, installation, cable connections, power-on, power-off, and technical specifications. Read this document carefully before installing and operating the ESS.

Intended Audience

This document is intended for:

- Technical support engineers
- Hardware installation engineers
- Commissioning engineers
- Maintenance engineers

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.

Symbol	Description
 NOTE	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

Change History

Changes between document issues are cumulative. The latest document issue contains all the changes made in earlier issues.

Issue 03 (2025-02-20)

Updated [5.3.2 Installing Lead-Acid Batteries in the Extinguishant Control Panel](#).

Updated [5.3.3 Removing the Compressor Bracket and Checking the LTMS Switch Status](#).

Updated [6.6 Installing DC Power Cables](#).

Updated [6.7 Installing a Three-Phase AC Input Power Cable \(With External Grid Power Supply\)](#).

Updated [D.2 Crimping an OT or DT Terminal](#).

Issue 02 (2025-01-15)

Updated [2.3.4 Liquid Cooling Unit Cabin](#).

Updated [2.4.4.3 Extinguishant Control Panel](#).

Updated [2.4.4.11 Water Sprinkler System](#).

Updated [4.3 Foundation Requirements](#).

Updated [5.1.1 Preparing Tools](#).

Updated [5.2.2 Hoisting the ESS](#).

Updated [5.2.5 Securing the ESS](#).

Added [5.3.3 Removing the Compressor Bracket and Checking the LTMS Switch Status](#).

Updated [6.2 Removing and Installing Covers](#).

Updated [7.1 Check Before Power-On](#).

Updated [8 Deployment and Commissioning](#).

Updated [11 Technical Specifications](#).

Issue 01 (2024-09-30)

This issue is used for first office application (FOA).

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1 Safety Information

Statement

Before transporting, storing, installing, operating, using, and/or maintaining the equipment, read this document, strictly follow the instructions provided herein, and follow all the safety instructions on the equipment and in this document. In this document, "equipment" refers to the products, software, components, spare parts, and/or services related to this document; "the Company" refers to the manufacturer (producer), seller, and/or service provider of the equipment; "you" refers to the entity that transports, stores, installs, operates, uses, and/or maintains the equipment.

The **Danger, Warning, Caution, and Notice** statements described in this document do not cover all the safety precautions. You also need to comply with relevant international, national, or regional standards and industry practices. **The Company shall not be liable for any consequences that may arise due to violations of safety requirements or safety standards concerning the design, production, and usage of the equipment.**

The equipment shall be used in an environment that meets the design specifications. Otherwise, the equipment may be faulty, malfunctioning, or damaged, which is not covered under the warranty. The Company shall not be liable for any property loss, personal injury, or even death caused thereby.

Comply with applicable laws, regulations, standards, and specifications during transportation, storage, installation, operation, use, and maintenance.

Do not perform reverse engineering, decompilation, disassembly, adaptation, implantation, or other derivative operations on the equipment software. Do not study the internal implementation logic of the equipment, obtain the source code of the equipment software, violate intellectual property rights, or disclose any of the performance test results of the equipment software.

The Company shall not be liable for any of the following circumstances or their consequences:

- The equipment is damaged due to force majeure such as earthquakes, floods, volcanic eruptions, debris flows, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, and other extreme weather conditions.
- The equipment is operated beyond the conditions specified in this document.

- The equipment is installed or used in environments that do not comply with international, national, or regional standards.
- The equipment is installed or used by unqualified personnel.
- You fail to follow the operation instructions and safety precautions on the product and in the document.
- You remove or modify the product or modify the software code without authorization.
- You or a third party authorized by you cause the equipment damage during transportation.
- The equipment is damaged due to storage conditions that do not meet the requirements specified in the product document.
- You fail to prepare materials and tools that comply with local laws, regulations, and related standards.
- The equipment is damaged due to your or a third party's negligence, intentional breach, gross negligence, or improper operations, or other reasons not related to the Company.

1.1 Personal Safety

DANGER

Ensure that power is off during installation. Do not install or remove a cable with power on. Transient contact between the core of the cable and the conductor will cause electric arcs, sparks, fire, or explosion, which may result in personal injury.

DANGER

Non-standard and improper operations on the energized equipment may cause fire, electric shocks, or explosion, resulting in property damage, personal injury, or even death.

DANGER

Before operations, remove conductive objects such as watches, bracelets, bangles, rings, and necklaces to prevent electric shocks.

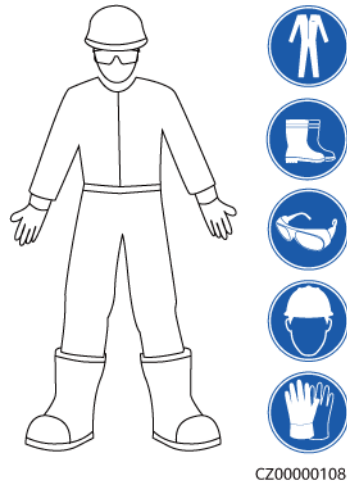
DANGER

During operations, use dedicated insulated tools to prevent electric shocks or short circuits. The dielectric withstanding voltage level must comply with local laws, regulations, standards, and specifications.

WARNING

During operations, wear personal protective equipment such as protective clothing, insulated shoes, goggles, safety helmets, and insulated gloves.

Figure 1-1 Personal protective equipment



General Requirements

- Do not stop protective devices. Pay attention to the warnings, cautions, and related precautionary measures in this document and on the equipment.
- If there is a likelihood of personal injury or equipment damage during operations, immediately stop, report the case to the supervisor, and take feasible protective measures.
- Do not power on the equipment before it is installed or confirmed by professionals.
- Do not touch the power supply equipment directly or with conductors such as damp objects. Before touching any conductor surface or terminal, measure the voltage at the contact point to ensure that there is no risk of electric shock.
- Do not touch operating equipment because the enclosure is hot.
- Do not touch a running fan with your hands, components, screws, tools, or boards. Otherwise, personal injury or equipment damage may occur.
- In the case of a fire, immediately leave the building or the equipment area and activate the fire alarm or call emergency services. Do not enter the affected building or equipment area under any circumstances.

Personnel Requirements

- Only professionals and trained personnel are allowed to operate the equipment.
 - Professionals: personnel who are familiar with the working principles and structure of the equipment, trained or experienced in equipment operations and are clear of the sources and degree of various potential hazards in equipment installation, operation, maintenance

- Trained personnel: personnel who are trained in technology and safety, have required experience, are aware of possible hazards on themselves in certain operations, and are able to take protective measures to minimize the hazards on themselves and other people
- Personnel who plan to install or maintain the equipment must receive adequate training, be able to correctly perform all operations, and understand all necessary safety precautions and local relevant standards.
- Only qualified professionals or trained personnel are allowed to install, operate, and maintain the equipment.
- Only qualified professionals are allowed to remove safety facilities and inspect the equipment.
- Personnel who will perform special tasks such as electrical operations, working at heights, and operations of special equipment must possess the required local qualifications.
- Only authorized professionals are allowed to replace the equipment or components (including software).
- Only personnel who need to work on the equipment are allowed to access the equipment.

1.2 Electrical Safety

DANGER

Before connecting cables, ensure that the equipment is intact. Otherwise, electric shocks or fire may occur.

DANGER

Non-standard and improper operations may result in fire or electric shocks.

DANGER

Prevent foreign matter from entering the equipment during operations. Otherwise, equipment short-circuits or damage, load power derating, power failure, or personal injury may occur.

WARNING

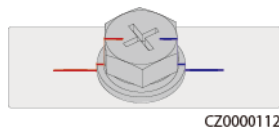
For the equipment that needs to be grounded, install the ground cable first when installing the equipment and remove the ground cable last when removing the equipment.

 CAUTION

Do not route cables near the air intake or exhaust vents of the equipment.

General Requirements

- Follow the procedures described in the document for installation, operation, and maintenance. Do not reconstruct or alter the equipment, add components, or change the installation sequence without permission.
- Obtain approval from the national or local electric utility company before connecting the equipment to the grid.
- Observe the power plant safety regulations, such as the operation and work ticket mechanisms.
- Install temporary fences or warning ropes and hang "No Entry" signs around the operation area to keep unauthorized personnel away from the area.
- Before installing or removing power cables, turn off the switches of the equipment and its upstream and downstream switches.
- If any liquid is detected inside the equipment, disconnect the power supply immediately and do not use the equipment.
- Before performing operations on the equipment, check that all tools meet the requirements and record the tools. After the operations are complete, collect all of the tools to prevent them from being left inside the equipment.
- Before installing power cables, check that cable labels are correct and cable terminals are insulated.
- When installing the equipment, use a torque tool of a proper measurement range to tighten the screws. When using a wrench to tighten the screws, ensure that the wrench does not tilt and the torque error does not exceed 10% of the specified value.
- Ensure that bolts are tightened with a torque tool and marked in red and blue after double-check. Installation personnel mark tightened bolts in blue. Quality inspection personnel confirm that the bolts are tightened and then mark them in red. (The marks must cross the edges of the bolts.)



- After the installation is complete, ensure that protective cases, insulation tubes, and other necessary items for all electrical components are in position to avoid electric shocks.
- If the equipment has multiple inputs, disconnect all the inputs and wait until the equipment is completely powered off before performing operations on the equipment.
- Before maintaining a downstream electrical or power distribution device, turn off the output switch on the power supply equipment.
- During equipment maintenance, attach "Do not switch on" labels near the upstream and downstream switches or circuit breakers as well as warning signs to prevent accidental connection. The equipment can be powered on only after troubleshooting is complete.

- If fault diagnosis and troubleshooting need to be performed after power-off, take the following safety measures: Disconnect the power supply. Check whether the equipment is live. Install a ground cable. Hang warning signs and set up fences.
- Check equipment connections periodically, ensuring that all screws are securely tightened.
- Only qualified professionals can replace a damaged cable.
- Do not scrawl, damage, or block any labels or nameplates on the equipment. Promptly replace labels that have worn out.
- Do not use solvents such as water, alcohol, or oil to clean electrical components inside or outside of the equipment.

Grounding

- Ensure that the grounding impedance of the equipment complies with local electrical standards.
- Ensure that the equipment is connected permanently to the protective ground. Before operating the equipment, check its electrical connection to ensure that it is reliably grounded.
- Do not work on the equipment in the absence of a properly installed ground conductor.
- Do not damage the ground conductor.
- For the equipment that uses a three-pin socket, ensure that the ground terminal in the socket is connected to the protective ground point.
- If high touch current may occur on the equipment, ground the protective ground terminal on the equipment enclosure before connecting the power supply; otherwise, electric shock as a result of touch current may occur.

Cabling Requirements

- When selecting, installing, and routing cables, follow local safety regulations and rules.
- When routing power cables, ensure that there is no coiling or twisting. Do not join or weld power cables. If necessary, use a longer cable.
- Ensure that all cables are properly connected and insulated, and meet specifications.
- Ensure that the slots and holes for routing cables are free from sharp edges, and that the positions where cables are routed through pipes or cable holes are equipped with cushion materials to prevent the cables from being damaged by sharp edges or burrs.
- If a cable is routed into the cabinet from the top, bend the cable in a U shape outside the cabinet and then route it into the cabinet.
- Ensure that cables of the same type are bound together neatly and straight and that the cable sheath is intact. When routing cables of different types, ensure that they are at least 30 mm away from each other.
- When cable connection is completed or paused for a short period of time, seal the cable holes with sealing putty immediately to prevent small animals or moisture from entering.

- Secure buried cables using cable supports and cable clips. Ensure that the cables in the backfill area are in close contact with the ground to prevent cable deformation or damage during backfilling.
- If the external conditions (such as the cable layout or ambient temperature) change, verify the cable usage in accordance with the IEC-60364-5-52 or local laws and regulations. For example, check that the current-carrying capacity meets requirements.
- When routing cables, reserve at least 30 mm clearance between the cables and heat-generating components or areas. This prevents deterioration or damage to the cable insulation layer.
- When the temperature is low, violent impact or vibration may damage the plastic cable sheathing. To ensure safety, comply with the following requirements:
 - Cables can be laid or installed only when the temperature is higher than 0°C. Handle cables with caution, especially at a low temperature.
 - Cables stored at below 0°C must be stored at room temperature for more than 24 hours before they are laid out.
- Do not perform any improper operations, for example, dropping cables directly from a vehicle. Otherwise, the cable performance may deteriorate due to cable damage, which affects the current-carrying capacity and temperature rise.

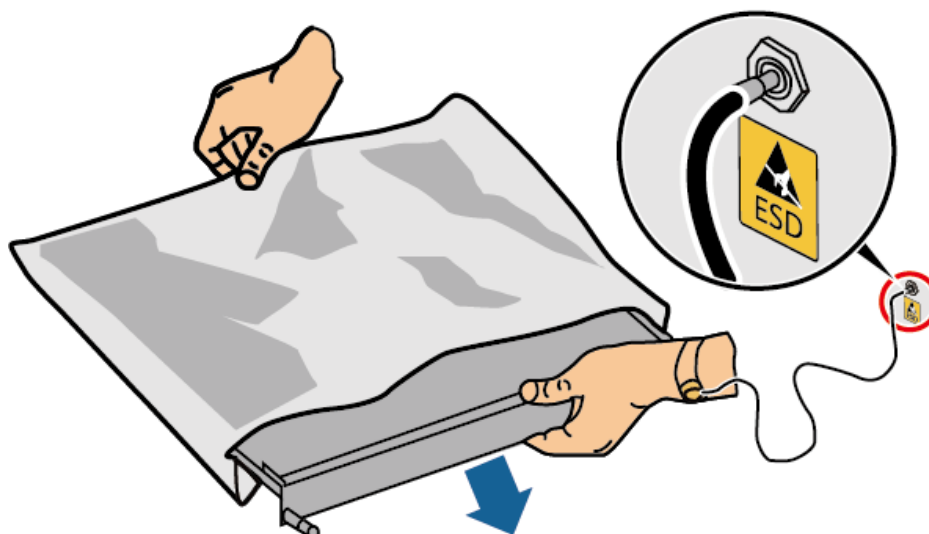
ESD

NOTICE

The static electricity generated by human bodies may damage the electrostatic-sensitive components on boards, for example, the large-scale integrated (LSI) circuits.

- When touching the equipment and handling boards, modules with exposed circuit boards, or application-specific integrated circuits (ASICs), observe ESD protection regulations and wear ESD clothing and ESD gloves or a well-grounded ESD wrist strap.

Figure 1-2 Wearing an ESD wrist strap



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- When holding a board or a module with exposed circuit boards, hold its edge without touching any components. Do not touch the components with bare hands.
- Package boards or modules with ESD packaging materials before storing or transporting them.

1.3 Environment Requirements

DANGER

Do not expose the equipment to flammable or explosive gas or smoke. Do not perform any operation on the equipment in such environments.

DANGER

Do not store any flammable or explosive materials in the equipment area.

DANGER

Do not place the equipment near heat sources or fire sources, such as smoke, candles, heaters, or other heating devices. Overheat may damage the equipment or cause a fire.

 WARNING

Install the equipment in an area far away from liquids. Do not install it under areas prone to condensation, such as under water pipes and air exhaust vents, or areas prone to water leakage, such as air conditioner vents, ventilation vents, or feeder windows of the equipment room. Ensure that no liquid enters the equipment to prevent faults or short circuits.

 WARNING

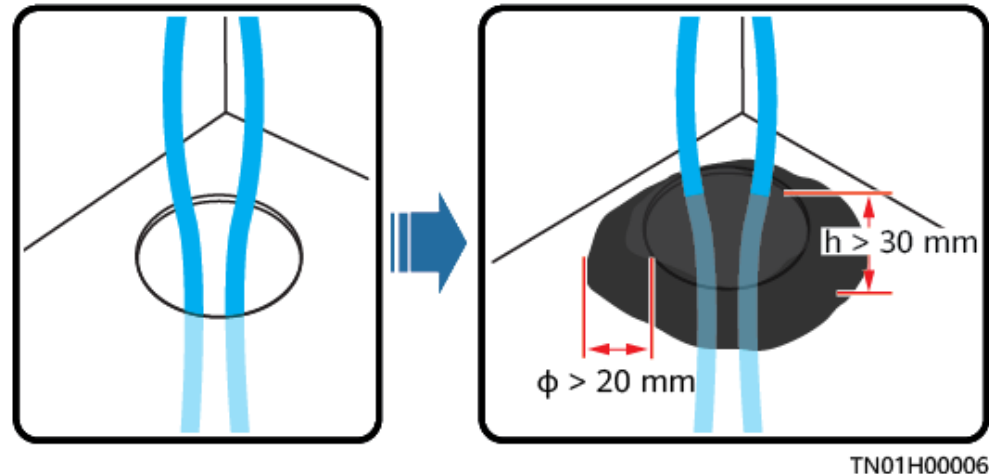
To prevent damage or fire due to high temperature, ensure that the ventilation vents or heat dissipation systems are not obstructed or covered by other objects while the equipment is running.

General Requirements

- Ensure that the equipment is stored in a clean, dry, and well ventilated area with proper temperature and humidity and is protected from dust and condensation.
- Keep the installation and operating environments of the equipment within the allowed ranges. Otherwise, its performance and safety will be compromised.
- Do not install, use, or operate outdoor equipment and cables (including but not limited to moving equipment, operating equipment and cables, inserting connectors to or removing connectors from signal ports connected to outdoor facilities, working at heights, performing outdoor installation, and opening doors) in harsh weather conditions such as lightning, rain, snow, sandstorm, and level 6 or stronger wind.
- Do not install the equipment in an environment with dust, smoke, volatile or corrosive gases, infrared and other radiations, organic solvents, or salty air.
- Do not install the equipment in an environment with conductive metal or magnetic dust.
- Do not install the equipment in an area conducive to the growth of microorganisms such as fungus or mildew.
- Do not install the equipment in an area with strong vibration, noise, or electromagnetic interference.
- Ensure that the site complies with local laws, regulations, and related standards.
- Ensure that the ground in the installation environment is solid, free from spongy or soft soil, and not prone to subsidence. The site must not be located in a low-lying land prone to water or snow accumulation, and the horizontal level of the site must be above the highest water level of that area in history.
- Do not install the equipment in a position that may be submerged in water.
- If the equipment is installed in a place with abundant vegetation, in addition to routine weeding, harden the ground underneath the equipment using cement or gravel.
- Before opening doors during the installation, operation, and maintenance of the equipment, clean up any water, ice, snow, or other foreign objects on the

top of the equipment to prevent foreign objects from falling into the equipment.

- When installing the equipment, ensure that the installation surface is solid enough to bear the weight of the equipment.
- All cable holes must be sealed. Seal the used cable holes with sealing putty. Seal the unused cable holes with the caps delivered with the equipment. The following figure shows the criteria for correct sealing with sealing putty.



- After installing the equipment, remove the packing materials such as cartons, foam, plastics, and cable ties from the equipment area.
- If the equipment is installed near the sea (50–2000 m away from the coast) or at a high altitude (greater than 4000 m), check whether the product specifications meet the requirements.

1.4 Mechanical Safety

DANGER

When working at heights, wear a safety helmet and safety harness or waist belt and fasten it to a solid structure. Do not mount it on an insecure moveable object or metal object with sharp edges. Make sure that the hooks will not slide off.

WARNING

Ensure that all necessary tools are ready and inspected by a professional organization. Do not use tools that have signs of scratches or fail to pass the inspection or whose inspection validity period has expired. Ensure that the tools are secure and not overloaded.

 WARNING

Before installing equipment in a cabinet, ensure that the cabinet is securely fastened with a balanced center of gravity. Otherwise, tipping or falling cabinets may cause bodily injury and equipment damage.

 WARNING

When pulling equipment out of a cabinet, be aware of unstable or heavy objects in the cabinet to prevent injury.

 WARNING

Do not drill holes into the equipment. Doing so may affect the sealing performance and electromagnetic containment of the equipment and damage components or cables inside. Metal shavings from drilling may short-circuit boards inside the equipment.

General Requirements

- Repaint any paint scratches caused during equipment transportation or installation in a timely manner. Equipment with scratches must not be exposed for an extended period of time.
- Do not perform operations such as arc welding and cutting on the equipment without evaluation by the Company.
- Do not install other devices on the top of the equipment without evaluation by the Company.
- When performing operations over the top of the equipment, take measures to protect the equipment against damage.
- Use correct tools and operate them in the correct way.

Moving Heavy Objects

- Be cautious to prevent injury when moving heavy objects.



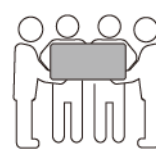
< 18 kg
(< 40 lbs)



18–32 kg
(40–70 lbs)



32–55 kg
(70–121 lbs)



55–68 kg
(121–150 lbs)

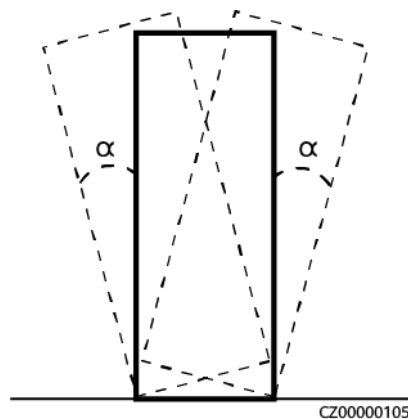


> 68 kg
(> 150 lbs)

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- If multiple persons need to move a heavy object together, determine the manpower and work division with consideration of height and other conditions to ensure that the weight is equally distributed.
- If two persons or more move a heavy object together, ensure that the object is lifted and landed simultaneously and moved at a uniform pace under the supervision of one person.

- Wear personal protective gears such as protective gloves and shoes when manually moving the equipment.
- To move an object by hand, approach to the object, squat down, and then lift the object gently and stably by the force of the legs instead of your back. Do not lift it suddenly or turn your body around.
- Move or lift the equipment by holding its handles or lower edges. Do not hold the handles of modules that are installed in the equipment.
- Do not quickly lift a heavy object above your waist. Place the object on a workbench that is half-waist high or any other appropriate place, adjust the positions of your palms, and then lift it.
- Move a heavy object stably with balanced force at an even and low speed. Put down the object stably and slowly to prevent any collision or drop from scratching the surface of the equipment or damaging the components and cables.
- When moving a heavy object, be aware of the workbench, slope, staircase, and slippery places. When moving a heavy object through a door, ensure that the door is wide enough to move the object and avoid bumping or injury.
- When transferring a heavy object, move your feet instead of turning your waist around. When lifting and transferring a heavy object, ensure that your feet point to the target direction of movement.
- When transporting the equipment using a pallet truck or forklift, ensure that the tynes are properly positioned so that the equipment does not topple. Before moving the equipment, secure it to the pallet truck or forklift using ropes. When moving the equipment, assign dedicated personnel to take care of it.
- Choose sea or roads in good conditions for transportation. Do not transport the equipment by railway or air.
- The tilt angle of the ESS shall meet the requirements shown in the figure: $\alpha \leq 5^\circ$.



- When moving and transporting the air conditioner or LTMS, keep it upright. Do not place it horizontally or upside down.

Working at Heights

- Any operations performed 2 m or higher above the ground shall be supervised properly.
- Only trained and qualified personnel are allowed to work at heights.

- Do not work at heights when steel pipes are wet or other risky situations exist. After the preceding conditions no longer exist, the safety owner and relevant technical personnel need to check the involved equipment. Operators can begin working only after safety is confirmed.
- Set a restricted area and prominent signs for working at heights to warn away irrelevant personnel.
- Set guard rails and warning signs at the edges and openings of the area involving working at heights to prevent falls.
- Do not pile up scaffolding, springboards, or other objects on the ground under the area involving working at heights. Do not allow people to stay or pass under the area involving working at heights.
- Carry operation machines and tools properly to prevent equipment damage or personal injury caused by falling objects.
- Personnel involving working at heights are not allowed to throw objects from the height to the ground, or vice versa. Objects shall be transported by slings, hanging baskets, aerial work platforms, or cranes.
- Do not perform operations on the upper and lower layers at the same time. If unavoidable, install a dedicated protective shelter between the upper and lower layers or take other protective measures. Do not pile up tools or materials on the upper layer.
- Dismantle the scaffolding from top down after finishing the job. Do not dismantle the upper and lower layers at the same time. When removing a part, ensure that other parts will not collapse.
- Ensure that personnel working at heights strictly comply with the safety regulations. The Company is not responsible for any accident caused by violation of the safety regulations on working at heights.
- Behave cautiously when working at heights. Do not rest at heights.

Using Ladders

- Use wooden or insulated ladders when you need to perform live-line working at heights.
- Platform ladders with protective rails are preferred. Do not use single ladders.
- Before using a ladder, check that it is intact and confirm its load bearing capacity. Do not overload it.
- Ensure that the ladder is securely positioned and held firm.



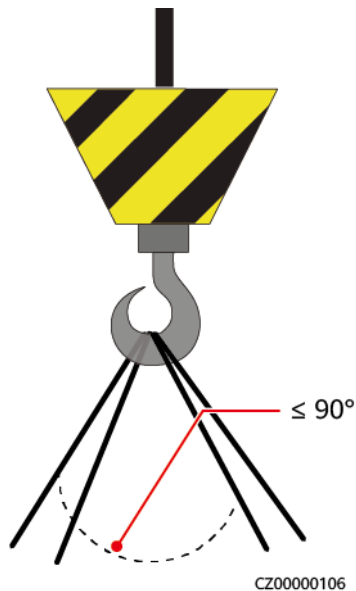
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- When climbing up the ladder, keep your body stable and your center of gravity between the side rails, and do not overreach to the sides.

- When a step ladder is used, ensure that the pull ropes are secured.

Hoisting

- Only trained and qualified personnel are allowed to perform hoisting operations.
- Install temporary warning signs or fences to isolate the hoisting area.
- Ensure that the foundation where hoisting is performed on meets the load-bearing requirements.
- Before hoisting objects, ensure that hoisting tools are firmly secured onto a fixed object or wall that meets the load-bearing requirements.
- During hoisting, do not stand or walk under the crane or the hoisted objects.
- Do not drag steel ropes and hoisting tools or bump the hoisted objects against hard objects during hoisting.
- Ensure that the angle between two hoisting ropes is no more than 90 degrees, as shown in the following figure.



Drilling Holes

- Obtain consent from the customer and contractor before drilling holes.
- Wear protective equipment such as safety goggles and protective gloves when drilling holes.
- To avoid short circuits or other risks, do not drill holes into buried pipes or cables.
- When drilling holes, protect the equipment from shavings. After drilling, clean up any shavings.

Welding

- A welder must have a work permit. Obtain consent from the customer before welding.
- Ensure that at least two persons are present onsite for welding and that fire extinguishers, wet cloth, and water containers are available.

- Ensure that the welding site is free from inflammables.
- Do not weld or cut on pressurized containers or pipes. Electric devices must be powered off before welding.
- A burning welding torch must not be placed on a component or on the floor, and must not be placed in a metal container with acetylene and oxygen. Otherwise, the gas may leak and cause a fire.
- High-temperature pipes after welding must be promptly cooled.

Using a Jack

- A hydraulic jack is used to lift the container. The lifting capacity of the jack shall be greater than 42 t.
- Only one side of the equipment can be raised or lowered. Before applying force, place wood sleepers and pads and take measures to prevent the jack from slipping and the equipment from vibrating.
- You can use two jacks to apply even forces simultaneously at two points on a short side of the equipment. Lift the equipment only from one side and then the other side, alternately. The height shall not exceed 120 mm each time the equipment is lifted.

1.5 Equipment Safety

1.5.1 ESS Safety

DANGER

Do not open a battery cabin door or the left door of the control unit cabin when the system is running.

DANGER

If the ESS is faulty, do not stand within the opening range of the battery cabin doors.

WARNING

Only professionals are allowed to perform maintenance on and inspect the liquid cooling pipes and LTMS.

CAUTION

The equipment is equipped with a fire suppression system. Start the fire suppression system only in emergency.

 CAUTION

Do not disable the protection devices.

 CAUTION

Evacuate from the site immediately once the fire alarm horn/strobe is triggered.

NOTICE

Take protection and isolation measures for the ESS site, such as installing fences, walls, and safety warning signs to prevent personal injury or property damage caused by unauthorized access during operations.

- When installing the ESS, comply with the fire separation distance or fire wall requirements specified in local standards, including but not limited to *GB 51048-2014 Design Code for Electrochemical Energy Storage Station* and *NFPA 855 Standard for the Installation of Stationary Energy Storage Systems*.
- Check the fire safety of the ESS regularly, at least once a month.
- When inspecting the system with power on, pay attention to the hazard warning signs on the equipment. Do not stand at the battery cabin doors. You are advised to perform the inspection near the control unit cabin.
- After power components of the ESS are replaced or cable connections are changed, you need to manually start cable connection detection to prevent system malfunction.
- After the equipment except battery packs is powered off, wait for 15 minutes and ensure that the equipment voltage is lower than the safety voltage for human body before operations.
- It is recommended that you prepare a camera to record the detailed processes of equipment installation, operation, and maintenance.

1.5.2 Battery Safety

 DANGER

Do not connect the positive and negative poles of a battery together. Otherwise, the battery may be short-circuited. Battery short circuits can generate high instantaneous current and releases a large amount of energy, which may cause battery leakage, smoke, flammable gas release, thermal runaway, fire, or explosion. To avoid battery short circuits, do not maintain batteries with power on.

 DANGER

Do not expose batteries at high temperatures or around heat sources, such as scorching sunlight, fire sources, transformers, and heaters. Battery overheating may cause leakage, smoke, flammable gas release, thermal runaway, fire, or explosion.

 DANGER

Protect batteries from mechanical vibration, falling, collision, punctures, and strong impact. Otherwise, the batteries may be damaged or catch fire.

 DANGER

To avoid leakage, smoke, flammable gas release, thermal runaway, fire, or explosion, do not disassemble, alter, or damage batteries, for example, insert foreign objects into batteries, squeeze batteries, or immerse batteries in water or other liquids.

 DANGER

Do not touch battery terminals with other metal objects. Otherwise, electric shocks or battery short circuits may occur.

 DANGER

There is a risk of fire or explosion if the model of the battery in use or used for replacement is incorrect. Use a battery of the model recommended by the manufacturer.

 DANGER

Battery electrolyte is toxic and volatile. Do not get contact with leaked liquids or inhale gases in the case of battery leakage or odor. In such cases, stay away from the battery and contact professionals immediately. Professionals must wear safety goggles, rubber gloves, gas masks, and protective clothing, power off the equipment, remove the battery, and contact technical engineers.

 DANGER

A battery is an enclosed system and will not release any gases under normal operations. If a battery is improperly treated, for example, burnt, needle-pricked, squeezed, struck by lightning, overcharged, or subject to other adverse conditions that may cause battery thermal runaway, the battery may be damaged or an abnormal chemical reaction may occur inside the battery, resulting in electrolyte leakage or production of gases such as CO and H₂. To prevent fire or device corrosion, ensure that flammable gas is properly exhausted.

 DANGER

If a battery has obvious damage or abnormal odor, smoke, or fire occurs, evacuate the personnel immediately, call emergency services, and contact the professionals. The professionals shall use fire extinguishing facilities to extinguish the fire under safety protection.

 DANGER

The gas generated by a burning battery may irritate your eyes, skin, and upper respiratory tract. Take protective measures promptly.

 WARNING

Install batteries in a dry area. Do not install them under areas prone to water leakage, such as air conditioner vents, ventilation vents, feeder windows of the equipment room, or water pipes. Ensure that no liquid enters the equipment to prevent faults or short circuits.

 WARNING

Before installing and commissioning batteries, prepare fire fighting facilities, such as fire sand and carbon dioxide fire extinguishers, according to construction standards and regulations. Before putting into operation, ensure that fire fighting facilities that comply with local laws and regulations are installed.

 WARNING

Before unpacking, storage, and transportation, ensure that the packing cases are intact and the batteries are correctly placed according to the labels on the packing cases. Do not place a battery upside down or vertically, lay it on one side, or tilt it. Stack the batteries according to the stacking requirements on the packing cases. Ensure that the batteries do not fall or get damaged. Otherwise, they will need to be scrapped.

 WARNING

After unpacking batteries, place them in the required direction. Do not place a battery upside down or vertically, lay it on one side, tilt it, or stack it. Ensure that the batteries do not fall or get damaged. Otherwise, they will need to be scrapped.

 WARNING

After batteries are discharged, charge them in time to avoid damage due to overdischarge.

Statement

The Company shall not be liable for any battery damage, personal injury, death, property loss, and/or other consequences caused by the following reasons:

- Force majeure such as earthquakes, floods, volcanic eruptions, debris flows, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, and other extreme weather conditions
- The battery warranty period has expired. You are advised not to use a battery whose warranty period has expired, as this poses safety risks.
- Actions that do not follow instructions in the user manual or direct advice from the Company, including but not limited to the following scenarios:
 - The onsite equipment operating environment or external power parameters do not meet the environment requirements for normal operation, for example, the actual operating temperature of batteries is too high or too low, or the power grid is unstable and experiences outages frequently.
 - Batteries are dropped or incorrectly operated or connected.
 - Batteries are overdischarged due to delayed acceptance or power-on after battery installation.
 - Battery running parameters are incorrectly set.
 - Different types of batteries, for example, batteries of different brands or rated capacities, are used together without prior approval from the Company.
 - Batteries are frequently overdischarged due to improper battery maintenance.
 - Battery use scenarios are changed without prior approval from the Company.
 - Battery maintenance is not performed according to the instructions in the user manual, for example, failing to check battery terminals regularly.
 - Batteries are not transported, stored, or charged according to the instructions in the user manual.
 - Instructions from the Company are not followed during battery relocation or reinstallation.

General Requirements

NOTICE

To ensure battery safety and battery management accuracy, use batteries provided by the Company. The Company is not responsible for any faults of batteries not provided by it.

- Before installing, operating, and maintaining batteries, read the battery manufacturer's instructions and comply with their requirements. The safety precautions specified in this document are highly important and require special attention. For additional safety precautions, see the instructions provided by the battery manufacturer.
- Use batteries within the specified temperature range. When the ambient temperature of the batteries is lower than the allowed range, do not charge the batteries to prevent internal short circuits caused during low-temperature charging.
- Before unpacking batteries, check whether the packaging is intact. Do not use batteries with damaged packaging. If any damage is found, notify the carrier and manufacturer immediately.
- Install batteries within 24 hours after unpacking. If the batteries cannot be installed in time, put them in the original packaging and place them in a dry indoor environment without corrosive gases. The process from unpacking batteries to powering on the system must be completed within 72 hours. During routine maintenance, ensure that the power-off time does not exceed 24 hours.
- Do not use a damaged battery (such as damage caused when a battery is dropped, bumped, bulged, or dented on the enclosure), because the damage may cause electrolyte leakage or flammable gas release. In the case of electrolyte leakage or structural deformation, contact the installer or professional O&M personnel immediately to remove or replace the battery. Do not store the damaged battery near other devices or flammable materials and keep it away from non-professionals.
- Before working on a battery, ensure that there is no irritant or scorched smell around the battery.
- When installing batteries, do not place installation tools, metal parts, or sundries on the batteries. After the installation is complete, clean up the objects on the batteries and the surrounding area.
- Do not install battery packs on rainy, snowy, or foggy days. Otherwise, the battery packs may be corroded by moisture or rain.
- If batteries are exposed to water accidentally, do not install them. Instead, transport the batteries to a safe isolation point and contact technical engineers in a timely manner.
- Before installing a battery pack, check that its enclosure is not deformed or damaged.
- Check whether the positive and negative battery terminals are grounded unexpectedly. If so, disconnect the battery terminals from the ground.
- Do not perform welding or grinding work around batteries to prevent fire caused by electric sparks or arcs.

- If batteries are left unused for a long period of time, store and charge them according to the battery requirements.
- Do not charge or discharge batteries by using a device that does not comply with local laws and regulations.
- Keep the battery loop disconnected during installation and maintenance.
- Monitor damaged batteries during storage for signs of smoke, flame, electrolyte leakage, or heat.
- If a battery is faulty, its surface temperature may be high. Do not touch the battery to avoid scalds.
- Do not stand on, lean on, or sit on the top of the equipment.
- In backup power scenarios, do not use the batteries for the following situations:
 - Medical devices substantially important to human life
 - Control equipment such as trains and elevators, as this may cause personal injury
 - Computer systems of social and public importance
 - Locations near medical devices
 - Other devices similar to those described above

Short-Circuit Protection

- When installing and maintaining batteries, wrap the exposed cable terminals on the batteries with insulation tape.
- Avoid foreign objects (such as conductive objects, screws, and liquids) from entering a battery, as this may cause short circuits.

Leakage Handling

NOTICE

Electrolyte leakage may damage the equipment. It will corrode metal parts and boards, and ultimately damage the boards.

Electrolyte is corrosive and can cause irritation and chemical burns. If you come into direct contact with the battery electrolyte, do as follows:

- Inhalation: Evacuate from contaminated areas, get fresh air immediately, and seek immediate medical attention.
- Eye contact: Immediately wash your eyes with water for at least 15 minutes, do not rub your eyes, and seek immediate medical attention.
- Skin contact: Wash the affected areas immediately with soap and water and seek immediate medical attention.
- Intake: Seek immediate medical attention.

Recycling

- Dispose of waste batteries in accordance with local laws and regulations. Do not dispose of batteries as household waste. Improper disposal of batteries may result in environmental pollution or an explosion.
- If a battery leaks or is damaged, contact technical support or a battery recycling company for disposal.
- If batteries are out of service life, contact a battery recycling company for disposal.
- Do not expose waste batteries to high temperatures or direct sunlight.
- Do not place waste batteries in environments with high humidity or corrosive substances.
- Do not use faulty batteries. Contact a battery recycling company to scrap them as soon as possible to avoid environmental pollution.

2 Product Description

2.1 Overview

The Smart String ESS (excluding the Smart PCS) can manage charge and discharge of the DC power supplied by the Smart Power Control System (PCS) from an external power grid for power grid services such as peak shaving and frequency regulation.



NOTE

The ESS has multiple types of appearances. The preceding figure is for reference only.

2.2 Model Description

Product Model

This document involves the following product models:

- LUNA2000-4472-2S

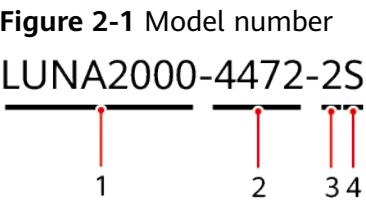


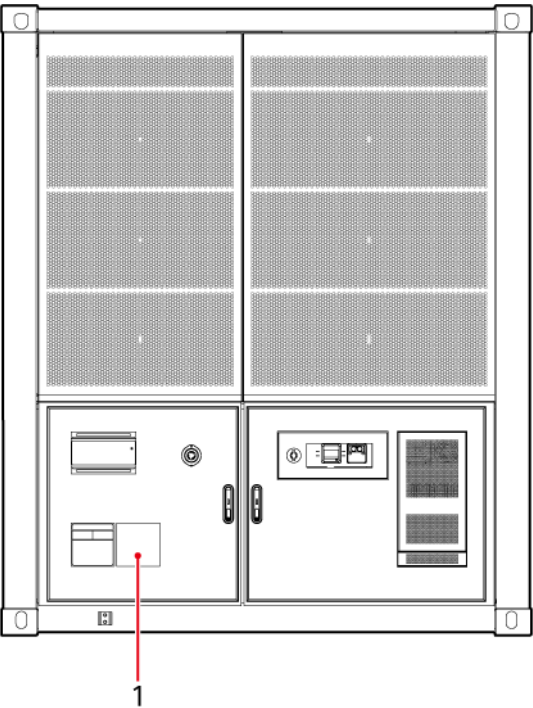
Table 2-1 Model number description

No.	Meaning	Description
1	Product family	LUNA2000: Smart String ESS
2	Energy level	4472: nominal energy
3	Backup power	2: Applies to scenarios where the backup duration is greater than or equal to 2 hours
4	Product type	S: energy storage system

Model Identification

You can view the product model on the nameplate on the side of the container.

Figure 2-2 Position of the nameplate



(1) Position of the nameplate

2.3 ESS Composition

NOTICE

- 40 bags of desiccants are placed at the bottom of the battery cabin, six bags of desiccants are placed at the bottom of the control unit cabin, and five bags of desiccants are placed in the liquid cooling unit cabin.
- Do not remove the desiccants when the ESS is not put into operation. If the ESS has been delivered for more than six months, replace the desiccants with those of the same specifications (Montmorillonite desiccant, 500 g/bag). Remove the desiccants promptly after the ESS is powered on.

2.3.1 Appearance

NOTE

The ESS has multiple types of appearances. The following figures are for reference only.

Figure 2-3 Appearance

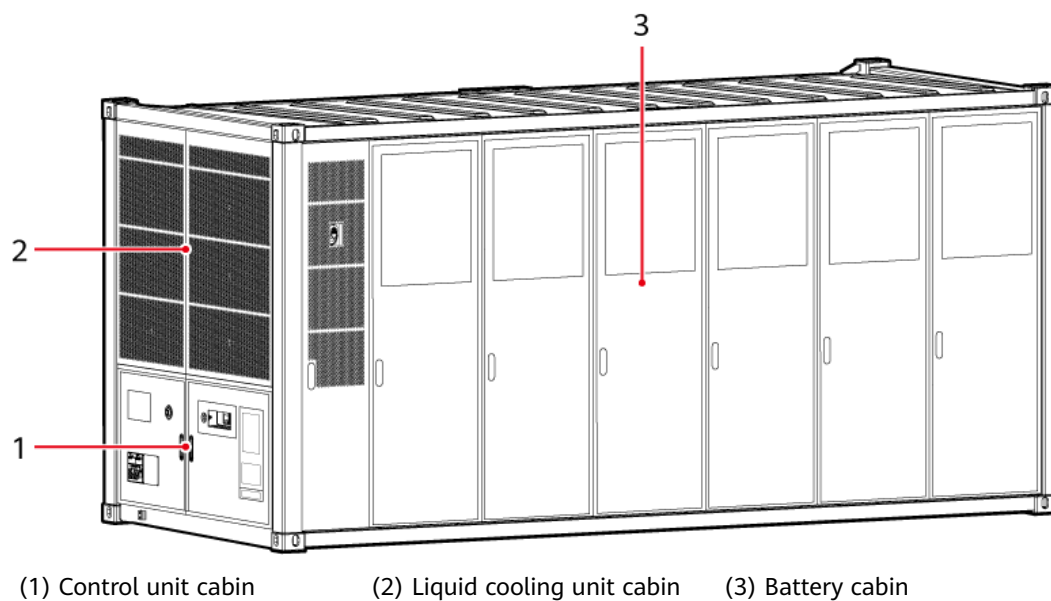
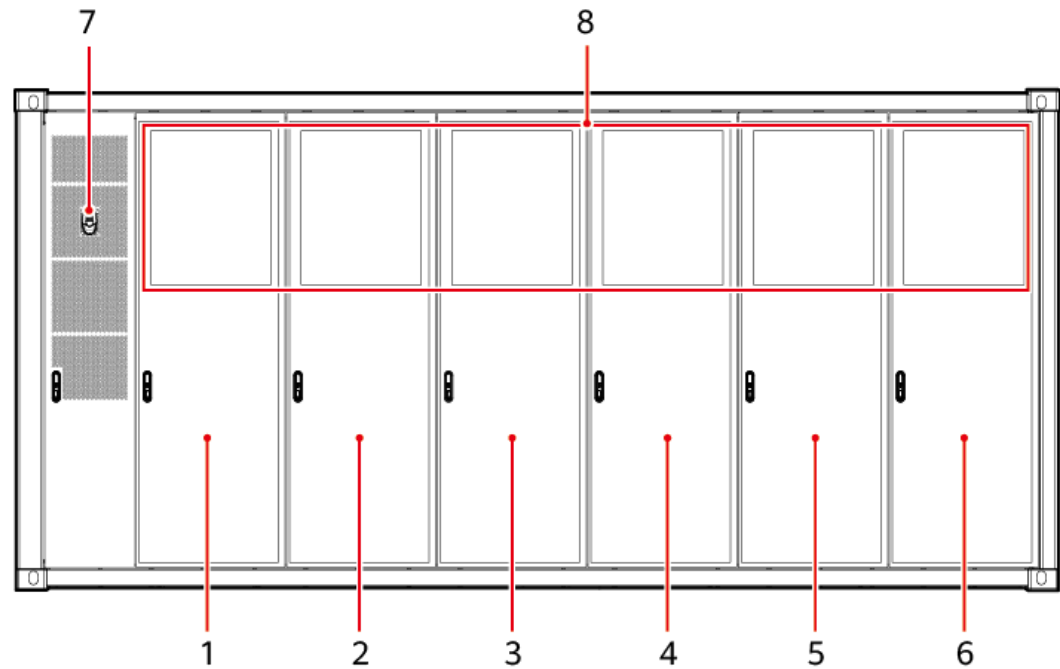


Figure 2-4 Front view

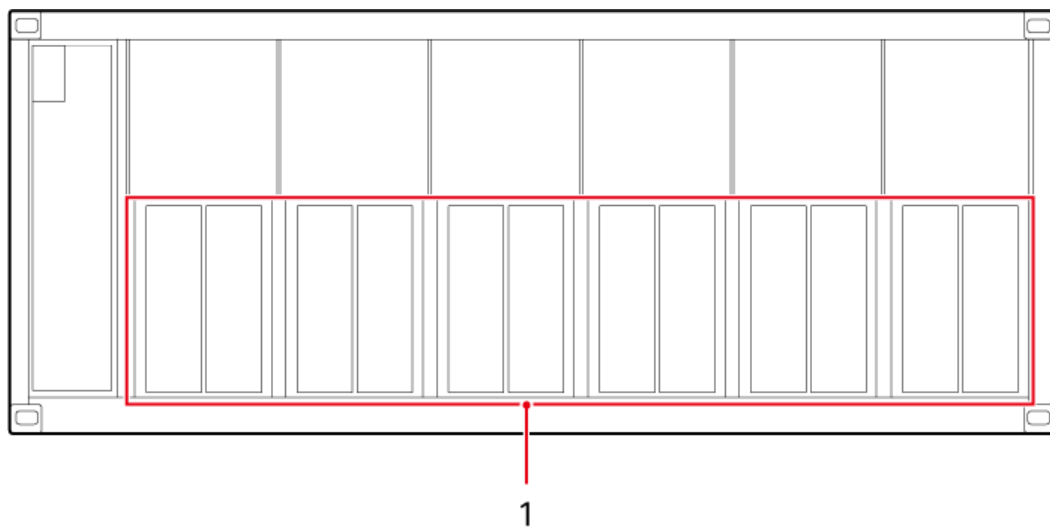


- | | | |
|----------------------------|--|---------------------------|
| (1) Rack 1 (battery rack) | (2) Rack 2 (battery rack) | (3) Rack 3 (battery rack) |
| (4) Rack 4 (battery rack) | (5) Rack 5 (battery rack) | (6) Rack 6 (battery rack) |
| (7) Fire alarm horn/strobe | (8) (Door-mounted) Explosion relief panels (only for some models) ^[1] | |

NOTE

Note^[1]: For some models, the explosion relief panels are located on the top of battery cabins. [Figure 2-5](#) shows the top view of the ESS with the top-mounted explosion relief panels. The actual product may vary.

Figure 2-5 Top view

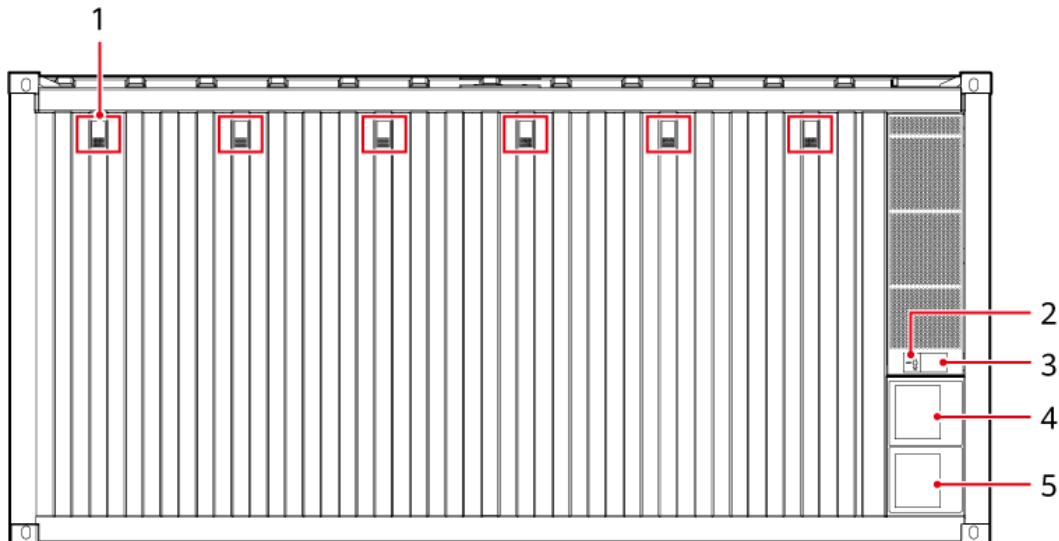


(1) (Top-mounted) Explosion relief panels (only for some models)^[1]

NOTE

Note^[1]: For some models, the explosion relief panels are located on the upper part of the battery cabin doors. [Figure 2-4](#) shows the front view of the ESS with the door-mounted explosion relief panels. The actual product may vary.

Figure 2-6 Rear view



(1) Smoke vent

(2) TSA approved lock
installation position (reserved)

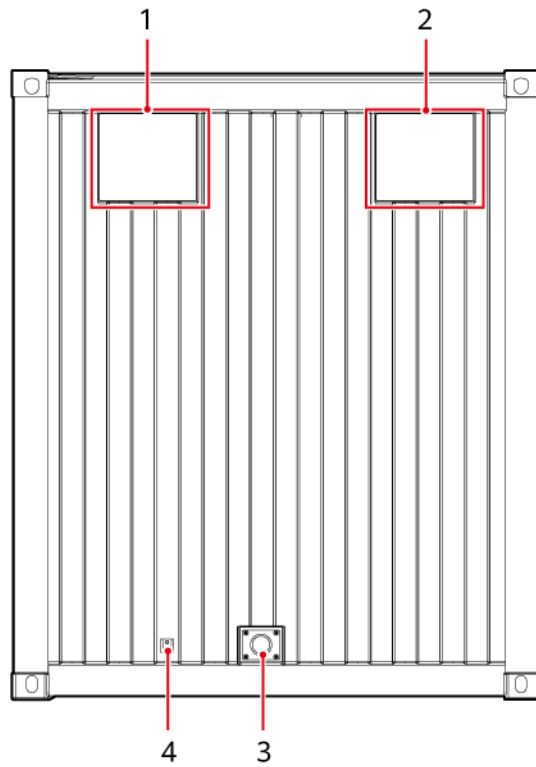
(3) ESS key box

(4) Air intake valve (supported
only by some models)

(5) Air intake valve

-

Figure 2-7 Right view



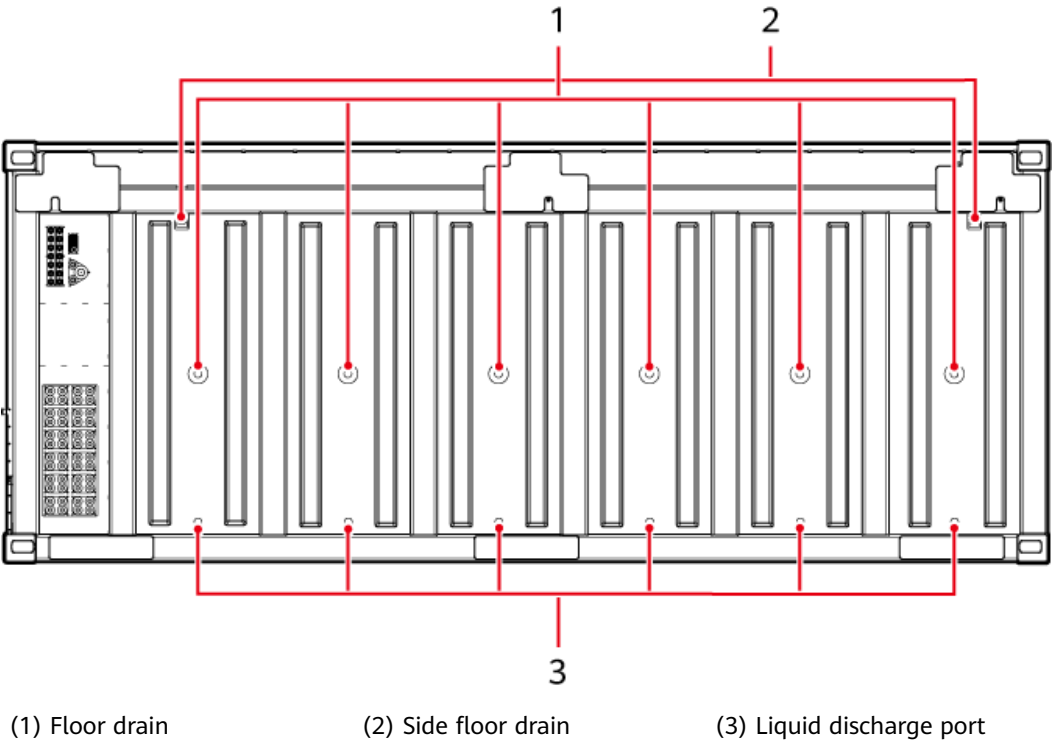
(1) Exhaust fan (air exhaust side)

(2) Exhaust fan (supported only by some models)

(3) Water inlet of the water sprinkler system

(4) Ground point of the container enclosure

Figure 2-8 Bottom view

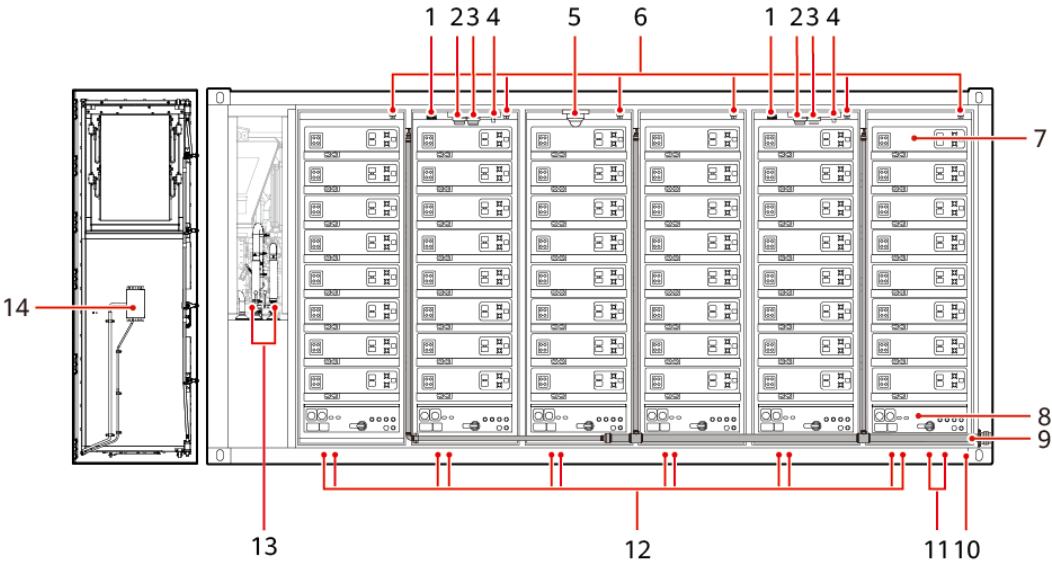


2.3.2 Battery Cabin

NOTE

When you open a battery cabin door, the ESS will be automatically powered off by default.

Figure 2-9 Battery cabin components

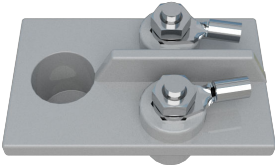


 NOTE

The appearance of each component is for reference only, and that of the actual product may vary.

Table 2-2 Description of battery cabin components

No.	Component	Appearance	Configuration	Quantity per ESS
1	Temperature and humidity (T/H) sensor		Mandatory	2
2	Smoke detector		Mandatory	2
3	Heat detector		Mandatory	2
4	CO sensor		Mandatory	2
5	Camera		Configured only for some models	1
6	Door limit switch		Mandatory	6

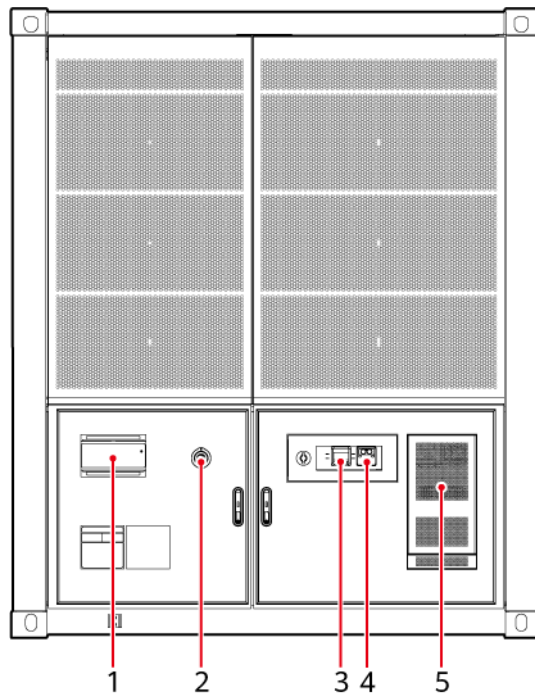
No.	Component	Appearance	Configuration	Quantity per ESS
7	Battery pack		Mandatory	48
8	Rack Control Module (RCM)	-	Mandatory	6
9	Water sprinkler system	-	Mandatory	1
10	Water sensor		Mandatory	1
11	Two-way stop valve		Mandatory	2
12	Ball valve		Mandatory	12
13	Butterfly valve		Mandatory	2
14	Dehumidifier ^[1]	-	Mandatory	3
Note 1: The dehumidifiers are located behind the doors of the battery racks 2, 4, and 6.				

2.3.3 Control Unit Cabin

NOTE

- The control unit cabin composition varies depending on the ESS model.
- Open the right door of the control unit cabin for normal maintenance and inspection. If you open the left door of the control unit cabin after power-on, the ESS will be automatically powered off. You are advised to open the left door of the control unit cabin only when necessary, such as installing cables and handling alarms.

Figure 2-10 Exterior of the control unit cabin (the extinguishant release button is combined with the extinguishant abort button)



(1) Extinguishant release indicator

(2) ESS abort button

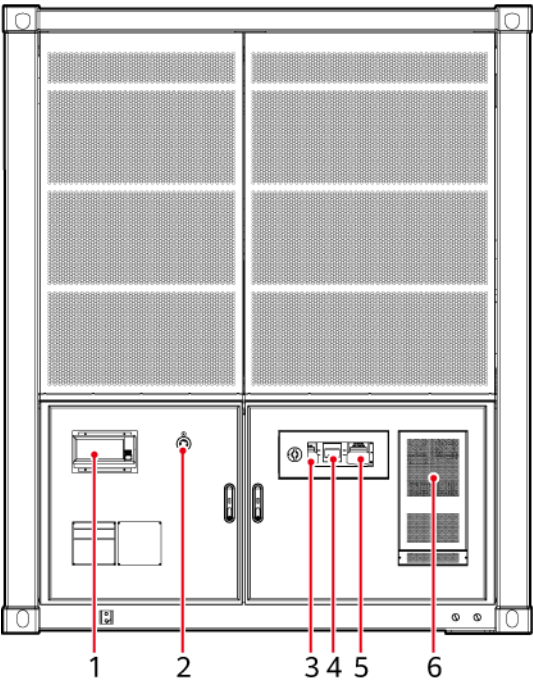
(3) Manual call point

(4) Extinguishant release/abort button

(5) Air conditioner button

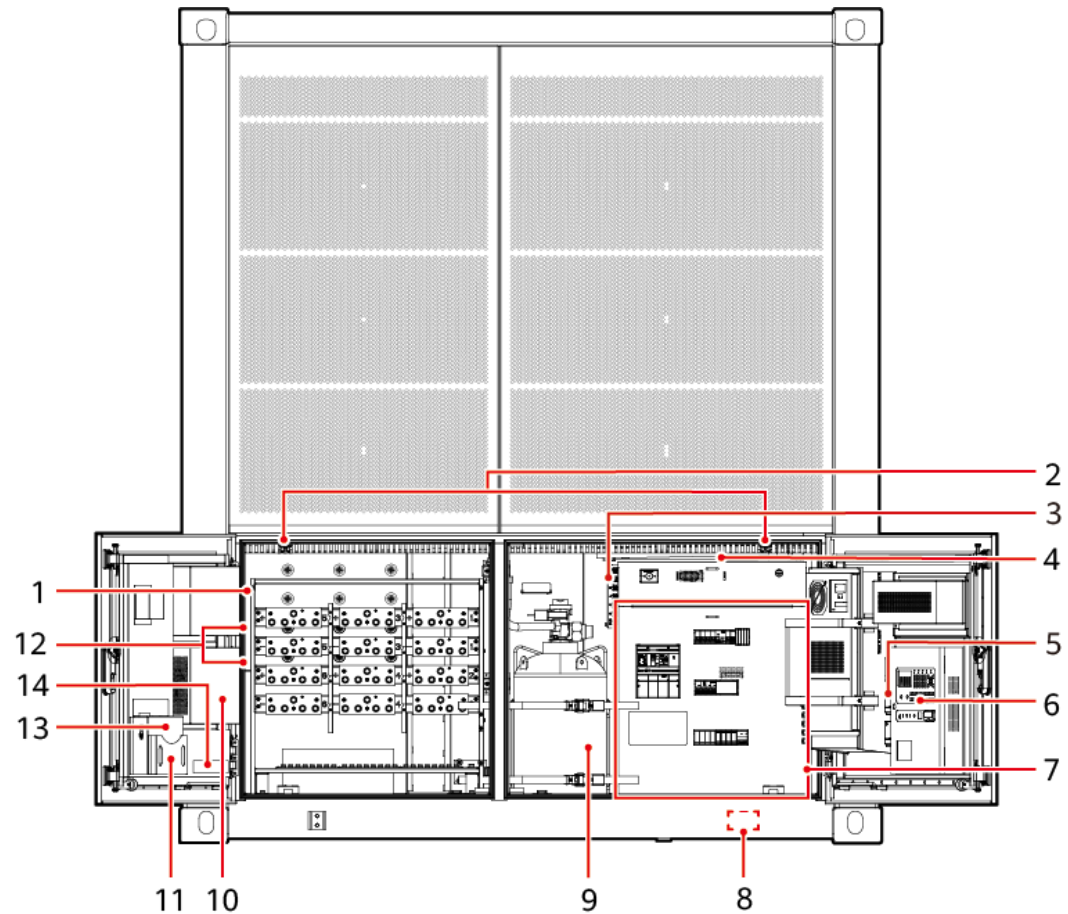
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Figure 2-11 Exterior of the control unit cabin (the extinguishant release button is separated from the extinguishant abort button)



- | | | |
|-------------------------------------|----------------------------------|--------------------------------|
| (1) Extinguishant release indicator | (2) ESS abort button | (3) Extinguishant abort button |
| (4) Manual call point | (5) Extinguishant release button | (6) Air conditioner |

Figure 2-12 Interior of the control unit cabin

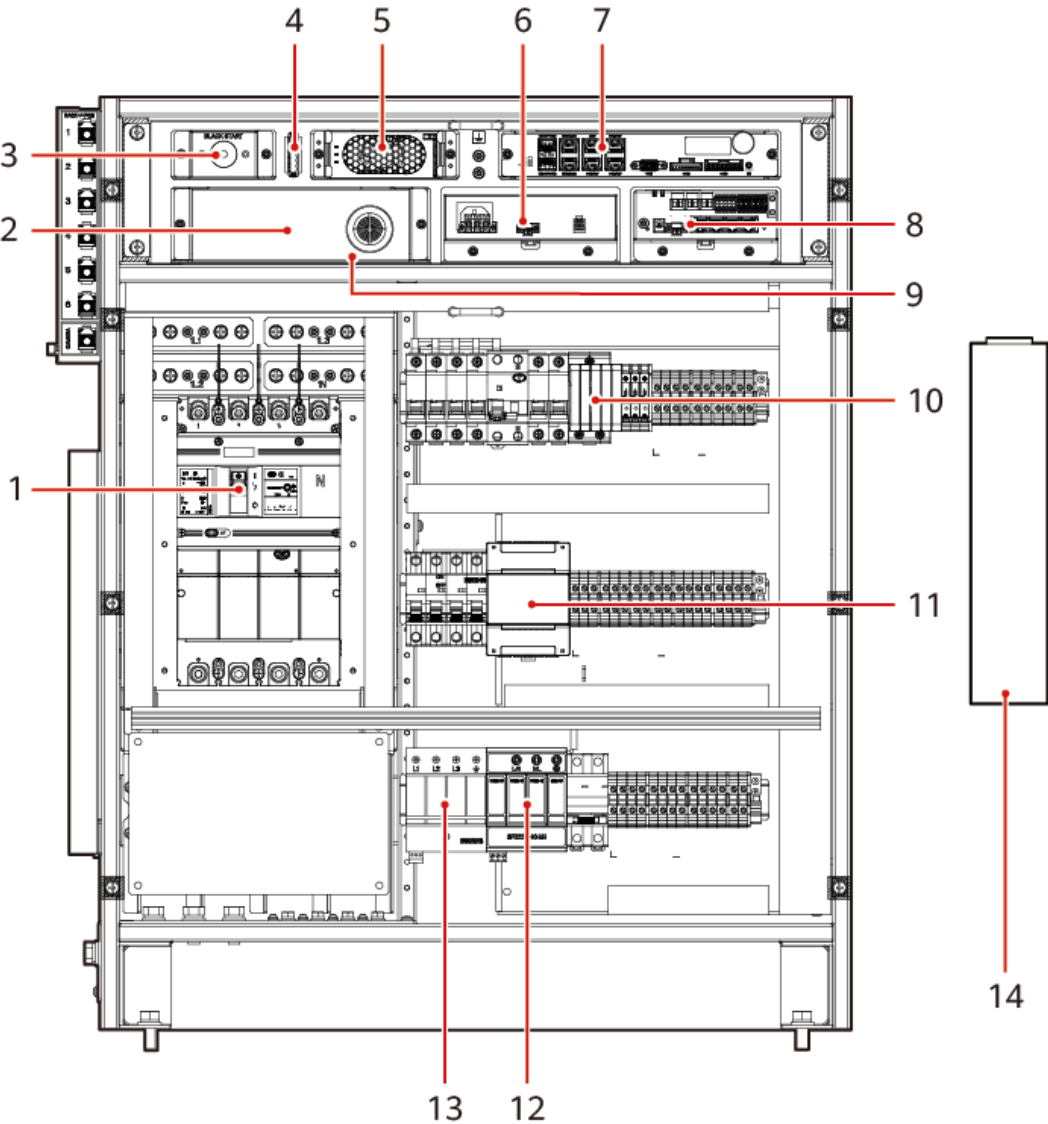


- | | | | |
|--|---|--------------------------------|-----------------------------|
| (1) T/H sensor | (2) Door limit switch | (3) Fiber splice tray | (4) Light |
| (5) Input/Output module of the fire suppression system | (6) Extinguishant control panel | (7) Power distribution cabinet | (8) Water sensor |
| (9) Fire cylinder | (10) Equivalent loop of the automatic transfer switch (ATS) | (11) Document holder | (12) NTC temperature sensor |
| (13) Tool slot 1 ^[1] | (14) Tool slot 2 ^[2] | - | - |

NOTE

- Note^[1]: The tools in tool slot 1 include the hose clamp pliers, eye bolts, extinguishant hose insertion/removal tool (only for some models), exhaust valve bonnet, hose clamp, L-shaped security torx wrench, and security torx screwdriver bit.
- Note^[2]: The tools in tool slot 2 include the two-way stop valve, socket, PV connector unlocking tool, key to the extinguishant control panel, manual call point reset device, and extinguishant release/abort reset device.

Figure 2-13 Power distribution cabinet in the control unit cabin



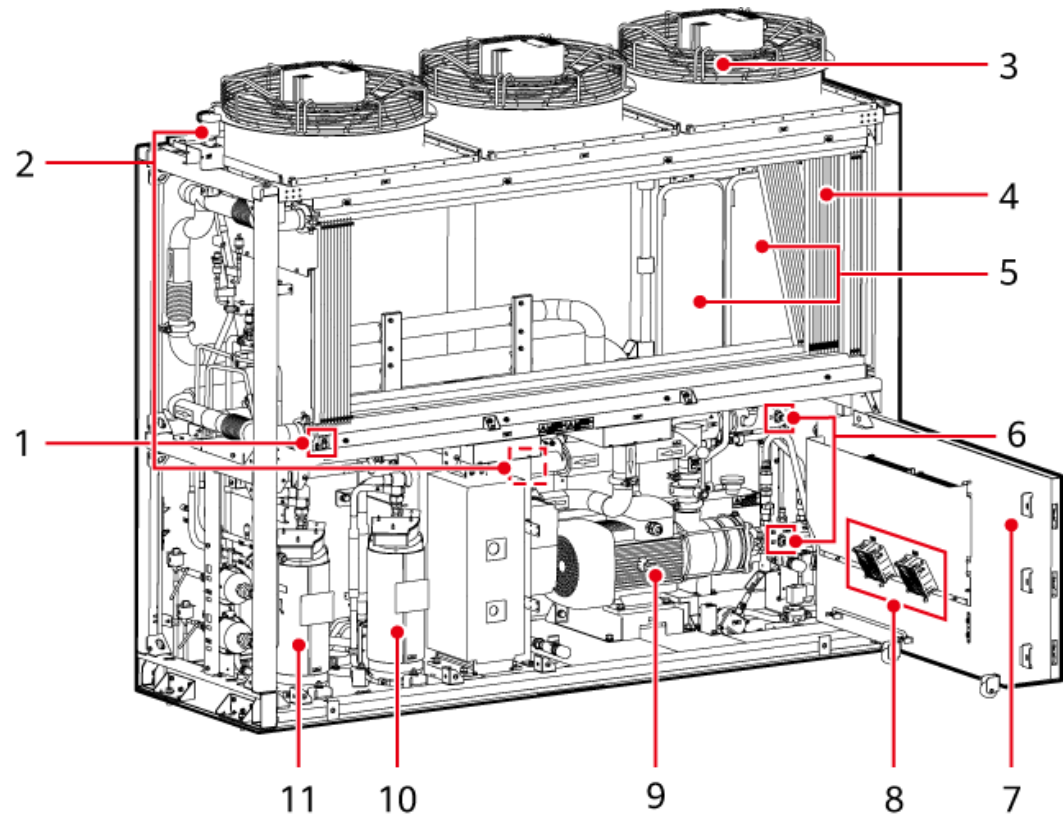
- | | | | |
|---------------------------------------|--|-----------------------------------|--|
| (1) AC auxiliary power general switch | (2) Relay expansion board | (3) Black start button | (4) Dedicated socket for the coolant filling/ drainage machine |
| (5) Power Supply Unit (PSU) | (6) Power adapter | (7) Central Monitoring Unit (CMU) | (8) SmartModule Unit (CMU) |
| (9) E-label board | (10) Maintenance socket/Reserved socket terminal | (11) AC power meter | (12) Surge protective device (SPD) for the UPS |
| (13) Mains SPD | (14) Black start board | - | - |

2.3.4 Liquid Cooling Unit Cabin

NOTE

The following figures are for reference only.

Figure 2-14 Interior of the liquid cooling unit cabin



(1) Outdoor ambient
temperature sensor

(2) Exhaust valve

(3) Outdoor fan

(4) Micro-channel heat
exchanger assembly

(5) Expansion tank

(6) Coolant temperature
sensor

(7) Electric control box

(8) Drive cooling fan

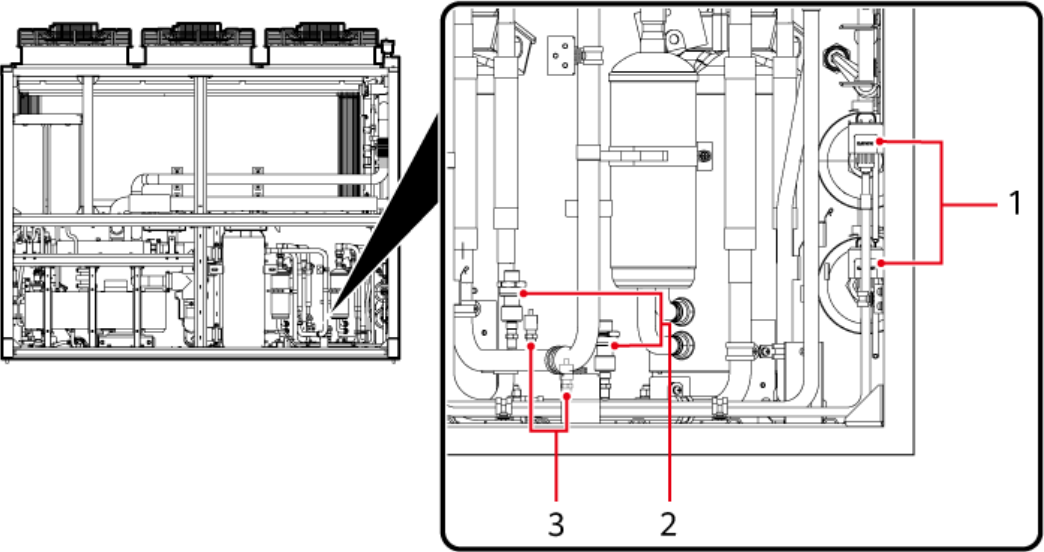
(9) Circulating pump

(10) Compressor 2

(11) Compressor 1

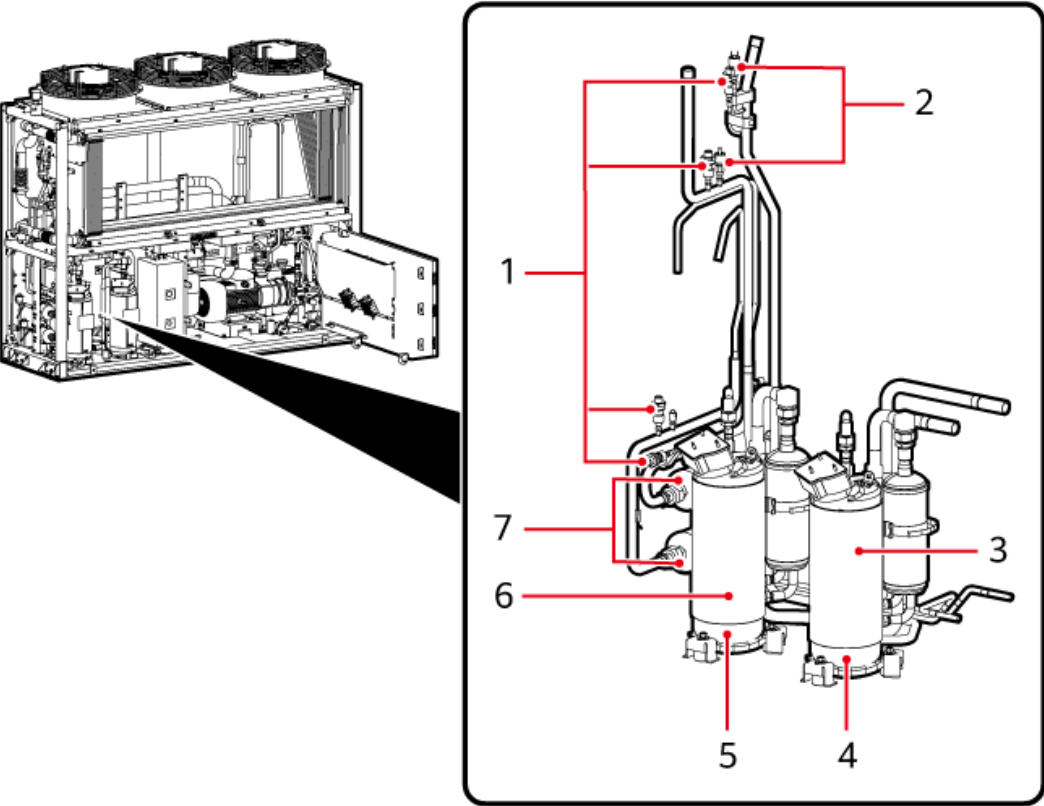
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Figure 2-15 Rear view of the liquid cooling unit cabin



(1) Electronic expansion valve (2) Suction low pressure sensor (3) Needle valve

Figure 2-16 Compressor and related components



(1) High pressure sensor (2) High pressure switch (3) Compressor 2 (4) Compressor 2 oil heating belt

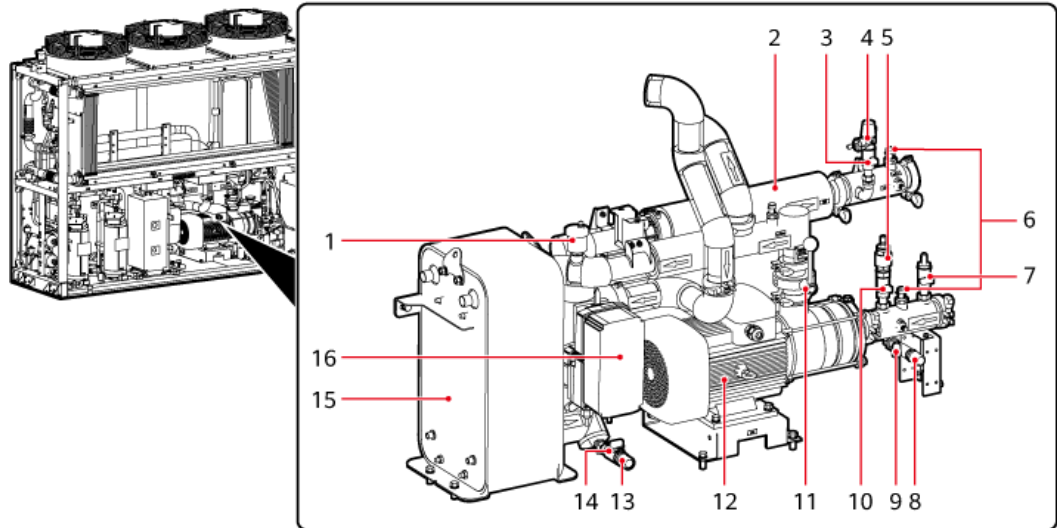
(5) Compressor 1 oil heating belt

(6) Compressor 1

(7) Filter dryer

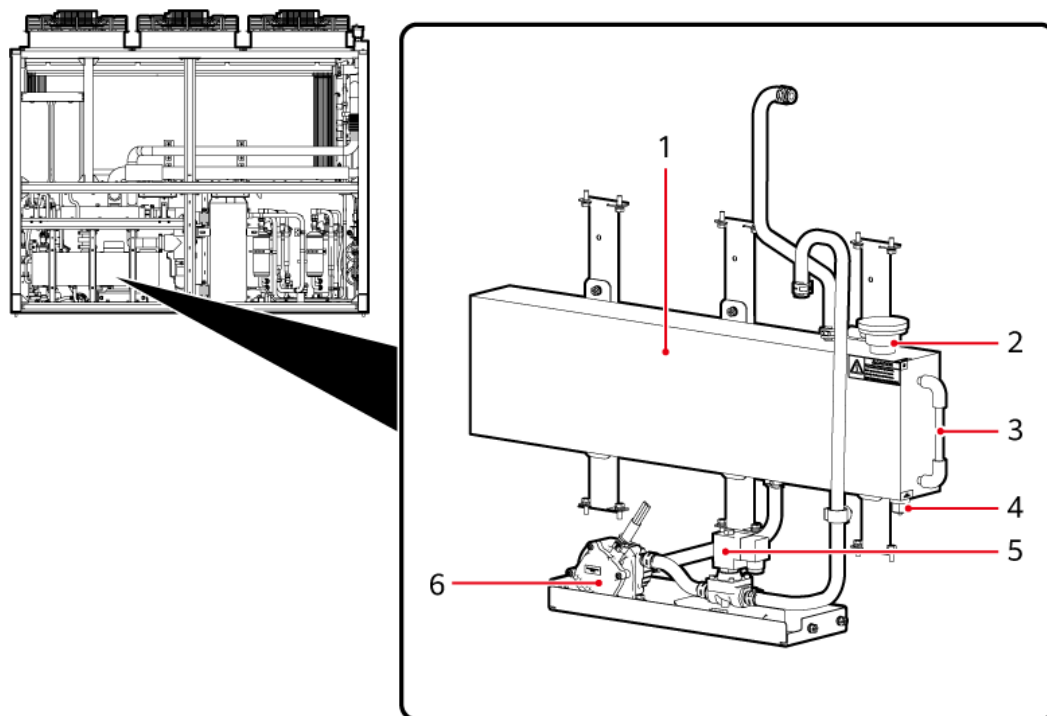
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Figure 2-17 Circulating pump and related components



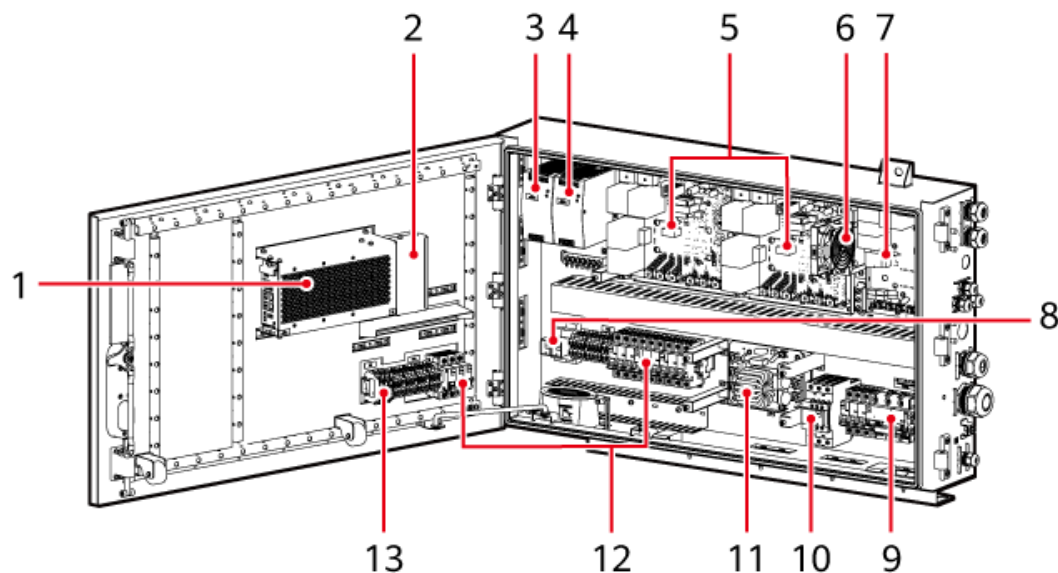
- | | | | |
|--|---|--|--------------------------------------|
| (1) Exhaust valve | (2) Electric heater | (3) Pressure relief ball valve | (4) Safety valve |
| (5) Check valve | (6) Coolant pressure sensor | (7) Expansion tank ball valve | (8) Coolant filling/ drainage port 1 |
| (9) Coolant filling/ drainage ball valve 1 | (10) Coolant refilling ball valve | (11) Butterfly valve for the coolant outlet pipe of the circulating pump | (12) Circulating pump |
| (13) Coolant filling/ drainage port 2 | (14) Coolant filling/ drainage ball valve 2 | (15) Evaporative plate heat exchanger | (16) Multi-way valve and actuator |

Figure 2-18 Coolant tank and refilling-related components



- | | | |
|-------------------------|--------------------------------------|----------------------------------|
| (1) Coolant tank | (2) Coolant inlet | (3) Liquid level gauge |
| (4) Liquid level sensor | (5) Coolant refilling solenoid valve | (6) Coolant refilling pump valve |

Figure 2-19 Interior of the electric control box



- | | | | |
|-------------------------------------|--|-----------------------------------|---------------------------------|
| (1) Liquid cooling controller (LCC) | (2) Backplane | (3) 24 V auxiliary power module | (4) 48 V auxiliary power module |
| (5) Compressor drive module | (6) Mixed-flow fan of the electric control box | (7) Circulating pump drive module | (8) Electromagnetic relay |

- (9) Liquid Thermal Management System (LTMS) general switch 1FCB^[1]
- (10) Electric heater contactor
- (11) Filter board
- (12) LTMS branch circuit breaker
- (13) Fuse
-
-
-

 NOTE

Note^[1]: The LTMS general switch of some models is 1FCB1. The actual product may vary.

Figure 2-20 LTMS branch circuit breaker

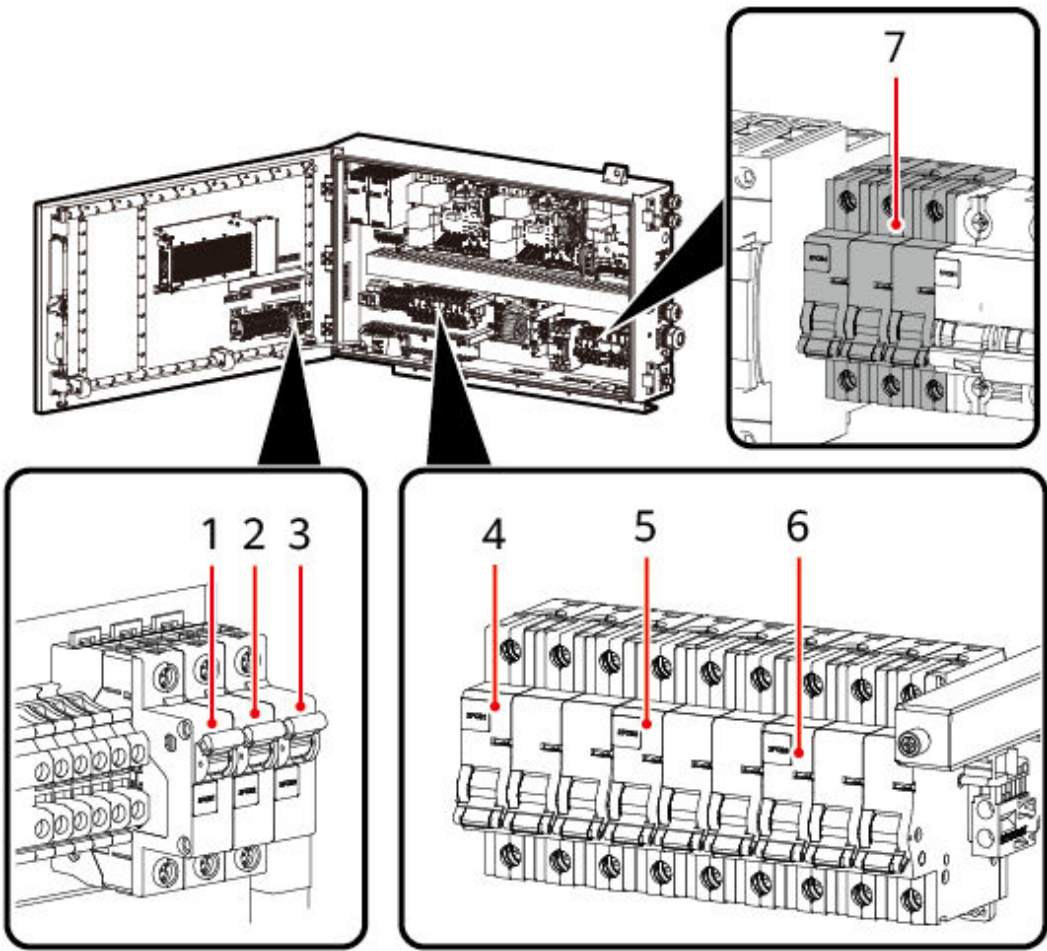


Table 2-3 LTMS branch circuit breaker

No.	Switch	Controlled Functional Module
1	3FCB1	LCC, backplane, temperature sensor, coolant temperature sensor, pressure sensor, and high pressure switch
2	3FCB2	Coolant refilling pump
3	3FCB3	Multi-way valve
4	2FCB1	Compressor drive module 1 and compressor 1

No.	Switch	Controlled Functional Module
5	2FCB2	Compressor drive module 2 and compressor 2
6	2FCB3	Outdoor fan, compressor heating belt, circulating pump drive module, circulating pump, auxiliary power module, drive cooling fan, and mixed-flow fan of the electric control box
7	2FCB4	Electric heater
Note: 3FCB1, 3FCB2, and 3FCB3 are collectively referred to as 24 V loop circuit breakers.		

2.4 Components

2.4.1 Power Supply and Distribution System

2.4.1.1 Battery Pack

A battery pack is the minimum energy storage unit that consists of multiple cells connected in series and parallel. It is used to store or release energy.

 NOTE

The appearance of the battery pack is for reference only, and that of the actual product may vary.

Figure 2-21 Front view of the battery pack

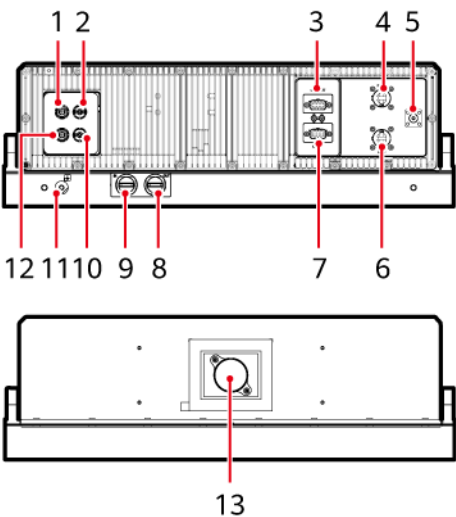


Table 2-4 Battery pack port description

No.	Silk Screen	Description	Function
1	DC+ OUT	Active balancing DC output port (positive)	Only some models support this function. Connects to the positive active balancing DC input port on the cascaded battery pack to balance the power between battery packs.
2	DC- OUT	Active balancing DC output port (negative)	Only some models support this function. Connects to the negative active balancing DC input port on the cascaded battery pack to balance the power between battery packs.
3	COM OUT	COM output port	Connects to the COM input port of the RCM or cascaded battery pack to form a loop between the battery pack and the RCM in the same battery rack.
4	BAT+	Battery charge/discharge port (positive)	Connects to the negative battery port on the RCM or the negative battery charge/discharge port on the cascaded battery pack.
5	Extinguishant port	Extinguishant inlet	Only some models support this function. Connects to the battery pack and extinguishant pipes.
6	BAT-	Battery charge/discharge port (negative)	Connects to the positive battery port on the RCM or the positive battery charge/discharge port on the cascaded battery pack.
7	COM IN	COM input port	Connects to the COM output port of the RCM or cascaded battery pack to form a loop between the battery pack and the RCM in the same battery rack.
8	OUTLET	Coolant outlet of the liquid cooling system	Connects to the liquid cooling pipe to adjust the internal temperature of the battery pack.
9	INLET	Coolant inlet of the liquid cooling system	Connects to the liquid cooling pipe to adjust the internal temperature of the battery pack.
10	DC- IN	Active balancing DC input port (negative)	Only some models support this function. Connects to the negative active balancing DC output port on the cascaded battery pack to balance the power between battery packs.
11	-	Protective earthing (PE) point	Connects to a PE cable to provide grounding protection for the battery pack.

No.	Silk Screen	Description	Function
12	DC+ IN	Active balancing DC input port (positive)	Only some models support this function. Connects to the positive active balancing DC output port on the cascaded battery pack to balance the power between battery packs.
13	-	Pressure relief valve	Exhausts smoke in the case of thermal runaway.

Table 2-5 Battery pack technical specifications

Item	Specifications
Battery configuration	Battery cell 2P52S
Nominal voltage	166.4 V
Voltage range	140.4–187.2 V
Nominal energy	93.2 kWh
Charge/Discharge rate	≤ 0.5CP
Dimensions (W x H x D)	785 mm x 250 mm x 2135 mm
Weight	≤ 700 kg
Cooling mode	Liquid cooling
Ingress protection (IP) rating	IP65
Communications port	CAN, daisy chain
Battery cell type	Lithium iron phosphate
Nominal voltage/capacity of a battery cell	3.2 V/280 Ah
Nominal energy of a battery cell	896 Wh
Charge temperature range	0°C to 65°C
Discharge temperature range	–30°C to +65°C

2.4.1.2 RCM

The RCM implements power connection between the battery rack and PCS, fault detection, fault isolation, monitoring communication, and battery management.

Figure 2-22 Appearance

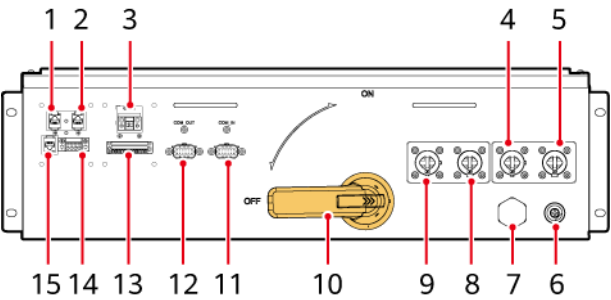


Table 2-6 RCM front panel

No.	Silk Screen	Description	Function
1	CON1	Battery Control Unit (BCU) ring network port 1	Used for ring network connection between RCMs of different battery racks.
2	CON2	BCU ring network port 2	Used for ring network connection between RCMs of different battery racks.
3	CON5	Local black start port	Used only for the first battery rack and connects to the black start button of the control unit cabin for local black start.
4	BAT-	Battery port (negative)	Connects to the positive battery charge/discharge port on the battery pack.
5	BAT+	Battery port (positive)	Connects to the negative battery charge/discharge port on the battery pack.
6	-	PE point	Connects to a PE cable to provide grounding protection for the RCM.
7	-	Ventilation valve	Balances the air pressure inside and outside the RCM.
8	BUS+	Bus port (positive)	Connects to the DC wiring copper bar of the control unit cabin for PCS connection.
9	BUS-	Bus port (negative)	Connects to the DC wiring copper bar of the control unit cabin for PCS connection.
10	-	Circuit breaker	Turns on or off the power connection between the RCM and the battery pack.

No.	Silk Screen	Description	Function
11	COM IN	COM input port	Connects to the COM output port on the battery pack.
12	COM OUT	COM output port	Connects to the COM input port on the battery pack.
13	CON4	Pin for emergency stop signal, DI signal of the I/O expansion board, 24 V output, 12 V output, and first battery rack physical identification	Used to transmit the emergency stop signal, black start activation signal, 12 V (CMU and SmartModule), 24 V (I/O expansion board) DC power supply, and first battery rack identification signal.
14	48V IN	48 V input port	Supplies power to the RCM.
15	CON3	Network port	Used for CAN communication and dry contact control between the RCM and the PCS.

Table 2-7 RCM technical specifications

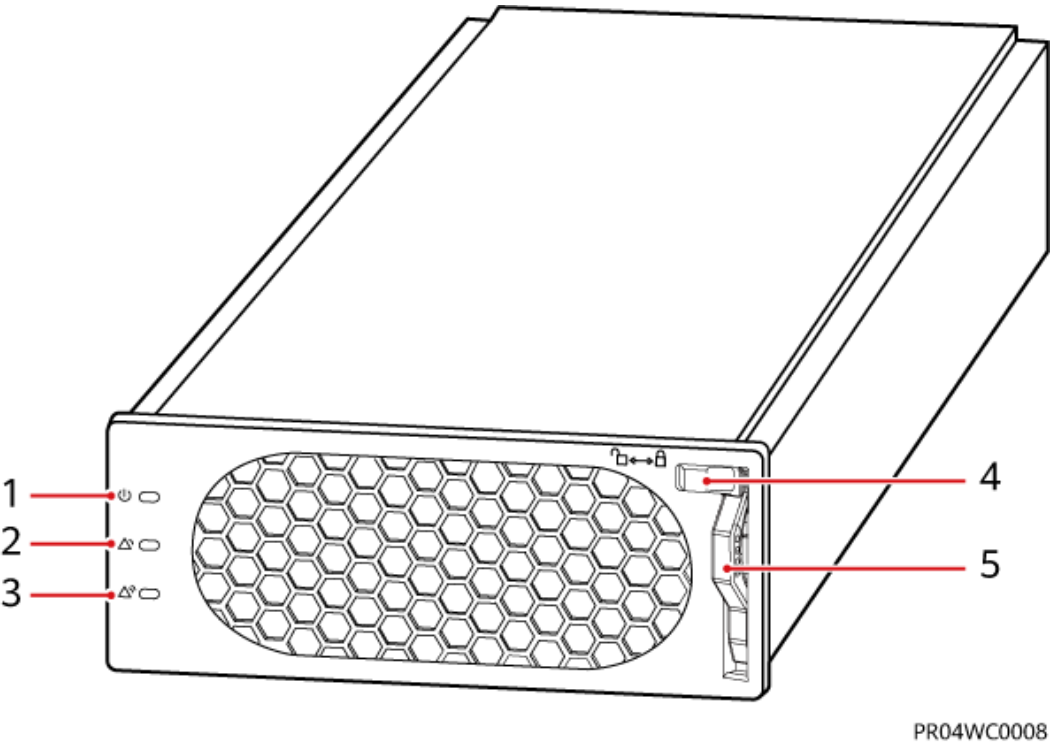
Item	RCM
Minimum operating voltage	750 V
Rated operating voltage	1330 V
Maximum operating voltage	1500 V
Dimensions (W x H x D)	785 mm x 220 mm x 600 mm
Net weight	≤ 45 kg
IP rating	IP55

2.4.1.3 PSU

The PSU (R4830G1) converts AC input power into stable DC power.

Appearance

Figure 2-23 Appearance



- (1) Power indicator
- (2) Alarm indicator
- (3) Fault indicator
- (4) Locking latch
- (5) Handle
-

Indicators

Table 2-8 Indicator description

Indicator	Color	Status	Description
Power indicator	Green	Steady on	The PSU has an AC input.
		Off	The PSU has no AC input.
			The PSU is faulty.
		Blinking at 0.5 Hz	Querying is in progress.
		Blinking at 4 Hz	The PSU is loading the application program.
Alarm indicator	Yellow	Off	The PSU has no protection alarm.

Indicator	Color	Status	Description
		Steady on	- A warning is generated due to ambient overtemperature. - A shutdown protection alarm is generated due to ambient overtemperature or undertemperature.
			AC input overvoltage or undervoltage protection is triggered.
			The PSU is hibernating.
		Blinking at 0.5 Hz	The communication between the PSU and the external equipment is interrupted.
Fault indicator	Red	Off	The PSU is normal.
		Steady on	The PSU locks out due to output overvoltage.
			The PSU has no output due to a fault.

2.4.2 Monitoring System

2.4.2.1 CMU

The CMU implements data collection, control, and management for the ESS, and manages the battery racks, liquid cooling system, fire suppression system, and environment control system inside the ESS.

Figure 2-24 Appearance

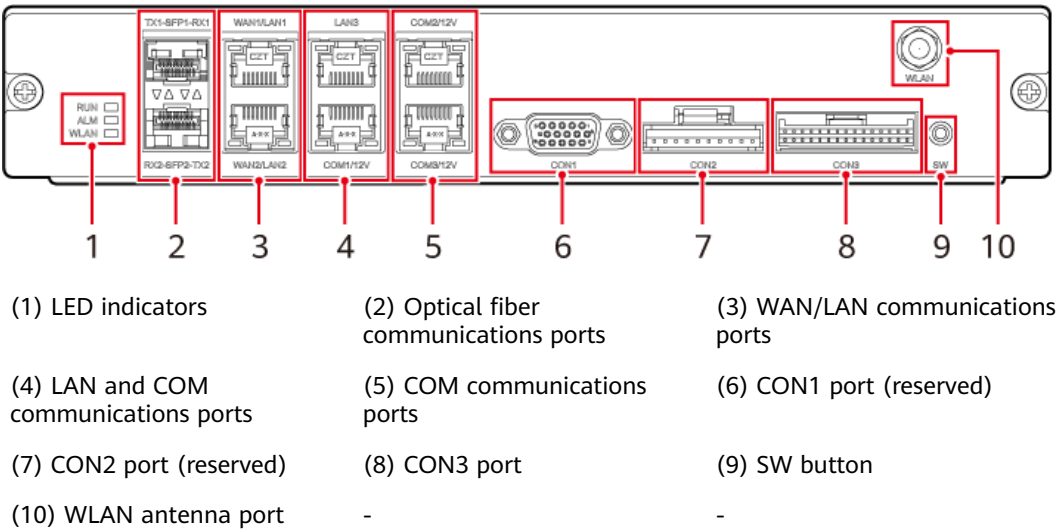


Table 2-9 SW button operations and functions

Key Pressing Duration	Function
1–3s	Turn on the WLAN.
10–20s	You can access the WLAN without a password within 3 minutes. After 3 minutes, the WLAN password set by the user is restored.
> 60s	Within 3 minutes after the CMU is powered on and restarted, hold down the SW reset button for more than 60s. After all indicators are off, the running indicator is on again. In this case, the CMU is restarted and factory settings are restored.

Table 2-10 CMU indicator description

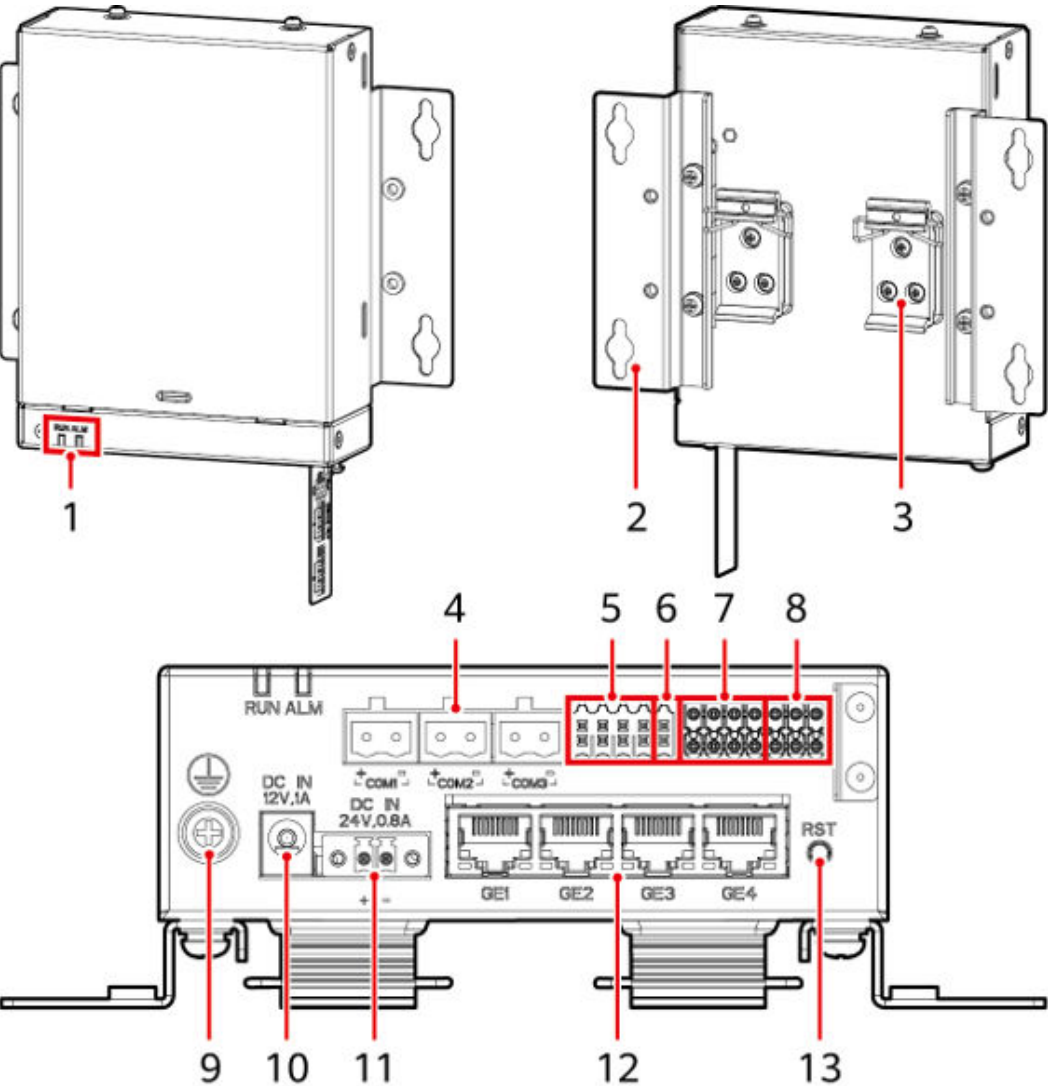
Indicator	Status		Description
Running indicator (RUN) RUN 	Off		The CMU is not powered on.
	Blinking green slowly (on for 1s and then off for 1s)		The communication with the northbound management system is normal.
	Blinking green fast (on for 0.125s and then off for 0.125s)		The communication with the northbound management system is interrupted.
Alarm/Maintenance indicator (ALM) ALM 	Alarm status	Off	The ESS has no alarm.
		Blinking red slowly (on for 1s and then off for 4s)	The ESS generates a warning alarm.
		Blinking red fast (on for 0.5s and then off for 0.5s)	The ESS generates a minor alarm.
		Steady red	The ESS generates a major alarm.
	Maintenance status	Off	No local maintenance is in progress.
		Blinking green slowly (on for 1s and then off for 1s)	Local maintenance is in progress.
		Blinking green fast (on for 0.125s and then off for 0.125s)	Local maintenance fails or the connection to the app is to be set up.
		Steady green	Local maintenance succeeded.
WLAN indicator (WLAN)	Off		The WLAN is off.
	Steady green		The WLAN is on.

2.4.2.2 SmartModule

The SmartModule is a CMU extension port which converges ports, converts protocols, and aggregates data for all devices in the ESS.

Appearance

Figure 2-25 Appearance



5000143

- | | | |
|----------------------------|----------------------------|----------------------------|
| (1) LED indicators | (2) Mounting ear | (3) Guide rail clamp |
| (4) COM ports | (5) DI ports | (6) 12 V output power port |
| (7) AI ports | (8) PT ports | (9) PE point |
| (10) 12 V input power port | (11) 24 V input power port | (12) GE ports |
| (13) RST button | - | - |

Indicators

Indicator	Status		Description
Running indicator (RUN) 	Off		The SmartModule is not powered on.
	Blinking green slowly (on for 1s and then off for 1s)		The communication with the CMU is normal.
	Blinking green fast (on for 0.125s and then off for 0.125s)		The communication with the CMU is interrupted.
Alarm/Maintenance indicator (ALM) 	Alarm status	Off	The SmartModule has no alarm.
		Blinking red slowly (on for 1s and then off for 4s)	The SmartModule runs and ignores digital certificate expiration.
		Blinking red fast (on for 0.5s and then off for 0.5s)	The SmartModule digital certificate is invalid.
		Steady red	Reserved

2.4.2.3 Black Start Board

 NOTE

Only some models are equipped with the black start board.

The black start board controls and monitors the door limit switches, sensors, and air conditioners in the ESS, connects cables to the fire suppression system, and black starts the system.

Technical Specifications	Black Start Board
Model	ENF1DETC
Operating voltage	220 V AC/12 V DC/24 V DC
Operating current	≤ 1 A
Operating temperature	−30°C to +55°C
Humidity	≤ 95% RH (non-condensing)
Dimensions (W x H x D)	251 mm x 113.7 mm x 54.5 mm

2.4.2.4 Camera

The camera is connected to the external monitoring center through network cables for remote manual confirmation after an alarm is generated in the fire suppression system.

NOTE

Only some models are configured with cameras.

For detailed technical specifications, log in to <https://holosens.e.huawei.com>, search for the camera model **C3222-10-SIR**, and view the corresponding brochure.

The default camera IP address is 192.168.0.120, and the default username is **admin**. Set the password as prompted upon the first login.

For more information about the camera, visit <http://support.huawei.com/enterprise>, search for the camera model **C3222-10-SIR**, and obtain the latest documents, including the product documentation and open source software notice.

2.4.3 Environment Control System

2.4.3.1 LTMS

The LTMS is used to heat or cool battery packs of the ESS.

Technical Specifications	LTMS
Dimensions (W x H x D)	1950 mm x 650 mm x 600 mm
Weight	≤ 700 kg (excluding the refrigerant and coolant)
Refrigerant	R410A
Coolant	Ethylene glycol solution
Rated cooling energy efficiency	2.7 @ 35°C
Maximum power	≤ 33 kW @ 45°C
Heating power	14 kW
Northbound communication	Communications port: RJ45
	Communications protocol: BIN
Auxiliary power supply	380–400 V AC

Technical Specifications	LTMS
IP rating	IPX5 for the LTMS; IP55 for the electric control box

2.4.3.2 T/H Sensor

The T/H sensor detects the real-time ambient temperature and humidity inside the ESS.

Technical Specifications	T/H Sensor
Temperature measuring range	-20°C to +80°C
Temperature accuracy	±0.5°C (25°C) ≤ ±1°C (full measuring range)
Operating temperature	-20°C to +80°C
Operating voltage	9-16 V DC
Storage temperature	-40°C to +80°C
Signal output	Two RJ45 ports, bidirectional cascading

The T/H sensor uses an RJ45 connector.

Figure 2-26 Pins of an RJ45 connector
RJ45 female connector

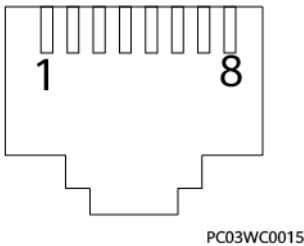


Table 2-11 Pin definitions of an RJ45 connector

Pin	Description
Pin 1 or pin 4	A
Pin 2 or pin 5	B
Pin 3	V+
Pin 6	Reserved

Pin	Description
Pin 7	Reserved
Pin 8	V-

2.4.3.3 Air Conditioner

The air conditioner is used to heat and cool components inside the control unit cabin.

Technical Specifications	Air Conditioner
Model	PC300D-3
Operating temperature	-30°C to +55°C
Rated DC input voltage	-48 V DC
Rated power	130 W
Rated current	3 A
Cooling capacity (L35/ L35)	300 W
Heating capacity	300 W
Dimensions (W x H x D)	352 mm x 583 mm x 175 mm (with flanges)
Net weight	14 kg
IP rating	IP55
Refrigerant	R134a

2.4.3.4 Water Sensor

The water sensor detects water based on the resistance change between two electrodes.

When the electrodes detect water, they are short-circuited and the CMU reports an alarm.

Technical Specifications	Water Sensor
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +80°C

2.4.3.5 Light

The light provides lighting in the control unit cabin.

Technical Specifications	Light
Installation mode	Ceiling-mounted
Lighting type	LED light
Light holder	The light holder and light are integrated.
IP rating	IP20
Rated voltage	220 V AC
Frequency	50 Hz
Power	10.5 W (68 x 0.2 W)
Color temperature	5700K
Color	White

2.4.4 Fire Suppression System

NOTE

The component models in this section are for reference only. The actual configurations may vary.

2.4.4.1 CO Sensor

The CO sensor is used to check the concentration of carbon monoxide (CO) in combustible gases.

Technical Specifications	CO Sensor
Operating voltage	12 V DC
Detection range	0–2000 ppm
Output signal	RS485
Response time	≤ 60s
Cabling mode	RJ45 network port

2.4.4.2 Motorized Air Damper

The motorized air damper is an active exhaust device of the ESS. It is used to reduce the concentration of combustible gases in the battery cabin when the battery valve is opened to release combustible gases.

Technical Specifications	Motorized Air Damper
Rated voltage	220 V AC (50/60 Hz)
Operating voltage range	187–265 V AC
Exhaust air volume	≥9m ³ /min @130pa
Rated noise	≤ 75 dB
IP rating	Close: IP55 Open: IP33

2.4.4.3 Extinguishant Control Panel

The extinguishant control panel is used to generate fire alarms and control automatic fire suppression.

Table 2-12 Specifications of extinguishant control panels of different models

Item	C050SZEG	JB-QBL-QM210/ZEKA0100
Operating voltage	AC input voltage: 220±20% V AC, 50 Hz	AC input voltage: 220±20% V AC, 50 Hz
Power	AC input ≤ 100 W	AC input ≤ 120 W
Capacity	Number of detector loops: 1	Number of detector loops: 2
Detector loop requirements	Detector loop system: bus system	Detector loop system: bus system
IP rating	IP30	IP30

Table 2-13 Specifications of batteries in different models of extinguishant control panels

Item	Sealed Lead-Acid Battery (C050SZEG)	Sealed Lead-Acid Battery (JB-QBL-QM210)	Sealed Lead-Acid Battery (ZEKA0100)
Rated voltage	12 V	12 V	12 V
Capacity	7 Ah	5 Ah	7 Ah
Dimensions (W x H x D)	151 mm x 65 mm x 99 mm	90 mm x 70 mm x 100 mm	151 mm x 65 mm x 95 mm

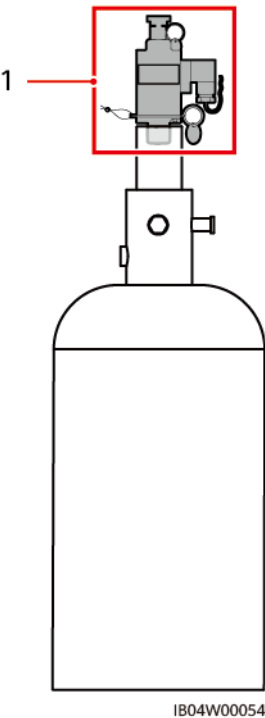
2.4.4.4 Fire Cylinder

The fire cylinder stores fire extinguishant and is used together with related components, including solenoid valves, pressure gauges, and pipes.

NOTICE

Keep the fire cylinder away from direct sunlight.

Figure 2-27 Appearance of the fire cylinder



(1) Position of the solenoid valve after installation

NOTE

The actual appearance and color of the fire cylinder may vary.

Technical Specifications	P0009438	YF40/2.5	CNES-F-50/4.2
Operating voltage	24 V DC	24 V DC	24 V DC
Storage pressure (at 20°C)	2.5 Mpa	2.5 Mpa	2.5 Mpa
Maximum operating pressure (50°C)	3 Mpa	4.2 Mpa	4.2 Mpa

Technical Specifications	P0009438	YF40/2.5	CNES-F-50/4.2
Startup mode	Electromagnetic startup	Electromagnetic startup	Electromagnetic startup
Solenoid valve startup voltage/ current	24 V DC/0.6 A	24 V DC/1 A	24 V DC/1 A
Cylinder outer diameter	330 mm	328 mm	312 mm
Cylinder height	≤ 850 mm	918 mm	950 mm
Extinguishant release time	≤ 10s	≤ 10s	≤ 10s
Hose	Length: 800 mm; diameter: DN20	Length: 800 mm; diameter: DN20	Length: 550 mm; inlet: DN32; outlet: DN20
Extinguishant	Perfluorohexanone	Perfluorohexanone	Perfluorohexanone
Cylinder volume	40 L	40 L	40 L

2.4.4.5 Input/Output Module

The input/output modules receive early fire signals from the CMU and send the signals to the extinguishant control panel to implement early fire response and control.

 NOTE

Only some models are equipped with input/output modules. The input/output module varies depending on the model.

Table 2-14 Technical specifications

Item	EM312SR	KZJ-956
Wiring mode	Bus system	Bus system
Monitoring current	< 80 μA	< 600 μA
Alarm current	< 20 mA	< 10 mA

Table 2-15 EM312SR indicator description

Silk Screen	Color	Status Description
A	Red	The fire alarm signal of the extinguishant release indicator or extinguishant release/abort button or the leakage feedback signal of the fire cylinder is sent to the input/output module.
	Yellow	Input error
	Green	Inspection status, normal operation
	Off	No loop signal input
B	Yellow	Short circuit
	Off	Normal operation
C	Green	Normal output
	Yellow	An error occurs when the output signal is sent to the extinguishant release indicator or extinguishant release/abort button or when the leakage feedback signal is sent to the fire cylinder.
	Off	Normal operation

Table 2-16 KZJ-956 indicator description

Indicator	Color	Status	Description
Inspection/ Output indicator	Red	Steady on	Output status
		Blinking (once every 12s)	Inspection status
Input indicator	Red	Steady on	Input status

2.4.4.6 Heat Detector

The heat detector monitors the temperature of the battery cabin.

Table 2-17 Indicator description

Color	Status	Description
Red	Steady on	The detector enters the alarm state.

Color	Status	Description
	Blinking	The detector enters the monitoring state.

Table 2-18 Technical specifications

Item	ED200	JTW-ZD-920	JTW-ZOM-RF1110
Operating voltage	24 V DC	24 V DC	24 V DC
Alarm threshold	70°C–75°C	70°C–75°C	70°C–75°C
Wiring mode	Bus system	Bus system	Bus system
Operating current	≤ 10 mA	< 1.5 mA	≤ 0.4 mA
Encoding mode	- Onsite encoding through the encoder - Encoding through the extinguishant control panel	Onsite encoding through the encoder	Onsite encoding through the encoder
IP rating	IP40	IP30	IP30

2.4.4.7 Smoke Detector

The smoke detector can detect the smoke concentration in the environment.

 **CAUTION**

Do not use smoke detectors in condensation scenarios. Otherwise, false alarms may be generated. If a false alarm is generated, handle the alarm by referring to the LUNA2000-4472 Series Smart String ESS Alarm Reference.

Table 2-19 Indicator description

Color	Status	Description
Red	Steady on	The detector enters the alarm state.
	Blinking	The detector enters the monitoring state.

Table 2-20 Technical specifications

Item	ED100	JTY-GD-930	JTY-GM-RF1100C
Operating voltage	24 V DC	24 V DC	24 V DC
Wiring mode	Bus system	Bus system	Bus system
Operating current	≤ 10 mA	< 1.5 mA	≤ 0.4 mA
Encoding mode	- Onsite encoding through the encoder - Encoding through the extinguishant control panel	Onsite encoding through the encoder	Onsite encoding through the encoder
IP rating	IP40	IP30	IP30

2.4.4.8 Fire Alarm Horn/Strobe

The fire alarm horn/strobe is used for audible and visual alarm in the area where an accident occurs.

Table 2-21 Technical specifications

Item	ES2030RE	SG-993	RF1500A
Operating voltage	24 V DC	24 V DC	24 V DC
Operating current	≤ 200 μA	< 120 mA	≤ 5 mA
Flashing frequency	0.5 Hz	1–1.5 Hz	1–1.5 Hz
Alarm volume	101 dB	75–95 dB	75–95 dB
Encoding mode	- Onsite encoding through the encoder - Encoding through the extinguishant control panel	Onsite encoding through the encoder	Onsite encoding through the encoder
Wiring mode	Bus system	Bus system	Bus system
IP rating	IP65	IP30	IP30

2.4.4.9 Extinguishant Release Indicator

The extinguishant release indicator will be flashing when a fire occurs in the extinguishant protection area.

Technical Specifications	LF24W	QM-ZSD-02	RQ1100
Operating voltage	24 V DC	24 V DC	24 V DC
Operating current	≤ 50 mA	≤ 150 mA	≤30 mA
Encoding mode	- Onsite encoding through the encoder - Encoding through the extinguishant control panel	Onsite encoding through the encoder	Onsite encoding through the encoder
Wiring mode	Bus system	Bus system	Bus system
IP rating	IP65	IP30	IP30

2.4.4.10 Manual Call Point

The manual call point is used to manually report an alarm after a fire is confirmed by the personnel at the accident site.

Table 2-22 Indicator description

Color	Status	Description
Red	Steady on	The detector enters the alarm state.
	Blinking	The detector enters the monitoring state.

Technical Specifications	EC0020	J-SAP-M-962	J-SAP-M-RF2200
Operating voltage	24 V DC	24 V DC	24 V DC
Operating current	≤ 5 mA	≤ 2 mA	≤ 0.4 mA

Technical Specifications	EC0020	J-SAP-M-962	J-SAP-M-RF2200
Encoding mode	- Onsite encoding through the encoder - Encoding through the extinguishant control panel	Onsite encoding through the encoder	Onsite encoding through the encoder
Wiring mode	Bus system	Bus system	Bus system
IP rating	IP65	IP30	IP30

2.4.4.11 Water Sprinkler System

The water sprinkler system is used to put out a fire in the ESS if the fire suppression system fails or the fire cannot be put out due to other uncontrollable factors.

Figure 4 Right view shows the position of the water inlet of the water sprinkler system.

NOTE

Some models are configured with a water sprinkler system. The actual configurations may vary.

NOTICE

- The fire water valve is located at the site control station and cannot be monitored on the ESS side. Therefore, the customer shall enhance the management on the site control station to prevent false triggering. Equipment damage caused by false triggering is not covered by the warranty.
- The fire water at the site control station shall be obtained from external water sources. The continuous water spraying time is recommended to be at least two hours and shall meet the requirements of local fire laws and regulations.
- When the ESS is working properly, the water distribution pipe for the water sprinkler system is not filled with water. When the ESS is started, the external water source is manually connected.
- The manual control switch of the water sprinkler system must be away from the ESS. It is recommended that the distance be greater than 20 m.

Figure 2-28 Water sprinkler system layout

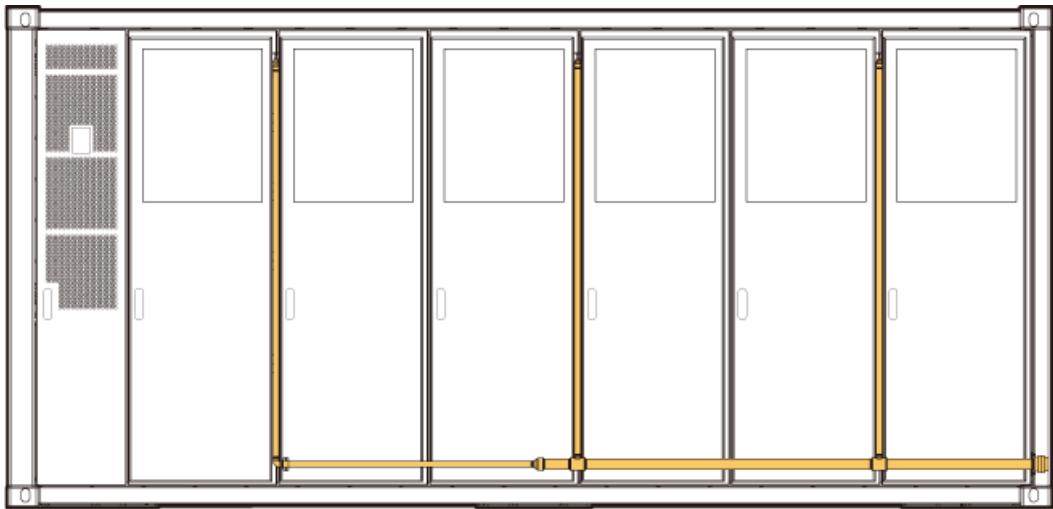


Table 2-23 Port specifications

Item	Specifications
External thread	R 2"
Thread length	20 mm

Table 2-24 Water inlet requirements

Item	Specifications
Total inlet water flow	≥ 244 L/min
Water inlet pressure	≥ 0.107 MPa
Water inlet pipe diameter	DN50

Startup Requirements

NOTICE

- Check that the extinguishant monitoring devices are connected to the plant control system.
 - Check that the ambient temperature monitoring devices in the ESS are connected to the plant control system.
-
- Check the status of the extinguishant in the ESS via the plant control system. If the extinguishant is not released, do not start the water sprinkler system.

- Check that the extinguishant has been released and at least two temperature monitoring points exceed 80°C in the ESS via the plant control system. Then start the water sprinkler system.
- Start the water sprinkler system in the ESS if open flames outside the ESS are detected through the video surveillance of the plant control system.

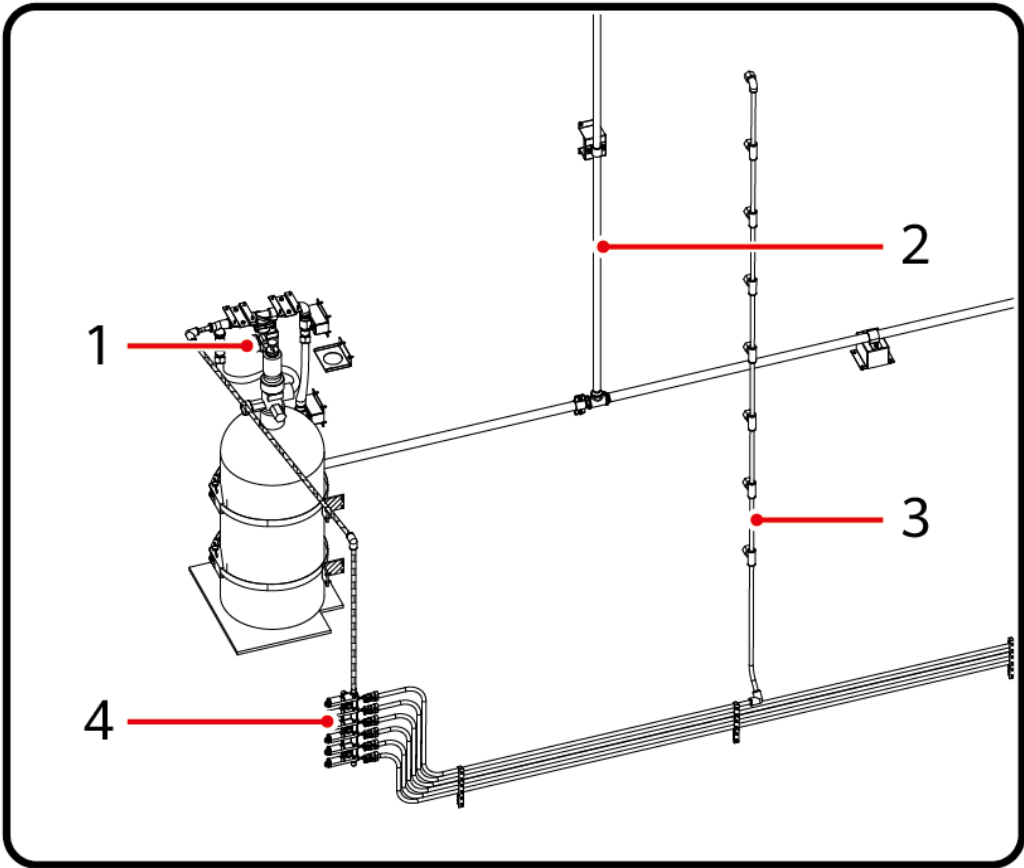
 NOTE

It is recommended that the video surveillance system with the infrared temperature measurement function be used.

2.4.4.12 Gas Fire Suppression Devices

The ESS is equipped with cabin-level and pack-level gas fire suppression devices. Only some models support the pack-level gas fire suppression devices.

The pack-level gas fire suppression devices consist of pack-level gas fire suppression pipes, zone-level solenoid valves, and cabin-level solenoid valves. They can release the extinguishant into a battery pack experiencing thermal runaway to cool the battery pack.



(1) Cabin-level solenoid valve	(2) Cabin-level gas fire extinguishing pipe
(3) Pack-level gas fire extinguishing pipe	(4) Zone-level solenoid valve

2.5 Circuit Diagrams

NOTE

The ESS has various circuit diagrams. The following figures are for reference only.

Figure 2-29 Circuit diagram of the general power loop

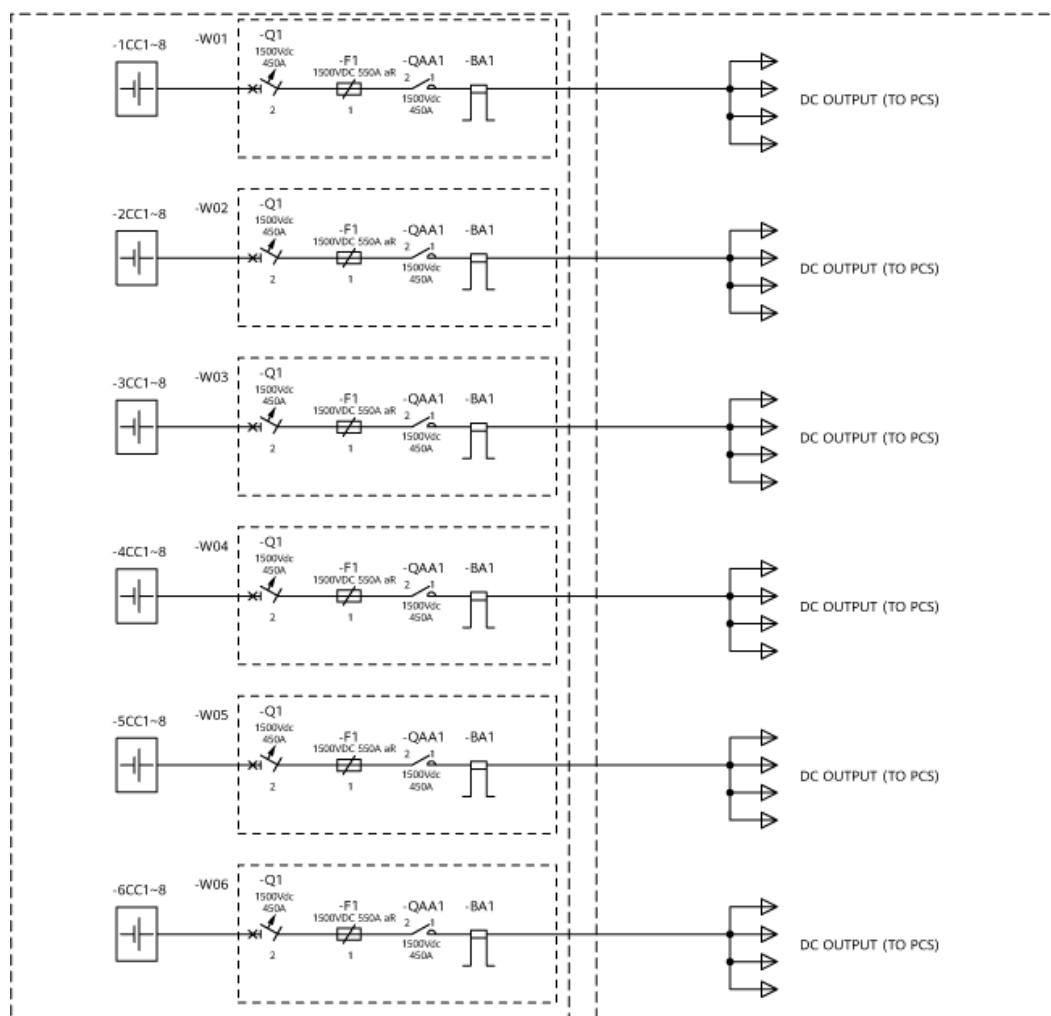
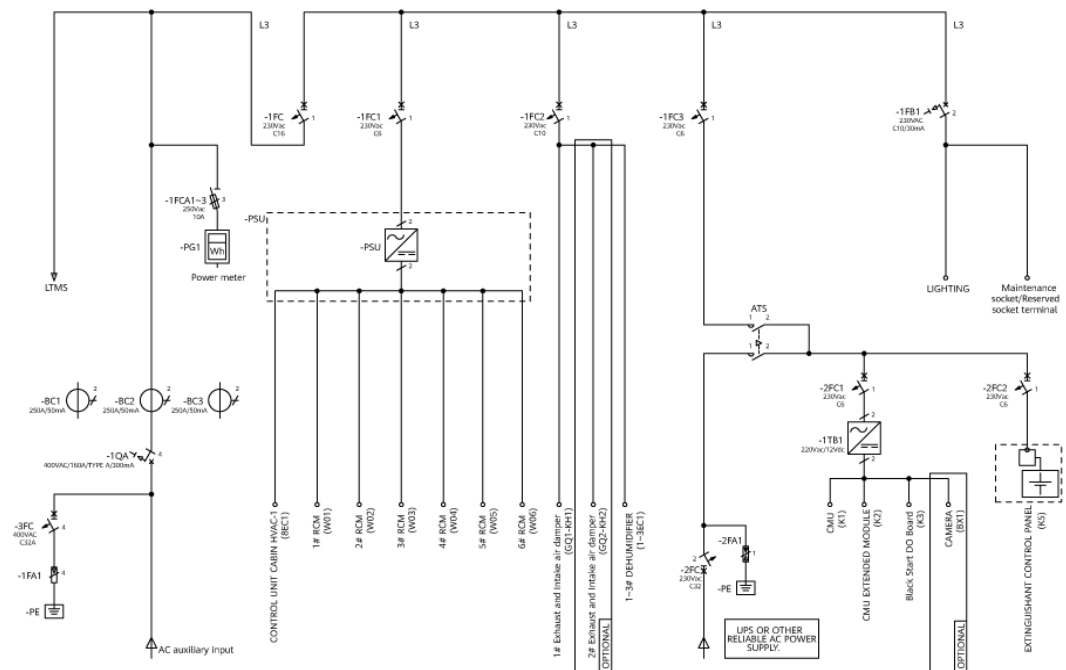


Figure 2-30 Circuit diagram of the AC auxiliary power loop



2.6 Typical Application Scenarios

For details about the networking architecture, power-on, and commissioning in the on-grid scenario, see [LUNA2000-4472 Series Utility-Scale Energy Storage On-Grid Solution User Manual](#).

3 Transportation and Storage

3.1 Transportation Requirements

General Requirements

- Be cautious to prevent injury when moving heavy objects.



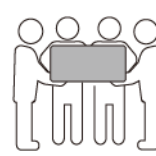
< 18 kg
(< 40 lbs)



18–32 kg
(40–70 lbs)



32–55 kg
(70–121 lbs)



55–68 kg
(121–150 lbs)



> 68 kg
(> 150 lbs)

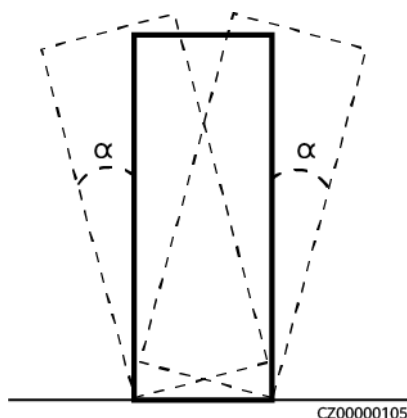
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- If multiple persons need to move a heavy object together, determine the manpower and work division with consideration of height and other conditions to ensure that the weight is equally distributed.
- If two persons or more move a heavy object together, ensure that the object is lifted and landed simultaneously and moved at a uniform pace under the supervision of one person.
- Wear personal protective gears such as protective gloves and shoes when manually moving the equipment.
- To move an object by hand, approach to the object, squat down, and then lift the object gently and stably by the force of the legs instead of your back. Do not lift it suddenly or turn your body around.
- Move or lift the equipment by holding its handles or lower edges. Do not hold the handles of modules that are installed in the equipment.
- Do not quickly lift a heavy object above your waist. Place the object on a workbench that is half-waist high or any other appropriate place, adjust the positions of your palms, and then lift it.
- Move a heavy object stably with balanced force at an even and low speed. Put down the object stably and slowly to prevent any collision or drop from scratching the surface of the equipment or damaging the components and cables.

- When moving a heavy object, be aware of the workbench, slope, staircase, and slippery places. When moving a heavy object through a door, ensure that the door is wide enough to move the object and avoid bumping or injury.
- When transferring a heavy object, move your feet instead of turning your waist around. When lifting and transferring a heavy object, ensure that your feet point to the target direction of movement.
- When transporting the equipment using a pallet truck or forklift, ensure that the tynes are properly positioned so that the equipment does not topple. Before moving the equipment, secure it to the pallet truck or forklift using ropes. When moving the equipment, assign dedicated personnel to take care of it.
- When moving and transporting the air conditioner or LTMS, keep it upright. Do not place it horizontally or upside down.
- Choose sea or roads in good conditions for transportation. Do not transport the equipment by railway or air.
- Handle the ESS with care during loading, unloading, and transportation, and ensure that moisture-proof measures are in place. The product specifications upon delivery may be affected subsequently by the environment conditions, such as temperature, transportation, and storage.

ESS Storage Requirements

- Transportation and warehousing service providers must have the qualifications required by local laws, regulations, and standards for dangerous goods operations.
- Comply with the latest international and national rules on the transportation and storage of dangerous goods, including but not limited to the *International Maritime Dangerous Goods Code (IMDG Code)*, *Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)*, and China's transportation industry standards (JT/T 617) *Regulations concerning road transportation of dangerous goods*, as well as the requirements of the transportation regulatory authorities in the countries of departure, route, and destination.
- Before transportation, ensure that the ESS container is intact, the cabin doors are closed and locked, no foreign matter protrudes from the container, and there is no smell of smoke or burning. Otherwise, do not transport the ESS.
- Before transportation, make a compliant and accurate declaration. Ensure that there is no abnormal odor, leakage, smoke, or fire. Otherwise, do not transport the ESS.
- During hoisting, ensure that the angle between the rope and the container top surface is greater than 60°.
- The weight of an ESS is about 42 t. The transportation and hoisting equipment must meet the load-bearing requirements.
- Stacking requirements during storage at ports and transportation on ships: A maximum of five layers of ESSs shall be permitted to be stacked.
- The tilt angle of the ESS shall meet the requirements shown in the figure: $\alpha \leq 5^\circ$.



- During land transportation, the speed and road conditions must be monitored throughout the entire transportation process. The land transportation distance must be less than or equal to 6400 km.
- The vehicle must be equipped with shock absorption devices and completely secured to the four corner fittings of the container.
- Follow the speed limits in the following table, on speed limit signs, or as required in specific scenarios, whichever is the smallest.

Road Surface	Basic Speed Limit	Driving Requirement
Paved road with good conditions (including controlled-access highways and national highways)	≤ 80 km/h	1. Follow the speed limits specified on the speed limit signs (for example, the speed limit is 40 km/h at a ramp). 2. In specific scenarios: The speed must be reduced to less than 60 km/h in the case of road conditions such as tactile paving surfaces and slightly uneven roads.
Common paved road	≤ 60 km/h	1. Follow the speed limits specified on the speed limit signs (for example, the speed limit is 30 km/h at a village or school). 2. In specific scenarios: The speed must be reduced to less than 20 km/h in the case of road conditions such as roads with obvious potholes and obviously uneven roads.
Non-paved hardened road	≤ 20 km/h	1. Generally, no speed limit is available. 2. In specific scenarios: The speed must be reduced to less than 5 km/h in the case of road conditions such as roads with obvious potholes, obviously uneven roads, and partially wet roads.

Road Surface	Basic Speed Limit	Driving Requirement
Road with speed bumps, railway tracks, etc.	≤ 5 km/h	1. In the case of road conditions such as speed bumps and railway tracks, the speed must be reduced to less than 5 km/h. 2. Do not drive on roads with conditions such as severe water accumulation, severe potholes, overall road subsidence, and insufficient load-bearing capacity of the roadbed. 3. After those prohibited roads are repaired, you can drive on them with speed limits that match the road conditions after the repair.

 NOTE

Considering the impact of rainfall, turning radius, and slope, it is recommended that the speed be limited to less than 5 km/h when the turning radius is about 40 m. When the turning radius is about 100 m, it is recommended that the vehicle run at a speed of 15% of the road speed limit or 10–15 km/h. The speed limit depends on actual conditions.

Battery Transportation Requirements

 DANGER

Load or unload batteries with caution. Otherwise, the batteries may be short-circuited or damaged (such as leakage and crack), catch fire, or explode.

 WARNING

Do not move a battery by holding its terminals, bolts, or cables. Otherwise, the battery may be damaged.

Keep batteries in the correct direction during transportation. They must not be placed upside down or tilted, and must be protected against falling down, mechanical impact, rains, snows, and falling into water during transportation.

- According to the UN *Recommendations on the Transport of Dangerous Goods: Model Regulations* (also referred to as TDG or UN Orange Book), batteries belong to class 9 dangerous goods and shall pass the related tests required in Part III Subsection 38.3 of the UN *Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria*.
- Transportation and storage service providers must have the qualifications for dangerous goods operations required by local laws, regulations, and

standards. Rigid box trucks shall be used for transportation and pickup trucks are prohibited.

- Comply with the latest international and national rules on the transportation and storage of dangerous goods, including but not limited to the *International Maritime Dangerous Goods Code (IMDG Code)*, *Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)*, and China's transportation industry standards (JT/T 617) *Regulations concerning road transportation of dangerous goods*, as well as the requirements of the transportation regulatory authorities in the countries of departure, route, and destination.
- Before transportation, make a compliant and accurate declaration. Ensure that the battery packaging, labels, and markings are intact and there is no abnormal smell, leakage, smoke, or fire. Otherwise, the batteries must not be transported.
- The packing case must be solid and strong. Handle the packages with care during loading, transportation, and unloading. Do not place the packages on one side or upside down. Bind the packages securely to avoid displacement. Ensure that the dangerous goods labels are visible.
- Exercise caution when moving batteries to prevent bumping and ensure personal safety.
- Unless otherwise specified, dangerous goods must not be mixed with goods containing food, medicine, animal feed, or their additives in the same vehicle or container.
- If the local laws, regulations, and standards allow the mixed transportation of specified different dangerous goods and that of dangerous goods and common goods, the dangerous goods shall be isolated according to the local laws, regulations, and standards. If there is no specific local requirement, refer to the following requirements for isolation when dangerous goods and common goods are in the same vehicle or container:
 - Use a spacer that is as high as the packages.
 - Keep a distance of at least 0.8 m around.
- Before transporting a faulty battery (with scorch, leakage, bulge, or water intrusion), insulate its positive and negative terminals, pack it, and place it in an insulated explosion-proof box as soon as possible. Record information such as the site name, address, time, and fault symptom on the box.
- When transporting faulty batteries, avoid approaching flammable material storage areas, residential areas, or other densely populated places, such as mass transit facilities or elevators.

3.2 Storage Requirements

General Requirements

- Proof that the product is stored according to the requirements must be available, such as temperature and humidity log data, storage environment photos, and inspection reports.
- The storage environment must be clean and dry. The product must be protected against water.

- The air must not contain corrosive or flammable gases.
- Do not tilt the product or place it upside down.
- If equipment except battery packs has been stored for more than two years, it must be checked and tested by professionals before use.

ESS Storage Requirements

- Stacking is prohibited during storage (except for temporary storage at ports).
- The ground for (long-term or temporary) storage is level, and the height tolerance of the ground in contact with the container is less than 5 mm.
- The container doors are closed tightly.
- Storage temperature: -40°C to $+60^{\circ}\text{C}$; relative humidity: 5%–95% RH
- For long-term storage (more than six months after delivery), replace the desiccants with those of the same specifications and amount (Montmorillonite desiccant, 500 g/bag).
- The main power loop of the ESS must be disconnected during onsite storage. It is recommended that the auxiliary power loop be powered on to ensure that the monitoring system works properly.

Battery Storage Requirements



WARNING

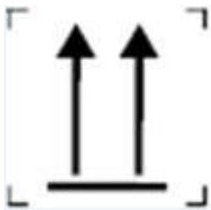
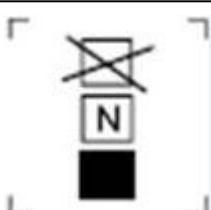
- Ensure that batteries are stored in a dry, clean, and ventilated indoor environment that is free from sources of strong infrared or other radiations, organic solvents, corrosive gases, and conductive metal dust. Do not expose batteries to direct sunlight or rain and keep them far away from sources of heat and ignition.
- If a battery is faulty (with scorch, leakage, bulge, or water intrusion), move it to a dangerous goods warehouse for separate storage. The distance between the battery and any combustible materials must be at least 3 m. The battery must be scrapped as soon as possible.
- Place batteries correctly according to the signs on the packing case during storage. Do not place batteries upside down, lay them on one side, or tilt them. Stack batteries in accordance with the stacking requirements on the packing cases.
- Store batteries separately. Do not store batteries together with other devices. A maximum of two layers of batteries with packaging shall be permitted to be stacked. Batteries without packaging must not be stacked. The site must be equipped with qualified fire fighting facilities, such as fire sand and fire extinguishers.
- After batteries are powered off, static power consumption and self-discharge loss may occur in internal modules, which may cause battery damage due to overdischarge. Do not store batteries in low SOC and charge batteries in a timely manner. Permanent battery faults caused by delayed charge are not covered by the warranty. Storing the batteries in low SOC occurs in scenarios including but not limited to the following:
 - The power cables or signal cables are not connected.
 - The batteries cannot be charged due to a system fault after discharge.
 - The batteries cannot be charged due to incorrect configurations in the system.
 - The batteries cannot be charged due to long-term mains failure.
 - The batteries cannot be charged because the switch of the RCM, PCS, or main loop component is off.



CAUTION

It is recommended that batteries be used soon after being deployed onsite. Batteries that have been stored for an extended period shall be charged periodically. Otherwise, they may be damaged.

-
- Packaging label description

Label	Description
	This way up: The package shall be vertically oriented during transport and storage.
	Fragile: The package contains fragile objects and shall be handled with care.
	Keep dry: The package shall be kept away from rain.
	Stacking limit by number: The packages shall not be vertically stacked beyond the specified number. The actual label may vary.

- The storage environment requirements are as follows:
 - Ambient temperature: -40°C to $+60^{\circ}\text{C}$ (0°C to $+30^{\circ}\text{C}$ are recommended. If batteries are stored at a temperature higher than $+30^{\circ}\text{C}$ for extended periods, the battery performance and service life may be deteriorated.)
 - Relative humidity: 5%–95% RH (recommended: about 20%–70% RH)
 - Dry, clean, and well-ventilated
 - Away from corrosive organic solvents and gases
 - Away from direct sunlight
 - At least 2 m away from heat sources
- The batteries in storage must be disconnected from external devices. The indicators (if any) on the batteries must be off.
- 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 (recommended format: YYYY-MM-DD HH:MM) and the next charge time (Next charge time = Latest charge time + Charge interval) on the label.
- The following table lists the maximum charge intervals for batteries delivered separately. Charge the batteries promptly and calibrate the SOC to at least 50%. Otherwise, the battery performance and service life may be deteriorated.

Storage Temperature (T)	Maximum Charge Interval ^a
$-40^{\circ}\text{C} < T \leq +30^{\circ}\text{C}$	15 months
$30^{\circ}\text{C} < T \leq 40^{\circ}\text{C}$	11 months
$40^{\circ}\text{C} < T < 60^{\circ}\text{C}$	7 months
Note a: The interval starts from the latest charge time labeled on the battery package.	

- The following table lists the maximum total storage and transportation time for batteries delivered with the ESS. Charge the batteries promptly and calibrate the SOC to at least 50%. Otherwise, the battery performance and service life may be deteriorated.

Storage Temperature (T)	Maximum Total Storage and Transportation Time ^a
$-40^{\circ}\text{C} < T \leq +30^{\circ}\text{C}$	11 months
$30^{\circ}\text{C} < T \leq 40^{\circ}\text{C}$	7 months
$40^{\circ}\text{C} < T < 60^{\circ}\text{C}$	3 months
Note a: The total time starts from the time when the product is shipped.	

- Do not unpack batteries. If charging is necessary, they must be charged by professionals as required and then returned to their original packaging after charging.
- The warehouse keeper shall collect battery storage information every month and periodically report the battery inventory information. The batteries in long-term storage shall be charged in a timely manner.

⚠ CAUTION

- Only trained and qualified personnel are allowed to charge batteries. Wear insulated gloves and use dedicated insulated tools during the operation.
 - Observe onsite during charge and handle any exceptions in a timely manner.
 - If a battery experiences an abnormality such as bulging or smoking during charge, stop charging immediately and dispose of it.
-
- When stored in low SOC, the batteries must be charged within the maximum interval corresponding to the SOC when the batteries are powered off. If the batteries are not charged within the specified interval, they may be damaged due to overdischarge.

Power-Off SOC Before Storage	Maximum Charge Interval
SOC $\geq$ 50%	Refer to the charge intervals for batteries delivered separately.
5% $\leq$ SOC < 50%	20 days
SOC < 5%	48 hours

- For details about how to charge batteries, see [3.4 Battery Overdue Storage and Charging](#).
- If batteries have been stored for longer than allowed, promptly report the event to the person in charge.
- Ensure that batteries are delivered based on the "first in, first out" rule.
- Handle batteries with caution to avoid damage.

Storage Requirements for Fire Suppression Equipment

- Check the backup battery of the extinguishant control panel in the warehouse once a month. If the voltage of a lead-acid battery is lower than the standard voltage 11.5 V, charge the battery immediately.
- At room temperature (about 25°C), charge the backup battery of the extinguishant control panel at least once every six months. The charge interval is halved for every 10°C increase in temperature.
- When the fire suppression equipment is stored as spare parts, the ambient temperature shall range from 0°C to 50°C and the humidity shall be less than or equal to 95% RH.

RCM Storage Requirements

If a spare RCM will not be used immediately, store it according to the following requirements:

- Do not remove the packaging. Check the packaging regularly (recommended: once every three months). Replace any packing materials that become damaged during storage. If the RCM is unpacked but will not be used immediately, put it back to the original packaging with the desiccant, and seal with tape.
- Ensure that the RCM is stored in a dry, clean, and ventilated indoor environment that is free from sources of strong infrared or other radiations, organic solvents, corrosive gases, and conductive metal dust. Do not expose the RCM to direct sunlight or rain and keep it far away from sources of heat and ignition.
- Storage temperature: -40°C to +60°C; relative humidity: 5%–95% RH
- Stack the RCMs with caution to prevent them from falling over, resulting in personal injury or equipment damage.

3.3 Acceptance Inspection on Arrival

After the goods are delivered to the site, the carrier and customer shall perform acceptance on all ESSs one by one according to the following requirements, and

keep the text and pictures of the acceptance records. If the acceptance criteria are not met, contact the Company's engineers.

No.	Check Item	Acceptance Criteria
1	Check the protective cover and cleanness of the container.	1. It is acceptable if the protective cover is damaged or completely removed. 2. When the protective cover is damaged or removed, check whether the container is stained. If yes, clean the container promptly and then accept it. 3. Cleanable stains with a size of $\leq 1 \text{ m}^2$ and uncleanable stains, such as oil stains with a size of $\leq 0.01 \text{ m}^2$ are acceptable. 4. Water stains on the container surface are acceptable.
2	The customs lead seals on the container doors are intact.	The seals of the container doors are intact (except for customs inspection).
3	Check whether the logo, nameplate, and container number labels are intact.	1. The logo, nameplate, and container number are clear. 2. If there are obvious stains, it is acceptable after cleaning.
4	Check for any coolant leakage around the LTMS.	No leakage occurs.
5	Check whether the container is dented or deformed.	1. No dent or deformation exists. 2. Dents on the bottom surface are acceptable, and dents on the top are acceptable if no water accumulates. 3. If the distance between dents on the front, rear, left, and right of the container is $> 50 \text{ mm}$, the dent depth is $\leq 3 \text{ mm}$, the diameter is $\leq 12 \text{ mm}$, and the number of dents on a single surface is ≤ 15, it is acceptable after onsite repair.
6	Check whether there are scratches or paint flake-off on the container exterior.	1. No scratch or paint flake-off exists. 2. If there are deep scratches, paint flake-off, or rust on scratched areas, it is acceptable after onsite repair. If the gloss is different after repair, it is acceptable.

No.	Check Item	Acceptance Criteria
7	Check whether the corner fittings are rusty or the primer paint is exposed.	Partial deformation, scratches, and paint flake-off of corner fittings caused by normal forklifting or hoisting operations are acceptable. If the primer paint of corner fittings is exposed or the corner fittings are rusted on scratched areas, it is acceptable after repair.

3.4 Battery Overdue Storage and Charging

Material Delivery Check

There must be a battery charge label on the packing case. The charge label must specify the latest charge time and the next charge time.

Conditions for Determining Overdue Storage

- Do not store batteries for extended periods.
- The following table lists the maximum charge intervals for batteries delivered separately. Charge the batteries promptly and calibrate the SOC to at least 50%. Otherwise, the battery performance and service life may be deteriorated.

Storage Temperature (T)	Maximum Charge Interval ^a
$-40^{\circ}\text{C} < T \leq +30^{\circ}\text{C}$	15 months
$30^{\circ}\text{C} < T \leq 40^{\circ}\text{C}$	11 months
$40^{\circ}\text{C} < T < 60^{\circ}\text{C}$	7 months
Note a: The interval starts from the latest charge time labeled on the battery package.	

- The following table lists the maximum total storage and transportation time for batteries delivered with the ESS. Charge the batteries promptly and calibrate the SOC to at least 50%. Otherwise, the battery performance and service life may be deteriorated.

Storage Temperature (T)	Maximum Total Storage and Transportation Time ^a
$-40^{\circ}\text{C} < T \leq +30^{\circ}\text{C}$	11 months
$30^{\circ}\text{C} < T \leq 40^{\circ}\text{C}$	7 months
$40^{\circ}\text{C} < T < 60^{\circ}\text{C}$	3 months
Note a: The total time starts from the time when the product is shipped.	

- AC mains input voltage requirements for charging:
 - 220 V (three-phase 260–530 V AC or single-phase 176–300 V AC)
 - 110 V (three-phase 130–265 V AC or single-phase 90–175 V AC)
 - AC input power cables used for charging in the warehouse must have a through-current capacity greater than 40 A.
- If batteries have been stored for longer than allowed, promptly report the event to the person in charge.
- Dispose of deformed, damaged, or leaking batteries directly irrespective of how long they have been stored.
- 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 (recommended format: YYYY-MM-DD HH:MM) and the next charge time (Next charge time = Latest charge time + Charge interval) on the label.
- Batteries can be charged for a maximum of three times during storage. Dispose of batteries if the maximum charge times are exceeded.
- You can obtain the battery production completion time by querying the delivery record based on the battery pack serial number (SN) or consulting the Company's service engineers.

Preparing Charging Devices

- Multimeter
- Clamp meter
- Insulated torque socket wrench
- Charger
- Battery Control Unit (BCU)
- Cable package

Inspection Before Charge

1. Before charging a battery, you need to check its appearance. Charge the qualified battery or dispose of the unqualified one.
2. If any of the following symptoms occurs, the battery is unqualified.
 - Deformation
 - Shell damage
 - Leakage
3. Check that the accessories are complete based on the packing list delivered with the charger.

Full Charge Strategy

The charging ambient temperature ranges from 15°C to 40°C.

Charge and Discharge Current (Unit: Ampere)	Charging Duration (Excluding Equalization)
15	19 hours (fully discharge the battery and then charge the battery to 50% SOC)
40 ^[1]	8 hours (fully discharge the battery and then charge the battery to 50% SOC)
Note 1: In three-phase input mode, use the 380 V AC/40 A power cable delivered with the charger.	

Charging Procedure

NOTE

- Prepare battery packs that are qualified for charging.
- You need to purchase the communications cables and positive and negative DC input cables used with the charger from the Company.
- You need to purchase the BCU and its communications cables from the Company.

- Step 1** Connect the communications cable from the communications port of the charger to the FE communications port of the BCU.
- Step 2** Connect the communications cable from the CON communications port 1 of the BCU to the communications port of the battery pack.
- Step 3** Connect the positive and negative DC input power cables from the charger power ports to the battery pack power ports (general power ports).
- Step 4** Connect the AC INPUT port on the charger to the utility power source using the power cable delivered with the charger.
- Step 5** Turn on the AC circuit breaker of the charger.
- Step 6** Turn on the DC circuit breaker of the charger.
- Step 7** Operate the charger according to its manual.
- Step 8** After the discharge and charge are complete, wait until the fan in the charger keeps running for about 5 minutes to dissipate the residual heat, turn off the AC and DC circuit breakers, and remove the cables.

----End

4 Site Requirements

4.1 Site Selection Requirements

NOTICE

Refer to the GB 51048 *Design code for electrochemical energy storage station*, NFPA 855 *Standard for the Installation of Stationary Energy Storage Systems*, and local laws and regulations.

CAUTION

The ESS is Class A equipment and must meet the following installation requirements:

- It is not intended for use in a residential environment, must not be directly connected to a residential low-voltage overhead power grid, and may cause radio interference, in which case the user may be required to take additional mitigation measures against electromagnetic interference.
 - Considering the electromagnetic compatibility (EMC) requirements (CISPR 11/EN 55011), it shall be physically separated from residential environments or radio receivers by distance greater than 30 m, and can be equipped with additional filtering if necessary.
-

The site selection requirements for the ESS are as follows:

- The ESS applies only to outdoor scenarios and must not be deployed indoors.
- The horizontal level of the installation site shall be above the highest water level of that area in history and at least 300 mm above the ground. The site must not be located in a low-lying land.
- No obstacle shall be above the ESS. For example, the ESS must not be installed under a parking shed and PV modules must not be installed on the top of the ESS.

- For safety purposes, keep safety distances between the ESS and surrounding buildings and facilities.
 - The distance between the ESS and residential buildings must be greater than or equal to 12 m, and the distance between the ESS and densely populated buildings such as schools and hospitals must be greater than 30.5 m.
 - The distance between the ESS and production buildings in commercial and industrial scenarios must be greater than or equal to 12 m. If the distance does not meet the requirement, fire walls shall be installed between the ESS and production buildings. The fire walls shall have a 3-hour or higher fire resistance rating and shall extend 1.5 m above and 1.5 m beyond the physical boundary of the ESS. In addition, the clearance requirements for equipment transportation, installation, and maintenance shall be considered.
- There must be no vegetation, especially flammable plants within 3 m of the ESS or the site to protect the ESS from possible fires.
- It is recommended that outdoor open electrochemical energy storage plants be equipped with fences and walls. The external walls of an electrochemical energy storage plant deployed in a power plant or power transformation and distribution station shall be permitted to serve as the enclosure and isolation walls.
- The safety distances between the ESS and buildings shall comply with local fire protection regulations or standards.
- The ESS and the site must be in an environment free from explosion risks.
- Transportation to the site shall be convenient and fire suppression facilities shall be reliable.

 NOTE

- When installing, commissioning, and operating the ESS, ensure that at least two gas fire extinguishers are provided near each unit to ensure fire safety.
- The distance between the exhaust device of an ESS and the heating and ventilation vents, air intake vents of air conditioners, windows, doors, unloading platforms, and fire sources of other buildings or facilities must be greater than 4.6 m.
- Reserve sockets for the water fire suppression system at the ESS site.
- Outdoor fire hydrants shall be installed around the plant. The distance between fire hydrants shall be less than or equal to 60 m. The number of outdoor fire hydrants shall be calculated based on the flow rate and protection radius of fire hydrants. The maximum protection radius shall be less than or equal to 150 m, and the flow rate shall be greater than or equal to 15 L/s.
- The site area must meet the requirements and there shall be space for capacity expansion.
- The site shall be in a well-ventilated place.
- The ESS shall not be installed in salt-affected or polluted areas because this will cause corrosion. The ESS shall be used in the following or better environments:
 - Outdoor environment more than 2000 m away from the coast. When the site is 50–2000 m away from the coast, select a model based on the site corrosion level. Do not use the ESS in an area less than 50 m away from the coast.

- More than 1500–3000 m away from heavy pollution sources such as smelteries, coal mines, and thermal power plants
- More than 1000–2000 m away from medium pollution sources such as chemical, rubber, and electroplating industries
- More than 500–1000 m away from light pollution sources such as packing houses, tanneries, boiler rooms, slaughterhouses, landfill sites, and sewage treatment plants

 NOTE

You are advised to select another site if the safety distance for a site cannot meet the requirements of relevant national standards.

Do not select the sites that are not recommended by industry standards and regulations, including but not limited to the following areas:

- Areas with sources of strong vibration, loud noises, and strong electromagnetic interference
- Areas with dust, oil fumes, harmful gases, corrosive gases, etc.
- Areas with corrosive, flammable, and explosive materials
- Areas with existing underground facilities
- Areas with adverse geological conditions such as rubbery soil and soft soil layer, or prone to waterlogging and land subsidence
- Under a reservoir, water landscape, and water room

 NOTE

- If areas prone to waterlogging cannot be avoided, install water blocking and drainage facilities or raise the ground.
- Cable trenches shall not be used for drainage. Fire retardant sealing shall be implemented at cable holes (such as holes through partition walls and floors).
- Areas prone to earthquakes and with seismic fortification intensity higher than 9
- Areas prone to debris flow, landslide, quicksand, karst caves, and other direct hazards
- Areas within the mining land subsidence (dislocation) zone
- Areas within the scope of blasting hazard
- Areas prone to flood due to a dam or levee failure
- Protection areas for important water supply sources
- Protection areas for historic relics
- Populated areas, high-rise buildings, and underground buildings
- Intersections and busy roads of urban main roads

Requirements for flood and waterlogging prevention in site selection:

- The site design elevation of a large-scale electrochemical energy storage system (power ≥ 100 MW) shall be higher than the flood level with a probability of 1% or the historical highest waterlogging level.
- The site design elevation of a medium- or small-scale electrochemical energy storage system (power < 100 MW) shall be higher than the flood level with a probability of 2% or the historical highest waterlogging level.

- If the site design elevation cannot meet the preceding requirements, change the site location or take different flood and waterlogging prevention measures based on the site requirements.
- For energy storage plants prone to wind and waves from rivers, lakes, and seas, the elevation of flood prevention facilities shall consider the wind and wave height with a probability of 2% and an additional safety height of 0.5 m.
- When a large amount of catchment water flows into or passes through the site, it is recommended that side ditches or drainage ditches be built to drain water from the ground in an organized manner.

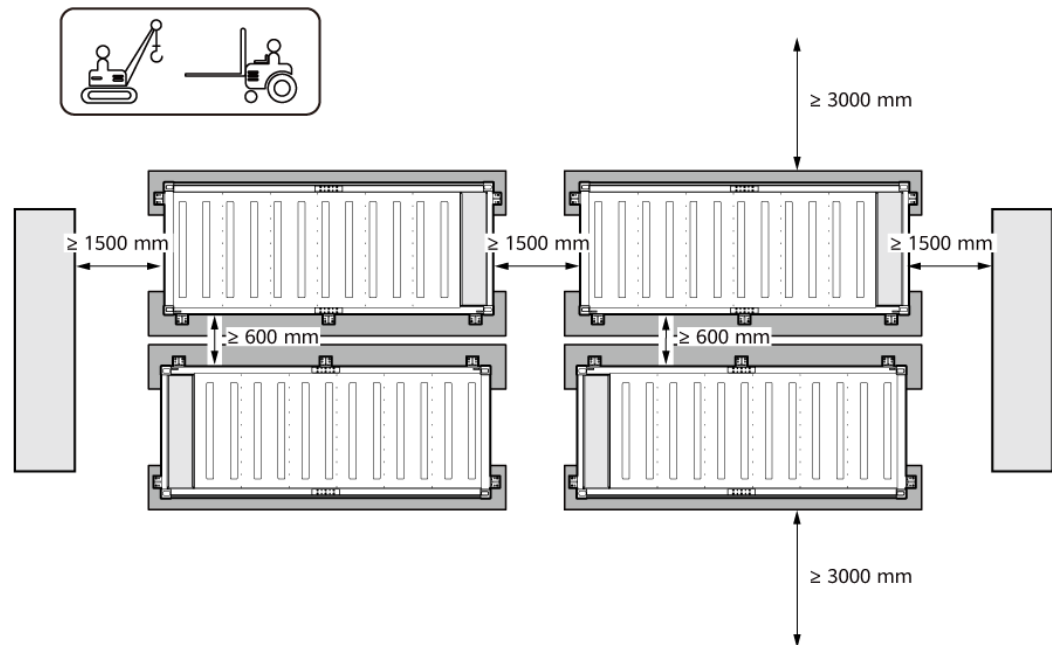
Security fencing:

It is recommended that physical walls or fences be used for isolation and protection in the energy storage equipment area. The fences shall be equipped with a door lock and the recommended fence height is greater than 2.2 m. Fire walls shall be permitted to be substituted for part or all of the fences, depending on the actual design plans.

4.2 Clearance and Ground Requirements

Reserve sufficient clearances for using a forklift and crane during product installation and O&M. For details, see [Figure 4-1](#), [Figure 4-2](#), and [Figure 4-3](#).

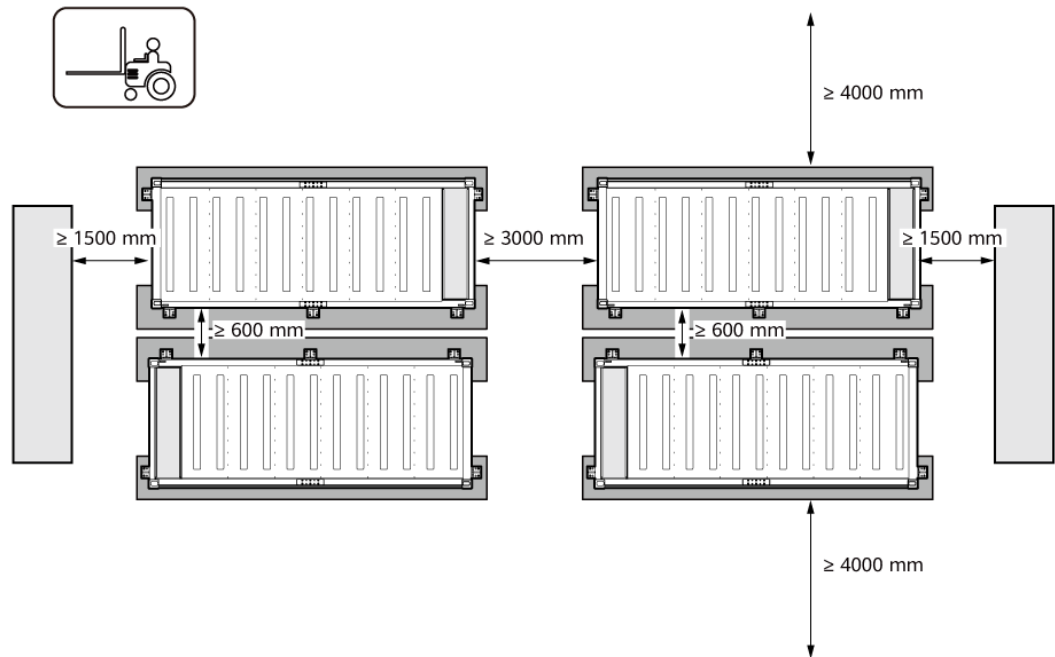
Figure 4-1 Scenario of using a forklift and crane



 NOTE

- Use a forklift to install and maintain a battery pack.
- Use a crane to install and maintain an LTMS.

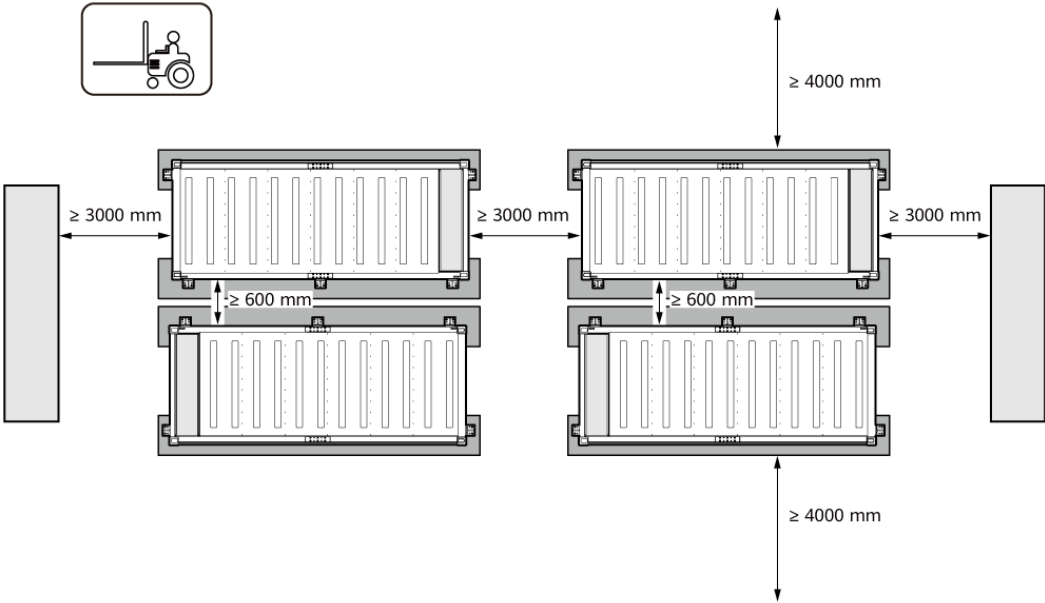
Figure 4-2 Scenario 1 of using a forklift only (the height of PCSs or obstacles around the ESS ≤ 1.8 m)



 NOTE

When using a forklift to install and maintain the LTMS on the PCS side, you need to lift the LTMS to a height greater than 1.8 m before moving the LTMS.

Figure 4-3 Scenario 2 of using a forklift only (the height of PCSs or obstacles around the ESS > 1.8 m)



NOTE

When using a forklift to install and maintain the LTMS on the PCS side, you can directly move the LTMS without lifting it.

Table 4-1 Clearance and ground requirements

Scenario	Tool	Ground Requirement	Clearance
Hardened ground	Crane and common forklift	- Levelness: 50 mm; load-bearing capacity ≥ 25 MPa (≥ C25 concrete) - The equipment is hoisted into the site by a crane.	Reserve at least 3000 mm clearance on the long side of the ESS and at least 1500 mm clearance on the control unit cabin side.

Scenario	Tool	Ground Requirement	Clearance
Hardened ground	Common forklift	Levelness: 50 mm; load-bearing capacity ≥ 25 MPa ($\geq$ C25 concrete)	- If the surrounding PCSs or obstacles are not higher than 1.8 m: Reserve at least 4000 mm clearance on the long side of the ESS and at least 1500 mm clearance on the control unit cabin side. - If the surrounding PCSs or obstacles are higher than 1.8 m: Reserve at least 4000 mm clearance on the long side of the ESS and at least 3000 mm clearance on the control unit cabin side.
Non-hardened ground	Crane and rough-terrain forklift	- Levelness: 50 mm; load-bearing capacity ≥ 100 kPa. The ground must be tamped soil ground, tamped coarse dirt ground, or gravel ground, and steel plates must be laid on the ground in front of the container. - The equipment is hoisted into the site by a crane.	Reserve at least 3000 mm clearance on the long side of the ESS and at least 1500 mm clearance on the control unit cabin side.
Non-hardened ground	Rough-terrain forklift	Levelness: 50 mm; load-bearing capacity ≥ 100 kPa. The ground must be tamped soil ground, tamped coarse dirt ground, or gravel ground, and steel plates must be laid on the ground in front of the container.	- If the surrounding PCSs or obstacles are not higher than 1.8 m: Reserve at least 4000 mm clearance on the long side of the ESS and at least 1500 mm clearance on the control unit cabin side. - If the surrounding PCSs or obstacles are higher than 1.8 m: Reserve at least 4000 mm clearance on the long side of the ESS and at least 3000 mm clearance on the control unit cabin side.

Scenario	Tool	Ground Requirement	Clearance
Note: • Ensure that there are no obstacles such as cable trenches and steps on the driving path of the forklift and crane. • The preceding clearance requirements are for reference only in terms of installation and O&M. The clearances must also comply with local fire control requirements. • If the preceding safety distance requirements cannot be met, install fire walls between the ESSs. Ensure that the length and height of the fire walls extending above and beyond the physical boundary of the ESS installation meet the requirements in section "Site Selection Requirements".			

4.3 Foundation Requirements

NOTE

The foundation layout design shall meet the space requirements for ESS installation and O&M. The design institute can contact the Company's engineers to obtain the drawings about the foundation.

Before installation, build concrete platforms and trenches on the selected ground. The foundation construction requirements are as follows:

- The dimensions of the foundation shall meet the installation and bearing requirements of the container.
- The foundation must meet the local antiseismic requirements.
- The foundation must be above the highest water level and snow depth of the local area in history and at least 300 mm above the ground.
- It is recommended that the height of the foundation above the horizontal ground be less than or equal to 500 mm to facilitate door opening and closing as well as maintenance. If the height of the foundation exceeds 500 mm, it is recommended that a maintenance platform be added for maintenance using a forklift.
- The levelness error of the contact surface between the foundation and container shall be less than 5 mm. During construction, consider the soil compaction factor to avoid subsidence, and periodically measure the levelness. If the levelness does not meet the requirement due to subsidence, use leveling spacers.
- The resistance of a bond shall be less than or equal to 0.1 ohms.
- The ESS uses bottom cabling. Cables shall be pre-buried under the control unit cabin. Cables must not be suspended above the ground.
- The inner diameter of the protective tube shall be greater than or equal to 1.5 times the outer diameter of the cable (including the protective layer).
- Construct drainage facilities based on the local geological conditions and municipal drainage requirements to ensure that no water will accumulate at

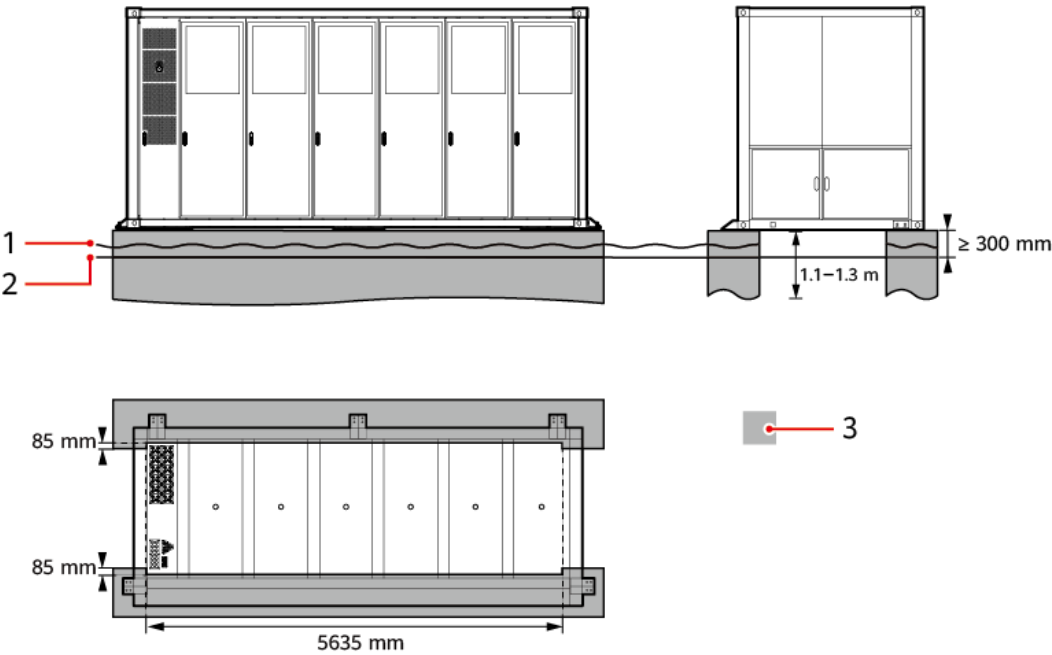
the equipment foundation. The foundation construction must meet the local drainage requirements for the maximum historical rainfall. The drained water must be disposed of in accordance with local laws and regulations.

- After the foundation is excavated, prevent water from entering the foundation. If water enters the foundation, excavate and refill the affected parts.
- Cable trenches (if any) shall not be used for drainage. Fire retardant sealing shall be implemented at cable holes (such as holes through partition walls and floors).

Table 4-2 Checklist

No.	Check Item	Acceptance Criteria
1	Cabling space at the bottom	• If no maintenance space at the bottom is required, it is recommended that the cabling space at the bottom of the container be greater than or equal to 1.1 m. • If maintenance space at the bottom is required, it is recommended that the cabling space at the bottom of the container be greater than or equal to 1.3 m.
2	Cable	• The bending radius of a cable is greater than or equal to 15 times the cable diameter. • The voltage drop of the farthest loop does not exceed 5%. • The sensitivity, voltage level, and thermal stability of the cables meet the local design specifications.

Figure 4-4 Foundation diagram



- (1) Highest water level of the local area in history (2) Ground
- (3) Foundation

5 Installation

5.1 Installation Preparations

5.1.1 Preparing Tools

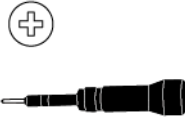
 NOTE

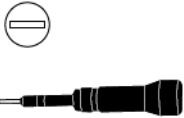
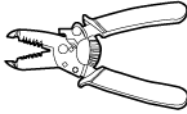
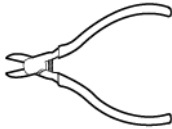
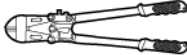
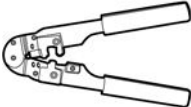
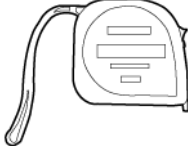
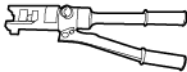
- The tools shown in the figures are for reference only.
- The tool table may not list out some tools required onsite. Onsite installation personnel and the customer need to prepare the tools based on site requirements.

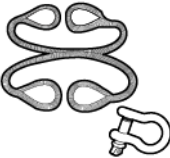
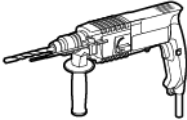
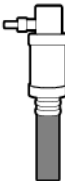
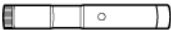
Installation Tools

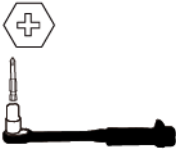
 CAUTION

Tools such as socket wrenches, torque wrenches, and screwdrivers must be insulated tools.

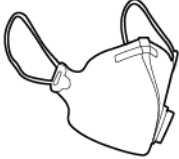
			
Adjustable torque wrench (M8)	Insulated torque socket wrench (including the extension rod > 30 cm) (M6, M8, M10, M12, M16, M20)	Torx insulated torque screwdriver (M6)	Phillips insulated torque screwdriver (M3, M4, M6)

 Flat-head insulated torque screwdriver (M3, M4)	 Wire strippers	 Diagonal pliers	 Utility knife
 Cable cutter	 Wire clippers	 RJ45 crimping tool	 Vacuum cleaner
 Multimeter DC voltage measurement range ≥ 1500 V DC	 Marker	 Steel measuring tape	 Level
 Hydraulic pliers	 Heat shrink tubing	 Heat gun	 Cable tie

 Insulated ladder (height ≥ 3 m)	 Crane Hoisting the ESS: ≥ 42 t Hoisting the LTMS: 5.6–12 t	 Steel wire rope sling and shackle	 Rubber mallet
 Claw hammer	 Hammer drill	 Drill bit ($\Phi 14$ mm, $\Phi 16$ mm, $\Phi 20$ mm, and $\Phi 26$ mm)	 Fire alarm tester
 Jack	 Laser level	 Network tester	 Laser pointer

 Electric forklift Load-bearing capacity: ≥ 3 t Fork length: 1300–1600 mm Fork width: 230–300 mm Fork thickness: 25–80 mm	 Insulated torque socket Phillips screwdriver (M6/M8)	-	-
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Personal Protective Equipment (PPE)

 Insulated gloves	 Protective gloves	 Safety goggles	 Dust mask
 Protective shoes	 Reflective vest	 Safety helmet	 Safety harness
 Medical kit	-	-	-

5.1.2 Pre-installation Check

Site Check

Check the site requirements one by one, and start installation only after all requirements are met. The Company will not be liable for any consequences in the case that the installation environment does not meet the requirements.

NOTICE

Mark the safe zone: Use red caution belts to delimit a safe zone, clean up obstacles in the safe zone, and place construction signs and warning signs in prominent positions.

ESS Check



WARNING

Take protective measures for working at heights during unpacking.

NOTICE

- After placing the equipment in the installation position, unpack it with care to prevent scratches. Keep the equipment stable during unpacking.
- After unpacking, check whether the fastening components and removable components are loose. If they are loose, notify the carrier and manufacturer immediately.

Check Item	Criteria	Precaution
Outer packaging	Check whether the outer packaging is damaged, such as holes, cracks, or other signs of internal damage. If any damage is found, do not unpack the equipment. Contact your vendor as soon as possible.	You are advised to remove the outer packaging within 24 hours before installing the equipment.
Product model	Check the product model. If the product model is incorrect, do not unpack the equipment. Contact your vendor as soon as possible.	None

Check Item	Criteria	Precaution
Equipment appearance	The equipment appearance (including the top) is intact and free from damage, rust, and paint flake-off. The equipment labels are clear. If any exception occurs, check the cause immediately and contact your vendor as soon as possible.	None
Note: Obtain and check the accessories delivered with the product by referring to 5.2.3 Opening the Doors of the ESS .		

5.2 Installing the ESS

5.2.1 Determining the Installation Position of the ESS

Prerequisites

Before installing the ESS, check the height of the foundations to ensure that the height difference between upper surfaces of all foundations does not exceed 5 mm.

NOTICE

The foundation levelness is critical to the ESS installation. Ensure that the foundations meet requirements before installing the ESS.

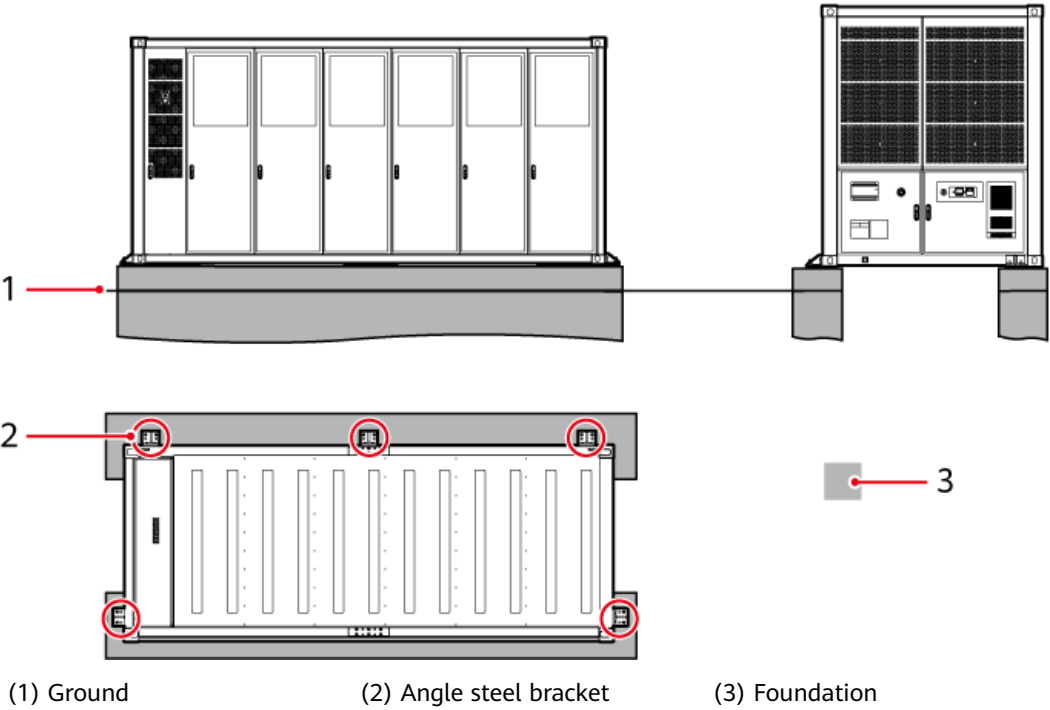
Procedure

- Step 1** Determine the reference points for installing the ESS on the foundations. Mark the reference points using a marker.
- Step 2** On the basis of the reference points, mark the mounting positions for the five angle steel brackets of the ESS using an ink line and a long soft measuring tape.

NOTICE

When marking the positions for angle steel brackets, ensure that the two angle steel brackets on the sides of the ESS are in a line, and the three angle steel brackets on the rear of the ESS are in a line.

Figure 5-1 Positions of angle steel brackets



----End

5.2.2 Hoisting the ESS

 **CAUTION**

Do not hoist the ESS in harsh weather conditions such as lightning, rain, snow, sandstorm, and level 6 or stronger wind.

Hoisting Precautions

Table 5-1 Hoisting precautions

Stage	Precautions
Before hoisting	Container weight ≤ 42 t. Select an appropriate crane based on the required operating radius. Select an appropriate crane based on standards of the crane company, and ask a professional to assess the crane onsite.
	Only trained and qualified personnel are allowed to perform hoisting operations.
	Check that hoisting tools are complete and in good condition.
	The hoisting brackets (shackles) and slings shall be prepared by the customer.

Stage	Precautions
	Ensure that the hoisting tools are secured to a load-bearing object or wall.
	Ensure that the slings are securely connected.
	Ensure that the slings and hoisting brackets (shackles) meet the requirements before hoisting.
	The container installation position is clearly marked on the foundations, and the spacing marks meet the requirements for the distance between the container edges and the foundation edges in the drawings.
	Ensure that all ESS doors are closed and locked.
	It is recommended that the equipment be hoisted from left to right or from right to left.
During hoisting	It is recommended that the ESS be hoisted on sunny days without wind. Ensure that the ambient temperature is higher than -40°C.
	Do not allow any unauthorized person to enter the hoisting areas and do not stand within the operating radius.
	Ensure that the crane is properly located and avoid long-distance hoisting.
	When installing or removing the hoisting equipment, do not drag it on the ESS to prevent scratches.
	Ensure that the ESS is stable and the diagonal gradient of the ESS is less than or equal to 5 degrees.
	Ensure that the angle between two slings is less than or equal to 90°.
	When hoisting the equipment for the first time, you are advised to conduct a trial hoisting. When hoisting the equipment, lift and land it slowly and stably with caution to avoid causing damage to the container or internal equipment.
	Remove the slings after ensuring that the ESS is placed evenly on the foundations.
After hoisting	Immediately check whether the cable outlet module at the bottom of the control unit cabin is blocked by the foundations (standard installation: cables can be routed properly). If yes, hoist the ESS immediately and adjust the installation position.
	Check whether the distance between the mounting holes of the angle steel brackets and the foundation edge meets the requirements specified in the foundation drawings.

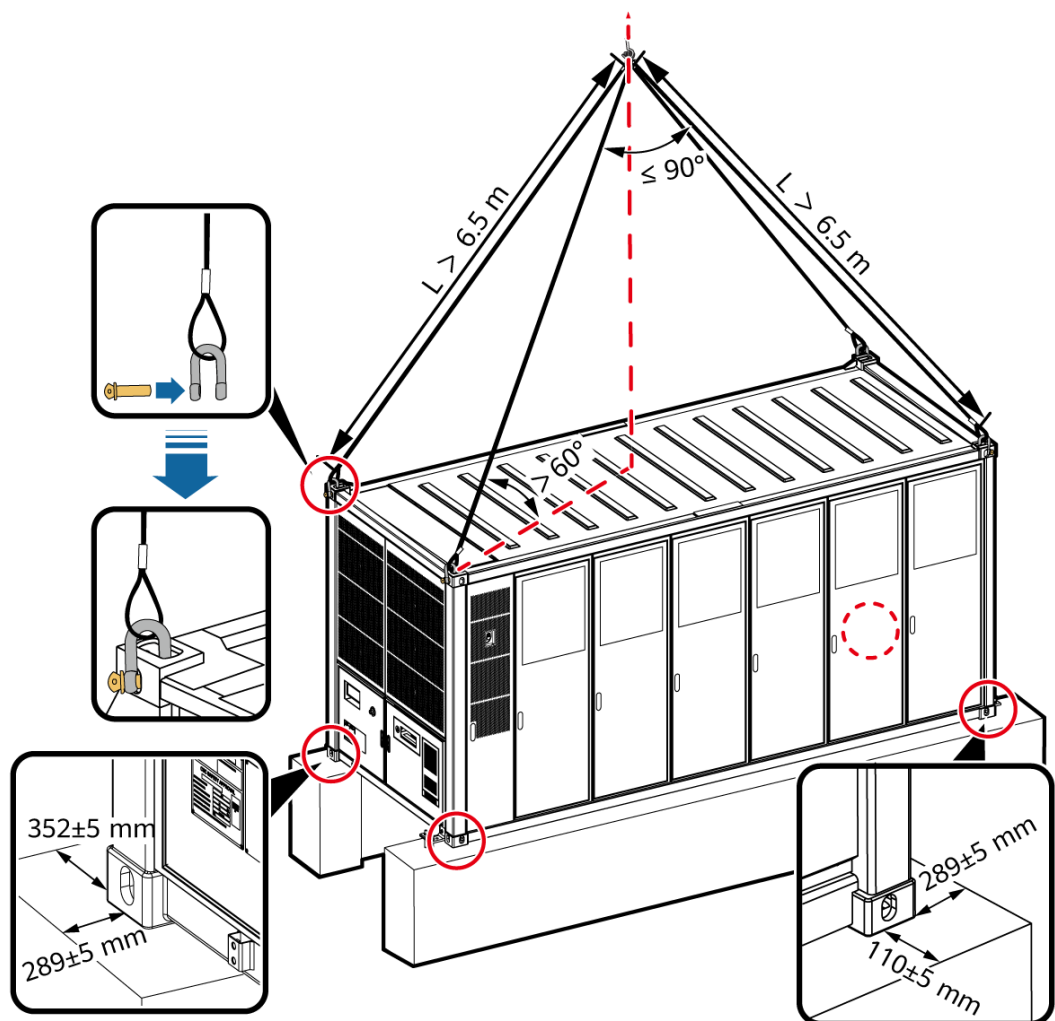
Procedure

Step 1 Connect the slings and hoist the ESS to the foundations.

NOTICE

The following figure shows the required distances between the four corners of the ESS and the foundation edges.

Figure 5-2 Hoisting the ESS



Step 2 Remove the protective cover.

⚠ WARNING

When removing the protective cover, take protective measures for working at heights.

 NOTE

You do not need to remove the protective cover in the case of temporary storage.

----End

5.2.3 Opening the Doors of the ESS

 CAUTION

Do not remove ice or open the door in harsh weather conditions such as lightning, rain, snow, sandstorm, and level 6 or stronger wind.

 NOTE

In the case of freezing weather, remove the ice before opening the door.

Step 1 Open the key box at the rear of the ESS and take out the key. The position of the key box is shown in [Figure 2-6](#).

 NOTE

The keys in the key box is used to open the door of the control unit cabin, the doors of the battery cabins, and the door of the electric control box in the liquid cooling unit cabin.

Step 2 Use the key to open the door of the control unit cabin.

Step 3 Obtain the packing list from the document holder on the left door of the control unit cabin and check the materials.

 NOTE

- If any materials are missing, contact technical support.
- Lock the doors promptly and store the keys properly under the management of dedicated personnel.
- In areas near the sea (< 2 km away from the sea), the frequency and duration for opening cabin doors must be minimized during operations and maintenance.
 - The duration for opening the door of each cabin shall be less than or equal to 2 hours.
 - If the door opening duration will be greater than 10 minutes, power off the ESS before opening the door.

----End

5.2.4 Grounding the ESS Enclosure

Prerequisites

 WARNING

Do not connect devices such as fuses and switches to the PE bus cable.

 CAUTION

The grounding shall comply with the local electrical safety regulations.

- There is one ground point on the left and right sides of the ESS. It is recommended that both ground points be grounded. Ground at least one ground point depending on the actual situation.
- Each ground point has two holes. Select one hole based on site requirements.
- The ESS enclosure can be grounded using PE cables or flat ground bars. This section uses the ground point on the left side of the ESS as an example to describe the two grounding methods. For the position of the ground point on the right side, see [Figure 2-7](#).

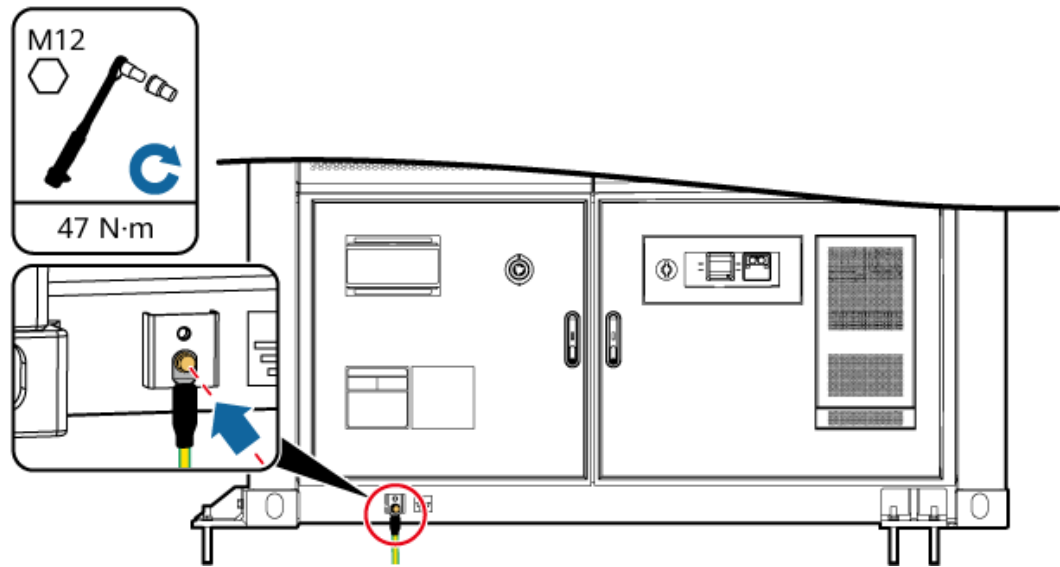
Method 1: Installing PE Cables

Table 5-2 PE cable description (purchased by the customer)

Cable	Type	Conductor Cross-Sectional Area	Outer Diameter	Terminal
PE cable	Single-core outdoor copper/aluminum cable or bare stranded cable	16–95 mm ²	≤ 32 mm	M12 OT/DT terminal
The specifications of the PE cable are subject to this table or calculated according to IEC 60364-5-54.				

- Step 1** Connect PE cables to the ground points of the ESS using M12x30 stainless steel bolt assemblies. The PE cables can be routed through plastic-coated metal hoses based on site requirements.

Figure 5-3 Installing a PE cable



----End

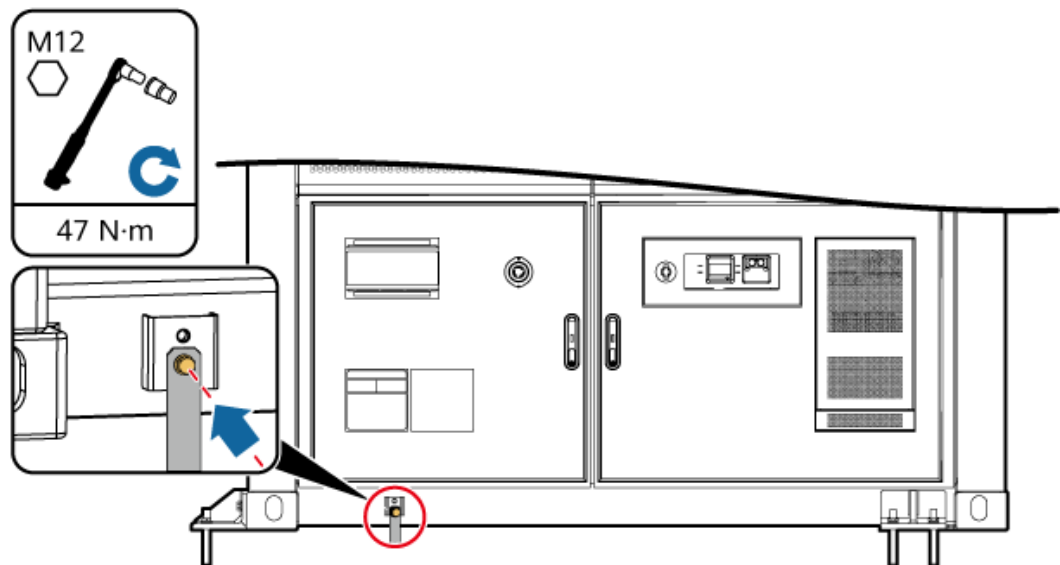
Method 2: Installing Flat Ground Bars

Step 1 Connect flat ground bars to the ESS ground points using M12x30 stainless steel bolt assemblies.

 NOTE

- Use hot-dip zinc-coated flat steel sheets with a cross-sectional area of 40 mm x 4 mm.
- Before installation, remove the tinfoil from the flat ground bars.

Figure 5-4 Installing a flat ground bar



----End

5.2.5 Securing the ESS

Prerequisites

Before securing the ESS, check whether there is a gap between the container and foundations. If yes, level the ESS using leveling spacers delivered with the product.

Procedure

Step 1 Remove the angle steel brackets from the DC copper bar in the control unit cabin.

 NOTE

- You are advised to use a 24# socket wrench to remove the M16 bolts from the angle steel brackets.
- Do not discard the removed M16 bolts because they will be used later to secure the ESS.

Step 2 Secure the ESS.



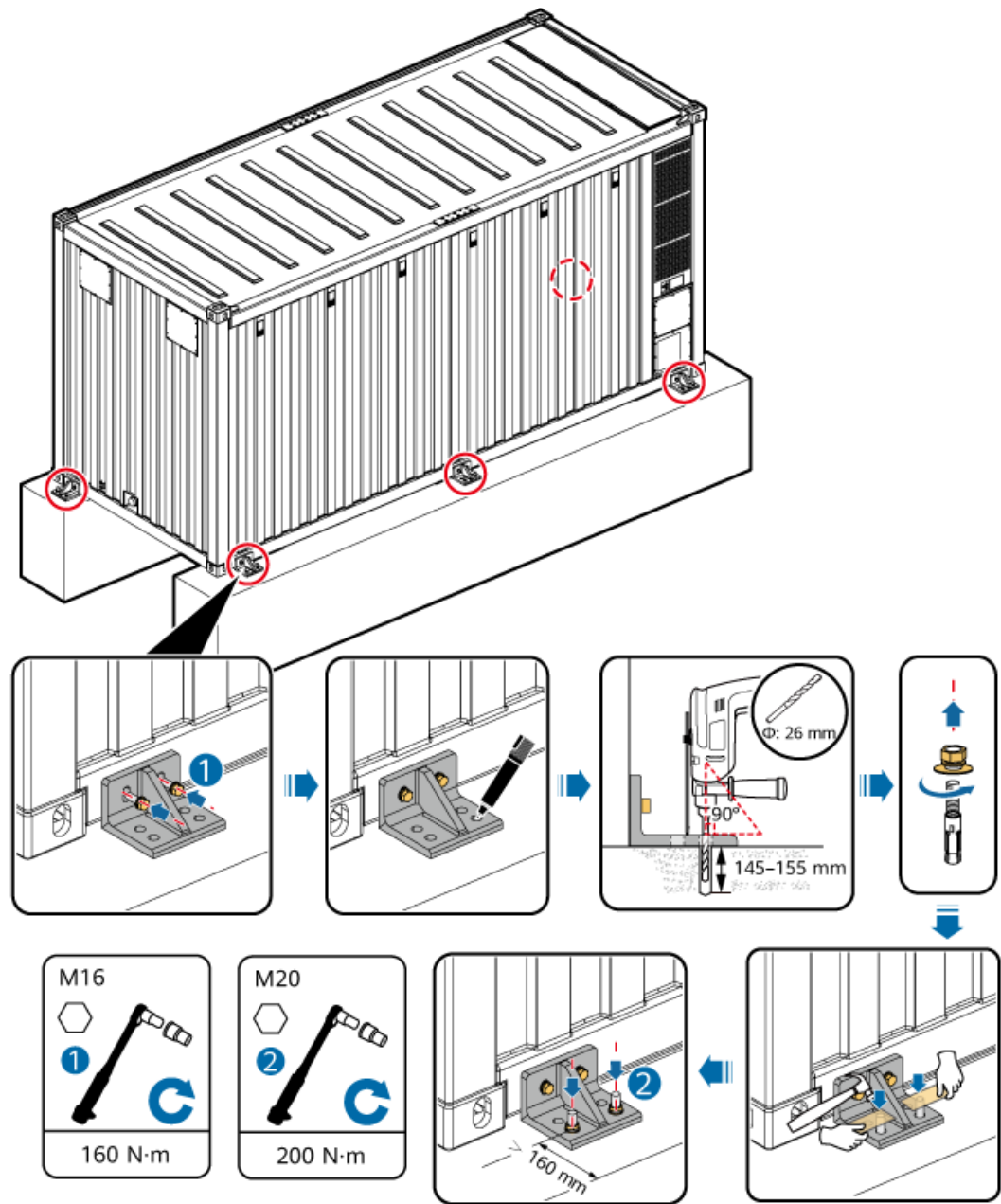
CAUTION

- To prevent the claw hammer from damaging the expansion bolt, use a wooden block between the claw hammer and the top of the bolt for protection.
- Ensure that the expansion bolts are tightened when securing the angle steel brackets to the base.

 NOTE

- There are four mounting holes where the angle steel brackets contact the base. Mark all mounting holes.
- Each angle steel bracket must be secured using at least two mounting holes. It is recommended that the outer two mounting holes be used. If steel bars in a concrete base block the drill bit or the initial drilling is deviated, use the inner mounting holes.

Figure 5-5 Securing the ESS



After the ESS is secured, verify the installation to ensure normal use of products and smooth subsequent installation.

Table 5-3 Verifying the installation

No.	Check Item	Check Method	Criteria
1	Check whether bolts and nuts are tightened.	Tighten the bolts and nuts again using a wrench with the same torque.	Bolts and nuts are tightened.

No.	Check Item	Check Method	Criteria
2	Check whether the doors of the ESS can be opened and closed properly.	Open and close the doors of the ESS.	All doors of the ESS can be opened and closed properly.

----End

5.3 Installing Components

CAUTION

- Ensure that the ESS is not powered on.
- The installation personnel have taken safety protection measures, for example, wearing insulated gloves and shoes.

5.3.1 Filling the Fire Cylinder with Extinguishant

CAUTION

- Only some models of fire cylinders (such as P0009438) are delivered without extinguishant. In the deployment and O&M phases, fill the fire cylinders with extinguishant at a dedicated station. Some models of fire cylinders (such as YF40/2.5 and CNES-F-50/4.2) are delivered with extinguishant, you do not need to perform this step during the deployment phase. After the extinguishant is used up in the O&M phase, replace the fire cylinder with a spare one.
- Protect the fire cylinder during transportation and installation to prevent extinguishant leakage caused by impact on the solenoid valve or pressure gauge.
- Before moving the fire cylinder, bind the cables to avoid damaging the cables.
- This document uses the P0009438 fire cylinder as an example to describe the extinguishant filling requirements and how to remove and install the fire cylinder.

Requirements on Extinguishant Filling (P0009438)

Table 5-4 Requirements on extinguishant filling

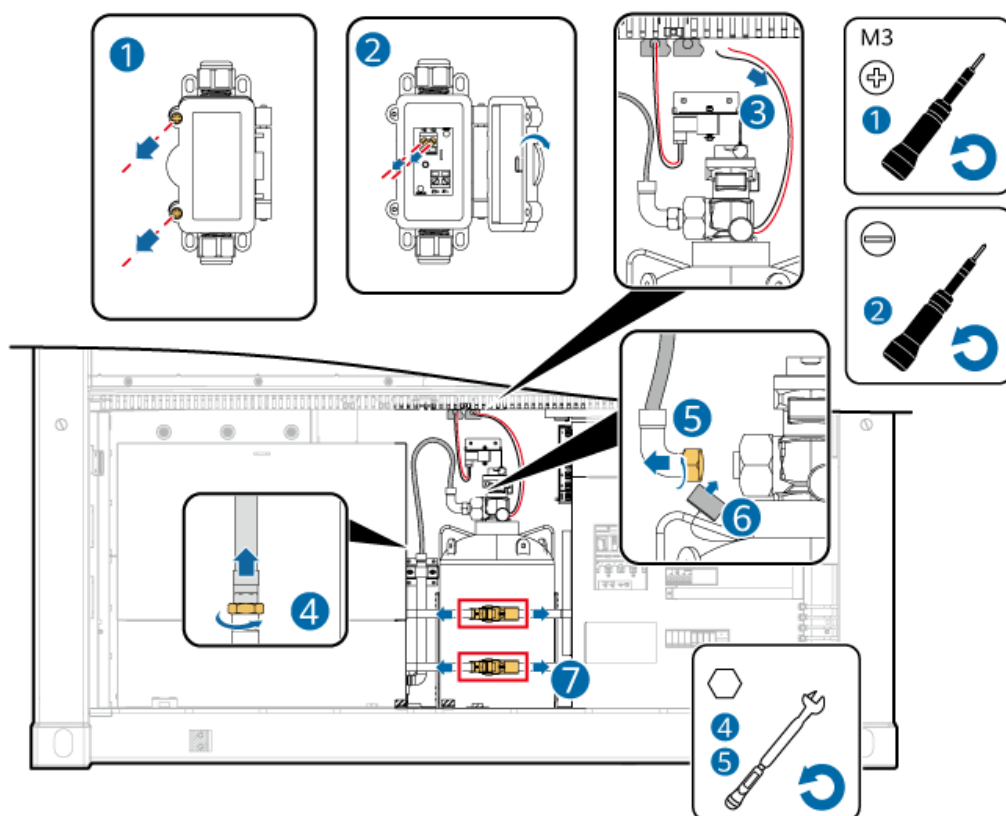
Item	Specifications
Extinguishant	Perfluorohexanone
Extinguishant weight	31–32 kg

Item	Specifications
Purity requirement	≥ 99.9%

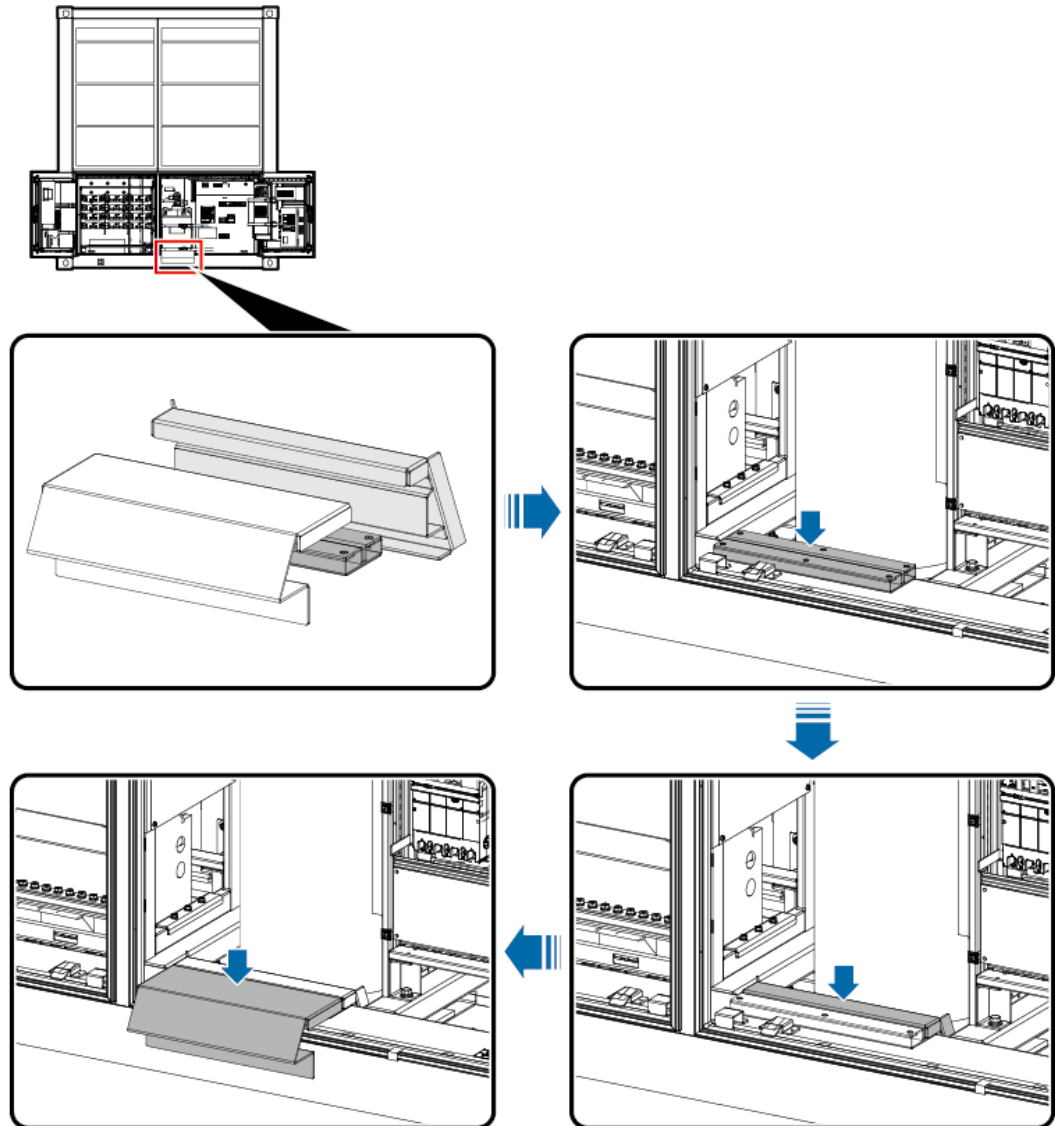
Removing the Fire Cylinder (P0009438)

- Step 1** Open the cover of the pressure gauge wiring board.
- Step 2** Remove the cable screws from the pressure gauge wiring board.
- Step 3** Remove the cables from the pressure gauge wiring board.
- Step 4** Remove the release hose from the ESS pipe.
- Step 5** Remove the high-pressure elbow of the hose from the valve release vent.
- Step 6** Install the safety cap of the release vent.
- Step 7** Loosen the clamp of the fire cylinder.

Figure 5-6 Removing the fire cylinder



- Step 8** Install the fire cylinder deck.



Step 9 Remove the fire cylinder from the ESS.

----End

Installing the Fire Cylinder (P0009438)

Step 1 Move the fire cylinder into the ESS.

Step 2 Remove the fire cylinder deck.

Step 3 Secure the clamp of the fire cylinder.

Step 4 Remove the safety cap of the release vent.

Step 5 Wrap eight turns of sealing tape around the external thread connector of the high-pressure elbow and install the high-pressure elbow to the valve release vent. Remove any old sealing tape from the threads.

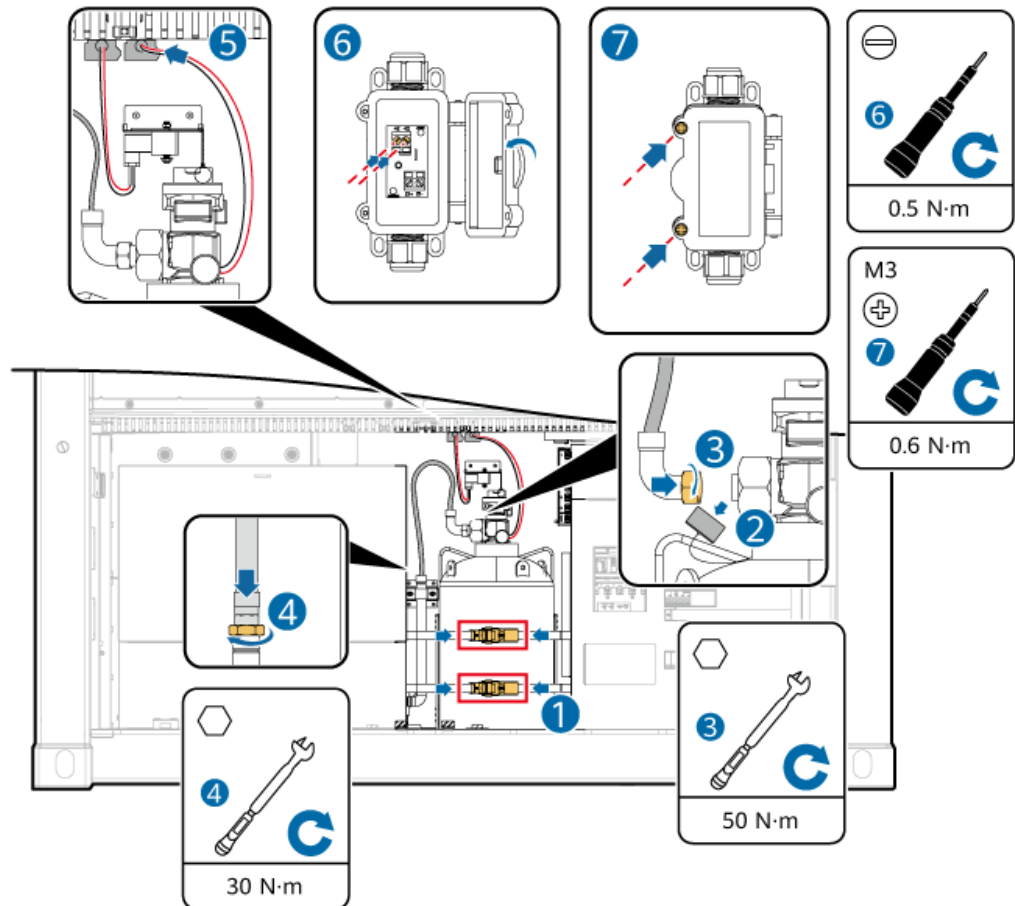
Step 6 Remove the old sealing tape from the threads, wrap eight turns of sealing tape around the external thread connector of the extinguishant release hose, and install the extinguishant release hose to the ESS pipe.

Step 7 Connect the cables from the pressure gauge wiring board.

Step 8 Tighten the cable screws from the pressure gauge wiring board.

Step 9 Reinstall the cover of the pressure gauge wiring board.

Figure 5-7 Installing the fire cylinder



----End

5.3.2 Installing Lead-Acid Batteries in the Extinguishant Control Panel

CAUTION

- Do not damage components in the extinguishant control panel during the installation.
 - Install lead-acid batteries before connecting the auxiliary power supply. If the power supply is disconnected, restore the power supply to the extinguishant control panel as soon as possible to prevent battery failure. The maximum power supply restoration period shall not exceed seven days. If the power supply restoration period exceeds 7 days, remove the lead-acid battery cables.
 - The batteries of the extinguishant control panel C050SZEG must be powered on together with the auxiliary power supply when used for the first time. In this way, the batteries can be activated to supply power to the extinguishant control panel. The batteries of the extinguishant control panels JB-QBL-QM210 and ZEKA0100 does not need to be powered on together with the auxiliary power supply when used for the first time. The batteries can supply power to the extinguishant control panel directly.
-

NOTICE

- The extinguishant control panel has been configured and commissioned before delivery. Non-professional personnel are prohibited from configuring the extinguishant control panel without permission.
 - You are advised to power on the lead-acid batteries within 24 hours after unpacking. If the batteries cannot be powered on in time, place it in a dry indoor environment without corrosive gases.
-

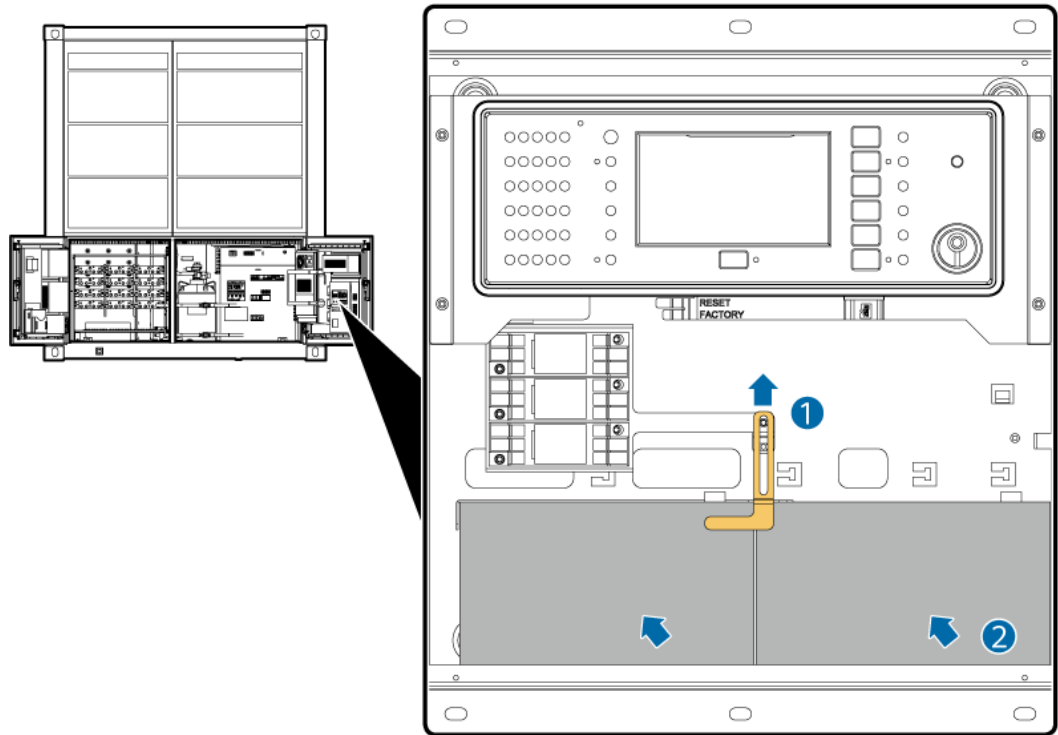
NOTE

The batteries are delivered with the product and can be obtained from the control unit cabin. If they need to be replaced, purchase batteries according to the specifications in [2.4.4.3 Extinguishant Control Panel](#).

C050SZEG

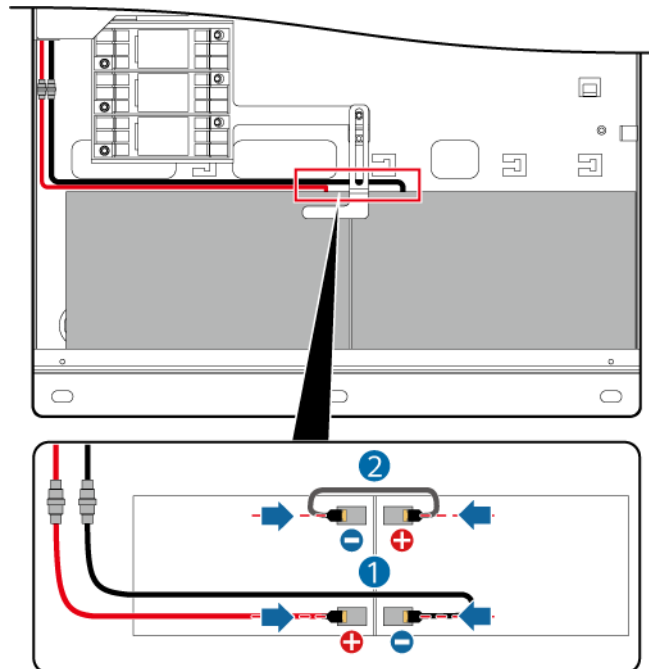
- Step 1** Take out the delivered lead-acid batteries and remove the white insulation covers from the batteries.
- Step 2** Adjust the battery support and install the lead-acid batteries in the extinguishant control panel.

Figure 5-8 Installing batteries



Step 3 Connect the battery cables.

Figure 5-9 Connecting the battery cables



Step 4 Adjust the height of the support and secure the lead-acid batteries.

----End

JB-QBL-QM210 and ZEKA0100

- Step 1** Remove the key from above the extinguishant control panel.
- Step 2** Open the extinguishant control panel and remove the cover for installing batteries.
- Step 3** Install the batteries in the extinguishant control panel and the cover.
- Step 4** Connect battery cables to the extinguishant control panel.

Figure 5-10 Installing batteries in the extinguishant control panel (JB-QBL-QM210)

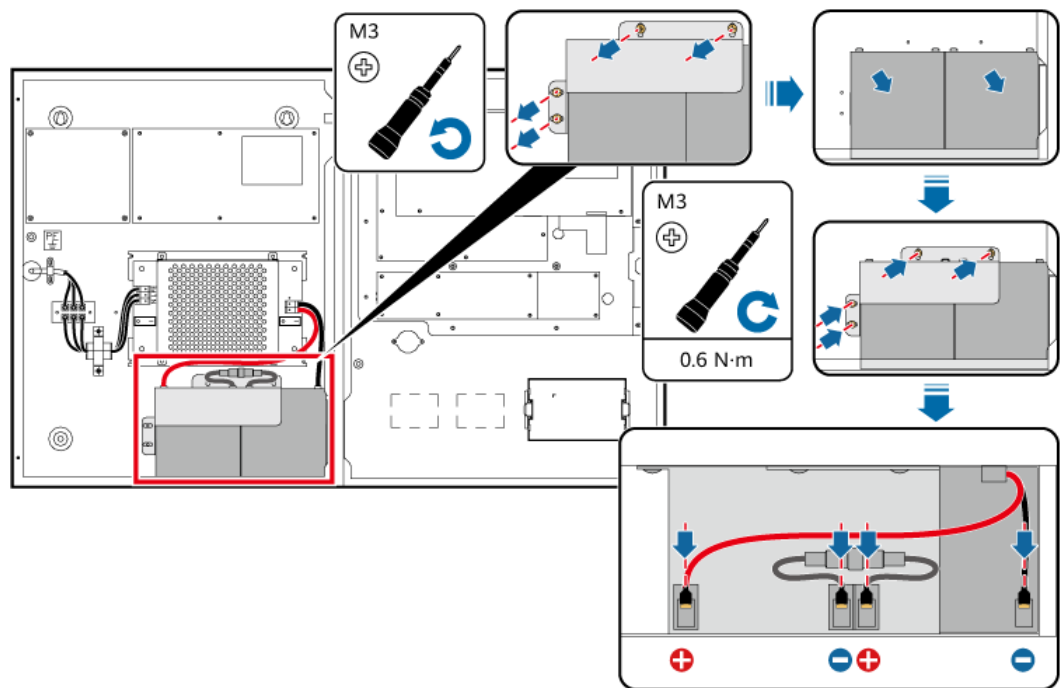
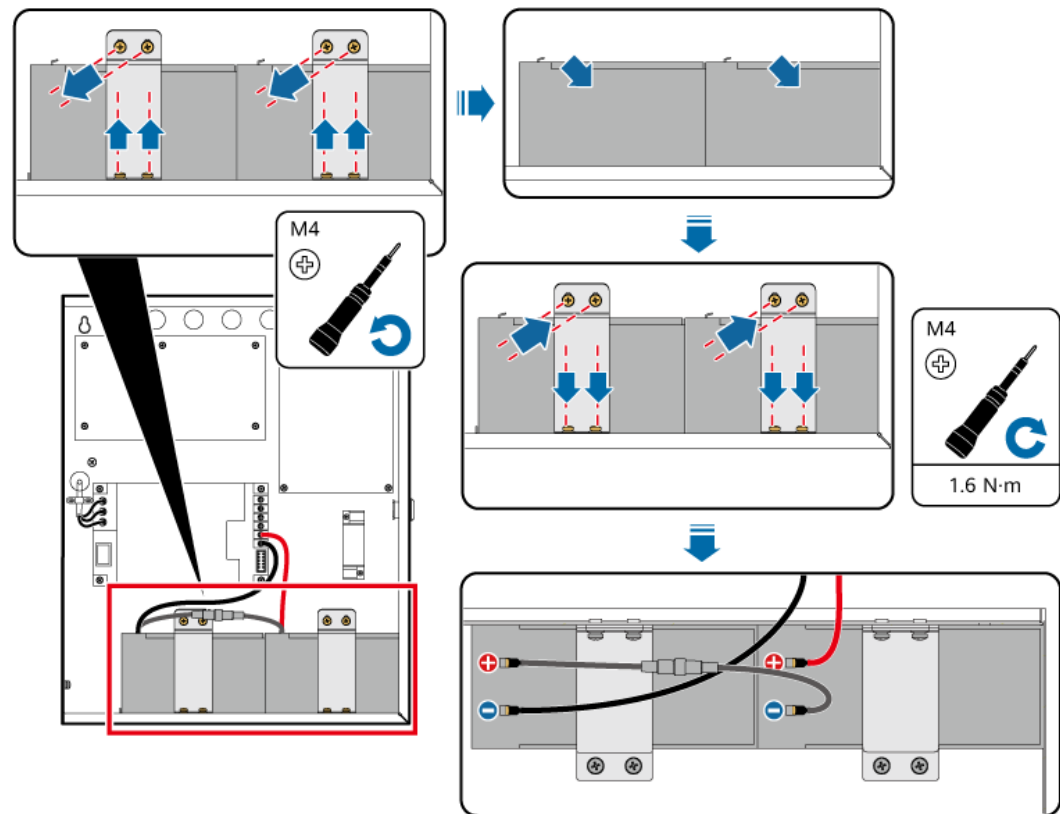


Figure 5-11 Installing batteries in the extinguishant control panel (ZEKA0100)



Step 5 Close the extinguishant control panel.

Step 6 Remove the key from the extinguishant control panel.

NOTE

Hand over the key to the responsible personnel for safekeeping.

----End

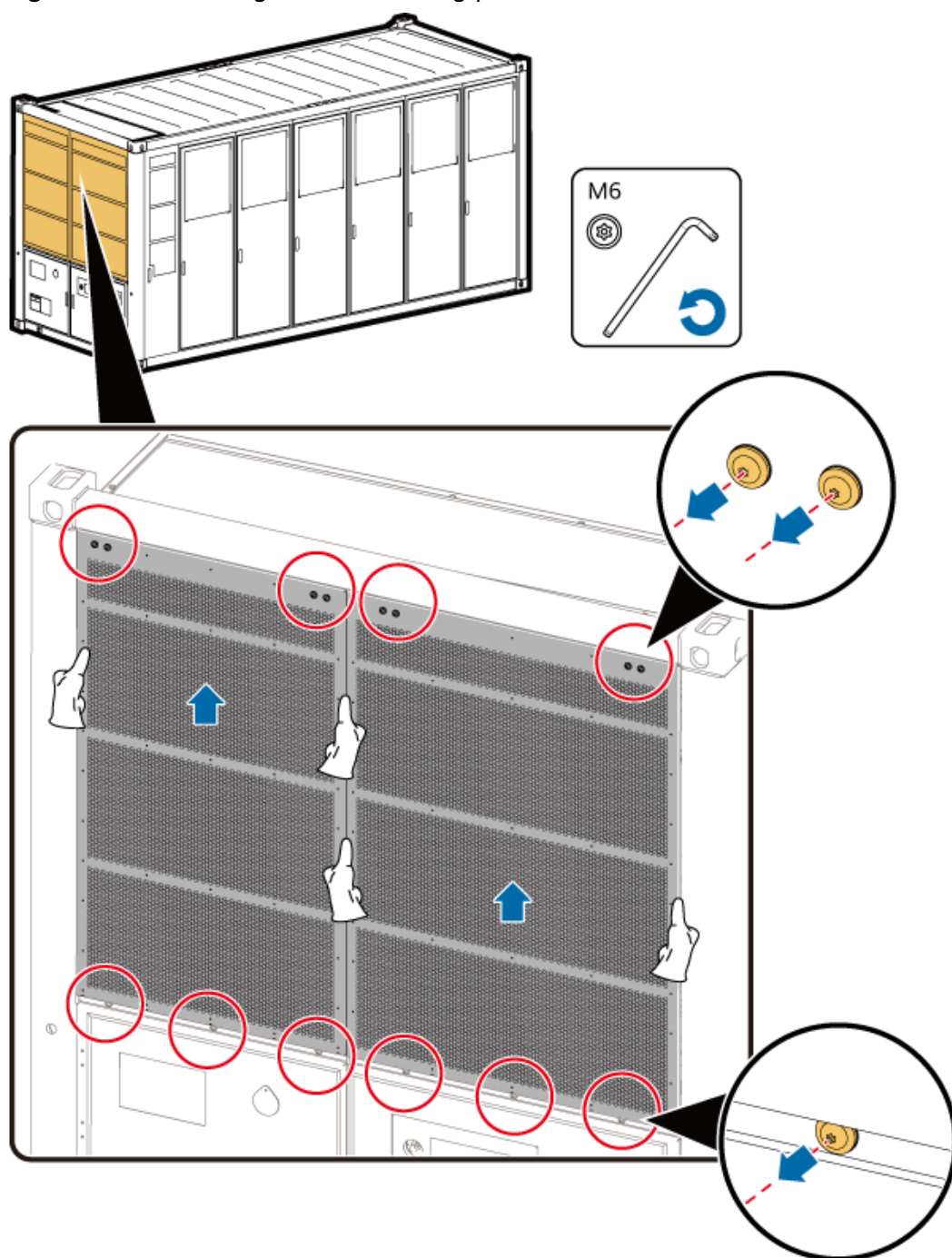
5.3.3 Removing the Compressor Bracket and Checking the LTMS Switch Status

NOTICE

Before powering on the ESS, remove the compressor bracket and check that the general switch and all branch circuit breakers of the LTMS are turned on.

Step 1 Remove screws from the two sealing plates on the front of the LTMS. Lift and take out the sealing plates.

Figure 5-12 Removing the front sealing plates from the LTMS



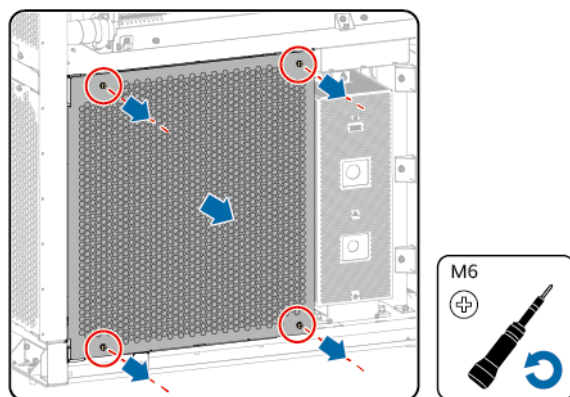
NOTE

- The L-shaped security torx wrench is stored in tool slot 1 of the control unit cabin. [Figure 2-12](#) shows the position of tool slot 1.
- Remove the eight screws from the two front sealing plates only when you remove the LTMS for the first time.

Step 2 Remove the compressor bracket.

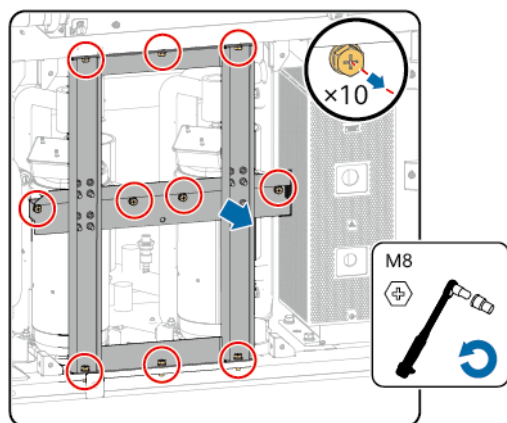
1. Remove the inner mesh board from the front of the LTMS.

Figure 5-13 Removing the inner mesh board from the front of the LTMS



2. Remove the compressor bracket.

Figure 5-14 Removing the compressor bracket

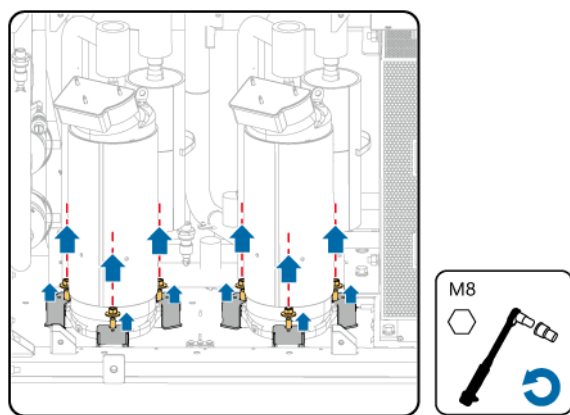


3. Remove the sheet metal fasteners from the bottom of the compressor.

NOTE

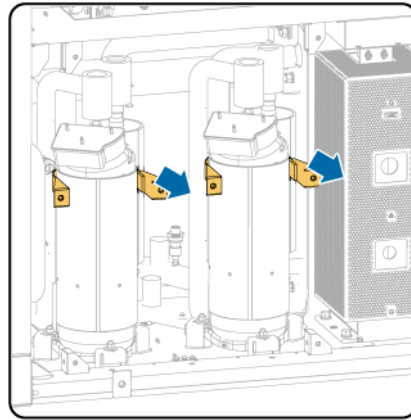
An insulated torque socket wrench with a length of less than 165 mm is recommended.

Figure 5-15 Removing the sheet metal fasteners from the bottom of the compressor



4. Remove the hose clamp from the compressor.

Figure 5-16 Removing the hose clamp from the compressor

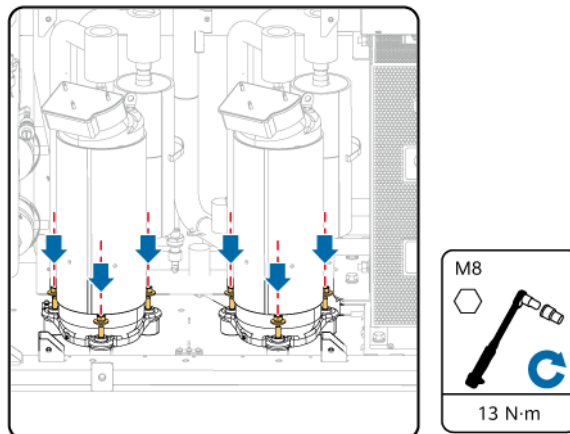


5. Reinstall the nuts at the bottom of the compressor.

 NOTE

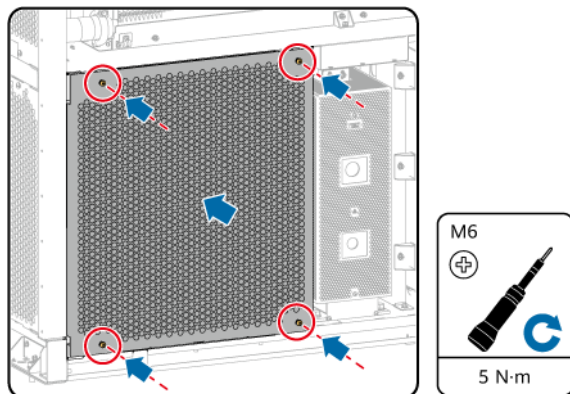
An insulated torque socket wrench with a length of less than 165 mm is recommended.

Figure 5-17 Reinstalling the nuts at the bottom of the compressor



6. Reinstall the inner mesh board to the front of the LTMS.

Figure 5-18 Reinstalling the inner mesh board to the front of the LTMS



Step 3 Check whether the general switch and all branch circuit breakers of the LTMS are turned on.

1. Open the door of the LTMS electric control box.

NOTE

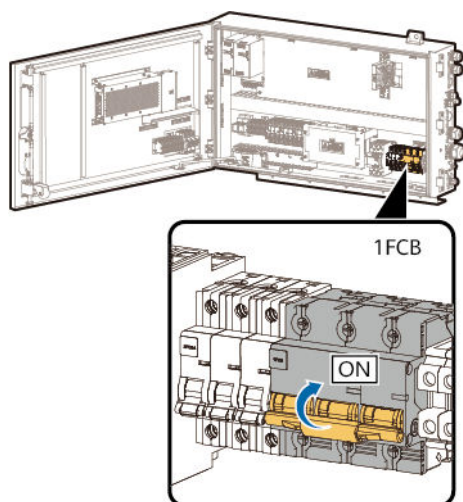
The key to the electric control box door is stored in the key box at the rear of the ESS. **Figure 2-6** shows the position of the key box.

2. Check whether the general switch 1FCB of the LTMS is turned on. If not, turn it on manually.

NOTE

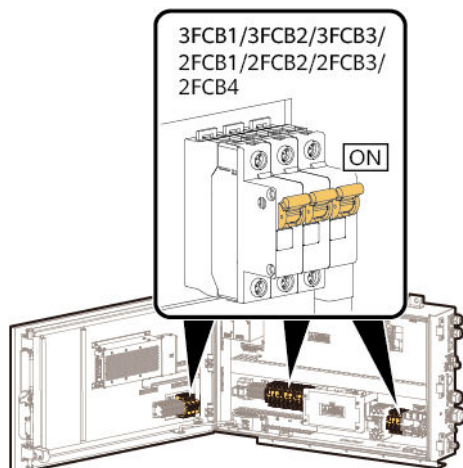
The LTMS general switch of some models is 1FCB1. The actual product may vary.

Figure 5-19 Checking whether the general switch 1FCB of the LTMS is turned on



3. Check whether all branch circuit breakers (3FCB1, 3FCB2, 3FCB3, 2FCB1, 2FCB2, 2FCB3, and 2FCB4) of the LTMS are turned on. If not, turn them on manually.

Figure 5-20 Checking whether all branch circuit breakers of the LTMS are turned on



4. Close the door of the electric control box.

 NOTE

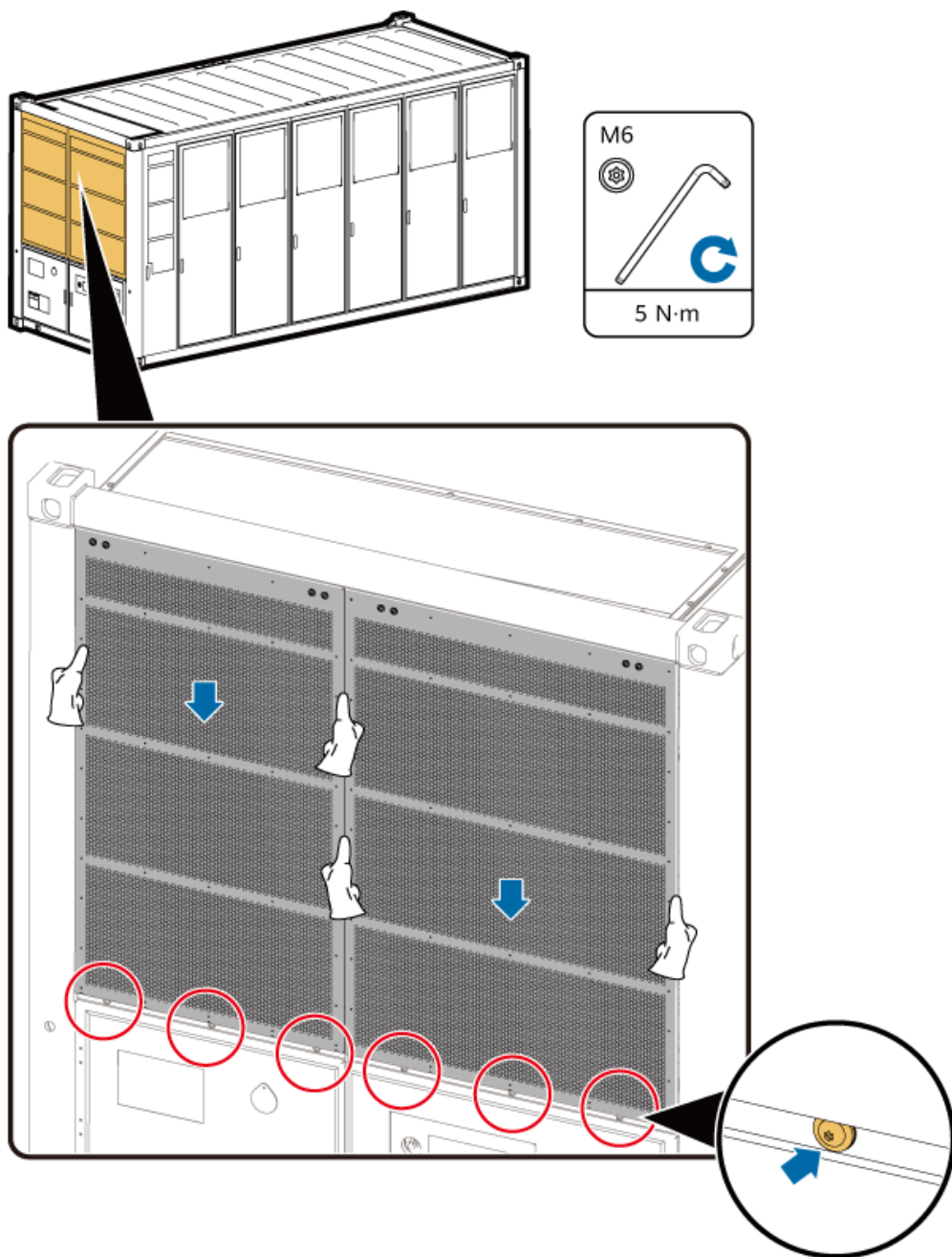
After using the key, hand it over to the responsible personnel for safekeeping.

- Step 4** Hang the two sealing plates at the front of the LTMS into the grooves and tighten the screws.

 NOTE

The screws on the top of the two sealing plates at the front of the LTMS need to be installed only for transportation. For operation, only the screws at the bottom of the sealing plates need to be installed.

Figure 5-21 Installing the front sealing plates to the LTMS



----End

6 Installing Cables

DANGER

- Do not smoke or have an open flame around batteries.
- The site must be equipped with qualified fire fighting facilities, such as fire sand and carbon dioxide fire extinguishers.
- Wear personal protective equipment and use dedicated insulated tools to avoid electric shocks or short circuits.

CAUTION

- Do not connect two or more cables to the positive or negative power port of a battery in parallel.
- Stay away from the equipment when preparing cables to prevent cable scraps from entering the equipment. Cable scraps may cause sparks and result in personal injury and equipment damage.

NOTICE

- Do not install battery packs on rainy, snowy, or foggy days. Otherwise, the battery packs may be corroded by moisture or rain.

6.1 Preparing Cables

CAUTION

Select cables in compliance with local cable standards, especially the electrical specifications and application environment. The key factors include the rated current, cable type, routing method, maximum expected line loss, rated temperature, ambient temperature, thermal resistance, acidity, sedimentation, and environmental protection requirements.

 NOTE

If the cable conductor cross-sectional area is greater than 16 mm², you are advised to add solder after crimping the terminal.

Table 6-1 List of cables prepared by the customer

Cable	Type	Conductor Cross-Sectional Area	Outer Diameter	Terminal	Description
PE bus cable	Single-core outdoor copper/aluminum cable or bare stranded cable	16–95 mm ²	≤ 32 mm	M10 OT/DT terminal	You can refer to the specifications of the PE bus cable in this table or calculate the specifications according to IEC 60364-5-54.
DC power cable	Single-core outdoor copper/aluminum cable, 1500 V DC	70–150 mm ²	≤ 50 mm	M12 OT/DT terminal	- Select either single-core or two-core cables. - The maximum conductor cross-sectional area of a single-core cable is 240 mm². - The cable quantity depends on the specific scenario.
	Two-core outdoor copper/copper-clad aluminum/aluminum alloy cable	70–150 mm ²	≤ 50 mm		
Three-phase AC input power cable	Four-core/Five-core outdoor copper/copper-clad aluminum/aluminum alloy cable (direct-buried or armored), 400 V AC	10–185 mm ²	≤ 72 mm	M10 OT/DT terminal	Used for scenarios with external grid power supply
Single-phase AC input power cable	Two-core/Three-core outdoor copper cable (direct-buried or armored)	1.5–10 mm ²	≤ 32 mm	Pin cord end terminal with an insertion depth of 14 mm	Optional, used for scenarios with UPS

Cable	Type	Conductor Cross-Sectional Area	Outer Diameter	Terminal	Description
Communications cable	CAT 5E outdoor shielded network cable (direct-buried or armored); internal resistance ≤ 1.5 ohms/10 m; conductor material: oxygen-free copper or pure copper; bending radius $\geq 5 \times$ Cable diameter	-	4.5–7.5 mm	Shielded RJ45 connector	-
Optical fiber cable	Four-core or eight-core single-mode optical fiber cable (direct-buried or armored) with a transmission wavelength of 1310 nm	-	≤ 18 m	Optical fiber terminal	-
Note: - FE/SFP communication is supported between the SACU and ESS. If the distance is greater than 100 m, use an optical fiber cable for communication through SFP ports. If the distance is less than or equal to 100 m, use an Ethernet cable for communication through FE ports. - The cable specifications are only recommended values. Select cables based on site requirements. The cable specifications shall be designed by the corresponding design institute.					

6.2 Removing and Installing Covers

Remove covers before installing cables, and reinstall the covers after installing cables. You are advised to reinstall the covers after all operations in this section are complete.

Figure 6-1 Removing covers

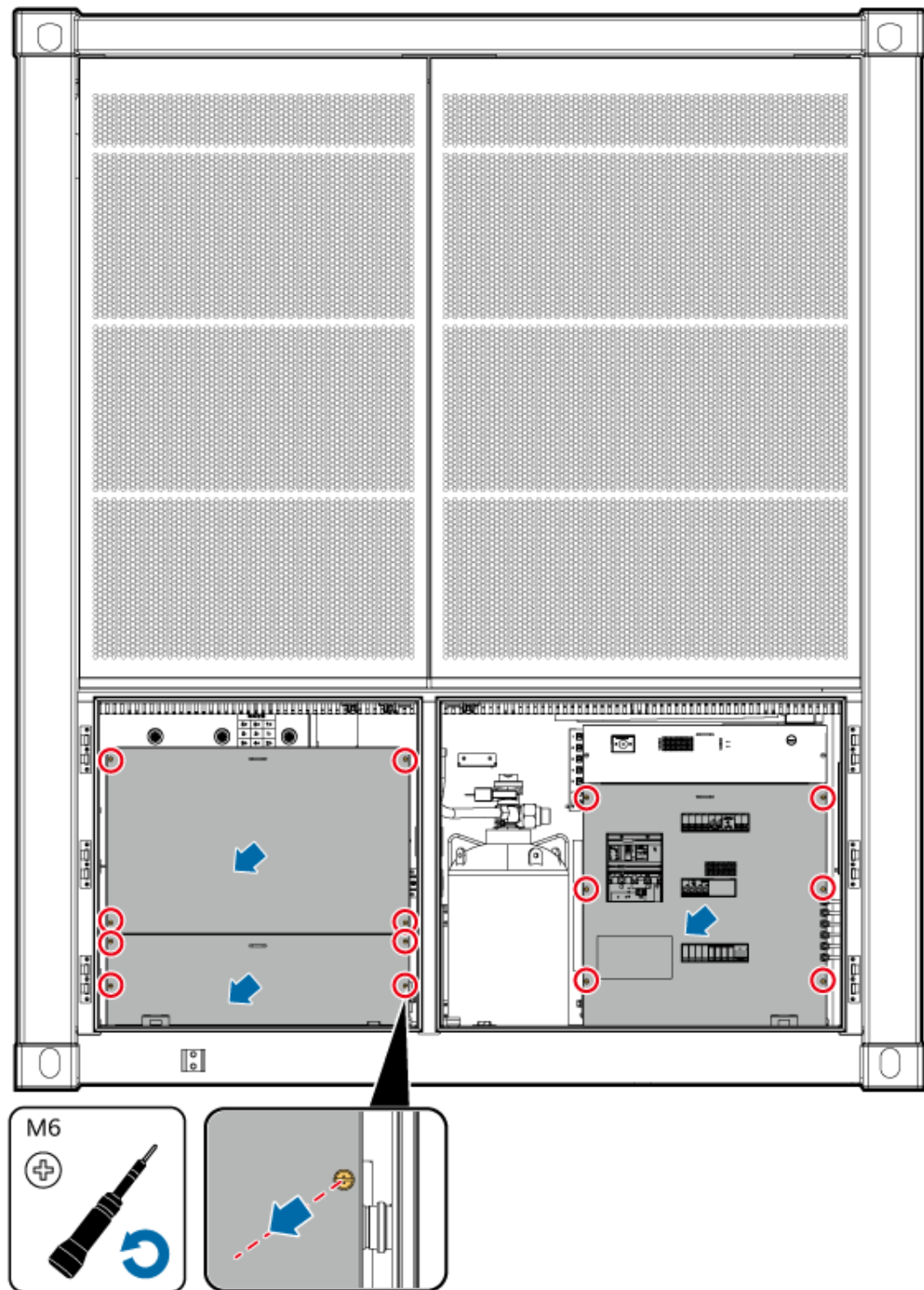
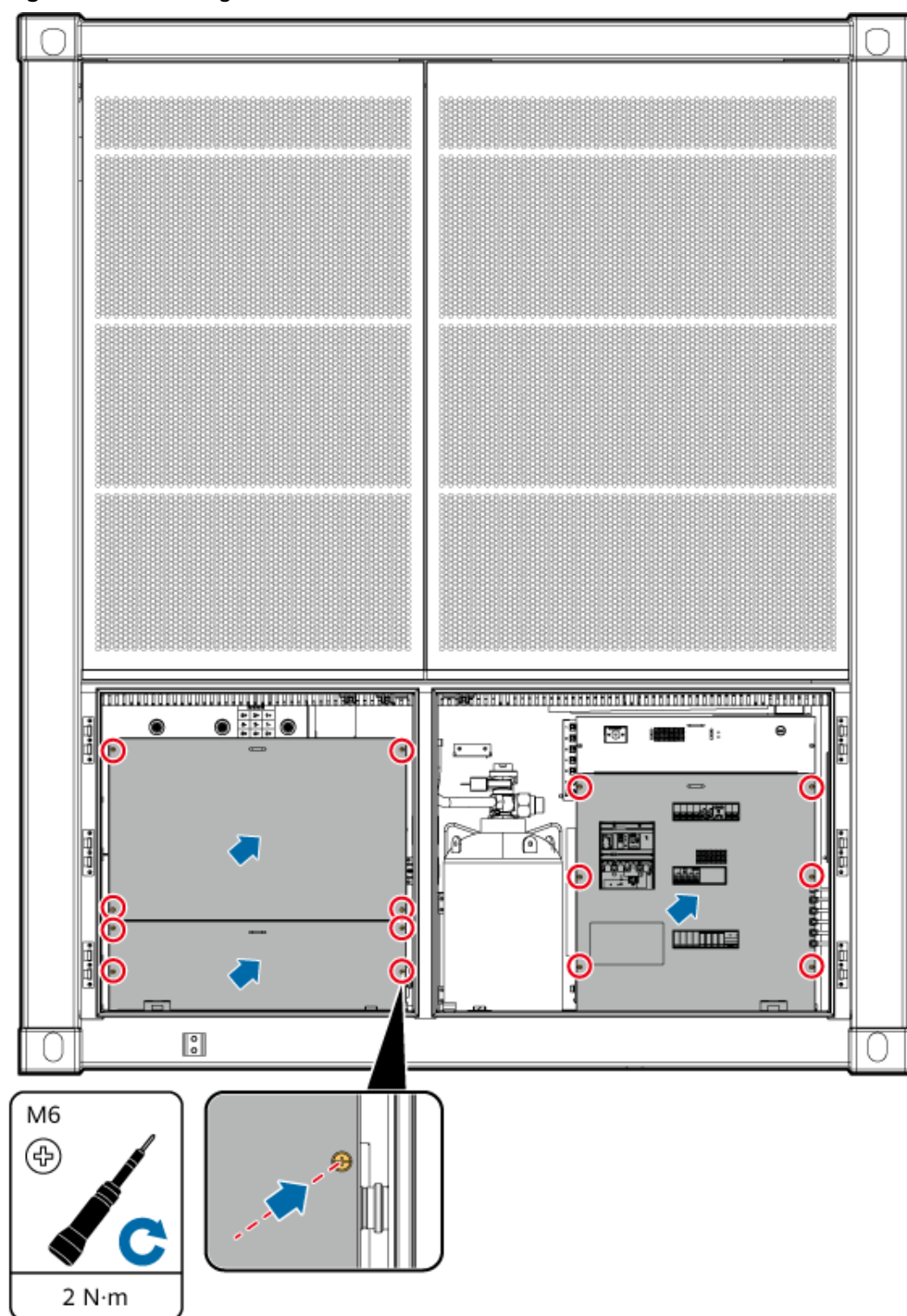
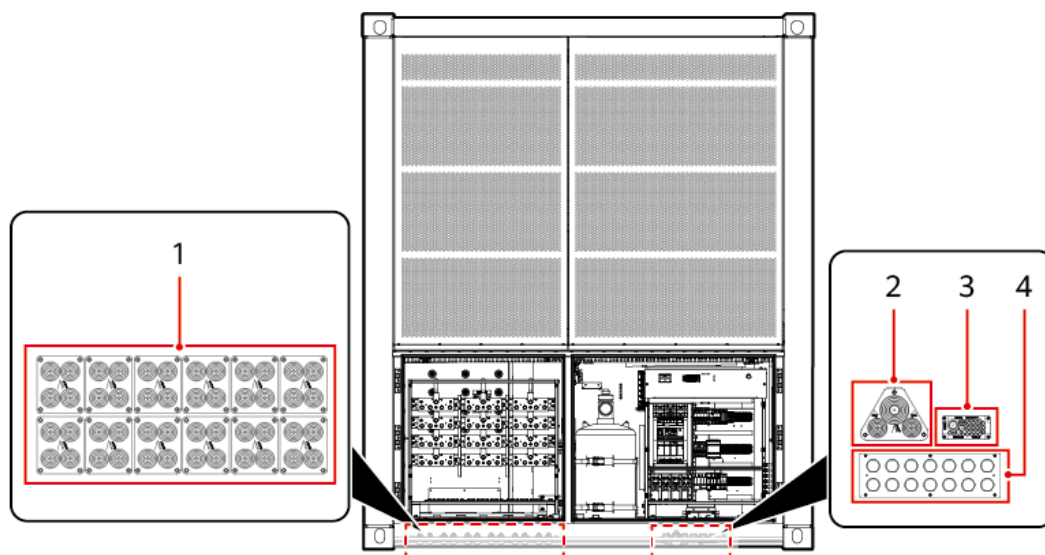


Figure 6-2 Installing covers



6.3 Positions of Cable Holes

Figure 6-3 Cable holes at the bottom



(1) DC power cable holes

(2) Three-phase AC input power cable and PE bus cable holes

(3) Single-phase AC input power cable holes

(4) Communications cable holes

6.4 Installing a PE Bus Cable

DANGER

The ESS will generate high touch current. Therefore, ground the PE terminal on the equipment enclosure before connecting the power supply to prevent electric shocks.

WARNING

Do not connect devices such as fuses and switches to the PE bus cable.

CAUTION

The grounding shall comply with the local electrical safety regulations.

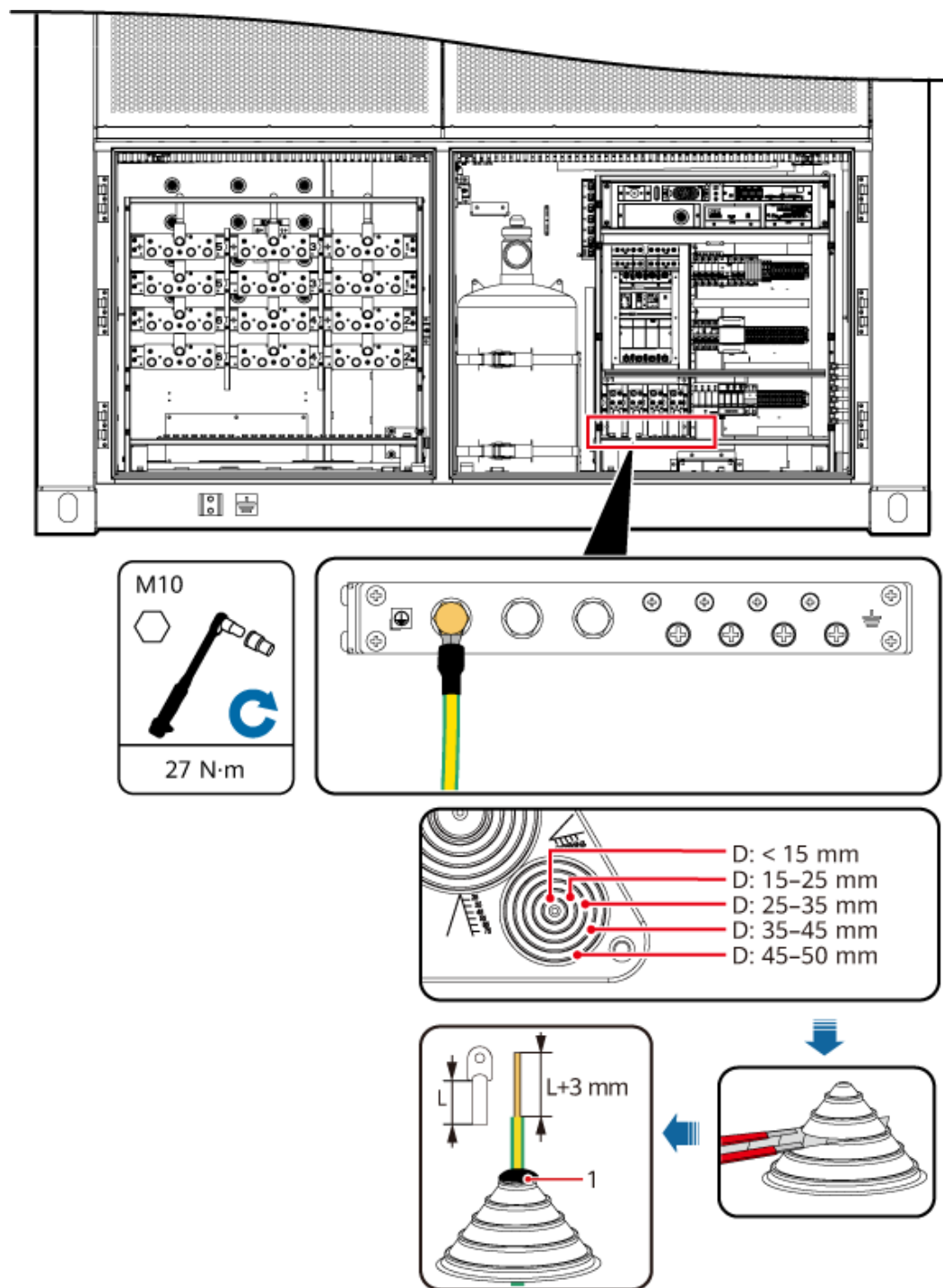
NOTICE

- The main ground cable for the main ground bar in the control unit cabin must be directly connected to the customer's ground grid.
 - After installing the PE bus cable of the main ground bar in the control unit cabin, close the door promptly.
-

 NOTE

The position for cutting the pagoda connector is for reference only. The actual cable usage may vary.

Figure 6-4 Installing the PE bus cable



6.5 Installing Battery Pack Power Cables

 CAUTION

Before connecting cables, ensure that the RCM circuit breaker Q1 is off.

Step 1 Remove the battery pack power cable bound to the pipe at the bottom of the ESS.

Step 2 Install power cables between battery packs.

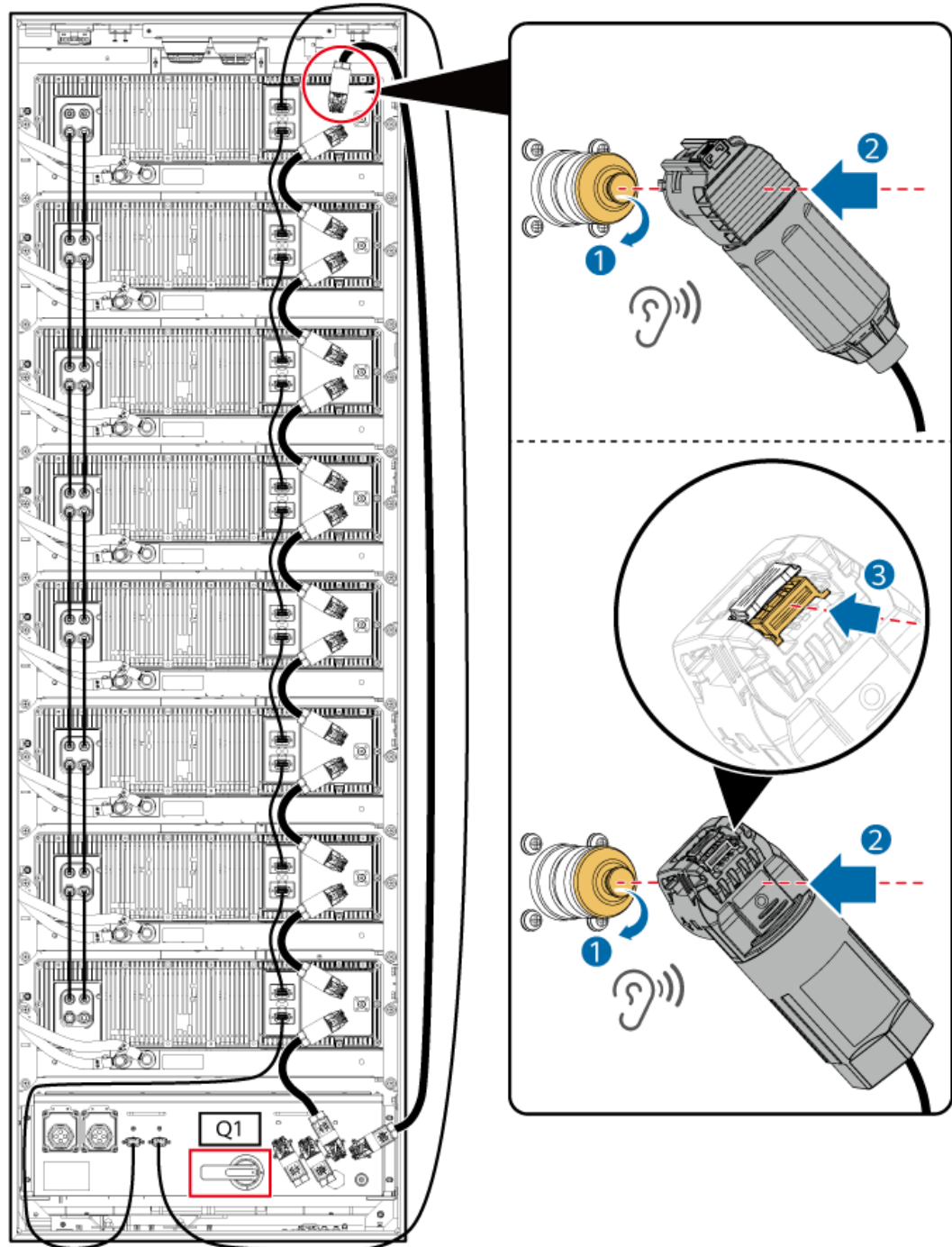
 DANGER

- Do not smoke or have an open flame around batteries.
 - The site must be equipped with qualified fire fighting facilities, such as fire sand and carbon dioxide fire extinguishers.
 - Wear personal protective equipment and use dedicated insulated tools to avoid electric shocks or short circuits.
-

 DANGER

- Do not touch the positive and negative battery terminals at the same time.
 - When removing and installing power cables, wear insulated gloves (insulation capability ≥ 1500 V DC).
-

Figure 6-5 Installing battery pack power cables



----End

6.6 Installing DC Power Cables

- DC power cables have been pre-buried according to the specifications.
- The OT/DT terminals have been crimped according to the specifications. For details, see [D.2 Crimping an OT or DT Terminal](#).

 CAUTION

Before connecting cables, ensure that the RCM circuit breaker Q1 is off, and the voltages between the positive and negative copper bars and between the copper bars and the ground are lower than the safe voltage for human body.

NOTICE

- Before installing cables, route cables to corresponding positions according to the design and label the cables.
 - There is an NTC temperature sensor on the DC wiring copper bar. Protect the NTC components when installing DC power cables.
 - The screw assembly whose model is subject to the delivery shall be tightened according to the corresponding standard torque.
 - Partially tighten the nuts to 5 N·m, and then install the nuts to the recommended torque.
 - Check the torque of the installed nuts. Use a marker to mark the nuts that have been checked.
 - After installing the power cables, ensure that the OT terminals are properly fitted to and aligned with the copper bar, and that the DC power cables point vertically downward.
-

 NOTE

- The armored layer of the ESS can be grounded. Twenty-four ground terminals (M8 bolts) are reserved for the armored layer.
- The number of DC power cables to be connected varies depending on the scenario.
- Connect cables to the DC wiring copper bars from inside to outside and from bottom to top. After installing lower-layer cables, check the torque promptly before installing upper-layer cables.
- Use a torque socket wrench and an extension rod to tighten nuts. The extension rod must be longer than 30 cm.

 NOTE

The position for cutting the pagoda connector is for reference only. The actual cable usage may vary.

Figure 6-6 Installing DC power cables (single-core cables, 6 PCSs)

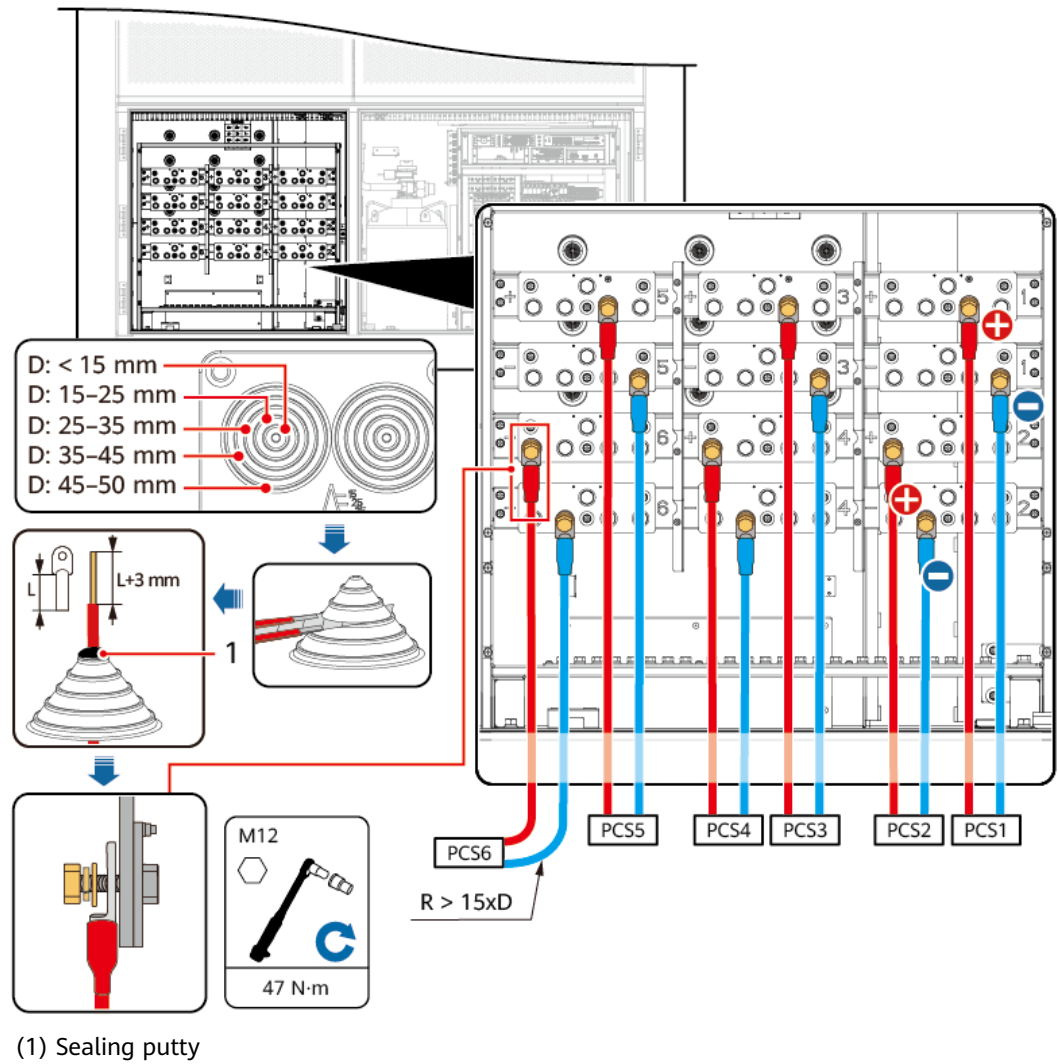
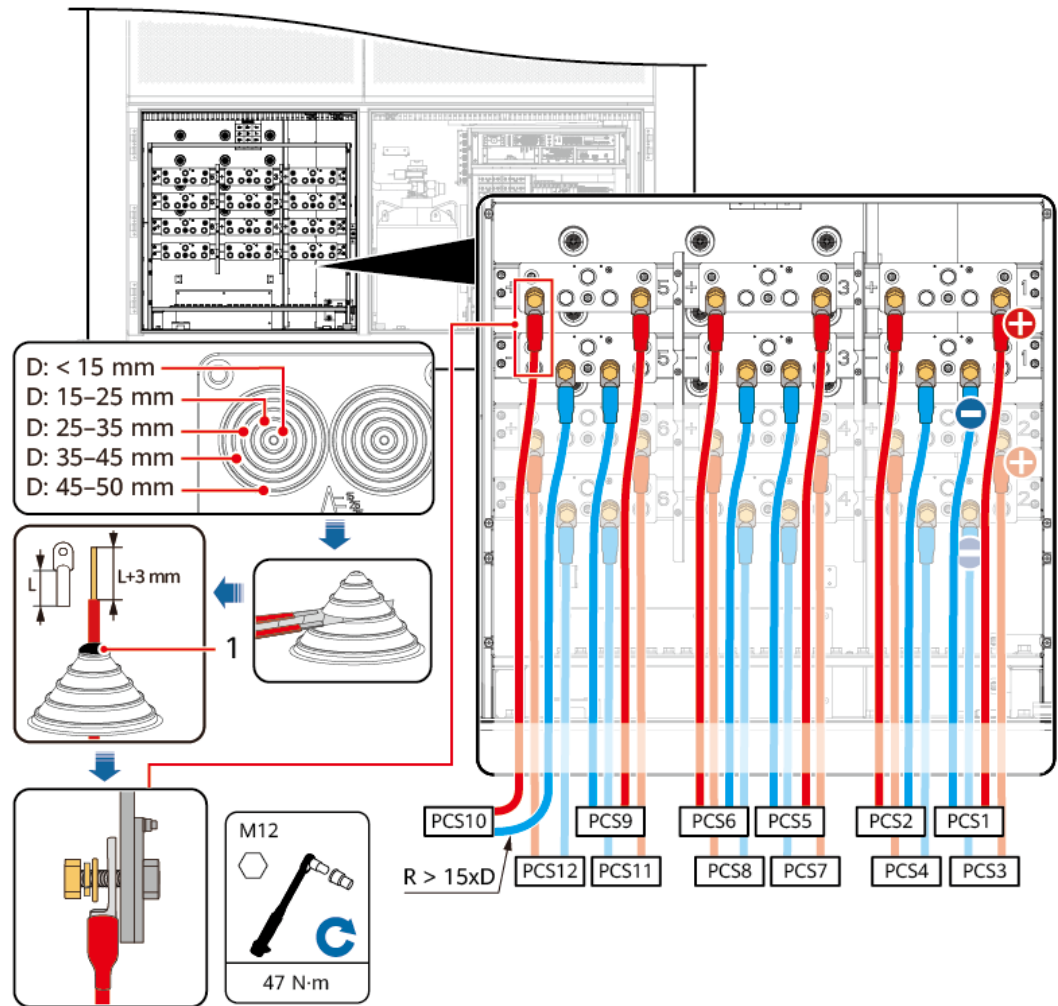


Figure 6-7 Installing DC power cables (single-core cables, 12 PCSs)



(1) Sealing putty

Figure 6-8 Installing DC power cables (single-core cables, 24 PCSs)

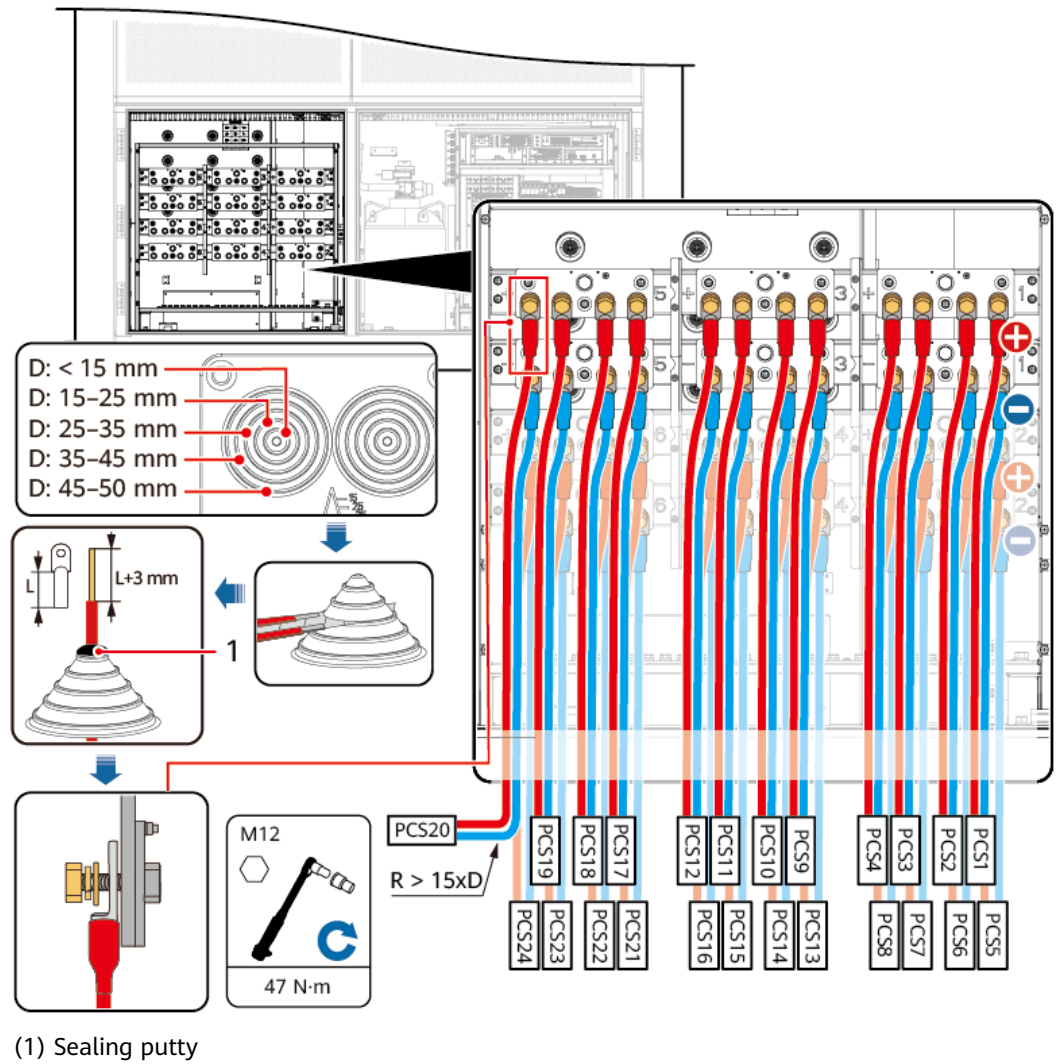


Figure 6-9 Installing DC power cables (two-core cables, 6 PCSs)

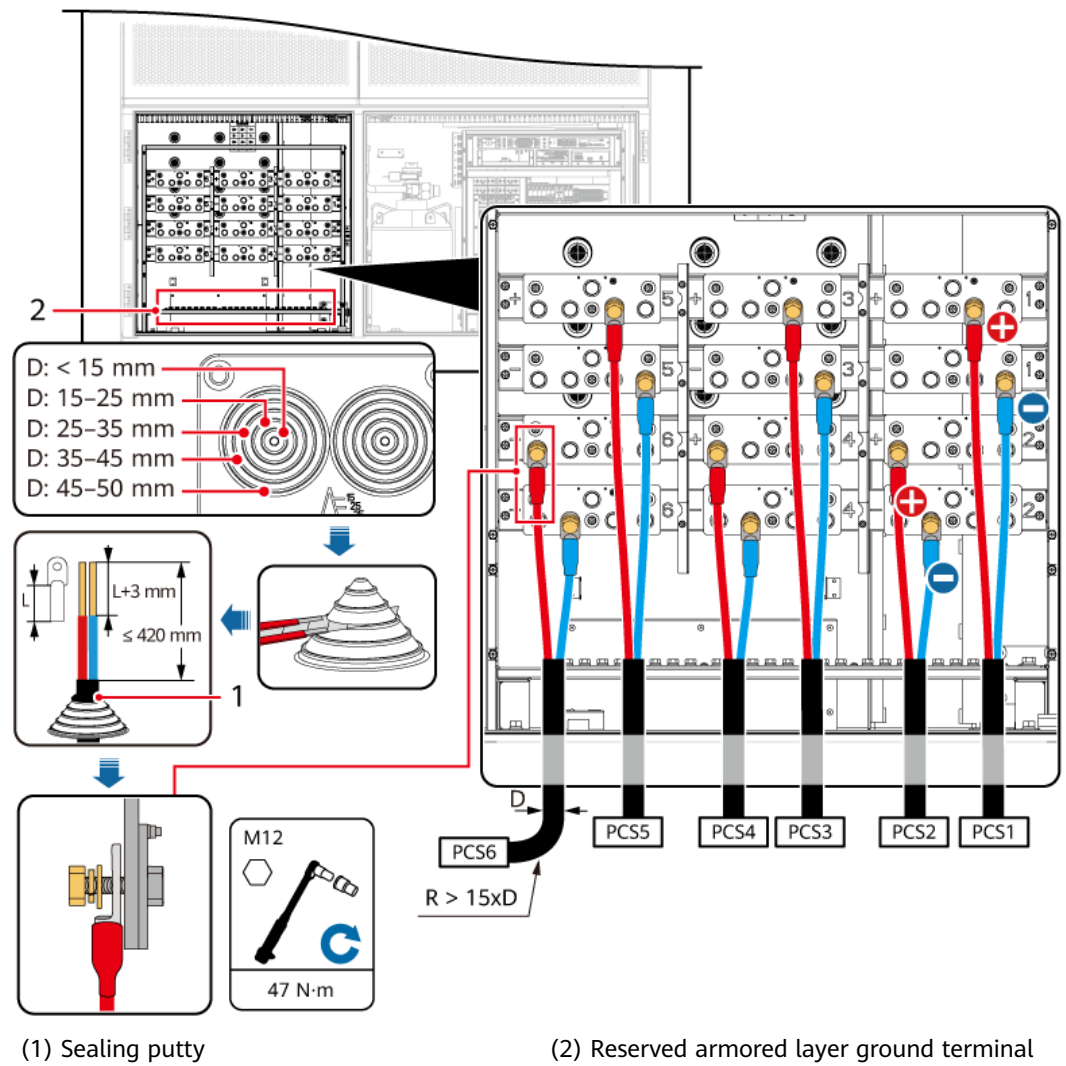


Figure 6-10 Installing DC power cables (two-core cables, 12 PCSs)

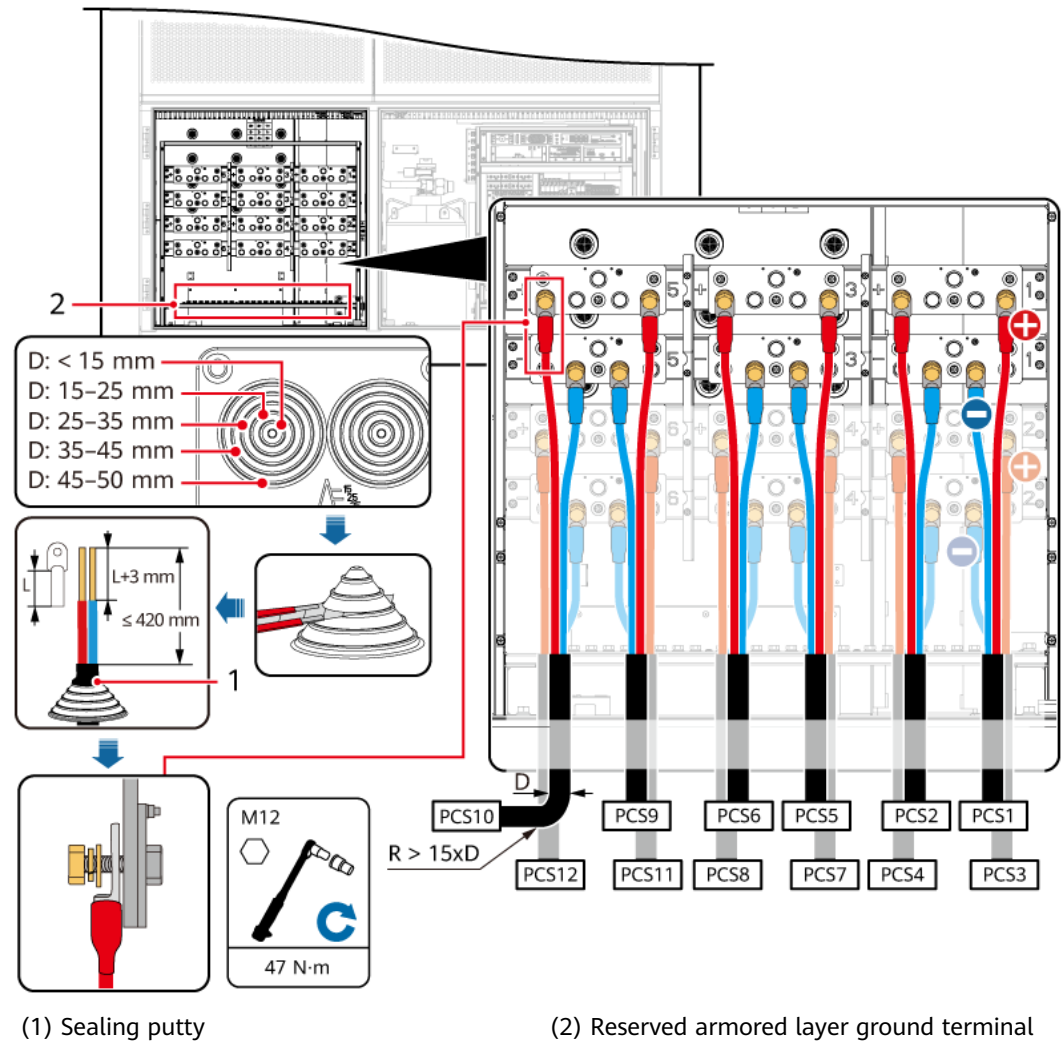
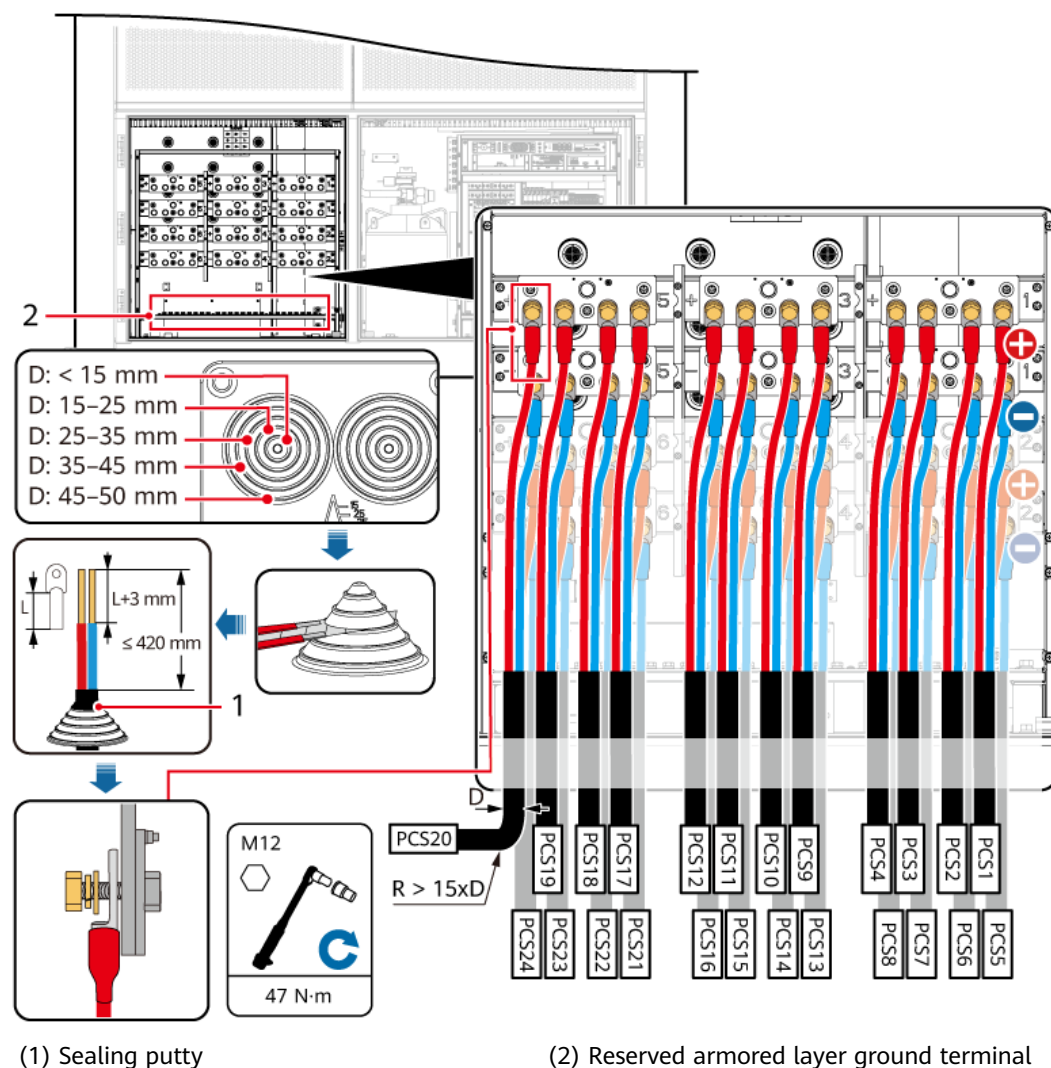


Figure 6-11 Installing DC power cables (two-core cables, 24 PCSs)



6.7 Installing a Three-Phase AC Input Power Cable (With External Grid Power Supply)

- AC input power cables have been pre-buried according to the specifications.
- The OT/DT terminals of the AC input power cables have been crimped according to the specifications. For details, see [D.2 Crimping an OT or DT Terminal](#).

CAUTION

- Before connecting cables, ensure that the general input switch 1QA for the AC auxiliary power is off.
- When connecting AC input power cables, ensure that the cables are not damaged or disconnected. Ensure that the neutral wire is securely connected. Otherwise, AC power devices in the system may be damaged.

NOTICE

- Before installing cables, route cables to corresponding positions according to the design and label the cables.
 - The screw assembly whose model is subject to the delivery shall be tightened according to the corresponding standard torque.
 - Partially tighten the nuts to 5 N·m, and then install the nuts to the recommended torque.
 - Check the torque of the installed bolts. Use a marker to mark the nuts that have been checked.
 - After installing the power cables, ensure that the OT terminals are properly fitted to and aligned with the copper bar, and that the DC power cables point vertically downward.
 - The external three-phase AC power supply must meet the general quality requirements of the power grid. Otherwise, a device for improving the power grid quality is required.
-

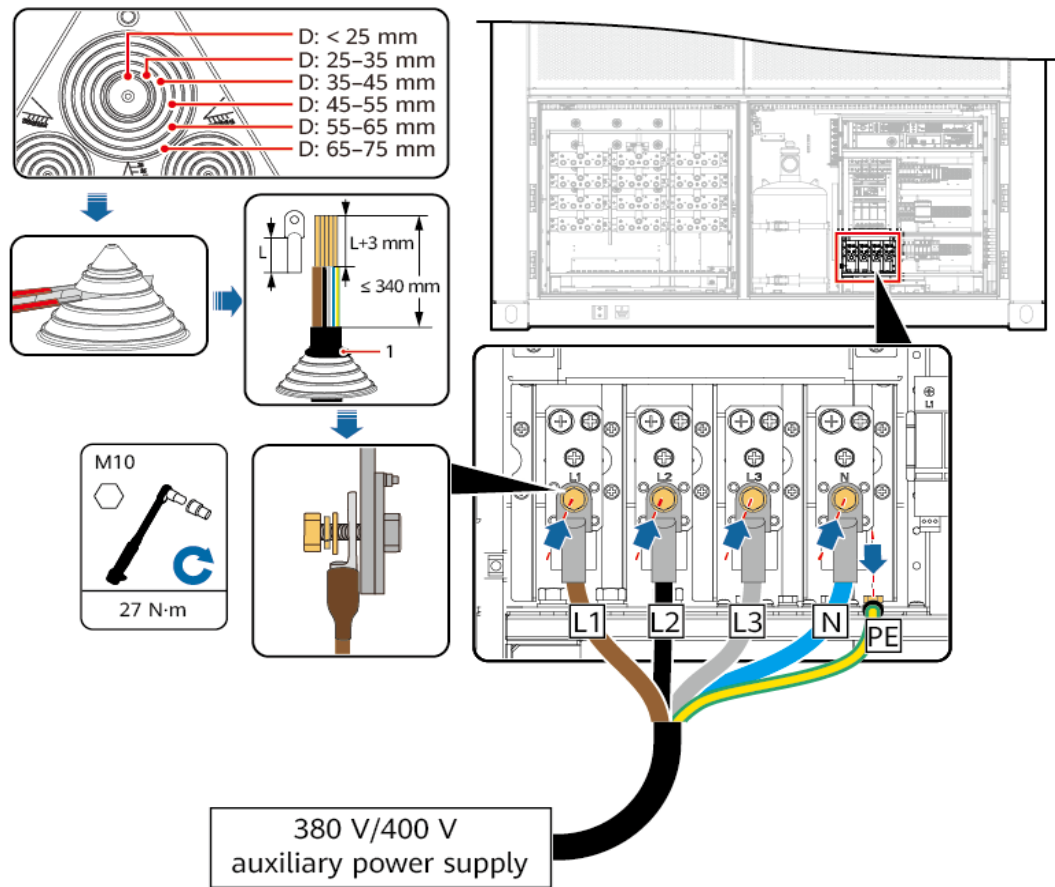
 NOTE

The three-phase AC auxiliary power supply is provided by a dedicated transformer.

 NOTE

The position for cutting the pagoda connector is for reference only. The actual cable usage may vary.

Figure 6-12 Connecting an AC input power cable (the PE wire is optional)



(1) Sealing putty

6.8 Installing a Single-Phase AC Input Power Cable (with UPS)

⚠ CAUTION

Before connecting cables, ensure that the UPS input switch 2FC is off.

📖 NOTE

If a UPS (provided by the customer) or other reliable backup power supplies (provided by the customer) is used to supply power, perform the following steps to install the single-phase AC input power cable.

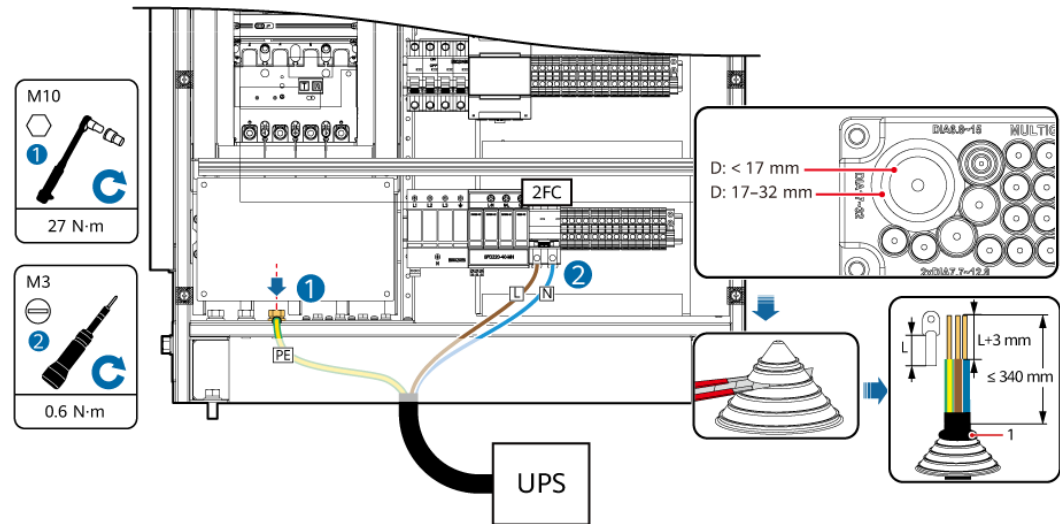
📖 NOTE

The position for cutting the pagoda connector is for reference only. The actual cable usage may vary.

Step 1 If the cable has an armored layer, connect the armored wire to the main ground point of the control unit cabin.

- Step 2** Connect the PE wire to the ground bar of the control unit cabin, and connect the L and N wires to switch 2FC.

Figure 6-13 Wiring diagram (the PE wire is optional)



(1) Sealing putty

-----End

6.9 Installing a Socket

NOTE

- Some models have sockets. If no socket is configured, the customer can install a socket onsite.
- The width of the socket to be installed must be less than or equal to 45 mm.
- After installing and connecting cables, determine the quantity of filler panels to be removed based on the width of the local sockets before reinstalling the cover of the power distribution cabinet.

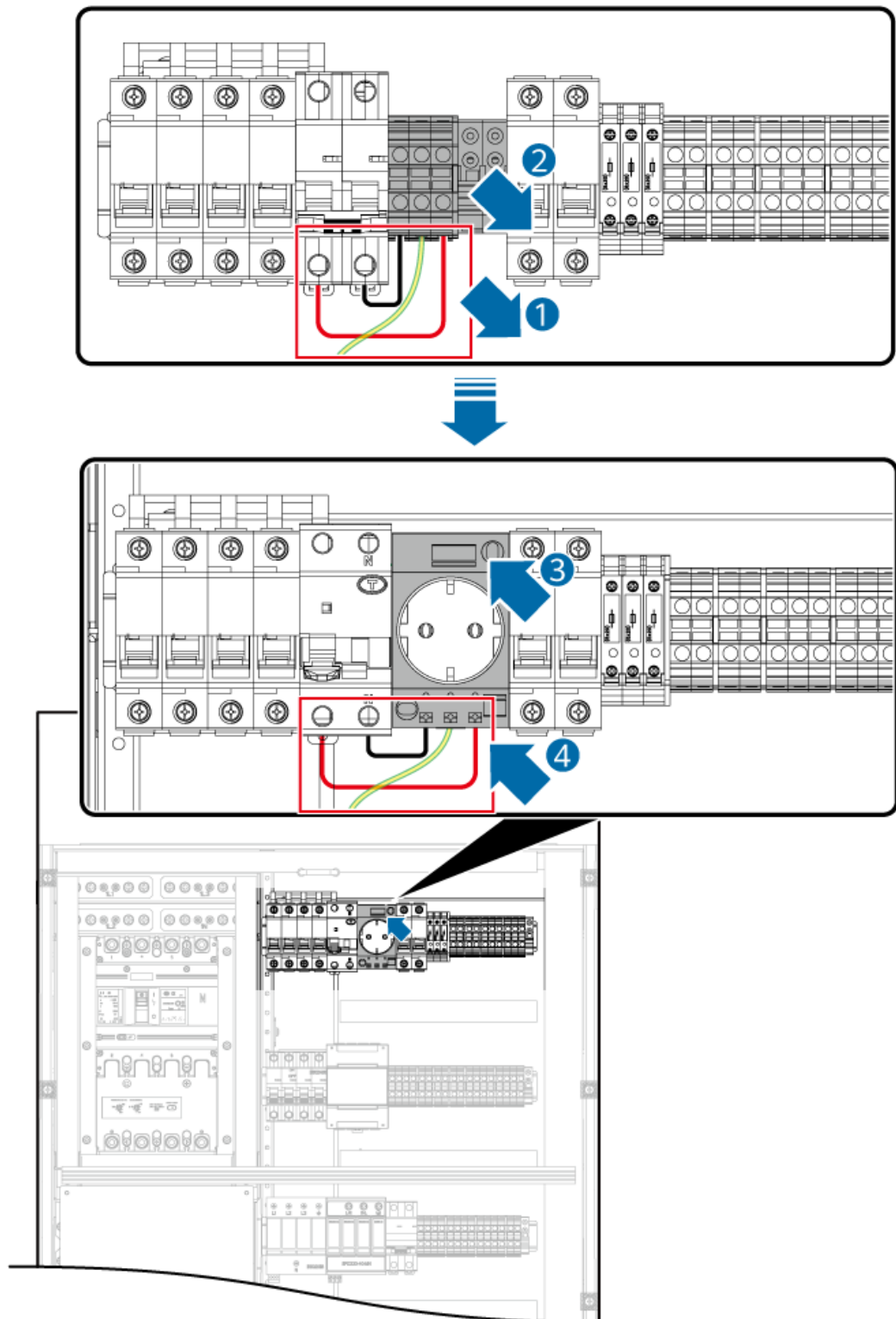
Step 1 Remove the cables pre-connected to the placeholder terminals.

Step 2 Remove the placeholder terminals.

Step 3 Install the socket.

Step 4 Connect the cables removed in **Step 1** to the socket.

Figure 6-14 Placeholder terminals and cables of the socket



----End

6.10 Installing Signal Cables

WAN communications cables or optical fiber cables can be used as signal cables between cascaded ESSs and between an ESS and the SACU.

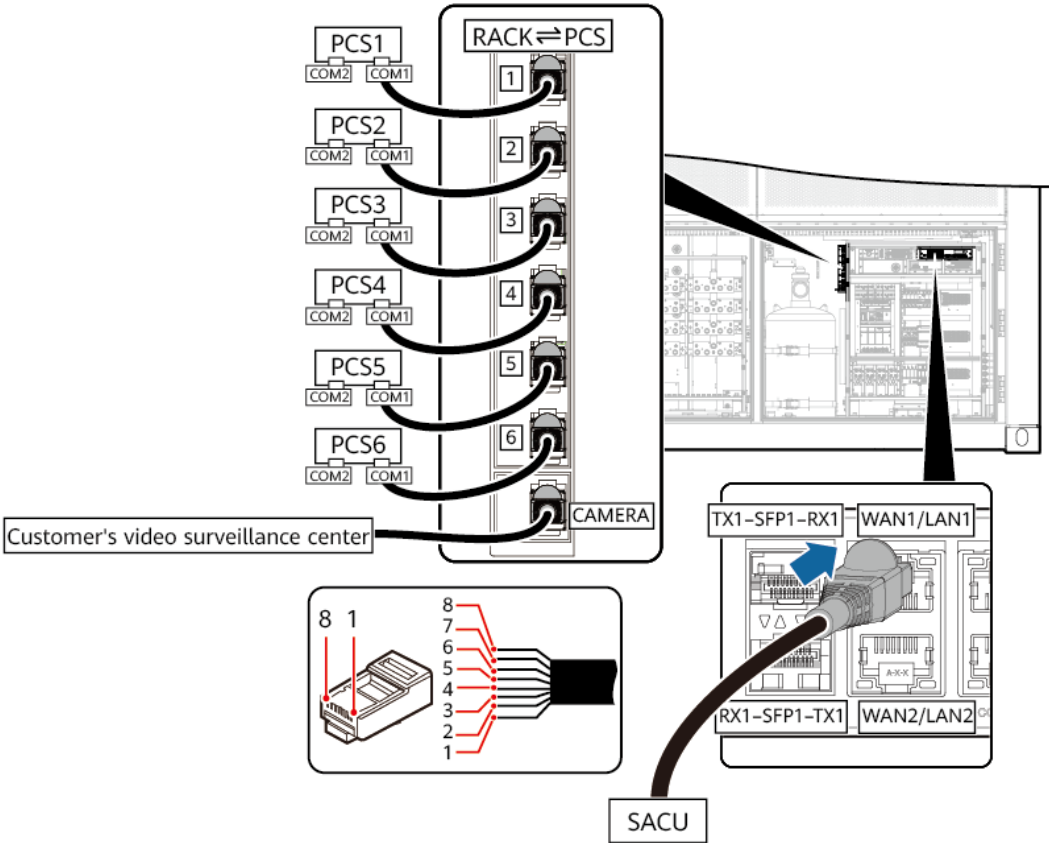
6.10.1 Installing Communications Cables

- Connect the communications cable between the ESS and the SACU. Connect either of WAN1/LAN1 or WAN2/LAN2 to the SACU.
- Connect the communications cables between the ESS and the PCSs.
 - When one battery rack is connected to multiple PCSs, connect the PCSs of the same battery rack in series, and then connect the last PCS in series to the ESS.
 - The six network ports connected to the PCSs correspond to six battery racks of the ESS from top to bottom. The DC power cables and communications cables of the same battery rack shall be connected to the same PCSs.
- Connect the communications cable between the ESS camera and the station control room.

NOTE

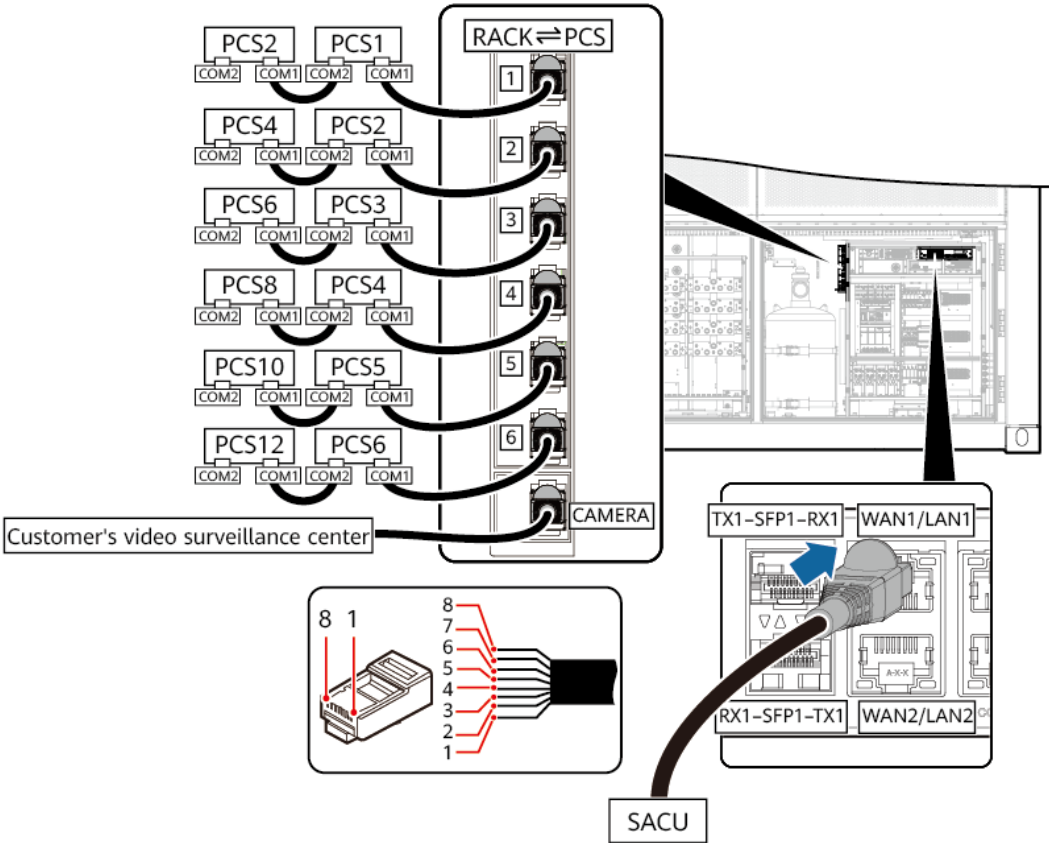
Only some models are configured with cameras.

Figure 6-15 Connecting communications cables (6 PCSs)



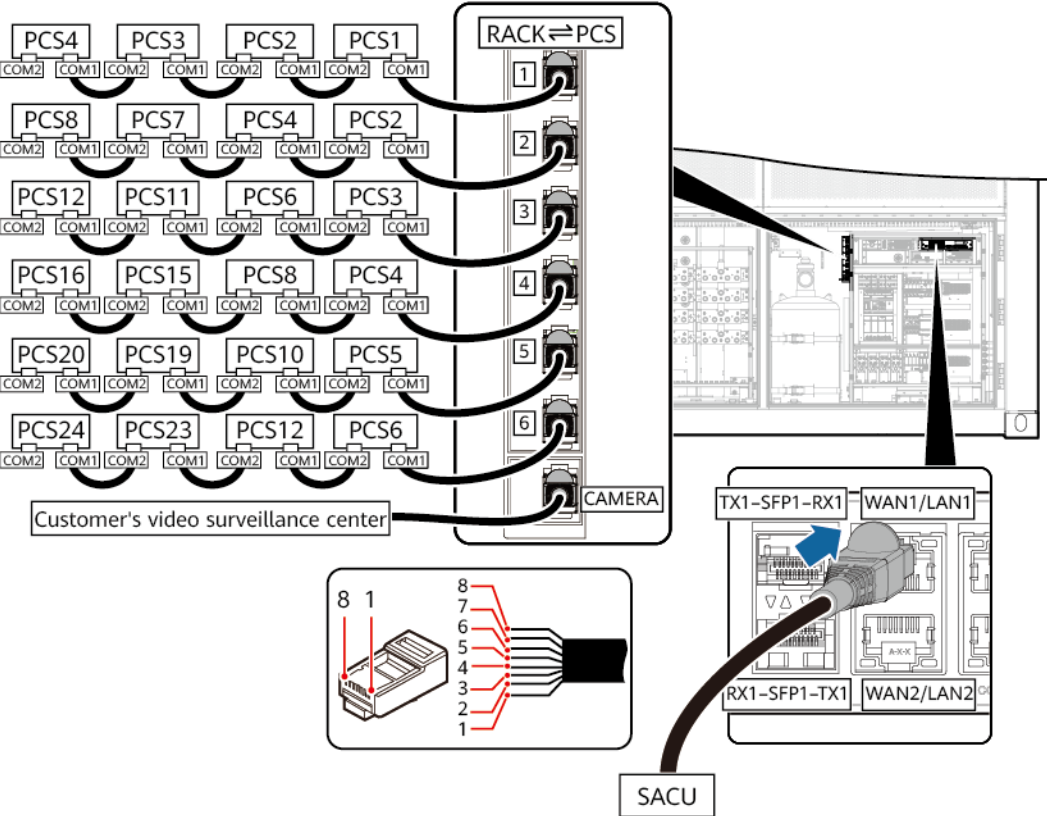
- | | | | |
|----------------------|------------|---------------------|-----------|
| (1) White-and-orange | (2) Orange | (3) White-and-green | (4) Blue |
| (5) White-and-blue | (6) Green | (7) White-and-brown | (8) Brown |

Figure 6-16 Connecting communications cables (12 PCSs)



- | | | | |
|----------------------|------------|---------------------|-----------|
| (1) White-and-orange | (2) Orange | (3) White-and-green | (4) Blue |
| (5) White-and-blue | (6) Green | (7) White-and-brown | (8) Brown |

Figure 6-17 Connecting communications cables (24 PCSs)



- (1) White-and-orange (2) Orange (3) White-and-green (4) Blue
- (5) White-and-blue (6) Green (7) White-and-brown (8) Brown

6.10.2 Installing Optical Fiber Cables

NOTICE

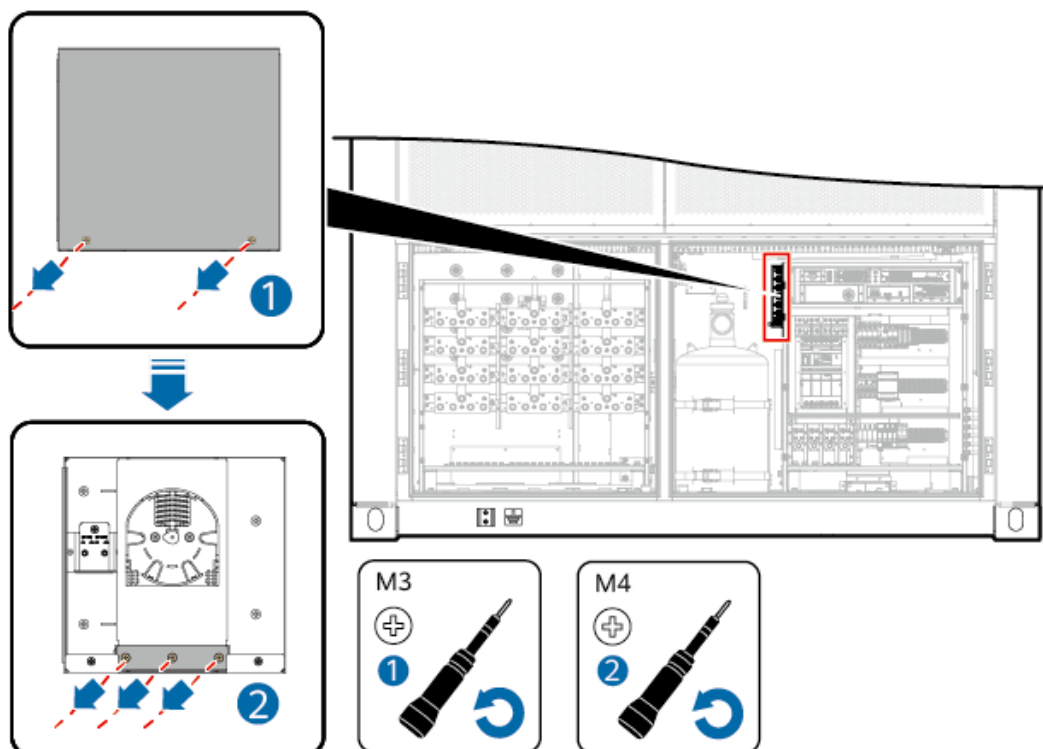
For optical fiber cables, connect the cables to the fiber splice tray first.

NOTE

Select either optical fiber communication or WAN communication.

Step 1 Remove the cover of the fiber splice tray and the optical fiber cable fastener.

Figure 6-18 Removing the cover of the fiber splice tray



Step 2 Connect the optical fiber cables.

1. Install the optical modules on the CMU panel. The optical modules are optional.

NOTE

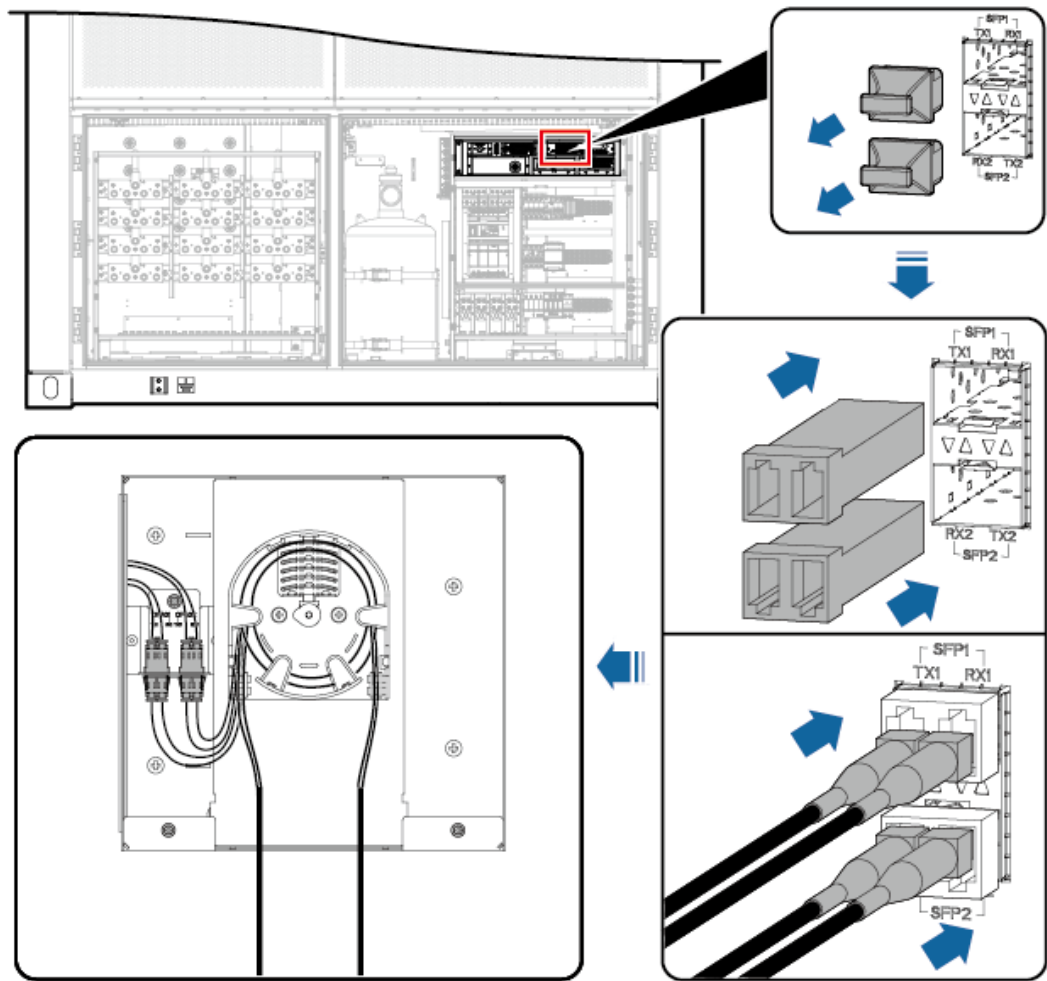
Optical module requirements:

- Supports GE ports with SFP or SFP and optical connectors.
 - Supports a ring network with a maximum communication distance of 1000 m.
 - Supports hot swapping. The rate can be set to 100 Mbit/s or 1000 Mbit/s.
2. Insert the optical fiber connectors bound near the CMU panel into the SPF ports or optical modules on the CMU.
 3. Connect the external device optical fiber cables to the pre-connected optical fiber connectors on the fiber splice tray, and wrap the cables around the fiber spool on the access terminal box (ATB).

NOTICE

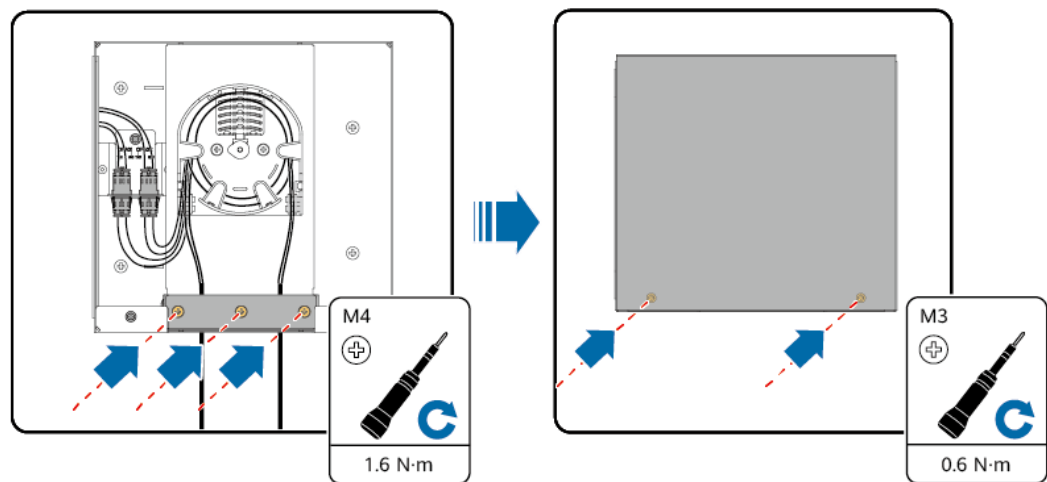
Only professionals are allowed to connect optical fiber cables.

Figure 6-19 Connecting optical fiber cables



Step 3 Check that the cables are connected correctly and securely, and then install the optical fiber cable fastener and the cover of the fiber splice tray.

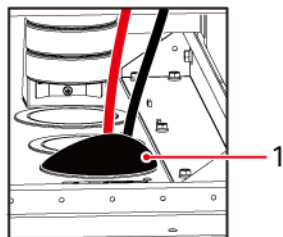
Figure 6-20 Installing the optical fiber cable fastener and the cover of the fiber splice tray



----End

6.11 Sealing the Cable Holes

After cables are installed, check that the cable holes are sealed with sealing putty.



(1) Sealing putty

7 Powering On the ESS

7.1 Check Before Power-On

Item	No.	Check Item	Acceptance Criteria
General check	1	Equipment appearance	• The equipment is intact and free from rust or paint flake-off. If paint flakes off, repaint the equipment. • The labels on the equipment are clear. Damaged labels must be replaced.
	2	Cable appearance	• Cable sheathings are properly wrapped and not damaged. • Cable hoses are intact.
	3	Cable connection	• Cables are connected in the designed positions. • Terminals are prepared as required and securely connected. • Labels on both ends of each cable are clear and specific, and attached in the same direction.
	4	Cable layout	• Electrical and extra low voltage (ELV) cables are routed separately. • Cables are neat and tidy. • Cable tie joints are evenly cut without burrs. • Cables are placed properly and with slack at bending points to avoid stress. • Cables are routed neatly without twists or crossovers in the cabinet. • There is no gap in cable holes. If there is a gap, seal it with sealing putty.
	5	Switch	• The RCM switch is off. • The AC circuit breaker is off.

Item	No.	Check Item	Acceptance Criteria
	6	Water sprinkler system	The water inlet is connected to the fire water pipe network of the site, and the fire water valve is closed. The water distribution pipe for the water sprinkler system is not filled with water. The manual control switch of the water sprinkler system must be away from the ESS. It is recommended that the distance be greater than 20 m.
	7	Liquid cooling pipe	Check the liquid cooling pipes and connectors for leakage.
Container check	1	Installation	- The installation meets the design requirements. - The ESS is level, and each door can be opened properly.
	2	Grounding	Each ESS has at least one ground point and is grounded securely. The resistance of a bond shall be less than or equal to 0.1 ohms.
	3	Accessories	The quantity and positions of external accessories installed meet the design requirements.
	4	Label	All labels are correct, clear, and complete.
	5	Cleanness	The ESS is clean and tidy inside, without any unnecessary cables, cable ends, terminals, or tools. No garbage is found outside the equipment.
Battery cabin check	1	Liquid cooling pipe	- The two butterfly valves connecting the LTMS to the container are open, that is, the handles of the butterfly valves are parallel to the pipes. - The ball valves (two for each battery rack, 12 in total) of the level-1 pipes at the bottom of cabins are open, that is, the handles of the ball valves are parallel to the pipes.
	2	Cable	The bolts for installing the cables are tightened and the cables are not loose.
	3	Cable hole sealing	Cable holes have been sealed.
	4	Component	All components are intact.
	5	Foreign object	Remove all foreign objects from the battery cabin, such as tools and remaining installation materials.
Control unit cabin check	1	SPD	The SPD indicator is green.
	2	Copper bar	The copper bar is not deformed, and no foreign objects are placed on the copper bar.
	3	AC meter	The buttons of the AC meter function properly and the screen is free of cracks.
	4	Cable	The bolts for installing the cables are tightened and the cables are not loose.

Item	No.	Check Item	Acceptance Criteria
	5	Foreign object	There are no foreign objects in the control unit cabin, such as packing materials.
	6	Component (such as CMU, adapter, extinguishant control panel)	All components are intact.
	7	Fire cylinder	The pressure of fire cylinder is normal.
Liquid cooling unit cabin check	1	Fastener	The LTMS is reliably secured to the fasteners on the container.
	2	Cable	The grounding is reliable, and cables are not loose when you try to pull them.
	3	Foreign object	There are no residual packaging materials or sundries in the liquid cooling unit cabin. The air inlet and outlet of the fan on the top are not blocked.
	4	Ball valve	Two coolant filling/drainage ball valves are closed, that is, the ball valve handles are vertical to the pipes.
	5	Electric control box	The electric control box is securely installed, all circuit breakers in the electric control box are ON, and the electric control box door is closed.

7.2 Installing the Solenoid Valve

CAUTION

Before installing the solenoid valve, ensure that the fire suppression system has been tested and passed the acceptance inspection (Auxiliary power-on is required for the test and acceptance of the fire suppression system.).

WARNING

For non-emergency manual operations, do not remove the safety pull ring.

 NOTE

- The appearance of the solenoid valve is for reference only, and that of the actual product may vary.
- The model of the solenoid valve varies. For details about the applicable installation procedure, see the model of the fire cylinder.

P0009438

Step 1 Check whether the solenoid valve is not activated. If the solenoid valve is activated, press the reset button on the extinguishant control panel to reset the solenoid valve.

- If the test contactor is closed at the bottom of the stud, the solenoid valve is activated.
- If the test contactor fails to be closed after being lifted to the bottom of the stud, the solenoid valve is not activated.

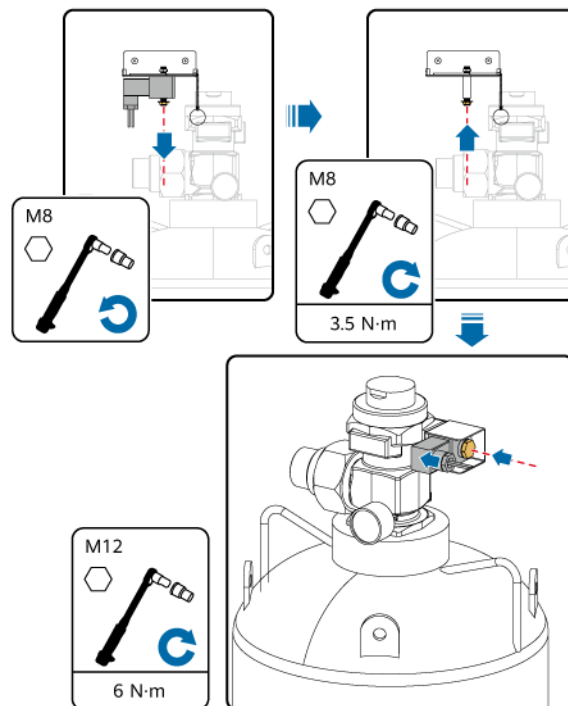
Step 2 Remove the solenoid valve from the bracket and reinstall the nut and washer.

Step 3 Install the solenoid valve on the corresponding stud on the fire cylinder.

 NOTE

Nut specifications: hex cap HEX17. Nuts are customized and cannot be replaced with common nuts.

Figure 7-1 Installing the solenoid valve

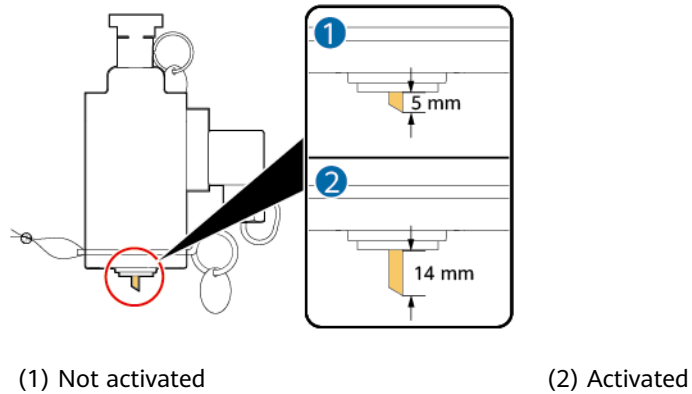


----End

YF40/2.5

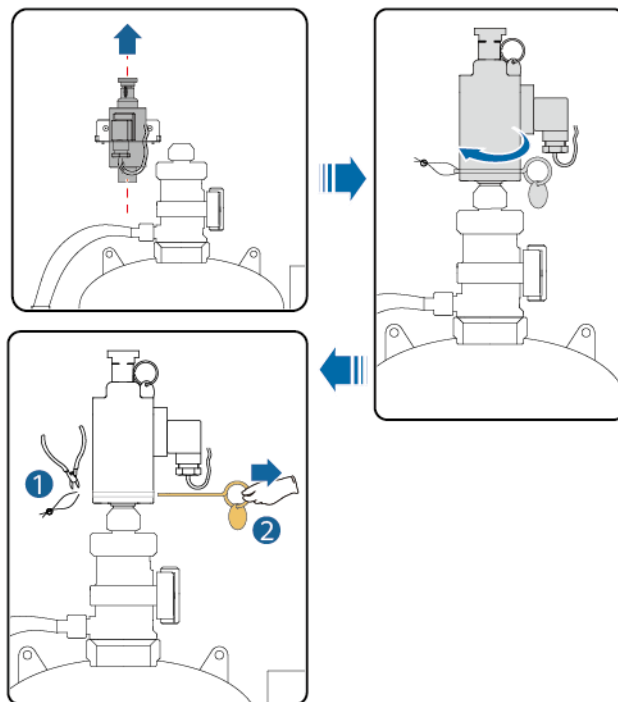
- Step 1** Check that the solenoid valve is not activated. If the solenoid valve is activated, press the reset button on the extinguishant control panel to reset the solenoid valve.

Figure 7-2 Solenoid valve status



- Step 2** Remove the solenoid valve from the bracket.
- Step 3** Tighten the solenoid valve clockwise to the top of the fire cylinder.
- Step 4** Remove the safety pin.

Figure 7-3 Installing the solenoid valve



----End

CNES-F-50/4.2

- Step 1** Check whether the solenoid valve is not activated. If the solenoid valve is activated, press the reset button on the extinguishant control panel to reset the solenoid valve.

Figure 7-4 Activated

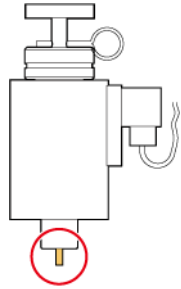
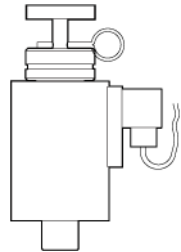
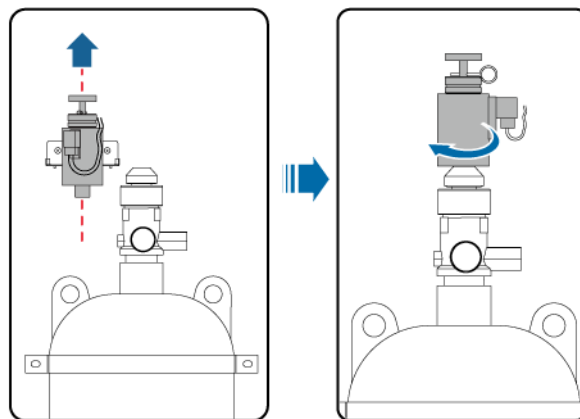


Figure 7-5 Not activated



- Step 2** Remove the solenoid valve from the bracket.
- Step 3** Tighten the solenoid valve clockwise to the top of the fire cylinder.

Figure 7-6 Installing the solenoid valve



----End

7.3 Power-On Operations

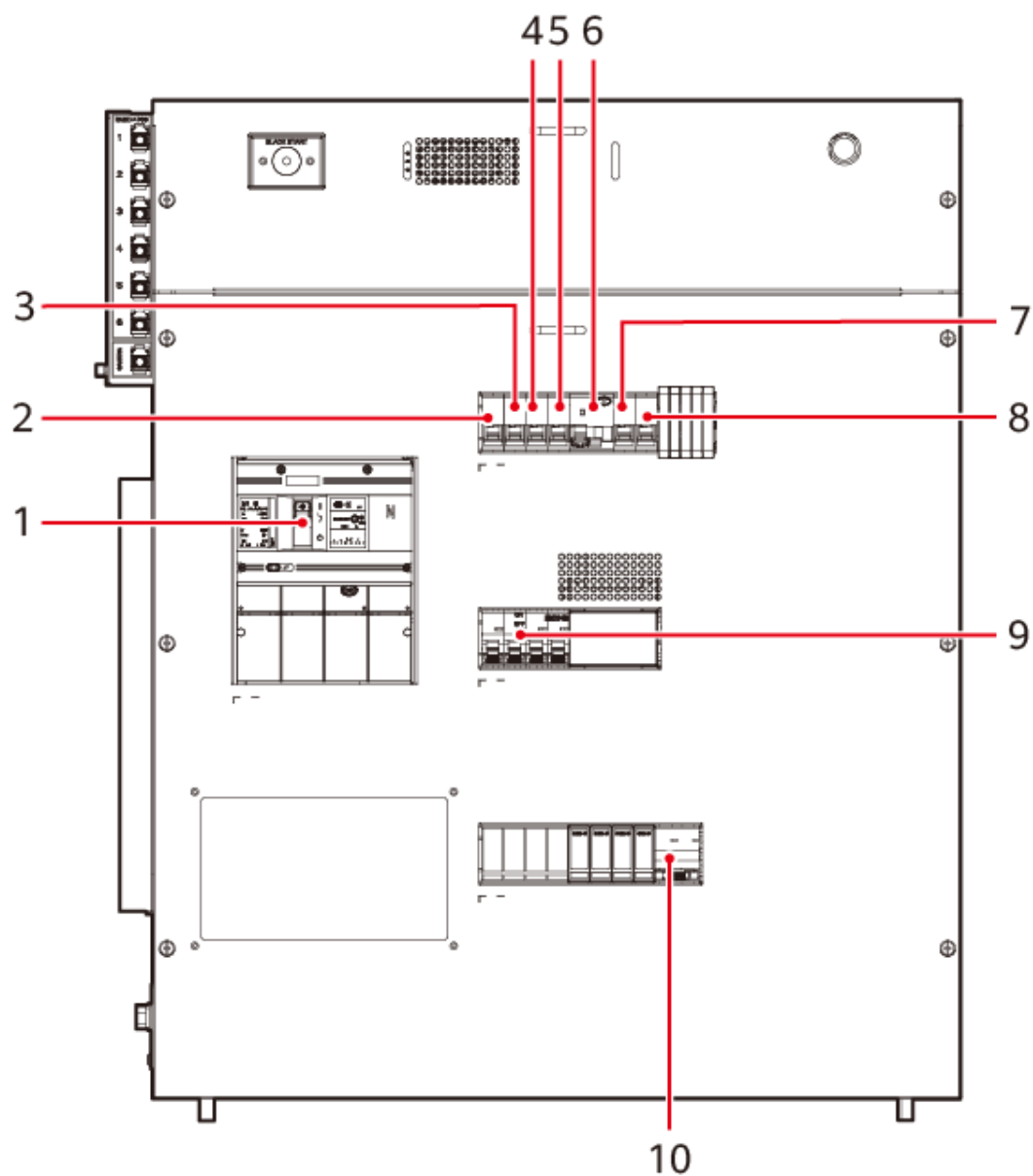
NOTICE

- Before the equipment is put into operation for the first time, ensure that the parameters are set correctly by professional personnel. Incorrect parameter settings may result in noncompliance with local grid connection requirements and affect the normal operations of the equipment.
 - Before turning on the internal switch of the ESS auxiliary power supply, check that the AC auxiliary power supply voltage is within the normal range.
 - If the ESS has not been used for six months or longer after being installed, it must be checked and tested by professionals before operation.
 - Perform power-on within two weeks after cables are connected. If the ESS has not been powered on for two weeks after cables are connected, replace the desiccants with new ones (Montmorillonite desiccant, 500 g/bag).
 - Before power-on, remove the desiccants from the cabins and dispose of them according to the applicable local waste disposal act.
- The protective film of ESS containers is used to prevent foreign objects from entering the container during storage. Do not remove the protective film before powering on and commissioning the ESS container.
蓝膜是用于存储时防止异物进入。存储时请勿撕毁，需要上电调试前请撕掉。
- Before power-on, remove the blue protective films with the label
 - Before power-on, remove the compressor bracket inside the LTMS and ensure that the general switch and all branch circuit breakers of the LTMS are turned on.
 - Do not open the battery cabin door and the left door of the control unit cabin after power-on. Otherwise, the system may shut down.

NOTE

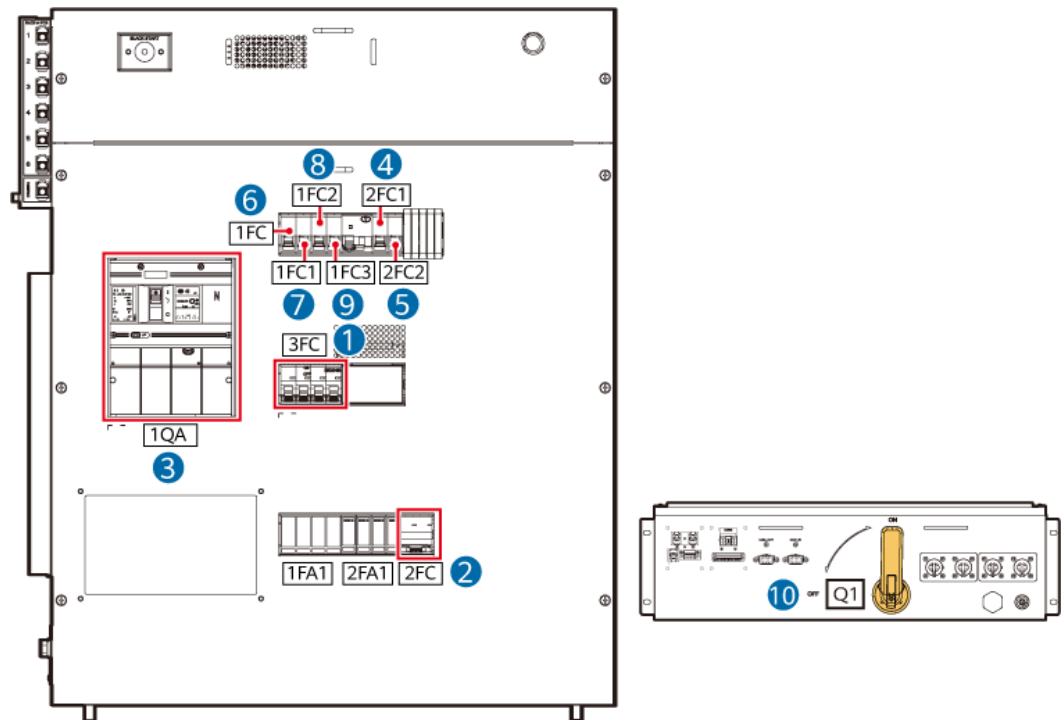
The switch position diagrams are for reference only, and those of the actual products may vary.

Figure 7-7 Positions of switches in the power distribution cabinet of the control unit cabin



- | | | | | |
|---|---|--|---------------------------------------|---------------------------------|
| (1) General switch 1QA for the AC auxiliary power | (2) Single-phase mains general switch 1FC | (3) PSU switch 1FC1 | (4) Electric air damper switch 1FC2 | (5) ATS mains input switch 1FC3 |
| (6) Socket & lighting switch 1FB1 | (7) Adapter switch 2FC1 | (8) Extinguisher control panel switch 2FC2 | (9) Mains SPD specific disconnect 3FC | (10) UPS input switch 2FC |

Figure 7-8 Power-on operations



- Step 1** Turn on the mains SPD specific disconnecter 3FC. Check that the display windows of the surge protection modules in the mains SPD 1FA1 are green.
- Step 2** Turn on the UPS input switch 2FC. Check that the display windows of the surge protection modules in the UPS SPD 2FA1 are green.
- Step 3** Turn on the general switch 1QA for the AC auxiliary power.

CAUTION

- Before turning on the general switch 1QA for the AC auxiliary power, ensure that the neutral wire is correctly connected. Otherwise, devices such as the air conditioner may be damaged.
- After turning on switch 1QA, immediately check that the L1, L2, and L3 phase voltages are 220 V AC/230 V AC using the multimeter. If the phase voltage displayed on the multimeter is 400 V or other values, the L1, L2, L3, and neutral wires may be incorrectly connected and you need to check the cables.

- Step 4** Turn on all switches in the power distribution system of the ESS.
1. Turn on the adapter switch 2FC1 and extinguishant control panel switch 2FC2.
 2. (Optional: Perform this step when the extinguishant control panel is C050SZEG.) Set the time of the extinguishant control panel to the current time. For details, see [D.1 How to Set the Time of the C050SZEG Extinguishant Control Panel](#).
 3. Turn on the single-phase mains general switch 1FC, PSU switch 1FC1, motorized air damper switch 1FC2, and ATS mains input switch 1FC3.

Step 5 Turn on the RCM circuit breaker Q1.



CAUTION

- The ESS can be powered on only when the battery cabin doors and the left door of the control unit cabin are closed.
- After the system is started successfully, it runs according to the received scheduling commands.

----End

8 Deployment and Commissioning

For details about deployment and commissioning in the on-grid scenario, see [LUNA2000-4472 Series Utility-Scale Energy Storage On-Grid Solution User Manual](#).

NOTICE

It is recommended that the interval between two charge/discharge cycles be less than or equal to five days to ensure that the ESS is in the optimal state.

9 Powering Off the ESS

9.1 Sending a Shutdown Command on the SmartLogger

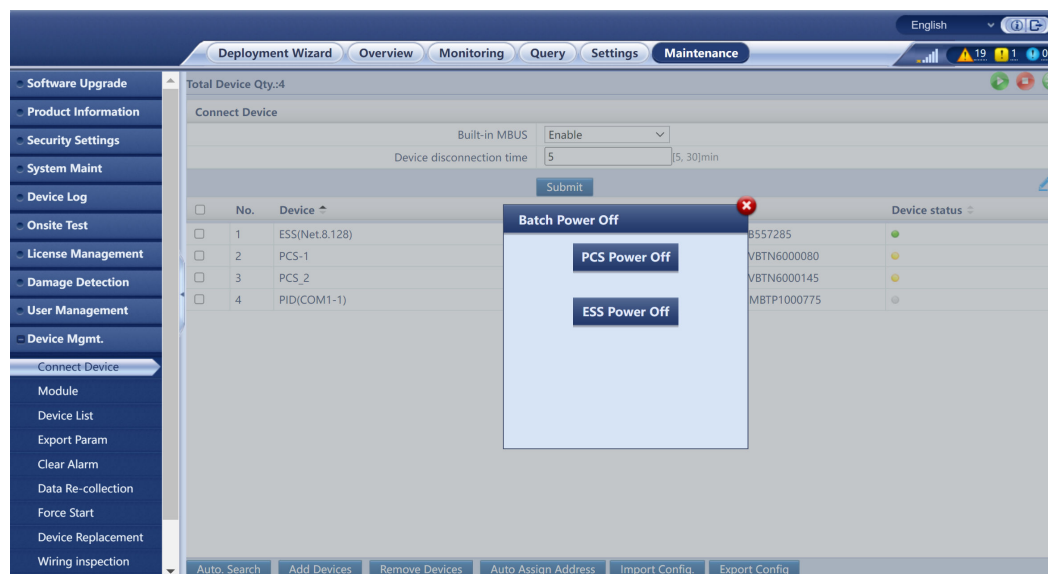
Prerequisites

The system has connected to the grid and is running properly.

Procedure

- Step 1** Log in to the SmartLogger WebUI, choose **Maintenance > Connect Device**, click , select **ESS Power Off**, and send a shutdown command.

Figure 9-1 Shutting down the ESS



- Step 2** Choose **Monitoring > PCS > Running Info.** and check the device status and DC voltage to verify that the shutdown is successful.

Step 3 Choose **Monitoring > ESS > ESR > Running Info.** and check the working status to verify that the shutdown is successful.

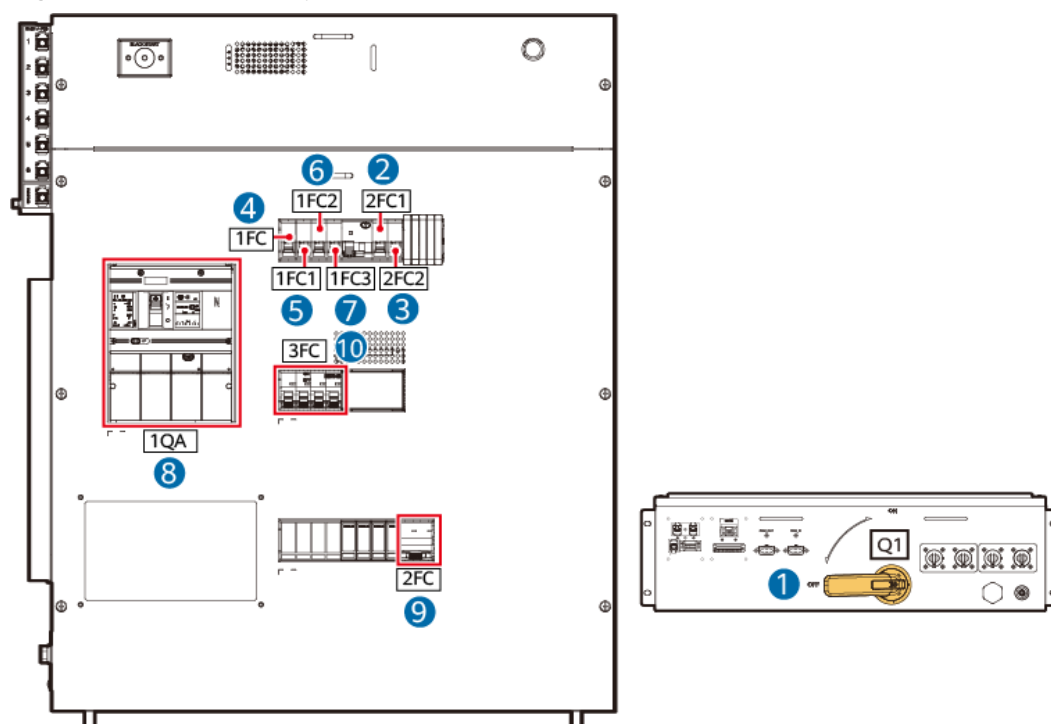
Step 4 Choose **Overview > Active Alarm** and check the system alarms after the shutdown. If an alarm is generated, handle the alarm according to the alarm handling suggestions.

-----End

9.2 Power-Off Operations

For details about the positions of circuit breakers and switches, see [Figure 7-7](#).

Figure 9-2 Power-off operations



Step 1 Turn off the RCM circuit breaker Q1.

Step 2 Turn off all switches in the power distribution system of the ESS.

1. Turn off the 12 V adapter input switch 2FC1 and extinguishant control panel input switch 2FC2.

NOTICE

If the extinguishant control panel has been powered off for more than 24 hours, you are advised to disconnect the cables of lead-acid batteries in the extinguishant control panel.

2. Turn off the single-phase mains general switch 1FC, PSU AC input switch 1FC1, motorized air damper switch 1FC2, and ATS mains input switch 1FC3.

Step 3 Turn off the general input switch 1QA for the AC auxiliary power.

Step 4 Turn off the UPS input switch 2FC.

Step 5 Turn off the mains SPD specific disconnecter 3FC.

-----End

10 Emergency Handling

If an accident (including but not limited to the following) occurs on the site, ensure the safety of onsite personnel first and contact the Company's service engineers.

Battery Falling or Strong Impact

- If a battery has obvious damage or abnormal odor, smoke, or fire occurs, evacuate the personnel immediately, call emergency services, and contact the professionals. The professionals shall use fire extinguishing facilities to extinguish the fire under safety protection.
- If the appearance is not deformed or damaged, and there is no obvious abnormal odor, smoke, or fire, ensure safety and perform the following operations:
 - Warehouse: Evacuate personnel, transfer the battery to an open and safe place by professionals using mechanical tools, and contact the Company's service engineers. Leave the battery for an hour and ensure that the battery temperature is within the room temperature range (tolerance: $\pm 10^{\circ}\text{C}$) before handling.
 - ESS onsite: Evacuate personnel, close the doors of the ESS, transfer the battery to an open and safe place by professionals using mechanical tools, and contact the Company's service engineers. Leave the battery for an hour before handling.

Flood

- Power off the system if it is safe to do so.
- If any part of the batteries is submerged in water, do not touch the batteries to avoid electric shock.
- Do not use batteries that have been soaked in water. Contact a battery recycling company for disposal.

Fire Alarm Horn/Strobe

When the alarm indicator on the equipment blinks or buzzes:

- Do not approach.

- Do not open the door.
- Stay away immediately.
- Cut off the power supply remotely only when your safety is guaranteed.

Gas Exhaust

- Onsite personal protection: Do not directly face the exhaust vents.
- Post-disaster product maintenance: Contact the Company's service engineers for evaluation.

Extinguishant Release or Fire

- Suggestions for onsite O&M personnel:
 - a. When a fire occurs, evacuate from the building or equipment area, press the fire alarm bell, and immediately call the fire emergency service. Notify the professional firefighters and provide them with relevant product information, including but not limited to battery pack types, ESS capacity, and battery pack location and distribution.
 - b. After calling the fire emergency service, remotely power off the system while ensuring your own safety.
 - c. Before professional firefighters arrive, do not enter the affected building or equipment area, and do not open the doors of the ESS. Isolate and monitor the site. Keep irrelevant personnel away from the site.
 - d. After professional firefighters arrive, provide relevant product information, including but not limited to battery pack types, ESS capacity, battery pack location and distribution, and user manuals.
 - e. After the fire is extinguished, the site must be handled by professionals in accordance with local laws and regulations. Do not open the doors of the ESS without permission.
 - f. Post-disaster product maintenance: Contact the Company's service engineers for evaluation.
- Suggestions for professional firefighters:
 - a. For product information, see the information provided by O&M personnel, including but not limited to battery pack types, ESS capacity, battery pack location and distribution, and user manuals.
 - b. Do not open the doors of the ESS before it is deemed safe by professionals.
 - c. Follow local fire fighting regulations.

11

Technical Specifications

Item	LUNA2000-4472-2S
Nominal energy	4472 kWh
Rated power	2236 kW
Maximum power	2236 kW
Rated DC voltage	1331.2 V
Maximum DC voltage	1500 V
Rated charge/discharge current	280 A x 6
Maximum charge/discharge current	331 A x 6
Number of battery racks per ESS	6
Battery temperature control mode	Liquid cooling
Battery rack model	LUNA2000-745-2R
Rated voltage of a battery rack	1331.2 V
Voltage range of a battery rack	1123–1497 V
Number of battery packs per rack	8
Nominal capacity of a battery rack	745.5 kWh
Charge/Discharge rate	≤ 0.5CP @ 50°C
Nominal power of a battery rack	372.7 kW
Intra-rack balancing mode	Active balancing at the battery pack level ^[1]

Item	LUNA2000-4472-2S
Rated input short circuit current of the three-phase AC auxiliary power supply (I _{cc})	30 kA
Rated input voltage of the three-phase AC auxiliary power supply	380/400 V AC±15%
Rated input current of the three-phase AC auxiliary power supply	57.7 A
Rated input frequency of the three-phase AC auxiliary power supply	50/60 Hz±2%
Rated input power of the three-phase AC auxiliary power supply	40 kVA
Input power factor of the three-phase AC auxiliary power supply	≥ 0.9
Input overvoltage level of the three-phase AC auxiliary power supply	III
Input power distribution system of the three-phase AC auxiliary power supply	TN-S
Rated input short circuit current of the single-phase AC auxiliary power supply (I _{cc})	6 kA
Rated input voltage of the single-phase AC auxiliary power supply	220/230 V AC±15%
Rated input current of the single-phase AC auxiliary power supply	0.87 A
Rated input frequency of the single-phase AC auxiliary power supply	50/60 Hz±2%
Rated input power of the single-phase AC auxiliary power supply	200 VA

Item	LUNA2000-4472-2S
Input power factor of the single-phase AC auxiliary power supply	≥ 0.9
Input overvoltage level of the single-phase AC auxiliary power supply	II
IP rating	IP55 (battery cabin and control unit cabin)
Protection level	I
Pollution degree	3
Corrosion resistance class	C5-M
Operating temperature range	-30°C to +55°C
Storage temperature range	-40°C to +60°C
Operating humidity range	0-100% (non-condensing)
Maximum operating altitude	4700 m ^[2]
Weight	< 42 t
Coolant type	Ethylene glycol solution
Operating pressure of the coolant	0.24 MPa
Maximum pressure of the coolant	0.26 MPa
ESS container dimensions (W x H x D)	20 ft: 6058 mm x 2896 mm x 2438 mm
Electromagnetic compatibility (EMC)	Class A
Noise	75 dB (0.5CP, 25°C)
Electrical protection	RCD and ISO detection protection
System communications interface	Optical fiber/Ethernet
System communications protocol	Modbus TCP
Power communications port	CAN
Standards compliance	IEC/EN 62477-1, EN 55011/CISPR 11, UL 9540A, UN 38.3, etc.

Item	LUNA2000-4472-2S
Note [1]: Applicable to only some models. This feature depends on whether battery packs have active balancing ports. Note [2]: Applicable to only some models. For details, see the nameplate on the side of the container.	

A Alarm Reference

For details about alarms, see [LUNA2000-4472 Series Smart String ESS Alarm Reference](#).

B Certificate Management and Maintenance

Initial Certificate Risk Disclaimer

Huawei's certificates preconfigured on Huawei devices during manufacturing are mandatory identity credentials for Huawei devices. The disclaimer statements for using the certificates are as follows:

1. Huawei's initial certificates are used only in the deployment phase, for establishing initial security channels between devices and the customer's network. Huawei does not promise or guarantee the security of the initial certificates.
2. Customers shall bear consequences of all security risks and security incidents arising from using Huawei's initial certificates as service certificates.
3. Huawei's initial certificates are valid from the manufacturing date until December, 2099.
4. Services using an initial certificate will be interrupted when the certificate expires.
5. It is recommended that customers deploy a PKI system to issue certificates for devices and software on the live network and manage the lifecycle of the certificates. To ensure security, certificates with short validity periods are recommended.

Application Scenarios of Initial Certificates

Component to Which the Certificate Belongs	Usage	Scenario	Description
CMU	Modbus-TCP northbound communication certificate	Authenticates the validity of the CMU when the CMU communicates with the SACU through Modbus-TCP.	For details about how to replace a certificate, obtain the release documentation of the corresponding product and choose the corresponding security maintenance manual in the contents on the left.
	App communication certificate	Authenticates the validity of the CMU when the mobile app communicates with the CMU through Modbus-TCP.	
	Southbound communication certificate	Authenticates the validity of the CMU when the LCC and BCU communicate with the CMU.	
BCU	Northbound communication certificate	Authenticates the validity of the BCU when the LCC communicates with the CMU.	
LCC	Northbound communication certificate	Authenticates the validity of the LCC when the LCC communicates with the CMU.	

C Contact Information

If you have any questions about this product, please contact us.



<https://digitalpower.huawei.com>

Path: **About Us > Contact Us > Service Hotlines**

To ensure faster and better services, we kindly request your assistance in providing the following information:

- Model
- Serial number (SN)
- Software version
- Alarm ID or name
- Brief description of the fault symptom

 NOTE

EU Representative Information: Huawei Technologies Hungary Kft.

Add.: HU-1133 Budapest, Váci út 116-118., 1. Building, 6. floor.

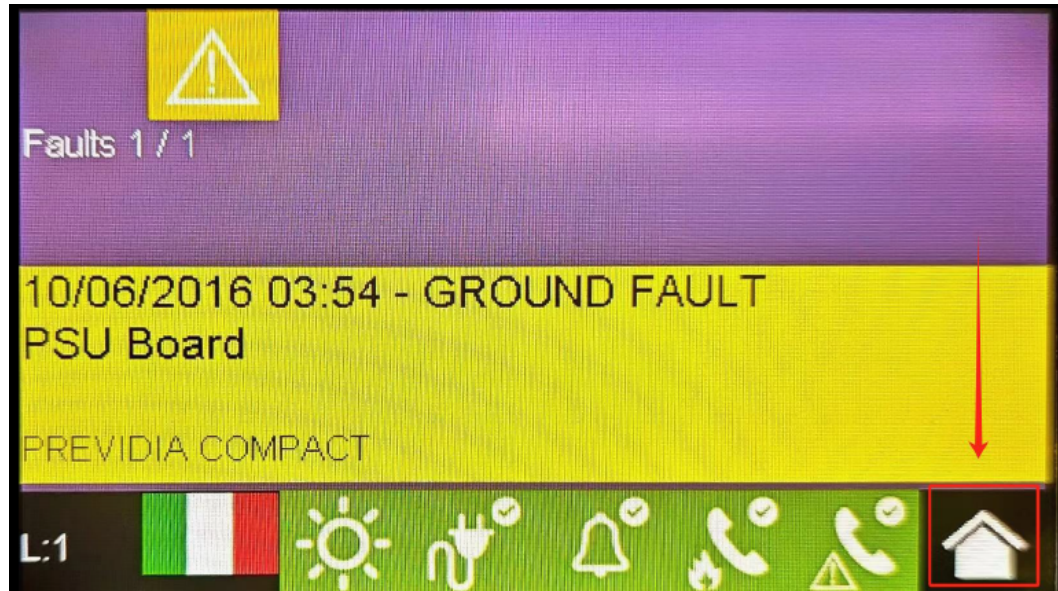
Email: hungary.reception@huawei.com

D FAQ

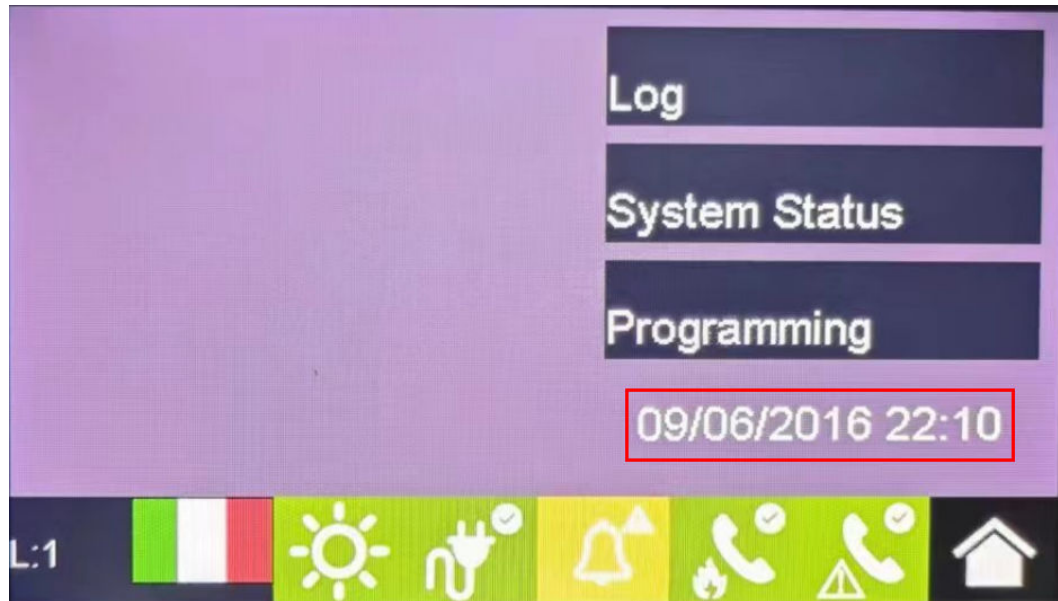
D.1 How to Set the Time of the C050SZEG Extinguishant Control Panel

After the active/standby power supply of the C050SZEG extinguishant control panel is powered off, the time cannot be updated. After the extinguishant control panel is powered on again, you need to manually update the time.

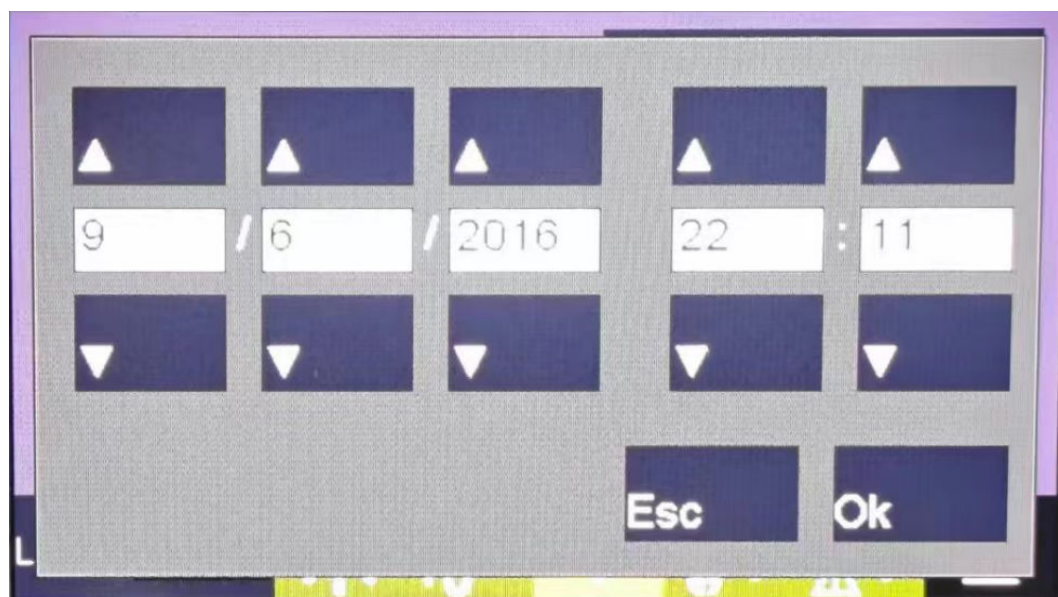
Step 1 Tap the house icon on the panel.



Step 2 Click the time displayed on the screen.



Step 3 Enter the current time and tap **OK**.



----End

D.2 Crimping an OT or DT Terminal

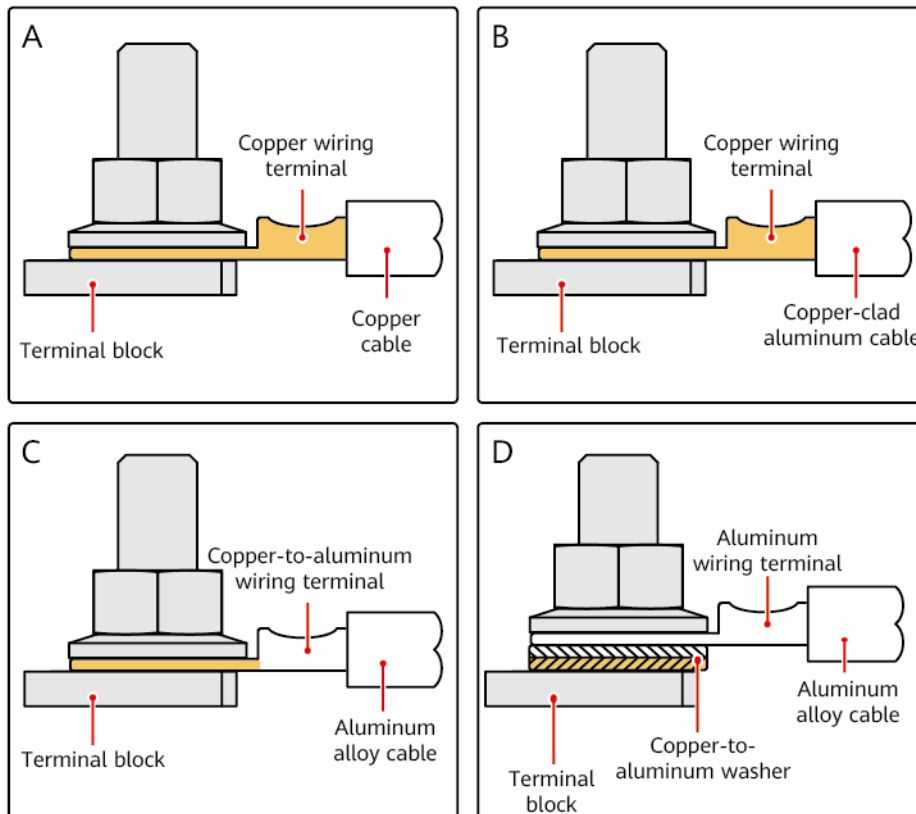
Requirements on an OT or DT Terminal

- If a copper cable is used, use copper wiring terminals.
- If a copper-clad aluminum cable is used, use copper wiring terminals.
- If an aluminum alloy cable is used, use copper-to-aluminum wiring terminals, or aluminum wiring terminals along with copper-to-aluminum washers.

NOTICE

- Do not connect aluminum wiring terminals to the terminal block. Otherwise electrochemical corrosion may occur, affecting the reliability of cable connections.
- Comply with the IEC 61238-1 requirements when using copper-to-aluminum wiring terminals, or aluminum wiring terminals along with copper-to-aluminum washers.
- Do not mix up the aluminum and copper sides of a copper-to-aluminum washer. The outer contour of the washer shall not be smaller than that of the OT/DT terminal. Ensure that the aluminum side of the washer contacts the aluminum wiring terminal, and that the copper side contacts the terminal block. It is recommended that washers and terminals be purchased from the same vendor.

Figure D-1 Requirements on an OT or DT terminal

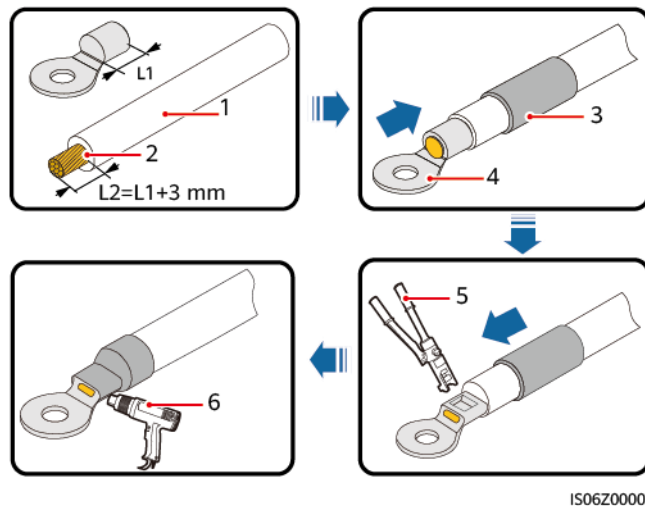


Crimping an OT or DT Terminal

NOTICE

- Avoid scratching the core wire when stripping a cable.
- The cavity formed after the conductor crimp strip of the OT or DT terminal has been crimped must wrap around the core wire completely. The core wire must make close contact with the OT or DT terminal.
- Wrap the wire crimping area with heat or cold shrink tubing. The heat shrink tubing is used as an example.
- Use a heat gun carefully to avoid heat damage to the equipment.

Figure D-2 Crimping an OT terminal



IS06Z00001

(1) Cable

(4) OT terminal

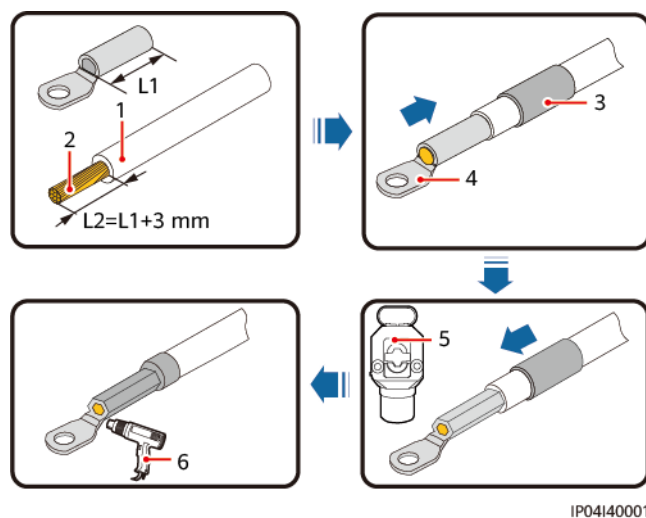
(2) Core wire

(5) Hydraulic pliers

(3) Heat shrink tubing

(6) Heat gun

Figure D-3 Crimping a DT terminal



IP04I40001

(1) Cable

(2) Core wire

(3) Heat shrink tubing

(4) DT terminal

(5) Hydraulic pliers

(6) Heat gun

D.3 How Do I Repair Paint Damage?

Prerequisites

- Do not apply paint in bad weather, such as rain, snow, strong wind, and sandstorm, when there is no shelter outdoors.
- You have prepared the RAL 9003 polyurethane top coat.

Paint Repair Description

The equipment appearance shall be intact. If paint has flaked off, repair paint damage immediately.

NOTE

Check the paint damage on the equipment and prepare appropriate tools and materials. The number of materials depends on site requirements.

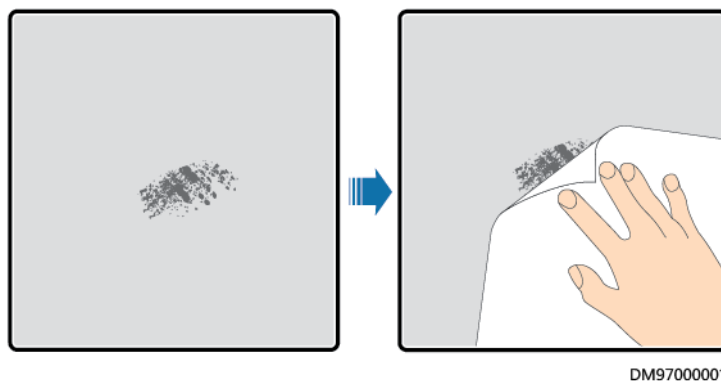
Table D-1 Paint repair description

Paint Damage	Tool and Material	Procedure	Description
Slight scratch (steel base material not exposed)	Spray paint or paint, brush (required for repainting a small area), fine sandpaper, anhydrous alcohol, cotton cloth, and paint spray gun (required for repainting a large area)	Steps 1, 2, 4, and 5	1. The color number of the top coat (polyurethane paint) is RAL 9003. 2. For a few scratches, smudges, or rust, manual paint spraying or brushing is recommended.
Smudges and rust that cannot be removed			
Deep scratch (primer damaged, steel base material exposed)	Spray paint or paint, zinc-rich primer, brush (required for repainting a small area), fine sandpaper, anhydrous alcohol, cotton cloth, paint spray gun (required for repainting a large area)	Steps 1, 2, 3, 4, and 5	3. For many scratches or large-area smudges and rusts, use a paint spray gun. 4. The paint coating shall be thin and even. Paint drops are prohibited on the coating. The surface shall be smooth. 5. Leave the repainted area for approximately 30 minutes before performing any further operation.
Logo and pattern damage	If a logo or pattern is damaged, provide the logo size and color number. Seek help from a local supplier of advertisement coatings to formulate a repair solution based on the logo size, color, and damage.		
Dent	1. If a dent is less than or equal to 100 mm ² in area and less than 3 mm in depth, fill the dent with Poly-Putty base and then perform the same operations as those for processing deep scratches. 2. If a dent is greater than 100 mm ² in area or greater than 3 mm in depth, ask the local supplier for an appropriate repainting solution.		

Procedure

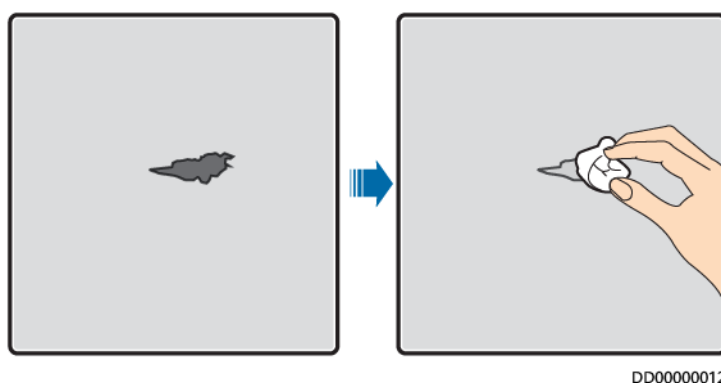
Step 1 Gently polish damaged areas using fine sandpaper to remove smudges or rust.

Figure D-4 Polishing a damaged area using sandpaper



Step 2 Dip a piece of cotton cloth into anhydrous alcohol and wipe the polished or damaged area to remove the dirt and dust. Then wipe off the anhydrous alcohol with a clean and dry cotton cloth

Figure D-5 Wiping a polished or damaged area using anhydrous alcohol



Step 3 Paint zinc-rich primer on the damaged coat using a brush or paint spray gun.

NOTICE

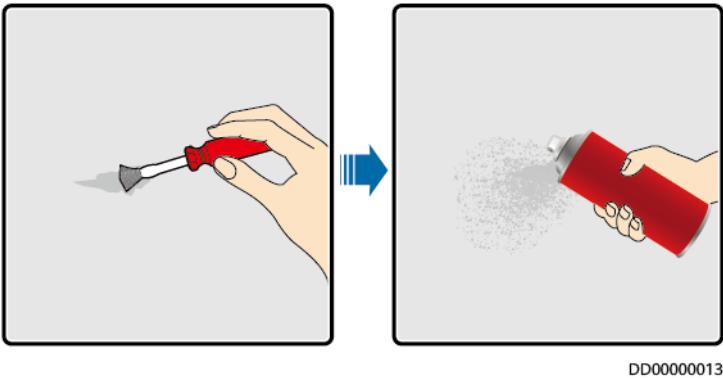
- If the base material is exposed in the area to be repaired, apply epoxy zinc-rich primer, wait until the paint has dried, and then apply acrylic acid top coat.
 - Select epoxy zinc-rich primer or acrylic acid top coat with a color the same as the surface coating color of the equipment.
-

Step 4 Apply paint evenly to the damaged area based on the damage degree of the paint using an aerosol spray, brush, or paint spray gun until all damage traces are invisible.

NOTICE

- Ensure that the painting is thin, even, and smooth.
- In the case that an equipment pattern has different colors, to prevent undamaged areas and those with different colors as the damaged area from being contaminated during repainting, cover such areas using white paper and adhesive tape before repairing paint.

Figure D-6 Repainting a damaged area



Step 5 Wait for 30 minutes and check whether the painting meets the requirements.

NOTE

- The color of the repainted area must be consistent with that of the surrounding area. Use a colorimeter to measure the color difference (ΔE), which shall be less than or equal to 3. If a colorimeter is unavailable, ensure that there is no visible edge between the repainted area and the surrounding area. The paint shall also be free of bulges, scratches, flaking, or cracks.
- If you choose to spray paint, it is recommended that you spray paint three times before checking the result. If the color does not meet the requirements, paint more times until the painting meets the requirements.

----End

Paint Supply Information

Table D-2 Paint requirements

Item	Requirement
Primer thickness	40 μm
Intermediate coat thickness	100 μm
Top coat thickness	40 μm
Primer type	Epoxy zinc-rich paint
Intermediate coat type	Epoxy micaceous iron oxide
Top coat type	RAL 9003 polyurethane top coat

E Acronyms and Abbreviations

B

BCU	Battery Control Unit
BMU	Battery Monitoring Unit

C

CMU	Central Monitoring Unit
------------	-------------------------

E

ESS	Smart String Energy Storage System
ETH	Ethernet
ESR	battery rack
ESM	battery pack

L

LCD	liquid crystal display
------------	------------------------

P

PSU	Power Supply Unit
PCS	Smart Power Control System
S	
SACU	Smart Array Controller
STS	Smart Transformer Station
T	
TCU	Temperature Control Unit