LUNA2000-(107-215) Series Smart String ESS

Maintenance Manual

Issue	08
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Huawei Digital Power Technologies Co., Ltd.

Address: Huawei Digital Power Antuoshan Headquarters

Futian, Shenzhen 518043

People's Republic of China

Website: https://digitalpower.huawei.com

About This Document

Purpose

This document describes routine maintenance, troubleshooting, and parts replacement of the following Smart String Energy Storage System (ESS) models. Before maintaining the ESS, read this document carefully to understand the safety information as well as functions and features of the ESS.

- LUNA2000-215-2S10
- LUNA2000-215-2S11
- LUNA2000-161-2S11
- LUNA2000-107-1S11

Intended Audience

This document is intended for:

- Technical support engineers
- Maintenance engineers

Symbol Conventions

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

Symbol	Description
⚠ DANGER	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

Symbol	Description
NOTICE	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.
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 08 (2025-03-31)

Updated **4 Replacing a Battery Pack**.

Updated **6 Replacing a DCDC**.

Updated **7.1 Replacing an Entire RCM**.

Updated **7.5 Replacing a BCU**.

Updated **8 Replacing an LTMS**.

Updated **10.1 Replacing a Smoke Detector**.

Updated **10.2 Replacing a Heat Detector**.

Updated **10.3 Replacing a CO Sensor**.

Updated **11 Replacing a Display Module**.

Updated **13 Replacing an Emergency Stop Switch**.

Updated **14 Replacing a Water Sensor**.

Issue 07 (2025-03-03)

Updated **9 Replacing LTMS Pipes**.

Updated **10.1 Replacing a Smoke Detector**.

Updated **10.2 Replacing a Heat Detector**.

Updated **10.3 Replacing a CO Sensor**.

Updated **18 Emergency Handling**.

Deleted the section "Replacing an Automatic Exhaust Valve."

Issue 06 (2025-02-07)

Updated **4.2 Replacing an Entire Battery Pack**.

Updated **4.3 Replacing a BMU Collection Board**.

Updated **5 Replacing a PCS**.

Updated **6 Replacing a DCDC**.

Updated **7 Replacing the RCM**.

Updated **8 Replacing an LTMS**.

Updated **9 Replacing LTMS Pipes**.

Updated **11 Replacing a Display Module**.

Issue 05 (2025-01-10)

Added **19.6 How Do I Fill Refrigerant?**

Issue 04 (2024-12-31)

Added **6 Replacing a DCDC**.

Updated **19.4 How Do I Use the Coolant Filling/Drainage Machine to Add or Drain Coolant?**

Issue 03 (2024-12-16)

Added **3 Alarm Reference**.

Added **19.5 How Do I Enable the Manual Exhaust Function of the LTMS?**

Updated **2 Routine Maintenance**.

Updated **2.5 Powering Off the ESS**.

Updated **4 Replacing a Battery Pack**.

Updated **5 Replacing a PCS**.

Updated **7.1 Replacing an Entire RCM**.

Updated **7.5 Replacing a BCU**.

Updated **19.4 How Do I Use the Coolant Filling/Drainage Machine to Add or Drain Coolant?**.

Issue 02 (2024-10-12)

Updated **4.3 Replacing a BMU Collection Board**.

Updated **8.9 Replacing an LTMS NTC Cable Harness**.

Updated **13 Replacing an Emergency Stop Switch**.

Issue 01 (2024-07-31)

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

Contents

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.

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 certified high-voltage electricians are allowed to operate medium-voltage equipment.

- 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.
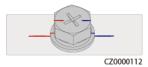
⚠ **CAUTION**

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.
- 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.
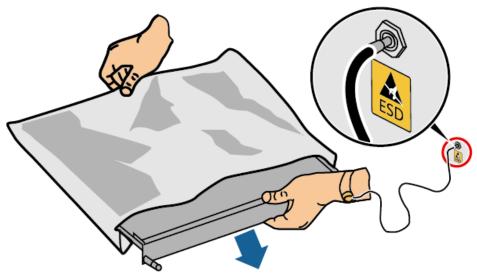
ESD

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 1-1 Wearing an ESD wrist strap

- 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.
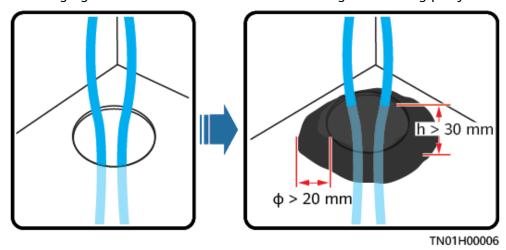
⚠ **WARNING**

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, 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.

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- After installing the equipment, remove the packing materials such as cartons, foam, plastics, and cable ties from the equipment area.

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.
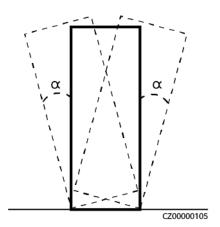
- If multiple persons need to move a heavy object together, determine the manpower and work division with consideration of height and other conditions to ensure that the weight is equally distributed.

- 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.

- Ensure that tilt angle of the cabinet meets the requirements shown in the figure. The tilt angle α of a cabinet with packaging must be less than or equal to 15°. After the cabinet is unpacked, its tilt angle α must be less than or equal to 10°.

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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.
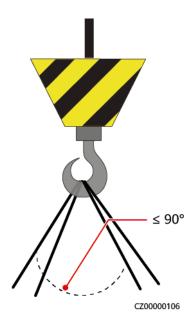
- Platform ladders with protective rails are preferred. Do not use single ladders.
- Before using a ladder, check that it is intact and confirm its load bearing capacity. Do not overload it.
- Ensure that the ladder is securely positioned and held firm.

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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.

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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.

1.5 Equipment Safety

1.5.1 ESS Safety

⚠ **DANGER**

Do not open cabinet doors when the system is running.

⚠ **DANGER**

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

⚠ **CAUTION**

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

- 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.

- 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.

- Do not insert or remove the auxiliary power module of the LTMS with power on.

- 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, which may cause heat or electrolyte leakage.

⚠ **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 H_2. To prevent fire or device corrosion, ensure that flammable gas is properly exhausted.

⚠ **DANGER**

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

⚠ **WARNING**

Install batteries 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**

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**

Tighten the screws on copper bars or cables to the torque specified in this document. Periodically confirm whether the screws are tightened, check for rust, corrosion, or other foreign objects, and clean them up if any. Loose screw connections will result in excessive voltage drops and batteries may catch fire when the current is high.

⚠ **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.
- 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.
- 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.
- When battery packs are installed as spare parts, the following requirements must be met:
  - 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. Power on the ESS within 24 hours after installation. 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.
  - Before installing a battery pack, check that its enclosure is not deformed or damaged.
  - 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.
- 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 Routine Maintenance

> ⚠ **CAUTION**
>
> Safety requirements in maintenance and repair:
>
> - Before connecting or removing cables, turn off the protection switch of the corresponding loop.
> - Place a warning sign indicating that the switch must not be turned on at the position where the switch resides.
> - Use an electroscope of a proper voltage level to check whether the equipment is energized and ensure that the equipment is completely powered off.
> - If charged bodies are found nearby, block or wrap them with insulation plates or insulation tapes.
> - Before performing maintenance or repair, securely connect the loop to be repaired to the main ground loop using a ground cable.
> - After the maintenance or repair is complete, remove the ground cable between the loop that has been maintained and the main ground loop.
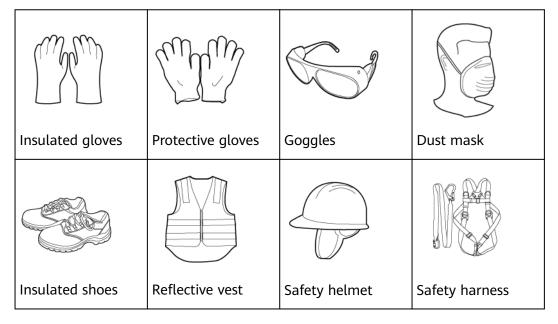
> **NOTICE**
>
> Do not open the cabinet door when the humidity is high (relative humidity ≥ 80% continuously), for example, on rainy days. If the cabinet door is open for 0.5 hour or longer when the humidity is high, manually perform forced dehumidification. Otherwise, the equipment may fail or the microgrid may collapse.
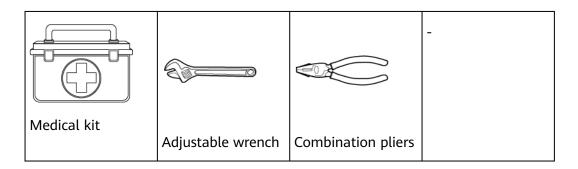>
> You can check **Scenario** on the SmartLogger WebUI to view the networking scenario. For details about the parameters, see **SmartLogger3000 User Manual**.
>
> Perform dehumidification as follows:
>
> 1. Check that the auxiliary AC power supply to the ESS is powered on. In off-grid scenarios, the genset or other external auxiliary power supply is used. In on/off-grid scenarios, the power grid supplies auxiliary power when available.
>
> 2. Log in to the SmartLogger WebUI and choose **Monitoring > ESS > Running Param**. The page for setting running parameters is displayed.
>
> 3. Choose **Basic Parameters** and set **Forced dehumidification control** to **Start-up**.
>
> 4. Click **Submit**. After the setting is successful, the manual dehumidification starts. View the alarm information to check that the system has started forced dehumidification. The alarm will be automatically cleared after the dehumidification is complete, which takes more than 10 minutes.

2.1 Preparations Before Maintenance

> **NOTE**
>
> This section lists only personal protective equipment. For details about the tools required for replacement, see the specific parts replacement section.

Insulated gloves	Protective gloves	Goggles	Dust mask
Insulated shoes	Reflective vest	Safety helmet	Safety harness

			-
Medical kit	Adjustable wrench	Combination pliers	

2.2 Routine Maintenance

Log in to the SmartLogger WebUI/FusionSolar app/management system and check whether there are major or minor alarms. If an alarm is generated, handle it by referring to the alarm reference.

☐ NOTE

For details, see the software user manuals.

2.3 Semi-annual Maintenance

Device Type	Check Item[1]	Troubleshooting	Power-Off Required or Not	Door Opening Required or Not
PACK/PCS/ DCDC maintenance fixture	Apply lubricating grease to the lead screw periodically: Apply grease to the nut, and then turn the handwheel to rotate the lead screw until the grease is evenly spread around the lead screw.	N/A **CAUTION** ● If the lead screw is kept idle indoors for more than 6 months, maintain the lead screw before using it each time. If the lead screw is used once or more times within 6 months, maintain it every 6 months. ● Butter, aluminum-based grease, composite grease can be used for lubricating the lead screw.	No	No

Device Type	Check Item[1]	Troubleshooting	Power-Off Required or Not	Door Opening Required or Not
SmartLogger WebUI	When the system is running, check that the parameters are correctly set and that there are no alarms.	Contact technical support.		
Cabinet	Check that the cabinet door lock is intact.	Replace the door lock.		
	Check that there is no obvious paint peeling or rust on the cabinet.	Repaint the damaged part.		
	Check that the cabinet exterior is free from obvious coating peeling and scratches.	Contact engineers to evaluate and handle the problem.		
	Check that the explosion relief panel is free from obvious paint peeling or rust.	Repaint in time.		
	Check that there is no foreign matter, ice, or snow on the top of the explosion relief panel.	Clean up accumulated objects in a timely manner.		
	Check that the air filter is not damaged or distorted.	Replace the filter.		

Device Type	Check Item[1]	Troubleshooting	Power-Off Required or Not	Door Opening Required or Not
	Check and clean the air filter of the heat exchanger and the outdoor fan vent to ensure that there is no scale, dirt, or blockage.	Clean the air filter of the heat exchanger. (You are advised to use a vacuum cleaner, cloth, or brush to clean the air filter. You do not need to remove the air filter for cleaning.) **NOTE** ● If the dirt or blockage is severe, increase the maintenance frequency. ● In harsh scenarios such as deserts and catkins, the heat exchanger must be cleaned periodically to ensure that there is no blockage or dust buildup.		
	Check that there is no dust buildup at the vents of the cabinet.	Clean up the dust.		
	Check that the protective tube for the communications cable on the rear of the cabinet is intact and secured.	Replace the damaged protective tube in a timely manner and reinforce the falling part.		

Device Type	Check Item[1]	Troubleshooting	Power-Off Required or Not	Door Opening Required or Not
	Check that the smoke exhaust vent on the top of the cabinet rear is not dirty or blocked.	Clean the smoke exhaust vent of the cabinet. **NOTE** If the smoke exhaust vent on the top of the cabinet rear is seriously blocked, remove the dirt and check and clean the smoke exhaust vent at the bottom.		
	Check that there are no potential hazards, contaminants, or rubbish around the unit.	Handle potential hazards and clean up rubbish.		
LTMS	Check whether the air exhaust vent blows out water in the upper part of the LTMS cabin.	Contact technical support.	No	Open the ESS door, but not the LTMS cabin door.
	Check that the operating compressor generates no metal friction noise or collision noise from inside.	Replace the LTMS.	No	Open the ESS door and the LTMS cabin door.
	Check that the dehumidifying and outdoor fan blades rotate properly and are free from deformation, damage, foreign matter, abnormal noise, and abnormal vibration.	Take out the foreign matter and repair or replace the fan. **NOTE** The LTMS periodically performs dust removal self-check. During non-charge/discharge periods, the outdoor fan speed will increase sharply in a short period of time, which is a normal phenomenon.		

Device Type	Check Item[1]	Troubleshooting	Power-Off Required or Not	Door Opening Required or Not
	Check that the pump works properly without abnormal noise.	Replace the LTMS.		
	Check that the multi-way valve generates no abnormal noise.	Replace the LTMS.		
	Check that no leakage occurs on the liquid cooling pipe and coolant inlet and outlet.	Replace the liquid cooling pipe.		
	Check that the dehumidifying fan screws are secured and not deformed.	Tighten the screws.	Yes. Power off the system by referring to **2.5 Powering Off the ESS**.	
	Check that the dehumidifying fan wiring terminals are securely connected.	Reconnect the cables.		
	Check that the air intake vent of the electric control module is not blocked.	Clear the blockage.		
	Check that the wiring terminals at the rear of the electric control module are securely connected.	Reconnect the cables.		
	Check that the compressor is secured properly.	Tighten the compressor screws.		

Device Type	Check Item[1]	Troubleshooting	Power-Off Required or Not	Door Opening Required or Not
	Check that the AC power cable above the compressor is secured.	Secure the AC power cable.		
	Check whether the coolant level is below the MIN level.	If the coolant level is below the MIN level, add coolant until it reaches the MAX level. **NOTE** For details about how to add coolant, see **19.4 How Do I Use the Coolant Filling/Drainage Machine to Add or Drain Coolant?**		
	Check that coolant in the tank does not leak.	Replace the LTMS.		
	Check that the PTC electric heater does not leak.	Replace the LTMS.		
	Check that the coolant in the pump does not leak.	Replace the LTMS.		
	Check that the multi-way valve does not leak.	Replace the LTMS.		
	Check that the liquid cooling condenser does not leak.	Replace the LTMS.		
	Check that the liquid cooling evaporator does not leak.	Replace the LTMS.		

Device Type	Check Item[1]	Troubleshooting	Power-Off Required or Not	Door Opening Required or Not
	• Check that the dehumidifying evaporator surface is free of obvious dirt. • Check that the dehumidifying evaporator fins are not pushed down.	• Clean the evaporator. (It is recommended that you use 5% soda solution for cleaning.) • Use a fin brush to organize the fins that are pushed down. **NOTE** If the dirt or blockage is severe, increase the maintenance frequency.		
	Check that the drainage port is free from leakage and blockage.	Replace the component where leakage occurs and clear the blockage.		
	Check that all pipes are intact and free from leakage.	Replace the faulty pipe.		
	Check that the clamps are intact and securely installed on the coolant pipes in the lower part of the LTMS cabin.	Replace the pipe support and secure it again.		
	Check that all cables are intact.	Replace the faulty cable.		
	Check that all cable wiring screws are tightened and all terminals are secured.	Tighten the screws and reconnect the cables.		

Device Type	Check Item[1]	Troubleshooting	Power-Off Required or Not	Door Opening Required or Not
Liquid cooling pipe	Check that no leakage occurs on the liquid cooling pipe and coolant inlet and outlet.	Replace the liquid cooling pipe.	Yes. Power off the system by referring to **2.5 Powering Off the ESS**.	Yes
PACK	Check that there is no obvious damage, paint peeling off, or rust on the appearance.	Contact technical support.	Yes. Power off the system by referring to **2.5 Powering Off the ESS**.	Yes
	Check that no leakage occurs on the coolant inlet and outlet of the pack and the metal edges at the bottom of the pack.	● Leakage at the coolant inlet and outlet: Replace the male connectors of the stop valves at the inlet and outlet after draining the coolant. ● Other cases: Replace the pack.		
	Check that cables are securely connected.	Secure the cables.		
	Check that cables are intact, especially that the cable sheath contacting a metal surface is intact.	Replace the faulty cable.		
	Check that the PE cable is securely connected.	Ensure reliable grounding.		

Device Type	Check Item[1]	Troubleshooting	Power-Off Required or Not	Door Opening Required or Not
PCS	Check for leakage at the coolant inlet and outlet of the PCS.	Leakage at the coolant inlet and outlet: Replace the male connectors of the stop valves at the inlet and outlet after draining the coolant.	Yes. Power off the system by referring to **2.5 Powering Off the ESS**.	Yes
	Check that the enclosure is not damaged or deformed.	Contact technical support.		
	Check that the parameters are set correctly.			
	Check that cables are securely connected.	Secure the cables.		
	Check that cables are intact, especially that the cable sheath contacting a metal surface is intact.	Replace the faulty cable.		
	Check that the PE cable is securely connected.	Ensure reliable grounding.		
DCDC	Check for leakage at the coolant inlet and outlet of the DCDC.	Leakage at the coolant inlet and outlet: Replace the male connectors of the stop valves at the inlet and outlet after draining the coolant.	Yes. Power off the system by referring to **2.5 Powering Off the ESS**.	Yes
	Check that cables are securely connected.	Secure the cables.		

Device Type	Check Item[1]	Troubleshooting	Power-Off Required or Not	Door Opening Required or Not
	Check that cables are intact, especially that the cable sheath contacting a metal surface is intact.	Replace the faulty cable.		
	Use a multimeter to check whether the ground terminals of the signal cables and power cables are reliably grounded.	Ensure reliable grounding.		
Fire suppression system	• Visually check that the smoke detector and heat detector are normal and that the inspection indicators blink properly. • Spot check the detectors with smoke or heat generated by using dedicated devices. • Check whether the detector indicators are steady red and whether the temperature changes are updated on the SmartLogger WebUI and app.	Replace the faulty component.	Yes. Power off the system by referring to **2.5 Powering Off the ESS**.	Yes
Note [1]: In harsh scenarios such as deserts and catkins, perform maintenance based on the site requirements to ensure that there is no blockage or dust buildup. If the dirt or blockage is severe, increase the maintenance frequency.				

2.4 Replacement of Components with a 10-Year Service Life

LTMS

Item	Troubleshooting	Power-Off Required or Not
LTMS	Replace the LTMS. For details, see **8 Replacing an LTMS**. Replace the LTMS pipe. For details, see **9 Replacing LTMS Pipes**.	Yes. Power off the system by referring to **2.5 Powering Off the ESS**.

Liquid Cooling Pipe

Item	Troubleshooting	Power-Off Required or Not
All liquid cooling pipes	For details, see **9.1 Replacing a Battery Pack Coolant Return Pipe**, **9.2 Replacing a Battery Pack Coolant Supply Pipe**, **9.3 Replacing a PCS/DCDC Pipe**, and **9.4 Replacing Male Connectors of the Liquid Cooling Pipe Stop Valves**. **NOTICE** After the liquid cooling pipe reaches the end of its 10-year service life, replace all the male connectors of the stop valves of the LTMS and PACK/PCS/DCDC. For details, see **9.4 Replacing Male Connectors of the Liquid Cooling Pipe Stop Valves**.	Yes. Power off the system by referring to **2.5 Powering Off the ESS**.
Coolant	For details, see **19.4 How Do I Use the Coolant Filling/Drainage Machine to Add or Drain Coolant?**	

Sensors

Item	Troubleshooting	Power-Off Required or Not
Heat detector	For details, see **10.2 Replacing a Heat Detector**.	Yes. Power off the system by referring to **2.5 Powering Off the ESS**.
Smoke detector	For details, see **10.1 Replacing a Smoke Detector**.	
CO sensor	For details, see **10.3 Replacing a CO Sensor**.	
Fire alarm horn/strobe	For details, see **10.4 Replacing a Fire Alarm Horn/Strobe**.	
T/H sensor	For details, see **16 Replacing a T/H Sensor**.	

2.5 Powering Off the ESS
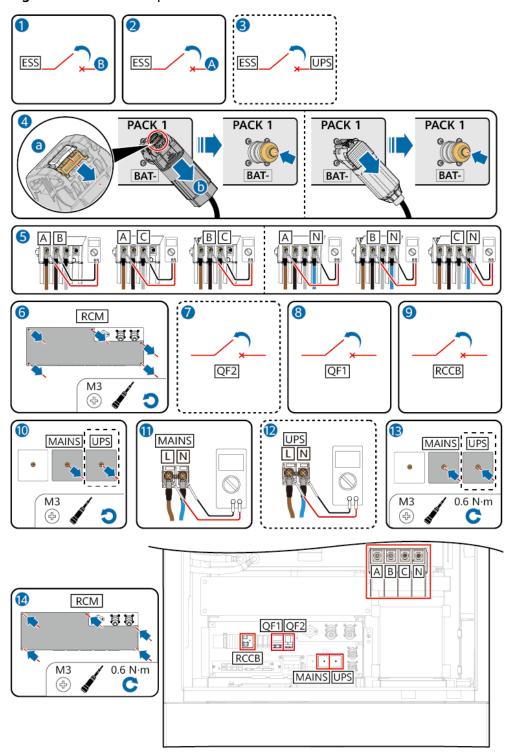
2.5.1 Powering Off the ESS

Step 1 Log in to the SmartLogger WebUI, click **Monitoring**, choose **ESS** in the navigation pane, select the ESS to be shut down, and click in the upper right corner.

Step 2 Choose **Overview** > **Active Alarms** to view system alarms generated after the shutdown. If any alarm is generated, handle the alarm according to the alarm handling suggestions.

Step 3 Click **Monitoring**, view the device status, and ensure that the shutdown is successful.

----End

2.5.2 Power-Off Operations

Figure 2-1 Power-off operations

A: Auxiliary power supply switch of the customer's power distribution cabinet	B: General power distribution switch of the customer's power distribution cabinet

Step 1 Turn off the general power distribution switch of the customer's power distribution cabinet.

Step 2 Turn off the auxiliary power supply switch of the customer's power distribution cabinet.

Step 3 (Optional) Turn off the ESS power switch on the UPS side. This operation is required when a UPS is configured.

Step 4 Remove the BAT– cable terminal from PACK1.

Step 5 Use a multimeter to measure the AC voltage of the PCS AC terminals. The voltage is close to 0.

Step 6 Remove the RCM cover.

Step 7 (Optional) Turn off the UPS AC input switch QF2 on the RCM. This operation is required when a UPS is configured.

Step 8 Turn off the mains AC input switch QF1 on the RCM.

Step 9 Turn off the RCCB on the RCM.

Step 10 Remove the protective cover from the mains AC input wiring terminal (MAINS). If a UPS is configured, remove the protective cover from the UPS AC input wiring terminal (UPS).

Step 11 Use a multimeter to measure the AC voltage of the mains input terminals (MAINS). The voltage is close to 0.

Step 12 (Optional) Use a multimeter to measure the AC voltage of the UPS input terminals (UPS). The voltage is close to 0.

Step 13 Reinstall the protective cover to the mains AC input wiring terminal (MAINS). If a UPS is configured, install the protective cover to the UPS AC input wiring terminal (UPS).

Step 14 Reinstall the RCM cover.

----End

3 Alarm Reference

For details about the alarms, see **LUNA2000-(107-215) Series Smart String ESS Alarm Reference**.

4 Replacing a Battery Pack

⚠ **DANGER**

- Before replacing a battery pack, ensure that the ESS is powered off. Otherwise, electric shocks may occur.
- Wear personal protective equipment and use dedicated insulated tools to avoid electric shocks or short circuits.
- Do not smoke or have an open flame around batteries.
- Do not use wet cloth to clean exposed copper bars or other conductive parts.
- Do not use water or any solvent to clean batteries.

⚠ **DANGER**

Note the polarities when installing batteries. Do not connect the positive and negative poles of a battery or battery string together. Otherwise, the battery may be short-circuited.

⚠ **WARNING**

Do not maintain batteries with power on. To power off the batteries before performing operations such as checking screw torque and tightening screws, explain the risks to the customer, obtain the customer's written consent, and take effective preventive measures.

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.

⚠ **CAUTION**

Exercise caution when moving batteries to prevent bumping and ensure personal safety.

⚠ **CAUTION**

To ensure the air tightness of the battery pack:

- Ensure that all the communications terminals and panel screws are securely installed.
- Before installing screws, check that the sealing strip is intact.
- Ensure that the installation is supervised by two persons, and take photos after the replacement.

NOTICE

- Before installation, ensure that battery packs are stored indoors in compliance with the storage requirements specified in the user manual.
- Before installation, check the status of the battery packs. Do not use the battery packs if the packing cases are exposed to rain, damaged, or deformed, or if the battery packs leak or fall.
- 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. Power on the ESS within 24 hours after installation. The process from unpacking batteries to powering on the system must be completed within 72 hours. During routine maintenance, ensure that the down time does not exceed 24 hours.
- Do not install battery packs and its components on rainy, snowy, or foggy days. Otherwise, the battery packs may be corroded by moisture or rain.

NOTICE

- For removed cables, wrap cable terminals with insulation materials, and prevent short circuits and falling off of foreign matter.
- To prevent electric leakage, avoid damaging the sheath of the cable harness when binding the cable harness or cutting off the cable tie.
- Prevent nuts from falling off during removal and installation. After removing nuts, ensure that no residue is left to avoid short circuits.

4.1 Fixture

> ⚠ **DANGER**
>
> - Do not enter the bottom of the battery pack fixture for observation or operation.
> - Do not stand under the fixture.
> - Do not put your head, hands, feet, or other body parts under the fixture.

> ⚠ **WARNING**
>
> If the battery cannot be pushed because the fixture is not aligned, do not push the battery forcibly. Instead, remove the battery, align the fixture, and try again to avoid damage to the battery.

> ⚠ **CAUTION**
>
> - In the preparation phase, check the ground flatness. Ensure that the ground flatness of the parking position for the forklift is within 50 mm. If the condition is not met, level the ground. It is recommended that hard spacers (steel plates are recommended) be laid to ensure that the height difference of the forklift plane is within 50 mm.
> - The installation ground must be solid without spongy or soft soil and not prone to subsidence. Common forklifts are recommended for concrete ground, and rough-terrain forklifts are recommended for other types of ground.
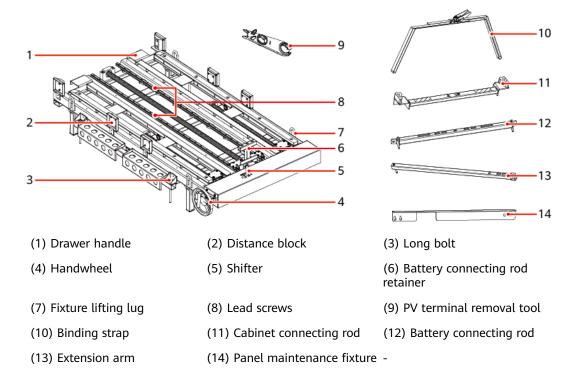
> ⚠ **CAUTION**
>
> - Multiple persons are required in the operation. Take protective measures to prevent collision.
> - After installing the battery, slowly lift the fixture to remove it and ensure that the handles do not contact the battery connecting rod.
> - When working at heights is involved, see the relevant safety precautions.
> - Place the ladder close to the handwheel and align it with the fixture. Stand on the ladder to operate the handwheel and observe the fixture connection and battery installation progress.

NOTICE

- Do not use the fixture on rainy days. If the fixture is exposed to water, dry it to prevent it from rusting.
- Place the fixture and lead screws in the fixture packing case after use and store the packing case in a dry place indoors.
- Remove rust from fixture components in a timely manner and apply lubricating grease.
- Periodically apply grease to the lead screw. For details, see **2.3 Semi-annual Maintenance**.
- Apply grease if the gear and rotating shaft generate loud noise or do not work properly.
- If the two small lead screws are misplaced during the operation, switch the shifter to position 1 and manually rotate the lead screws to correct their positions.

Maintenance Fixture

Figure 4-1 Components

(1) Drawer handle	(2) Distance block	(3) Long bolt
(4) Handwheel	(5) Shifter	(6) Battery connecting rod retainer
(7) Fixture lifting lug	(8) Lead screws	(9) PV terminal removal tool
(10) Binding strap	(11) Cabinet connecting rod	(12) Battery connecting rod
(13) Extension arm	(14) Panel maintenance fixture	-
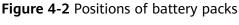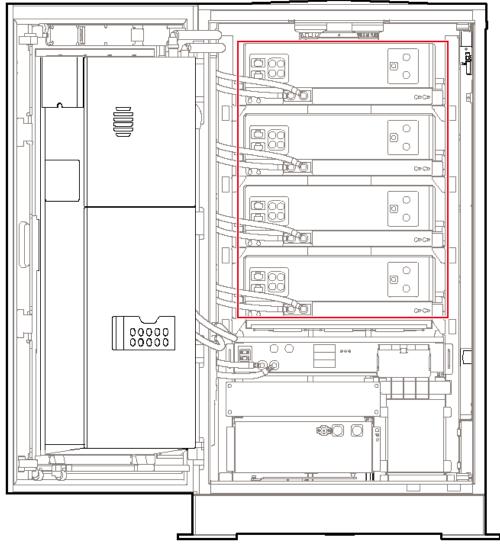
4.2 Replacing an Entire Battery Pack

Context

- The battery pack appearance may vary. The figures in this section are for reference only.

● The packs are numbered 1 to 4 from bottom to top.

Figure 4-2 Positions of battery packs

◫ **NOTE**

● For details about battery pack storage requirements and charge policies, see **ESS Storage and Charging** and **Battery Storage and Single Battery Charge** in the user manual.

● The Company is responsible for maintaining and transferring abnormal battery packs within the warranty scope. For battery packs whose warranty periods have expired, contact a local recycling agency for handling.

Prerequisites

● The following tools are available.

Tool	Specifications	Obtaining Method
Insulated torque socket wrench	Including 7#, 8#, 10#, 13#, 17#, and 19# sockets, extension rod ≥ 80 mm	Prepared by the customer
Socket for installing the male connector of the two-way stop valve	Hex socket: across-the-flats ≥ 27 mm, across-the-corners ≤ 37 mm, and depth ≥ 50 mm	Prepared by the customer or obtained from the Company's service engineers
Battery pack maintenance fixture	-	Purchased on the configurator
Ladder	-	Prepared by the customer
Claw hammer	-	Prepared by the customer
Forklift	- Load-bearing capacity ≥ 2 tons - Length of the tynes ≥ 1800 mm, width: 230–300 mm, thickness: 25–80 mm - Lifting height of a forklift: If the foundation is less than or equal to 0.3 m high, the lifting height shall be greater than or equal to 2 m. If the foundation is greater than 0.3 m high, the lifting height shall be increased accordingly.	Prepared by the customer
Crane (optional)	Load-bearing capacity ≥ 2 tons	Prepared by the customer
Flat-head insulated torque screwdriver	M6	Prepared by the customer

Tool	Specifications	Obtaining Method
Phillips insulated torque screwdriver	M4, M6	Prepared by the customer
PV terminal removal tool	-	Delivered with the fixture and used to remove PV terminals of the pack.
Adjustable wrench	-	Prepared by the customer
Protective gloves and waterproof insulated gloves	-	Prepared by the customer
Coolant	-	Purchased on the configurator
Coolant filling/ drainage machine	-	Purchased on the configurator
Coolant bucket	≥ 20 L	Prepared by the customer
Face mask	-	Prepared by the customer
Goggles	-	Prepared by the customer
New male connector of the stop valve	-	Delivered as spare parts

- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.
- At least four persons are required to replace the battery pack.

Checking the Faulty Battery Pack Status

After the ESS is powered off, wait for 5 to 10 minutes, open the ESS door, and check the battery pack status.

Step 1 Use an infrared tester to measure the temperature of the general power ports (BAT+ and BAT–) on the front panel of the battery pack and balancing DCDC module ports (DC+ OUT, DC– OUT, DC+ IN, and DC– IN). If the temperature is too high (the operating temperature should be lower than 55°C), wait until the temperature cools down before performing the next step.

Step 2 If any irritating odor, leakage, bulging, or damage is present, contact service engineers for handling.

Step 3 If signs of sparks or burn marks are found on the general power ports (BAT+ and BAT–) on the front panel of the battery pack and balancing DCDC module ports (DC+ OUT, DC– OUT, DC+ IN, and DC– IN), contact service engineers for handling.

Step 4 Check whether the battery pack appearance is normal and whether there is an irritating smell or leakage. If the inlet or outlet of the battery pack leaks, replace

the inlet or outlet valve after draining the coolant. If the liquid cooling bottom plate of the battery pack does not leak and the battery pack looks normal without irritating odor, remove the faulty battery pack.

----End

Removing an Old Battery Pack

Step 1 Ensure that the ESS has been powered off and the status of the old battery pack has been checked.

Step 2 Determine subsequent operations based on the ambient temperature.

- If the ambient temperature is higher than –10°C, skip this step and go to the next step.

- If the ambient temperature is less than or equal to –10°C, drain the coolant from the LTMS and the faulty component. For details about how to drain the coolant from the LTMS and battery pack, see **19.4.1 Draining Coolant from the LTMS** and **19.4.2 Draining Coolant from the PACK/PCS/DCDC**, respectively.

Step 3 (Optional) Before replacing the top-layer battery pack, remove the heat detector by referring to **10.2 Replacing a Heat Detector** and remove the smoke detector by referring to **10.1 Replacing a Smoke Detector**.

Step 4 Remove the cables and pipes from the front panel of the battery pack, prepare cable labels, and keep them properly.

1. Remove the power terminal. Select a removal method based on the appearance of the power terminal.

Figure 4-3 Method 1 for removing the power terminal
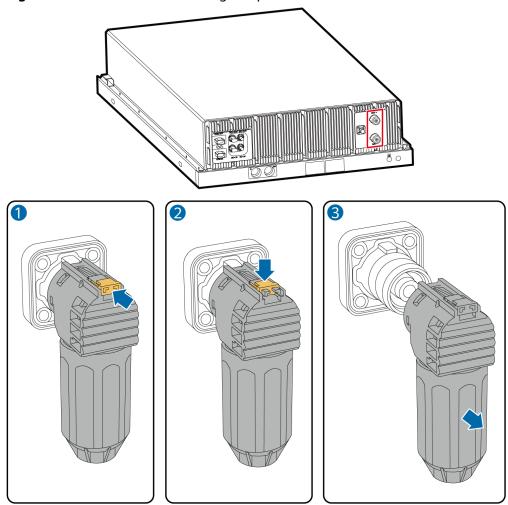
Figure 4-4 Method 2 for removing the power terminal

2. Remove the PV terminals from the pack.
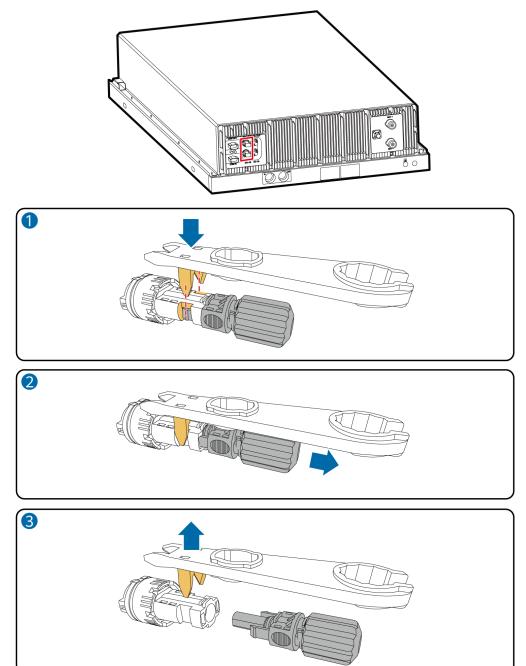
Figure 4-5 Removing the left PV terminal from the pack
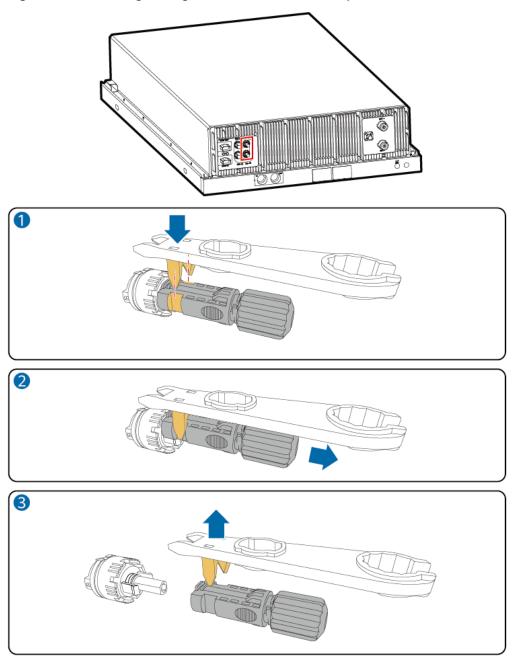
Figure 4-6 Removing the right PV terminal from the pack

3.   Remove the communications cable.
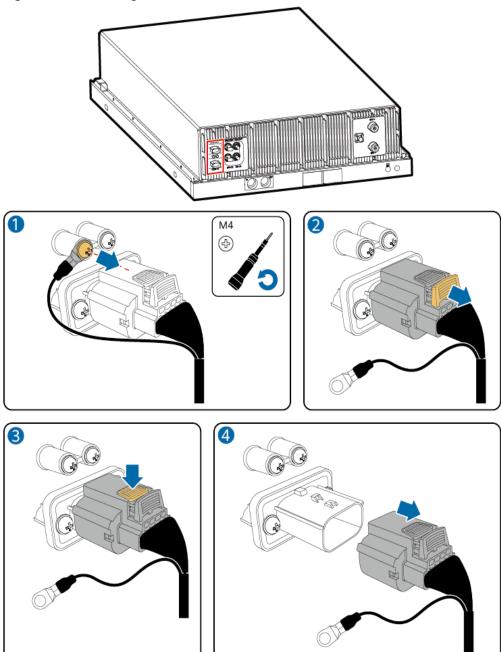
Figure 4-7 Removing the communications cable

4. Disconnect the female connector of the stop valve on the branch liquid cooling pipe from the male connector. Retain the old male connector. Remove the PE cable.

NOTICE

Put the disconnected branch liquid cooling pipes in the clip on the inner side of the cabinet to prevent the pipe from warping.
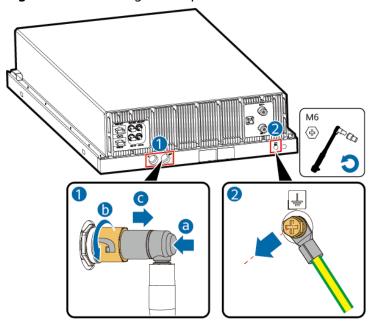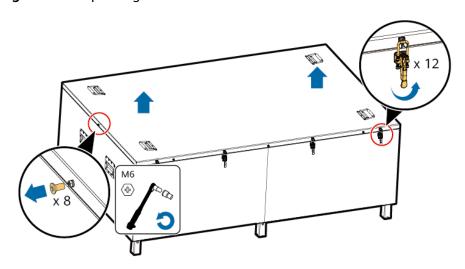
Figure 4-8 Removing the stop valve and PE cable

Step 5 Use a forklift or crane to transport the fixture packing case and open the packing case.

Figure 4-9 Unpacking the fixtures

Step 6 Take out the battery pack maintenance fixture (pack fixture for short).

1. Remove cable ties from the fixture.
2. Take out the pack fixture.
3. Take out the cabinet connecting rod and battery connecting rod.
4. Install the hooks and lift the pack fixture.
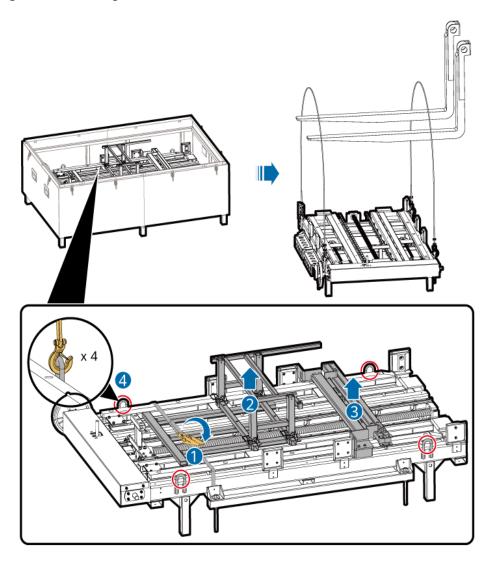
Figure 4-10 Taking out the fixtures

Step 7 Insert the forklift tynes into the pack fixture, adjust the tightness of the long bolt, and secure the pack fixture to the forklift.
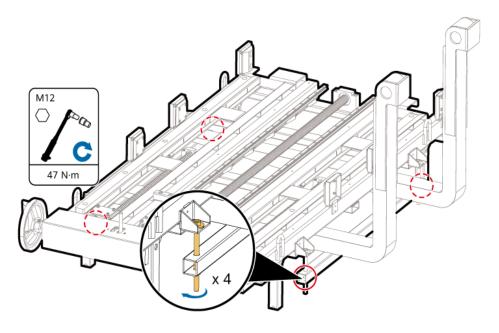
Figure 4-11 Securing the fixture

Step 8 Install the battery connecting rod and cabinet connecting rod.

1. Remove the screws that secure the battery pack to the cabinet.
2. Install the battery connecting rod.
3. Install the cabinet connecting rod and ensure that the side with the silk screen faces upwards.
4. Use the forklift to lift the fixture until the drawer handle is slightly higher than the cabinet connecting rod.

   Keep the front end of the fixture 200–900 mm away from the pack to prevent collision.
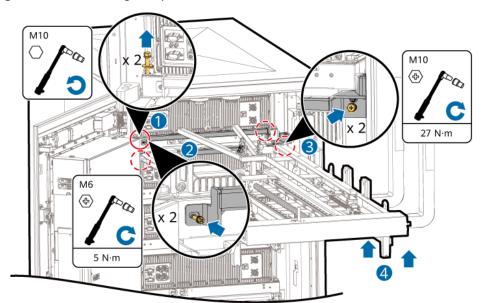
Figure 4-12 Installing the pack fixture

Step 9 Remove the battery pack.

1. Switch to position 2, rotate the handwheel counterclockwise, push the drawer handle to the top of the cabinet connecting rod, and adjust the forklift position to align the handle with the UP mark on the cabinet connecting rod. Lower the forklift tynes until the drawer handle comes in contact with the mark on the cabinet connecting rod.

2. Switch to position 1. Place the extension arm on the fixture, and secure one end of the extension arm to the cabinet connecting rod using the pin. Rotate the handwheel clockwise, align the hole on the other end of the extension arm with the hole on the I-shaped retainer, and insert the pin to secure the extension arm.

3. Keep the position at 1 and rotate the handwheel counterclockwise to pull out the battery pack to be replaced.
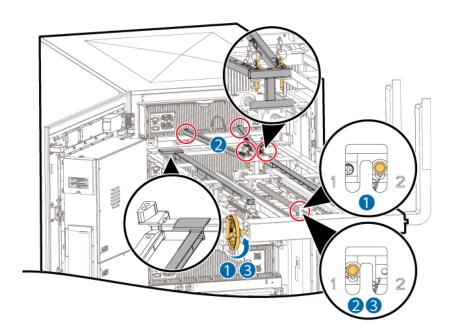
Figure 4-13 Adjusting the fixture position

Step 10 Keep the position at 1 and take out the battery pack.

1. Pull the retainer near the initial position (close to the gear), and then take out the extension arm.

2. Rotate the handwheel clockwise, align the hole on the battery connecting rod retainer with the hole on the battery connecting rod, and insert the pin.

3. Rotate the handwheel counterclockwise to pull the battery pack out of the ESS.
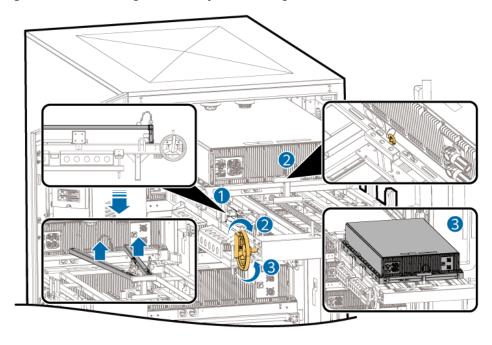
Figure 4-14 Installing the battery connecting rod

Step 11 Move the battery pack to a safe place.

1. Use the forklift to lift the fixture slowly until the drawer handle is slightly higher than the cabinet connecting rod.

2. Switch to position 2. Rotate the handwheel clockwise until the drawer handle is fully retracted, and remove the battery pack.
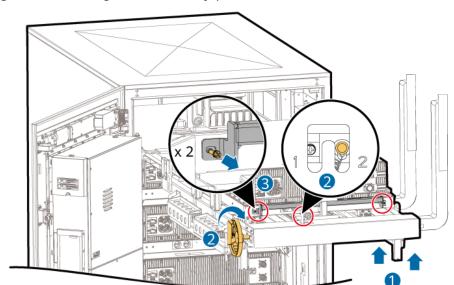
3. Remove the battery connecting rod.

Figure 4-15 Taking out the battery pack

----End

Installing a New Battery Pack

> **NOTICE**
>
> Use the hoisting tools designed by the Company. Otherwise, the product may be deformed or unhooked. If the hoisting point of the battery pack is deformed or bulges due to jolt during hoisting, use a rubber mallet to adjust it to ensure that the battery pack can be properly pushed into the cabinet.

Step 1 Take out a new battery pack. Place and secure it on the pack fixture.

1. Install the battery connecting rod.
2. Install the battery pack hoisting kit.
3. Install the hoisting kit, hook the battery pack, lift the battery pack using the forklift, and place the battery pack on the fixture.

   When placing the battery pack on the fixture, adjust the distance blocks to ensure that the battery pack is placed in the middle.
4. Switch to position 1, rotate the handwheel, align the holes on the battery connecting rod retainer with the holes on the battery connecting rod, and insert a pin.
5. Insert the forklift tynes into the fixture, adjust the tightness of the long bolt, and secure the pack fixture to the forklift.
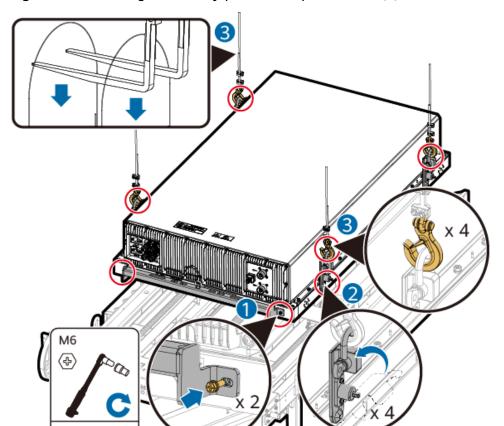
Figure 4-16 Securing the battery pack to the pack fixture (1)
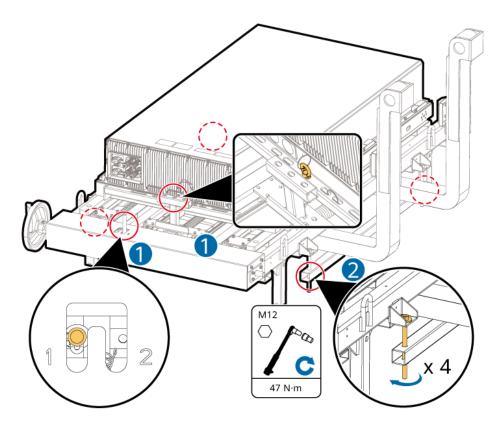
Figure 4-17 Securing the battery pack to the pack fixture (2)

Step 2 Push the front part of the new battery pack.

1. Use the forklift to lift the fixture until the drawer handle is slightly higher than the cabinet connecting rod.

   Keep the front end of the fixture 200–900 mm away from the cabinet to prevent collision.

2. Switch to position 2, rotate the handwheel counterclockwise, push the drawer handle to the top of the cabinet connecting rod, and adjust the forklift position to align the handle with the UP mark on the cabinet connecting rod. Lower the forklift tynes until the drawer handle comes in contact with the mark on the cabinet connecting rod.

3. Switch to position 1, rotate the handwheel clockwise, and push the front part of the battery pack into the cabinet.
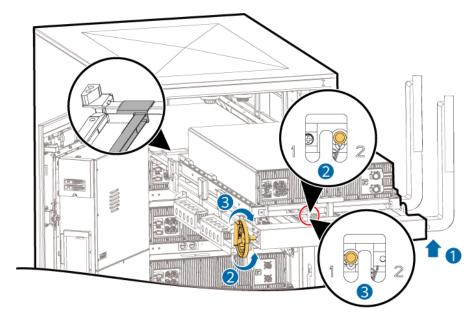
Figure 4-18 Pushing the front part of the new battery pack

Step 3 Keep the position at 1 and push the battery pack completely into the ESS.

1. Push the I-shaped retainer until it exceeds the distance block, as shown in the following figure. Pull out the battery connecting rod pin.

2. Place the extension arm on the fixture, and secure one end of the extension arm to the cabinet connecting rod using the pin. Rotate the handwheel clockwise, align the hole on the other end of the extension arm with the hole on the I-shaped retainer, and insert the pin to secure the extension arm.

3. Rotate the handwheel clockwise to push the battery pack completely into the cabinet until the front end of the battery pack is flush with the guide rail of the cabinet.
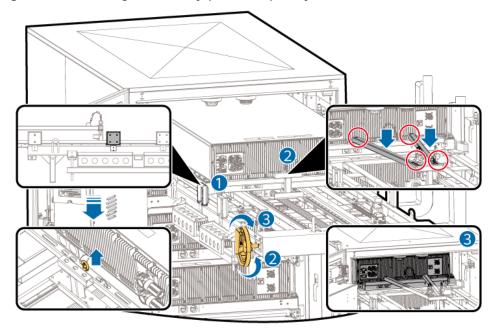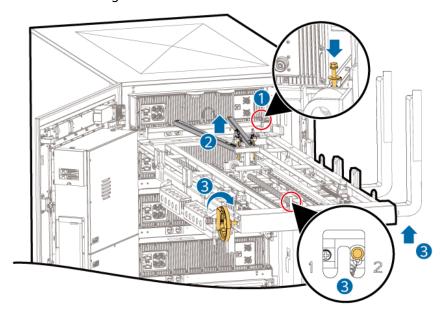
Figure 4-19 Pushing the battery pack completely into the cabinet

Step 4 Remove the fixture.

    1.   Manually tighten the screws partially on the battery pack.

    2.   Pull out the pin and take out the extension arm.

    3.   Use the forklift to lift the fixture so that the drawer handle is 10–15 cm higher than the cabinet connecting rod. Ensure that the drawer handle does not contact the battery connecting rod. Switch to position 2, rotate the handwheel clockwise until the drawer handle is fully retracted, and move the fixture to a safe place.

Figure 4-20 Removing the fixture

Step 5 Secure the new battery pack.

    1.   Install the screws on the other side of the battery pack and use a socket to tighten the screws on both sides.

    2.   Remove the cabinet connecting rod.

    3.   Remove the battery connecting rod.
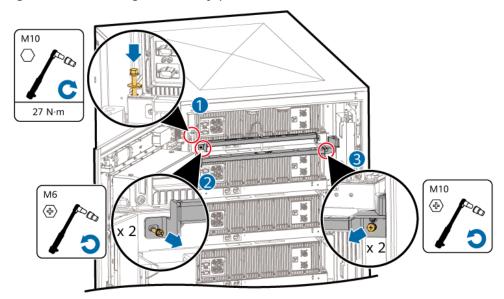
Figure 4-21 Securing the battery pack

Step 6 Reinstall the cables and pipes on the battery pack front panel.
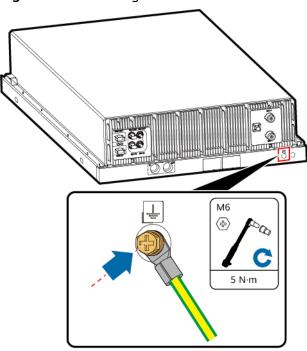
1. Install the PE cable.

Figure 4-22 Installing the PE cable

2. Connect the communications cable.

Figure 4-23 Connecting the communications cable
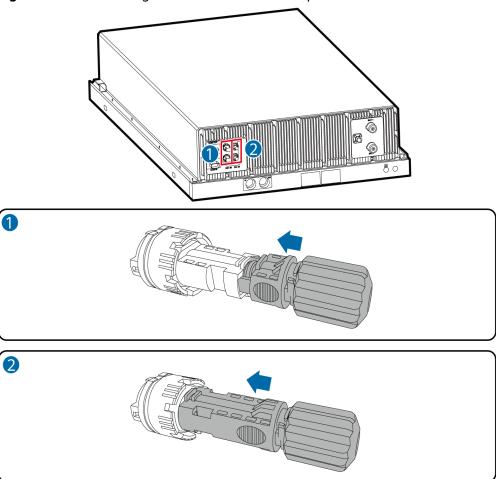

3. Connect the PV terminals of the pack.

Figure 4-24 Conneciting the PV terminals of the pack

4. Connect the power terminal. Select a connection method based on the appearance of the power terminal.

Figure 4-25 Method 1 for connecting the power terminal
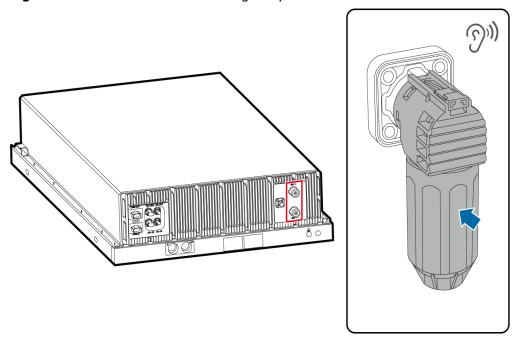
Figure 4-26 Method 2 for connecting the power terminal

Step 7 Install the new male connector of the stop valve to the new battery pack, and connect the female connector of the pipe to the new male connector. The new male connector of the stop valve must be equipped with two sealing rings.

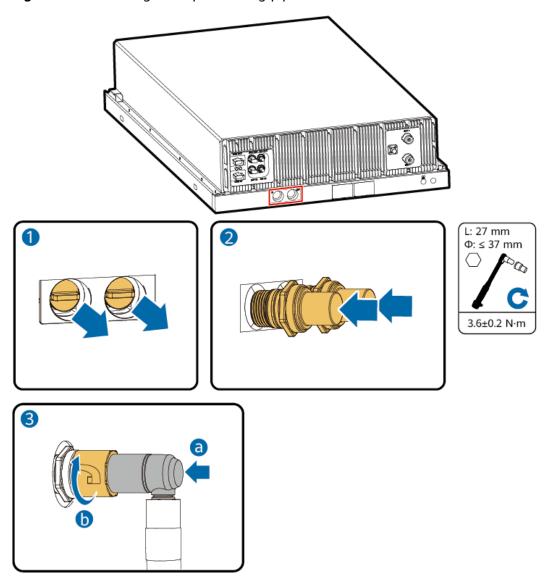**Figure 4-27** Male connector with two sealing rings

Figure 4-28 Installing the liquid cooling pipe

Step 8 Add a proper amount of coolant. For details, see **19.4.3 Adding Coolant to the LTMS**.

Step 9 Hoist the fixture, place it back in the packing case, and secure it.
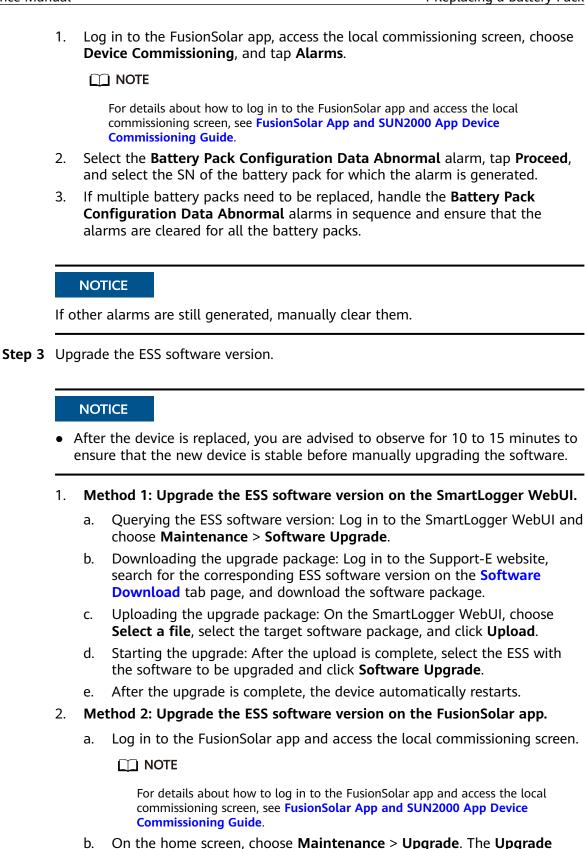
----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

☐ **NOTE**

In the off-grid scenario, the UPS must be configured and have power.

Step 2 Enable the WiFi function on the phone, log in to the FusionSolar app, connect to the ESS, and handle the **Battery Pack Configuration Data Abnormal** alarm.

1. Log in to the FusionSolar app, access the local commissioning screen, choose **Device Commissioning**, and tap **Alarms**.

   📖 **NOTE**

   > For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

2. Select the **Battery Pack Configuration Data Abnormal** alarm, tap **Proceed**, and select the SN of the battery pack for which the alarm is generated.

3. If multiple battery packs need to be replaced, handle the **Battery Pack Configuration Data Abnormal** alarms in sequence and ensure that the alarms are cleared for all the battery packs.

NOTICE

If other alarms are still generated, manually clear them.

Step 3 Upgrade the ESS software version.

NOTICE

- After the device is replaced, you are advised to observe for 10 to 15 minutes to ensure that the new device is stable before manually upgrading the software.

---

1. **Method 1: Upgrade the ESS software version on the SmartLogger WebUI.**

   a. Querying the ESS software version: Log in to the SmartLogger WebUI and choose **Maintenance** > **Software Upgrade**.

   b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

   c. Uploading the upgrade package: On the SmartLogger WebUI, choose **Select a file**, select the target software package, and click **Upload**.

   d. Starting the upgrade: After the upload is complete, select the ESS with the software to be upgraded and click **Software Upgrade**.

   e. After the upgrade is complete, the device automatically restarts.

2. **Method 2: Upgrade the ESS software version on the FusionSolar app.**

   a. Log in to the FusionSolar app and access the local commissioning screen.

   📖 **NOTE**

   > For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

   b. On the home screen, choose **Maintenance** > **Upgrade**. The **Upgrade** screen is displayed.

   c. Tap the download icon in the upper right corner to check whether an upgrade package is pushed. If yes, select the software package of the target version and perform the upgrade.

---

      d.   After you tap **Update Now**, check that the ESS enters the upgrade status.

      e.   After the upgrade is complete, the device automatically restarts.

3. **Method 3: Upgrade the ESS software version on the SmartPVMS.**

      a.   Log in to the SmartPVMS client.

      b.   Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

      c.   Uploading the upgrade package: Choose **Plants** > **Update Management** > **Software Packages**. On the page that is displayed, click **Upload** in the upper right corner to upload the software package of the target version.

      d.   Starting the upgrade: Choose **Device Upgrade** > **Create** > **Select manually**, set **Device type** to **ESS**, select the ESS to be upgraded, and set **Target Version** to the target version. Click **OK** to start the upgrade.

      e.   After the upgrade is complete, the device automatically restarts.

   📖 **NOTE**

   If the software upgrade fails and **SOC too low** is displayed in **Current Status** on the software upgrade screen, you are advised to charge the battery to over 20% SOC before upgrading the software. Otherwise, the upgrade will fail because the battery health check is not passed.

   After the software is upgraded successfully, wait for more than 10 minutes before performing the upgrade again. Otherwise, the upgrade will fail because the system initialization is not complete.

   ----End

4.3 Replacing a BMU Collection Board

Context

- The packs are numbered 1 to 4 from bottom to top.
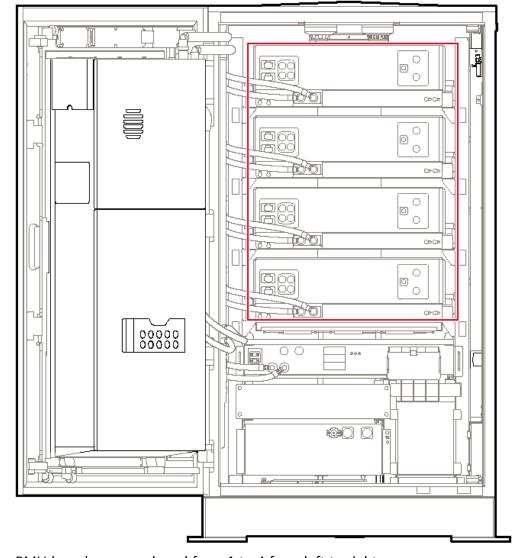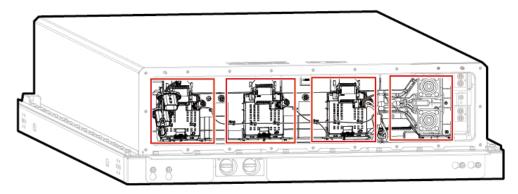
Figure 4-29 Positions of battery packs

- BMU boards are numbered from 1 to 4 from left to right.

Prerequisites

- Tools: insulation tape, insulated gloves, panel maintenance fixture (purchased on the configurator), PV terminal removal tool (delivered with the fixture), adjustable wrench, insulated torque socket wrench (including 10# insulated

socket), Phillips insulated torque screwdrivers (M4 and M6), diagonal pliers, and cable ties

- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.
- At least two persons are required to replace a BMU collection board.

Procedure

Step 1 Remove the cables and pipes from the front panel of the battery pack, prepare cable labels, and keep them properly.

1. Remove the power terminal. Select a removal method based on the appearance of the power terminal.

Figure 4-30 Method 1 for removing the power terminal
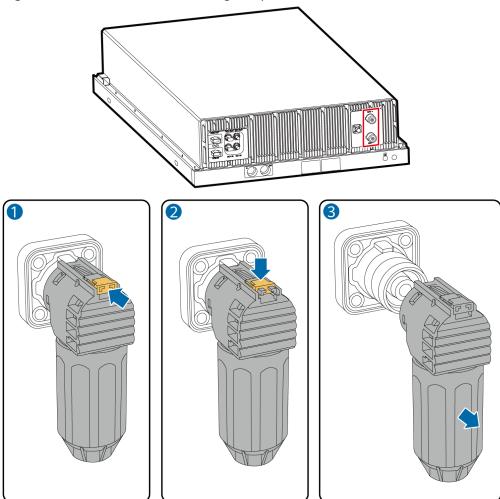
Figure 4-31 Method 2 for removing the power terminal

2. Remove the PV terminals from the pack.
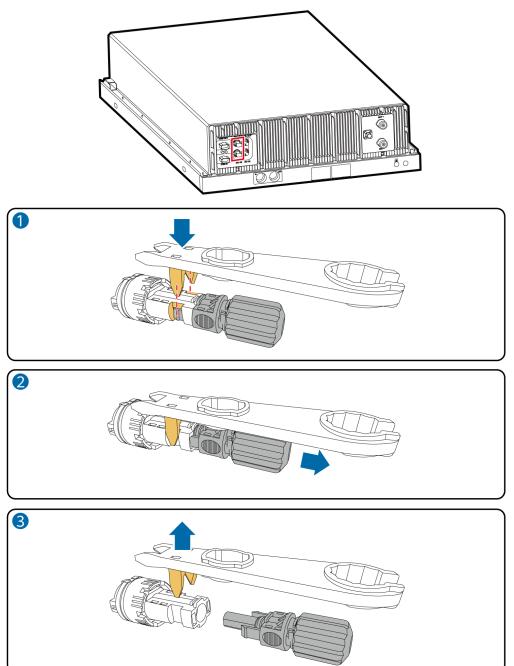
Figure 4-32 Removing the left PV terminal from the pack
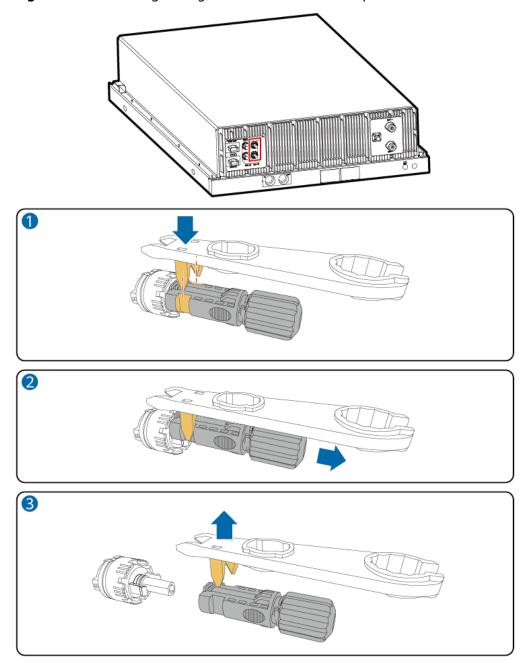
Figure 4-33 Removing the right PV terminal from the pack

3. Remove the communications cable.
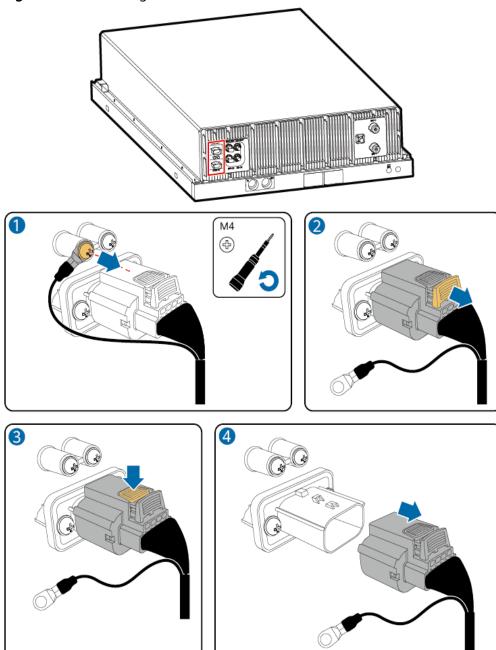
Figure 4-34 Removing the communications cable

4. Remove the PE cable.

NOTICE

Put the disconnected branch liquid cooling pipes in the clip on the inner side of the cabinet to prevent the pipe from warping.
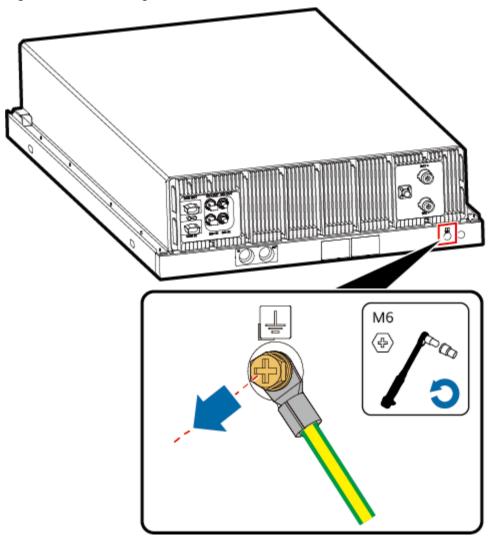
Figure 4-35 Removing the PE cable

Step 2 Install the maintenance fixture, and remove the screws securing the general power ports and panel in sequence.

Figure 4-36 Installing the fixture

Step 3 Remove the cable harness on the right side of the battery pack.

⚠ WARNING

Take insulation measures and exercise caution when performing operations with power on.

⚠ CAUTION

Exercise caution when cutting cable ties and avoid damaging cables.

NOTICE

Record the positions of cable ties so that cables can be correctly bound after the replacement.

1: Slowly pull out the battery pack panel until the general power terminals are removed from the panel.

2–3: Cut off cable ties.

4–6: Remove the cable harness.
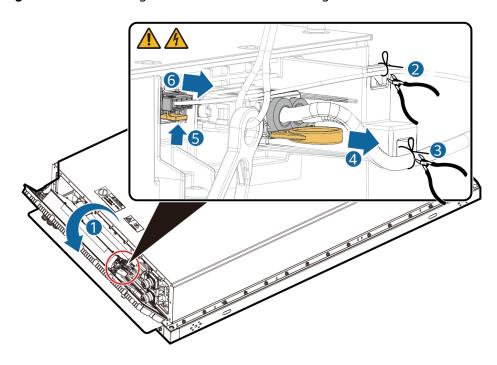
Figure 4-37 Removing the cable harness on the right

Step 4 Remove the cable harness on the left side of the battery pack: Slowly remove the communications terminals from the panel, remove the cable harness on the left side of the battery pack, and mount the cable harness to the cable clip.
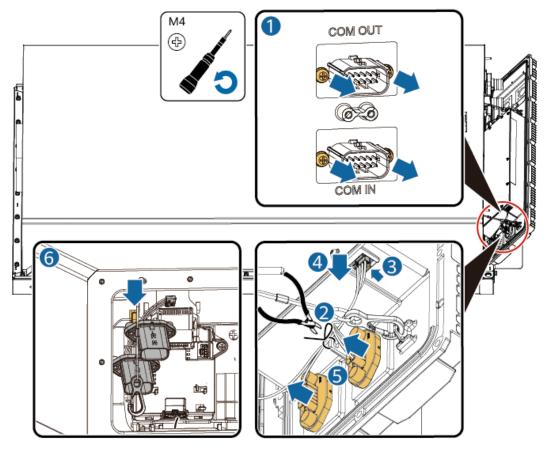
Figure 4-38 Removing the cable harness on the left

Step 5 Remove the two cable clips from the front panel and slowly remove the panel.

> ⚠️ **CAUTION**
>
> Exercise caution when removing the panel from the battery pack to prevent dropping the panel or damaging the wiring terminals.
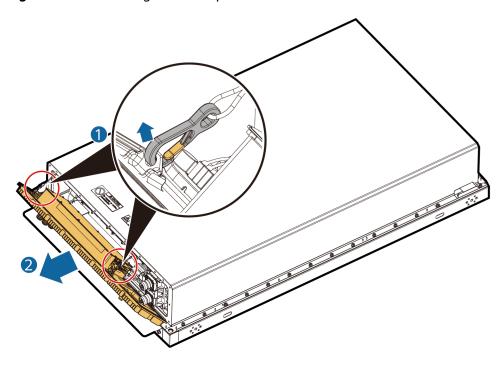
Figure 4-39 Removing the front panel

Step 6 Remove the BMU collection board to be replaced.

> ⚠ WARNING
>
> - During operations, wear personal protective equipment and use dedicated insulated tools to prevent electric shocks or short circuits.
> - During operations, ensure that the tool, battery pack enclosure, and general positive and negative power component do not contact to prevent short circuits between the general positive and negative power component and the enclosure.
> - For removed cables, wrap cable terminals with insulation materials, and prevent short circuits and falling off of foreign matter.

> **NOTICE**
>
> Any BMU collection board can be replaced separately. When removing a BMU collection board, remove the cable harness from the BMU collection board on the left.

Position of the BMU Collection Board	Step		Diagram
Left 1	Step 1	1–2: Press both ends of the FPC connector and remove it in the FPC flat cable direction. 3–4: Remove the cable harness plug.	
	Step 2	1: Remove the screw. (M4 screw with a torque of 1.6 N·m) 2: Gently remove the BMU collection board from the clip. 3: Tilt the BMU collection board upward to reserve space for inserting and removing the cable harness at the bottom. 4–5: Remove the cable harness plug from the bottom of the BMU collection board.	
Left 2	Step 1	Remove the cable harness from the first BMU collection board on the left.	See the figures of the first BMU collection board on the left.

Position of the BMU Collection Board	Step		Diagram
	Step 2	1–2: On the second BMU collection board on the left, press both ends of the FPC connector and remove it in the FPC flat cable direction. 3–4: Remove the cable harness plug. 5–8: Remove the mounting cable as shown in the figure.	
	Step 3	1: Remove the screw. (M4 screw with a torque of 1.6 N·m) 2: Gently remove the BMU collection board from the clip. 3: Tilt the BMU collection board upward to reserve space for inserting and removing the cable harness at the bottom. 4–5: Remove the cable harness plug from the bottom of the BMU collection board.	
Left 3	Step 1	Remove the cable harness from the second BMU collection board on the left.	See the figures of the second BMU collection board on the left.

Position of the BMU Collection Board	Step		Diagram
	Step 2	1–2: On the third BMU collection board on the left, press both ends of the FPC connector and remove it in the FPC flat cable direction. 3–4: Remove the cable harness plug. 5–8: Remove the mounting cable as shown in the figure.	
	Step 3	1: Remove the screw. (M4 screw with a torque of 1.6 N·m) 2: Gently remove the BMU collection board from the clip. 3: Tilt the BMU collection board upward to reserve space for inserting and removing the cable harness at the bottom. 4–5: Remove the cable harness plug from the bottom of the BMU collection board.	
Right 1	Step 1	Remove the cable harnesses from the second and third BMU collection boards on the left in sequence.	See the figures of the second and third BMU collection boards on the left.

Position of the BMU Collection Board	Step		Diagram
	Step 2	Remove copper bars between battery packs.	
	Step 3	Remove the general positive and negative power component. (M4 screws with a torque of 1.6 N·m; M6 screws with a torque of 5 N·m)	
	Step 4	1–2: Press both ends of the FPC connector and remove it in the FPC flat cable direction. 3–4: Remove the cable harness plug. 5: Remove the cable shown in the figure.	

Position of the BMU Collection Board	Step		Diagram
	Step 5	1: Remove the screw. (M4 screw with a torque of 1.6 N·m) 2: Gently remove the BMU collection board from the clip. 3: Tilt the BMU collection board upward to reserve space for inserting and removing the cable harness at the bottom. 4–5: Remove the cable harness plug from the bottom of the BMU collection board.	

Step 7 Install the new BMU collection board, cable harness, and FPC connector by referring to **Step 6** in the reverse order.

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NOTICE

When installing the cable harness, arrange the cable harness and properly secure the cable harness back to the original position using cable clips.

</div>

Step 8 Install the new panel. Place the panel on the lower edge of the opening at the front end of the cover, tilt the panel, and fasten the two cable clips to the die-casting panel.

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NOTICE

- Secure the cables using cable ties.
- Before installing the panel, temporarily mount and secure the cable harness extending beyond the door to prevent the cables from being clamped during installation.
- Check that the sealing rings on the left and right sides of the connectors are intact.

</div>
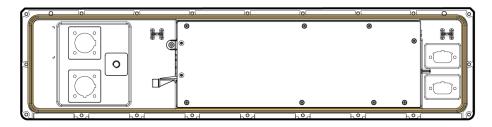
Step 9 Install the internal cable harness and close the battery pack panel. Tighten the left cable harness using M4 screws to 1.6 N·m.

Step 10 Install the communications terminals and general power terminals on the front panel, install the panel on the large window on the top cover using guide pins, and secure the panel.

> ⚠ **CAUTION**
>
> To ensure the air tightness of the battery pack:
>
> 1. Ensure that all the communications terminals and panel screws are securely installed.
> 2. Before installing screws, check that the sealing strip is intact.
> 3. Ensure that the installation is supervised by two persons, and take photos after the replacement.

Figure 4-40 Position of the sealing strip

Step 11 Install the screws that secure the general power ports and panel, and remove the panel maintenance fixture.

Step 12 Install the cables and pipes on the front panel of the battery pack.

Step 13 Close the cabinet door.

----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

> 📖 **NOTE**
>
> In the off-grid scenario, the UPS must be configured and have power.

Step 2 Enable the WiFi function on the phone, log in to the FusionSolar app, connect to the ESS, and handle the **Battery Pack Configuration Data Abnormal** alarm.

1. Log in to the FusionSolar app, access the local commissioning screen, choose **Device Commissioning**, and tap **Alarms**.

📖 **NOTE**

> For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

2. Select the **Battery Pack Configuration Data Abnormal** alarm, tap **Proceed**, and select the SN of the battery pack for which the alarm is generated.

3. If BMU collection boards in multiple battery packs need to be replaced, handle the **Battery Pack Configuration Data Abnormal** alarms in sequence and ensure that the alarms are cleared for all the battery packs.

NOTICE

If other alarms are still generated, manually clear them.

----End

4.4 Replacing a Balancing DCDC Module

Prerequisites

- The packs are numbered 1 to 4 from bottom to top.
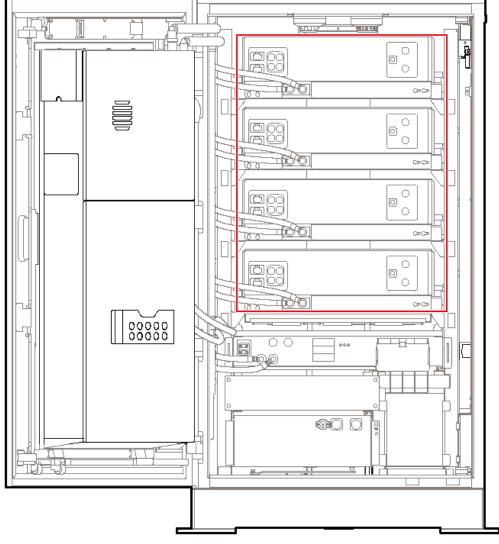
Figure 4-41 Positions of battery packs

- Tools: insulation tape, insulated gloves, panel maintenance fixture (purchased on the configurator), adjustable wrench, insulated torque socket wrench (M6, including 10# socket), Phillips insulated torque screwdrivers (M4 and M6), diagonal pliers, PV terminal removal tool (delivered with the fixture), and cable ties

- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

- At least two persons are required to replace a balancing DCDC module.

Procedure

Step 1 Remove the cables and pipes from the front panel of the battery pack, prepare cable labels, and keep them properly.

1. Remove the power terminal. Select a removal method based on the appearance of the power terminal.

Figure 4-42 Method 1 for removing the power terminal
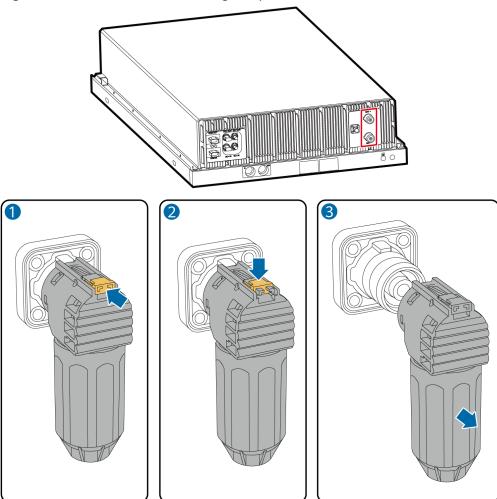
Figure 4-43 Method 2 for removing the power terminal

2. Remove the PV terminals from the pack.
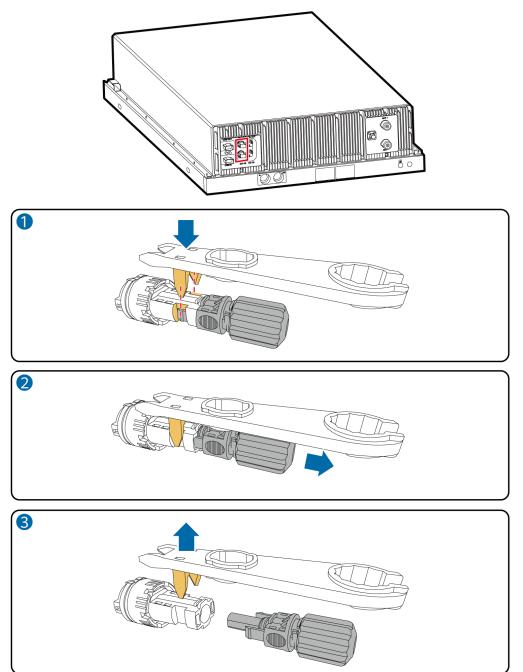
Figure 4-44 Removing the left PV terminal from the pack
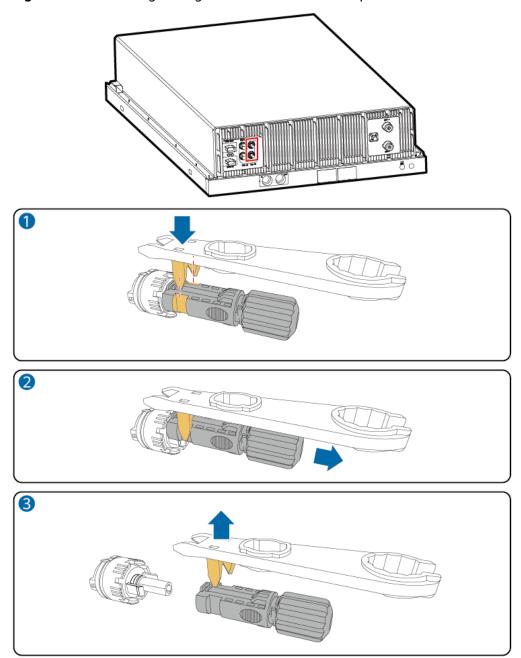
Figure 4-45 Removing the right PV terminal from the pack

3.   Remove the communications cable.

Figure 4-46 Removing the communications cable

4.   Remove the PE cable.

NOTICE

Put the disconnected branch liquid cooling pipes in the clip on the inner side of the cabinet to prevent the pipe from warping.
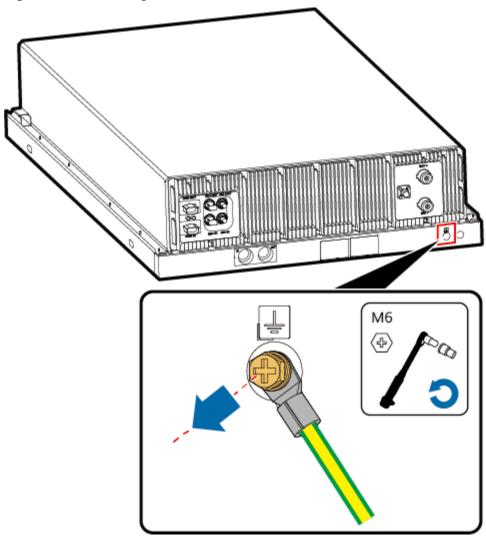
Figure 4-47 Removing the PE cable

Step 2 Install the maintenance fixture, and remove the screws securing the general power ports and panel in sequence.

Figure 4-48 Installing the fixture

Step 3 Remove the cable harness on the right side of the battery pack.

⚠ WARNING

Take insulation measures and exercise caution when performing operations with power on.

⚠ CAUTION

Exercise caution when cutting cable ties and avoid damaging cables.

NOTICE

Record the positions of cable ties so that cables can be correctly bound after the replacement.

1: Slowly pull out the battery pack panel until the general power terminals are removed from the panel.

2–3: Cut off cable ties.

4–6: Remove the cable harness.
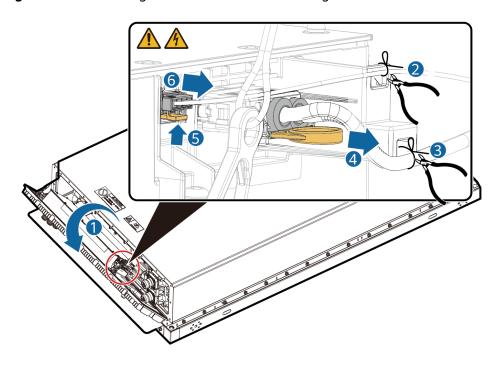
Figure 4-49 Removing the cable harness on the right

Step 4 Remove the cable harness on the left side of the battery pack: Slowly remove the communications terminals from the panel, remove the cable harness on the left side of the battery pack, and mount the cable harness to the cable clip.
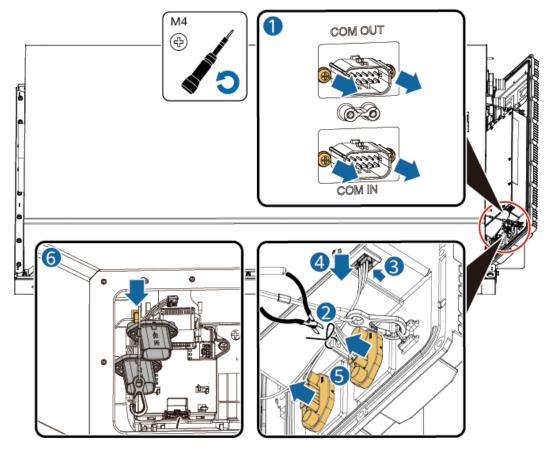
Figure 4-50 Removing the cable harness on the left

Step 5 Remove the two cable clips from the front panel, and remove the panel (that is, the balancing DCDC module).

⚠ CAUTION

Exercise caution when removing the panel from the battery pack to prevent dropping the panel or damaging the wiring terminals.
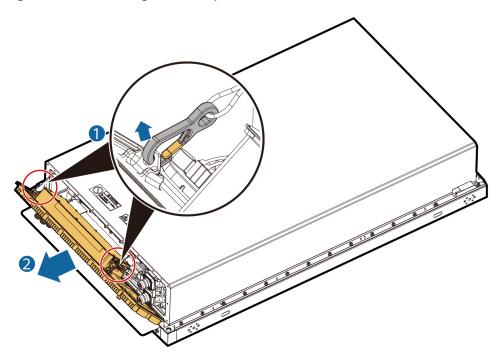
Figure 4-51 Removing the front panel

Step 6 Install the new panel. Place the panel on the lower edge of the opening at the front end of the cover, tilt the panel, and fasten the two cable clips to the die-casting panel.
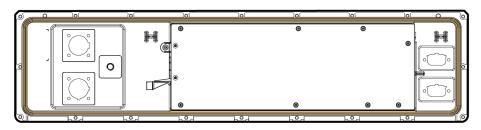
> **NOTICE**
>
> - Secure the cables using cable ties.
> - Before installing the panel, temporarily mount and secure the cable harness extending beyond the door to prevent the cables from being clamped during installation.
> - Check that the sealing rings on the left and right sides of the connectors are intact.

Step 7 Install the internal cable harness and close the battery pack panel. Tighten the left cable harness using M4 screws to 1.6 N·m.

Step 8 Install the communications terminals and general power terminals on the front panel, install the panel on the large window on the top cover using guide pins, and secure the panel.

⚠ **CAUTION**

To ensure the air tightness of the battery pack:

1. Ensure that all the communications terminals and panel screws are securely installed.
2. Before installing screws, check that the sealing strip is intact.
3. Ensure that the installation is supervised by two persons, and take photos after the replacement.

Figure 4-52 Position of the sealing strip

Step 9 Install the screws that secure the general power ports and panel, and remove the panel maintenance fixture.

Step 10 Install the cables and pipes on the front panel of the battery pack.

Step 11 Close the cabinet door.

----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 Log in to the FusionSolar app or SmartLogger WebUI to check for alarms. If there is still an alarm, manually clear it.

Step 3 Upgrade the ESS software version.

NOTICE

- After the device is replaced, you are advised to observe for 10 to 15 minutes to ensure that the new device is stable before manually upgrading the software.

1. **Method 1: Upgrade the ESS software version on the SmartLogger WebUI.**

    a. Querying the ESS software version: Log in to the SmartLogger WebUI and choose **Maintenance** > **Software Upgrade**.

    b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

   c.   Uploading the upgrade package: On the SmartLogger WebUI, choose **Select a file**, select the target software package, and click **Upload**.

   d.   Starting the upgrade: After the upload is complete, select the ESS with the software to be upgraded and click **Software Upgrade**.

   e.   After the upgrade is complete, the device automatically restarts.

2. **Method 2: Upgrade the ESS software version on the FusionSolar app.**

   a.   Log in to the FusionSolar app and access the local commissioning screen.

       📖 **NOTE**

        For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

   b.   On the home screen, choose **Maintenance** > **Upgrade**. The **Upgrade** screen is displayed.

   c.   Tap the download icon in the upper right corner to check whether an upgrade package is pushed. If yes, select the software package of the target version and perform the upgrade.

   d.   After you tap **Update Now**, check that the ESS enters the upgrade status.

   e.   After the upgrade is complete, the device automatically restarts.

3. **Method 3: Upgrade the ESS software version on the SmartPVMS.**

   a.   Log in to the SmartPVMS client.

   b.   Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

   c.   Uploading the upgrade package: Choose **Plants** > **Update Management** > **Software Packages**. On the page that is displayed, click **Upload** in the upper right corner to upload the software package of the target version.

   d.   Starting the upgrade: Choose **Device Upgrade** > **Create** > **Select manually**, set **Device type** to **ESS**, select the ESS to be upgraded, and set **Target Version** to the target version. Click **OK** to start the upgrade.

   e.   After the upgrade is complete, the device automatically restarts.

📖 **NOTE**

If the software upgrade fails and **SOC too low** is displayed in **Current Status** on the software upgrade screen, you are advised to charge the battery to over 20% SOC before upgrading the software. Otherwise, the upgrade will fail because the battery health check is not passed.

After the software is upgraded successfully, wait for more than 10 minutes before performing the upgrade again. Otherwise, the upgrade will fail because the system initialization is not complete.

----End

4.5 Replacing an NTC Cable Harness in the Battery Pack

NOTICE

There are four NTC cable harnesses in the battery pack. Two NTC cable harnesses are secured to the copper bar, and another two are secured to the general positive and negative power component.

4.5.1 Replacing an NTC Cable Harness on the Copper Bar

Prerequisites
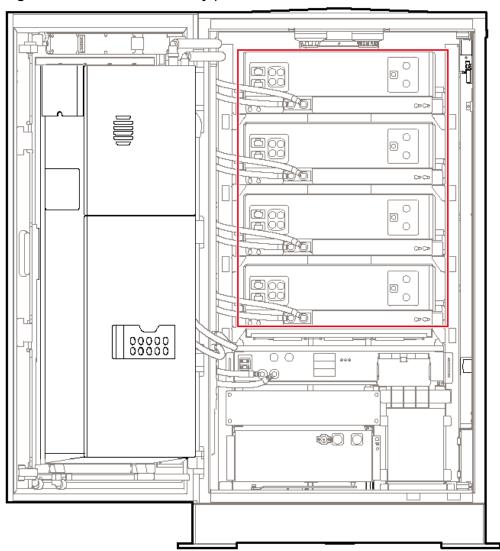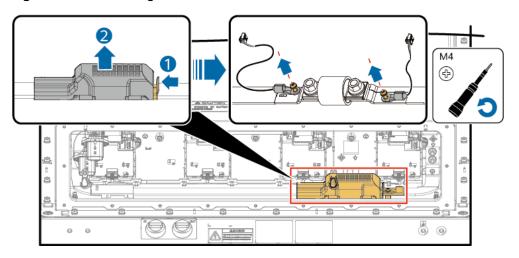
- The packs are numbered 1 to 4 from bottom to top.

Figure 4-53 Positions of battery packs

- Tools: insulation tape, insulated gloves, panel maintenance fixture (purchased on the configurator), PV terminal removal tool (delivered with the fixture), adjustable wrench, cable ties, insulated torque socket wrench (including 10# insulated socket), Phillips insulated torque screwdrivers (M4 and M6), and mini Phillips screwdriver (M4, length < 100 mm)
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.
- At least two persons are required to replace an NTC cable harness on the copper bar.
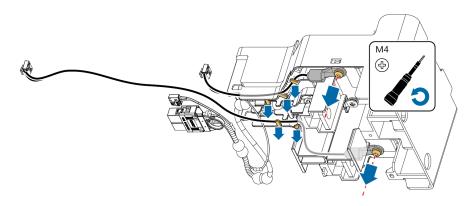
Procedure

Step 1 Remove the general positive and negative power component from the first BMU collection board on the right. For details, see **4.3 Replacing a BMU Collection Board**.

Step 2 Remove the NTC cable harness.

Figure 4-54 Removing the NTC cable harness

⚠️ WARNING

Do not pull or scratch the FPC connector during operations. Otherwise, the FPC connector may be damaged.

Step 3 Install a new NTC cable harness and tighten the M4 Phillips screws to 1.6 N·m.

Step 4 Install the cable harness, FPC connector, and battery components from right to left. For details, see **4.3 Replacing a BMU Collection Board**.

----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 Log in to the FusionSolar app or SmartLogger WebUI to check for alarms. If there is still an alarm, manually clear it.

----End

4.5.2 Replacing an NTC Cable Harness on the General Positive and Negative Power Component
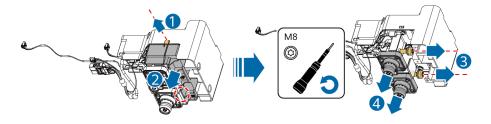
Prerequisites

- Tools: insulation tape, insulated gloves, panel maintenance fixture (purchased on the configurator), PV terminal removal tool (delivered with the fixture), adjustable wrench, insulated torque socket wrench (including 10# insulated socket), Phillips insulated torque screwdrivers (M4, M6, and M8), mini Phillips screwdriver (M4, length < 100 mm), diagonal pliers, and cable ties

- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

- At least two persons are required to replace an NTC cable harness on the general positive and negative power component.

Procedure

Step 1 Remove the general positive and negative power component from the first BMU collection board on the right. For details, see **4.3 Replacing a BMU Collection Board**.

Step 2 Remove the assemblies and general power ports from the general positive and negative power component.

Figure 4-55 Removing the NTC cable harness from the general positive and negative power component (1)

Step 3 Remove the faulty NTC cable harness from the general positive and negative power component.

Figure 4-56 Removing the NTC cable harness from the general positive and negative power component (2)

Step 4 Install a new NTC cable harness and tighten the M4 screws to 1.6 N·m.

Step 5 Install the general power ports and assemblies and tighten the M8 screws to 13 N·m.

Step 6 Install the general positive and negative power component. For details, see **4.3 Replacing a BMU Collection Board**.

----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 Log in to the FusionSolar app or SmartLogger WebUI to check for alarms. If there is still an alarm, manually clear it.

----End

5 Replacing a PCS

Prerequisites

Figure 5-1 Position of the PCS

- The following tools are available.

Tool	Specifications	Obtaining Method
Insulated torque socket wrench	Including 13# and 18# sockets and extension rods (≥ 80 mm); socket depth ≥ 50 mm	Prepared by the customer
Socket for installing the male connector of the two-way stop valve	Standard hex socket: 27 mm across the flats and 37 mm across the corners	Prepared by the customer or obtained from the Company's service engineers
Flat-head insulated torque screwdriver	M4	Prepared by the customer
Phillips insulated torque screwdriver	M4, M6	Prepared by the customer
PCS/DCDC maintenance fixture	-	Purchased on the configurator; screws delivered with the fixture
Lifting handles	-	4 (delivered with spare parts)
Coolant	-	Purchased on the configurator
Coolant filling/ drainage machine	-	Purchased on the configurator
Face mask	-	Prepared by the customer
Goggles	-	Prepared by the customer
New male connector of the stop valve	-	Delivered as spare parts
Protective gloves and waterproof insulated gloves	-	Prepared by the customer

- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.
- At least four persons are required to replace the PCS.

Procedure

Step 1 Determine subsequent operations based on the ambient temperature.

- If the ambient temperature is higher than –10°C, skip this step and go to the next step.

- If the ambient temperature is less than or equal to –10°C, drain the coolant from the LTMS and the faulty component. For details about how to drain the coolant from the LTMS and PCS, see **19.4.1 Draining Coolant from the LTMS** and **19.4.2 Draining Coolant from the PACK/PCS/DCDC**, respectively.
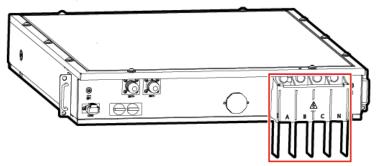
Step 2 Remove cables and pipes.
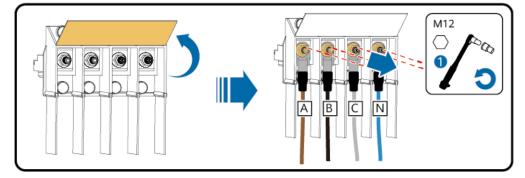
1. Remove the AC power cable and pull out the PCS AC power cable partition plate. This section uses a PCS AC power cable with four cores (A, B, C, and N) as an example. The actual situation may vary.

NOTICE

1. Preinstall bolts according to the recommended torque of 40 N·m.
2. Verify that the torque of the installed bolts is 40 N·m using a torque socket wrench.
3. Mark the nuts whose torque has been verified using a marker.

Figure 5-2 Removing the AC power cable

2. Remove the power terminal. Select a removal method based on the appearance of the power terminal.

Figure 5-3 Method 1 for removing the power terminal
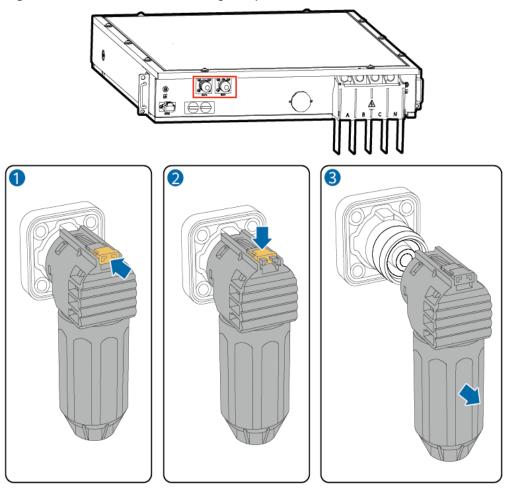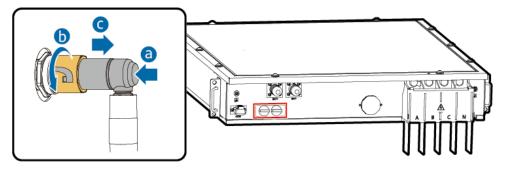
Figure 5-4 Method 2 for removing the power terminal

3. Disconnect the female connector of the stop valve on the branch liquid cooling pipe from the male connector. Retain the old male connector.

NOTICE
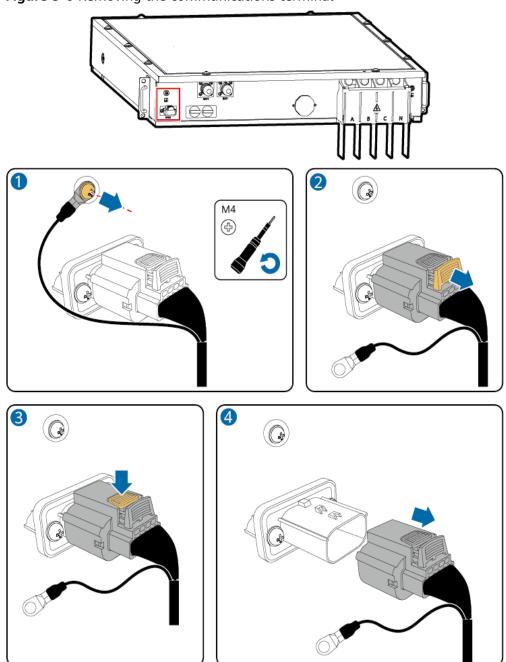
Put the disconnected branch liquid cooling pipes in the clip on the inner side of the cabinet to prevent the pipe from warping.

Figure 5-5 Disconnecting the female connector of the stop valve from the male connector

4. Remove the communications terminal.

Figure 5-6 Removing the communications terminal
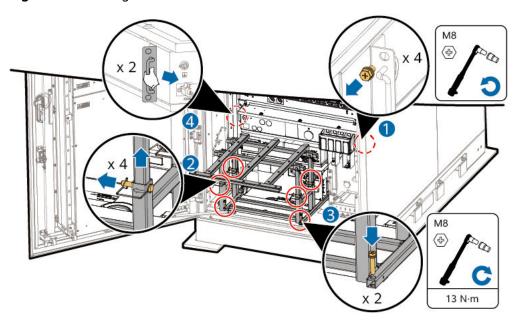
5. Remove the PE cable.

Figure 5-7 Removing the PE cable

Step 3 Take out the PCS fixture (fixture for short) by referring to the **process of unpacking the pack fixture**.

Step 4 Move the faulty PCS to the fixture.

1. Remove the screws.

2. Switch the fixture to the PCS position: Remove the pin, raise the fixture to the position shown in the figure, and insert the pin.

3. Secure the fixture to the ESS. The screws are delivered with the fixture.

4. Remove the screws from the faulty PCS, hold the handles on both sides of the PCS, and pull the PCS to the fixture.

Figure 5-8 Moving the PCS to the fixture
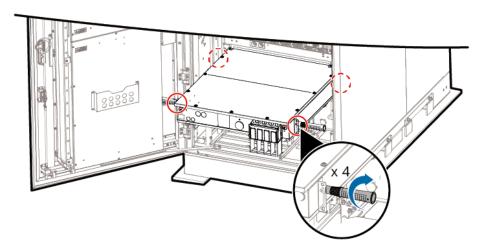
⚠ WARNING

● When placing the PCS on the fixture, ensure that most of the weight of the PCS is on the fixture to avoid damage caused by falling.

Step 5 Install the lifting handles and lift the PCS to a safe ground.

Figure 5-9 Installing the lifting handles

Step 6 Install the new PCS in the ESS cabinet.

1. Take out a new PCS and install the lifting handles.
2. Lift the PCS onto the fixture to avoid falling. Remove two lifting handles first.
3. Slowly push the PCS into the ESS cabinet and remove the remaining lifting handles.
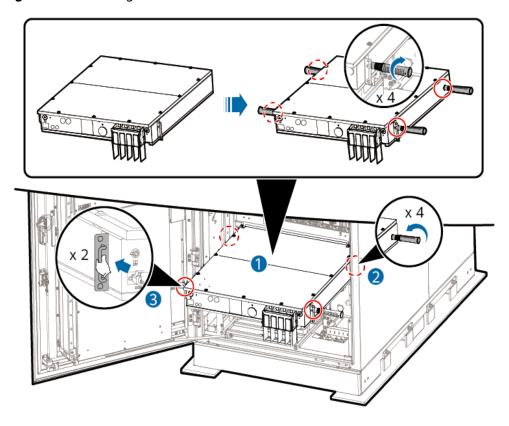
Figure 5-10 Pushing the PCS inward

Step 7 Complete PCS replacement.

> ⚠ **WARNING**
>
> When placing the PCS on the fixture, ensure that most of the weight of the PCS is on the fixture to avoid damage caused by falling.

> **NOTICE**
>
> The screws for securing the fixture need to be recycled. Keep them properly and store them together with the fixture.

1. Install the screws for securing the PCS.
2. Remove the screws from the fixture and keep them properly.
3. After removing the fixture and restoring it to the lowest position, place the fixture back to the packing case and secure it.
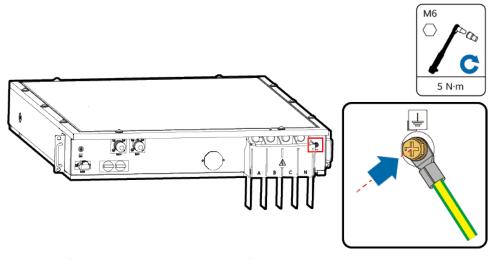
Figure 5-11 Completing PCS replacement

Step 8 Reinstall the PCS cables and pipes.

1. Connect the PE cable.

Figure 5-12 Connecting the PE cable

2. Connect the communications terminal.

Figure 5-13 Connecting the communications terminal

3. Install the new male connector of the stop valve to the new PCS, and connect the female connector of the pipe to the new male connector. The new male connector of the stop valve must be equipped with two sealing rings.

Figure 5-14 Male connector with two sealing rings
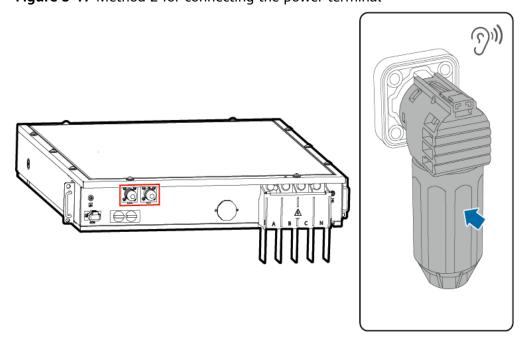
Figure 5-15 Connecting the stop valve

4. Connect the power terminal. Select a connection method based on the appearance of the power terminal.
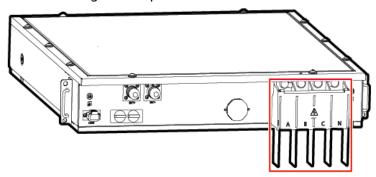
Figure 5-16 Method 1 for connecting the power terminal

Figure 5-17 Method 2 for connecting the power terminal
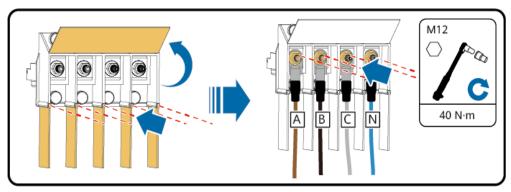
Step 9 Connect the AC power cable.

Figure 5-18 Connecting the AC power cable

Step 10 Add a proper amount of coolant. For details, see **19.4.3 Adding Coolant to the LTMS**.

----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 Upgrade the ESS software version.

⚠️ CAUTION

Software must be upgraded. Otherwise, **Total charged energy calibration** and **Total discharged energy calibration** may fail.

NOTICE

● After the device is replaced, you are advised to observe for 10 to 15 minutes to ensure that the new device is stable before manually upgrading the software.

1. **Method 1: Upgrade the ESS software version on the SmartLogger WebUI.**

   a. Querying the ESS software version: Log in to the SmartLogger WebUI and choose **Maintenance** > **Software Upgrade**.

    b.   Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

    c.   Uploading the upgrade package: On the SmartLogger WebUI, choose **Select a file**, select the target software package, and click **Upload**.

    d.   Starting the upgrade: After the upload is complete, select the ESS with the software to be upgraded and click **Software Upgrade**.

    e.   After the upgrade is complete, the device automatically restarts.

2.   **Method 2: Upgrade the ESS software version on the FusionSolar app.**

    a.   Log in to the FusionSolar app and access the local commissioning screen.

      📖 **NOTE**

        For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

    b.   On the home screen, choose **Maintenance** > **Upgrade**. The **Upgrade** screen is displayed.

    c.   Tap the download icon in the upper right corner to check whether an upgrade package is pushed. If yes, select the software package of the target version and perform the upgrade.

    d.   After you tap **Update Now**, check that the ESS enters the upgrade status.

    e.   After the upgrade is complete, the device automatically restarts.

3.   **Method 3: Upgrade the ESS software version on the SmartPVMS.**

    a.   Log in to the SmartPVMS client.

    b.   Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

    c.   Uploading the upgrade package: Choose **Plants** > **Update Management** > **Software Packages**. On the page that is displayed, click **Upload** in the upper right corner to upload the software package of the target version.

    d.   Starting the upgrade: Choose **Device Upgrade** > **Create** > **Select manually**, set **Device type** to **ESS**, select the ESS to be upgraded, and set **Target Version** to the target version. Click **OK** to start the upgrade.

    e.   After the upgrade is complete, the device automatically restarts.

    📖 **NOTE**

    If the software upgrade fails and **SOC too low** is displayed in **Current Status** on the software upgrade screen, you are advised to charge the battery to over 20% SOC before upgrading the software. Otherwise, the upgrade will fail because the battery health check is not passed.

    After the software is upgraded successfully, wait for more than 10 minutes before performing the upgrade again. Otherwise, the upgrade will fail because the system initialization is not complete.

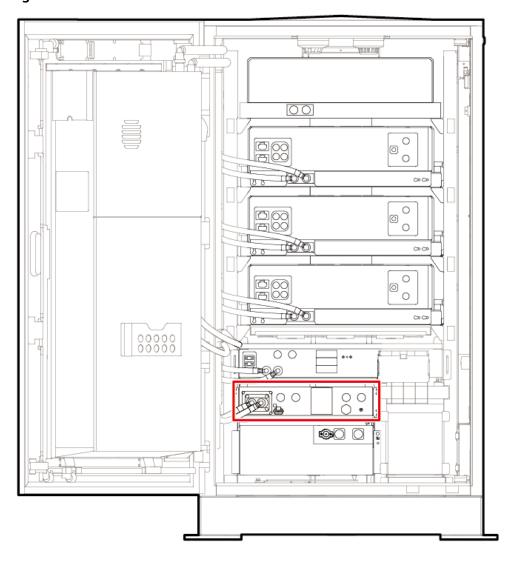**Step 3**   Perform system deployment again.

- On-grid scenario: For details, see **LUNA2000-(107-215) Series Commercial and Industrial On-Grid Energy Storage Solution User Manual**.

- Microgrid scenario: For details, see **LUNA2000-215-2S10 Commercial and Industrial Microgrid Energy Storage Solution User Manual**.

----End

6 Replacing a DCDC

Prerequisites

Figure 6-1 Position of the DCDC

- The following tools are available.

Tool	Specifications	Obtaining Method
Insulated torque socket wrench	Including 13# and 18# sockets and extension rods (≥ 80 mm)	Prepared by the customer
Socket for installing the male connector of the two-way stop valve	Standard hex socket: 27 mm across the flats and 37 mm across the corners	Prepared by the customer or obtained from the Company's service engineers
Phillips insulated torque screwdriver	M4, M6	Prepared by the customer
PCS/DCDC maintenance fixture	-	Purchased on the configurator; screws delivered with the fixture
Lifting handles	-	4 (delivered with spare parts)
Coolant	-	Purchased on the configurator
Coolant filling/ drainage machine	-	Purchased on the configurator
Face mask	-	Prepared by the customer
Goggles	-	Prepared by the customer
New male connector of the stop valve	-	Delivered as spare parts
Waterproof insulated gloves and protective gloves	-	Prepared by the customer

- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.
- At least four persons are required to replace the DCDC.

Procedure

Step 1 Determine subsequent operations based on the ambient temperature.

- If the ambient temperature is higher than –10°C, skip this step and go to the next step.
- If the ambient temperature is less than or equal to –10°C, drain the coolant from the LTMS and the faulty component. For details about how to drain the

coolant from the LTMS and DCDC, see **19.4.1 Draining Coolant from the LTMS** and **19.4.2 Draining Coolant from the PACK/PCS/DCDC**, respectively.

Step 2 Disconnect the cables connected to the faulty DCDC, and check whether the labels are intact. If not, confirm cables and prepare new labels.

1. Remove the power terminal. Select a removal method based on the appearance of the power terminal.

📖 **NOTE**

When removing power terminals, remove BAT– and then BAT+.

Figure 6-2 Method 1 for removing the power terminal
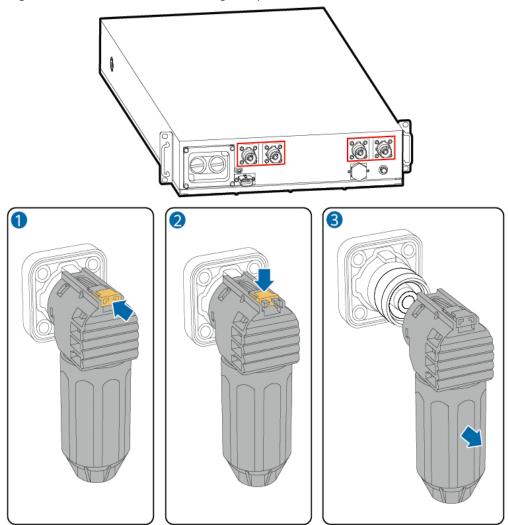
Figure 6-3 Method 2 for removing the power terminal

2. Remove the communications terminal.
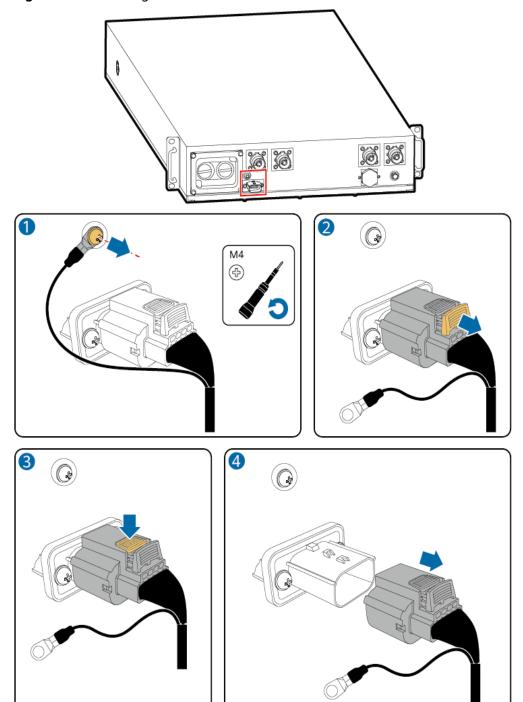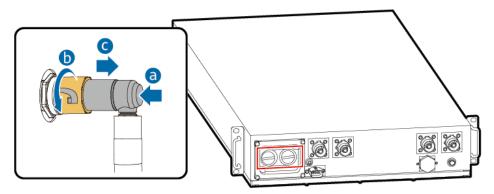
Figure 6-4 Removing the communications terminal

3. Disconnect the female connector of the stop valve on the branch liquid cooling pipe from the male connector. Retain the old male connector.

NOTICE
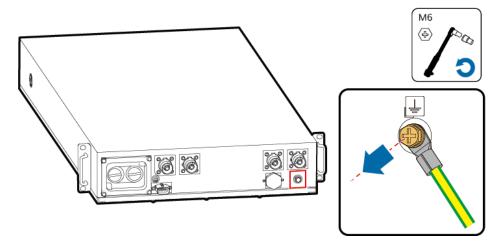
Put the disconnected branch liquid cooling pipes in the clip on the inner side of the cabinet to prevent the pipe from warping.

Figure 6-5 Disconnecting the female connector of the stop valve from the male connector

4. Remove the PE cable.

Figure 6-6 Removing the PE cable

Step 3 Take out the PCS/DCDC fixture and switch it to the DCDC position by referring to the **process of unpacking the pack fixture**.

Step 4 Move the faulty DCDC to the fixture.

1. Remove the screws that secure the faulty DCDC to the cabinet.
2. Secure the fixture to the ESS.
3. Hold the handles on both sides of the faulty DCDC and pull the DCDC to the fixture.
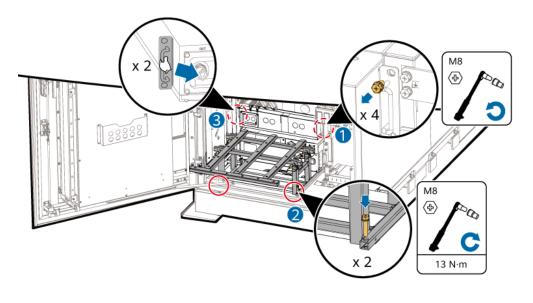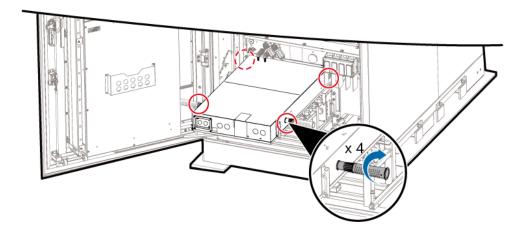
Figure 6-7 Moving the DCDC to the fixture

⚠️ **WARNING**

When placing the DCDC on the fixture, ensure that most of the weight of the DCDC is on the fixture to avoid damage caused by falling.

Step 5 Install the lifting handles and move the DCDC to a safe place.

Figure 6-8 Installing the lifting handles

Step 6 Push the DCDC.

1. Take out a new DCDC and install the lifting handles.

2. Lift the DCDC onto the fixture to avoid falling, and then remove the lifting handles.

3. Hold the handles on both sides and slowly push the DCDC into the ESS.
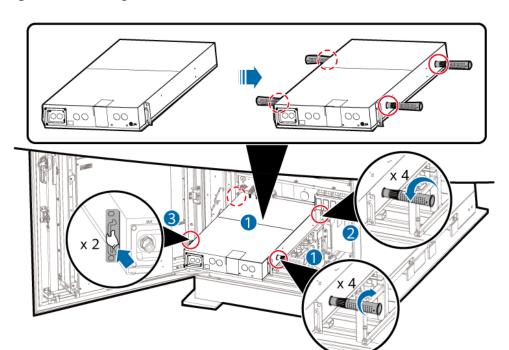
Figure 6-9 Pushing the DCDC

Step 7 Complete DCDC replacement.

1. Push the new DCDC completely into the ESS and tighten the screws.
2. Remove the screws from the PCS/DCDC fixture and take out the fixture.

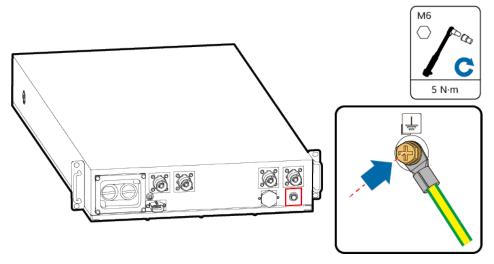**Figure 6-10** Completing DCDC replacement

⚠ **WARNING**

When placing the DCDC on the fixture, ensure that most of the weight of the DCDC is on the fixture to avoid damage caused by falling.

Step 8 After removing the fixture and restoring it to the DCDC position, place the fixture back to the packing case and secure it.

Step 9 Connect the cables based on the labels.

1. Connect the PE cable.

Figure 6-11 Connecting the PE cable

2. Install the new male connector of the stop valve to the new DCDC, and connect the female connector of the pipe to the new male connector. The new male connector of the stop valve must be equipped with two sealing rings.

Figure 6-12 Male connector with two sealing rings
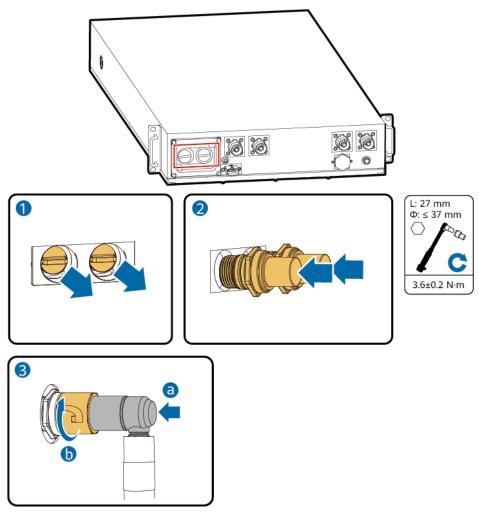
Figure 6-13 Connecting the stop valve

3. Connect the communications terminal.

Figure 6-14 Connecting the communications terminal

4. Connect the power terminal. Select a connection method based on the appearance of the power terminal.

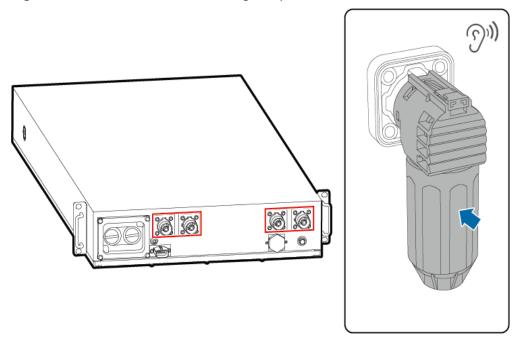**Figure 6-15** Method 1 for connecting the power terminal

Figure 6-16 Method 2 for connecting the power terminal

Step 10 Add a proper amount of coolant. For details, see **19.4.3 Adding Coolant to the LTMS**.

----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 Upgrade the ESS software version.

> **NOTICE**
>
> - After the device is replaced, you are advised to observe for 10 to 15 minutes to ensure that the new device is stable before manually upgrading the software.

1. **Method 1: Upgrade the ESS software version on the SmartLogger WebUI.**

   a. Querying the ESS software version: Log in to the SmartLogger WebUI and choose **Maintenance** > **Software Upgrade**.

   b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

   c. Uploading the upgrade package: On the SmartLogger WebUI, choose **Select a file**, select the target software package, and click **Upload**.

   d. Starting the upgrade: After the upload is complete, select the ESS with the software to be upgraded and click **Software Upgrade**.

   e. After the upgrade is complete, the device automatically restarts.

2. **Method 2: Upgrade the ESS software version on the FusionSolar app.**

a. Log in to the FusionSolar app and access the local commissioning screen.

☰ **NOTE**

For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

b. On the home screen, choose **Maintenance** > **Upgrade**. The **Upgrade** screen is displayed.

c. Tap the download icon in the upper right corner to check whether an upgrade package is pushed. If yes, select the software package of the target version and perform the upgrade.

d. After you tap **Update Now**, check that the ESS enters the upgrade status.

e. After the upgrade is complete, the device automatically restarts.

3. **Method 3: Upgrade the ESS software version on the SmartPVMS.**

a. Log in to the SmartPVMS client.

b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

c. Uploading the upgrade package: Choose **Plants** > **Update Management** > **Software Packages**. On the page that is displayed, click **Upload** in the upper right corner to upload the software package of the target version.

d. Starting the upgrade: Choose **Device Upgrade** > **Create** > **Select manually**, set **Device type** to **ESS**, select the ESS to be upgraded, and set **Target Version** to the target version. Click **OK** to start the upgrade.

e. After the upgrade is complete, the device automatically restarts.

☰ **NOTE**

If the software upgrade fails and **SOC too low** is displayed in **Current Status** on the software upgrade screen, you are advised to charge the battery to over 20% SOC before upgrading the software. Otherwise, the upgrade will fail because the battery health check is not passed.

After the software is upgraded successfully, wait for more than 10 minutes before performing the upgrade again. Otherwise, the upgrade will fail because the system initialization is not complete.
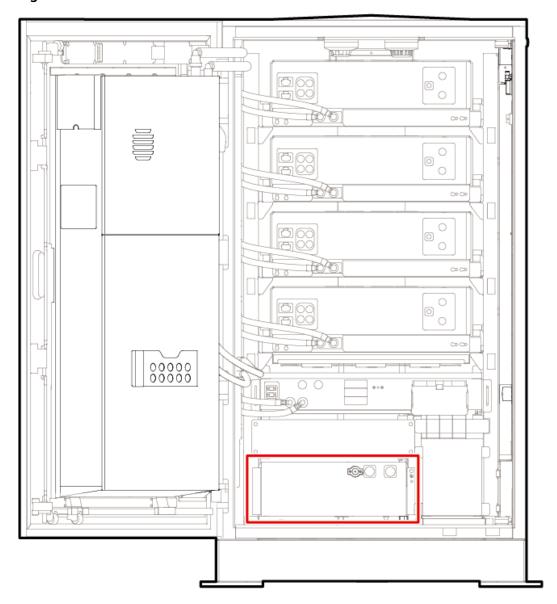
----End

7 Replacing the RCM

NOTICE

- There are multiple models of RCMs. The actual product may vary.
- The figures in this chapter are for reference only. The appearance of each component (such as a power meter) inside the RCM may vary.

7.1 Replacing an Entire RCM

Prerequisites

Figure 7-1 Position of the RCM

- (Optional) To ensure device data security, log in to the FusionSolar app and clear device data.

  a. Enable the WiFi function of the cabinet. Press and hold the WiFi button on the cabinet door for 1 to 6 seconds.

  b. Log in to the FusionSolar app and access the local commissioning screen.

📖 NOTE

> For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

c. Clear the configuration data of the device. Choose **Maintenance** > **Factory Reset**, select **Restore BCU to factory settings** under **Component**, and tap **Clear All Data**. Then the device automatically restarts. Wait for 5 to 8 minutes.

Table 7-1 Parameters

Parameter	Description
Restore Factory Defaults	Restore the factory defaults.
Clear All Data	Clear all historical data of the device.

d. Restore the configuration data of the device. After device restart is complete, reconnect the mobile phone to the device. Return to the local commissioning screen, choose **Maintenance** > **Factory Reset**, select **Restore BCU to factory settings** under **Component**, and tap **Restore Factory Defaults**. Then the device automatically restarts. Wait for 5 to 8 minutes.

● You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

● Tools: insulated torque socket wrench (M5 and M8, including 5# and 13# sockets and the extension rod), Phillips insulated torque screwdriver (M3 and M6), flat-head insulated torque screwdriver (M3), SMA torque wrench, needle-nose pliers, diagonal pliers, cable ties, and protective gloves

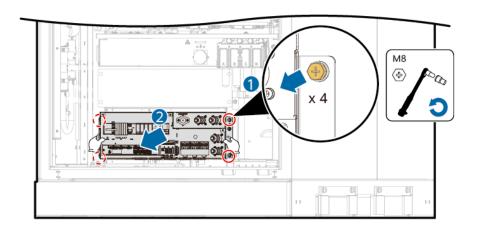● At least two persons are required to replace the RCM.

Procedure

Step 1 Remove the maintenance compartment cover and cable protective cover.

Figure 7-2 Removing the maintenance compartment cover and cable protective cover

Step 2 Remove cables. Use a Phillips insulated torque screwdriver (M6) to remove the cables under the RCM cable protective cover. Check whether the labels are intact. If any label is missing, check the cable and prepare a label.
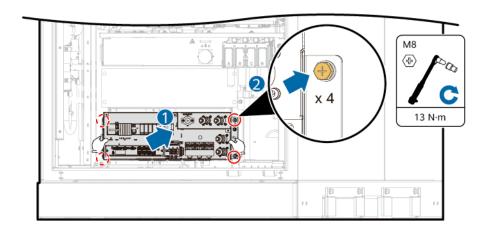
Step 3 Remove the faulty RCM.

Figure 7-3 Removing the faulty RCM

Step 4 Remove the BCU from the faulty RCM. For details, see **7.5 Replacing a BCU**.

Step 5 Install the removed BCU in the new RCM. For details, see **7.5 Replacing a BCU**.

Step 6 Install the RCM.

Figure 7-4 Installing the RCM

Step 7 Connect the RCM cables based on the cable labels and port silk screens. Use a Phillips insulated torque screwdriver (M6) to install cables under the RCM cable protective cover and tighten the screws to 3.5 N·m. If the UPS is connected, remove short-circuiting bars from terminals 2–3 and 5–6, and connect the short-circuiting bars to terminals 1–2 and 4–5.
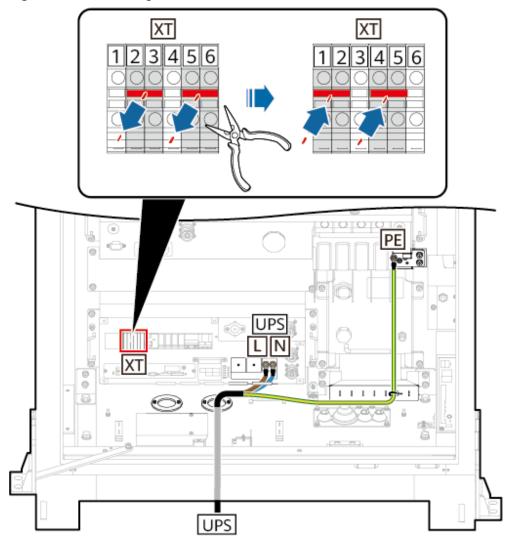
Figure 7-5 Connecting the UPS cable

⚠ CAUTION

Connect cables according to the cable labels and port silk screens. Otherwise, the device may be damaged.

Step 8 Install the cable protective cover and maintenance compartment cover.

Figure 7-6 Installing the cable protective cover and maintenance compartment cover

----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 Enable the WiFi function on the phone, log in to the FusionSolar app, connect to the ESS, and handle the **E-label Board Data Abnormal** alarm.

1. Log in to the FusionSolar app, access the local commissioning screen, choose **Device Commissioning**, and tap **Alarms**.

   📖 **NOTE**

   For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

2. Select the **E-label Board Data Abnormal** alarm, tap **Proceed**, and select the device SN.

3. Wait for the system to automatically restart. After the restart is complete, check whether the **E-label Board Data Abnormal** alarm is cleared.

> **NOTICE**
>
> If other alarms are still generated, manually clear them.

Step 3 Upgrade the ESS software version.

> **NOTICE**
>
> - After the device is replaced, you are advised to observe for 10 to 15 minutes to ensure that the new device is stable before manually upgrading the software.

1. **Method 1: Upgrade the ESS software version on the SmartLogger WebUI.**

   a. Querying the ESS software version: Log in to the SmartLogger WebUI and choose **Maintenance** > **Software Upgrade**.

   b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

   c. Uploading the upgrade package: On the SmartLogger WebUI, choose **Select a file**, select the target software package, and click **Upload**.

   d. Starting the upgrade: After the upload is complete, select the ESS with the software to be upgraded and click **Software Upgrade**.

   e. After the upgrade is complete, the device automatically restarts.

2. **Method 2: Upgrade the ESS software version on the FusionSolar app.**

   a. Log in to the FusionSolar app and access the local commissioning screen.

   > **□ NOTE**
   >
   > For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

   b. On the home screen, choose **Maintenance** > **Upgrade**. The **Upgrade** screen is displayed.

   c. Tap the download icon in the upper right corner to check whether an upgrade package is pushed. If yes, select the software package of the target version and perform the upgrade.

   d. After you tap **Update Now**, check that the ESS enters the upgrade status.

   e. After the upgrade is complete, the device automatically restarts.

3. **Method 3: Upgrade the ESS software version on the SmartPVMS.**

   a. Log in to the SmartPVMS client.

   b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

   c. Uploading the upgrade package: Choose **Plants** > **Update Management** > **Software Packages**. On the page that is displayed, click **Upload** in the upper right corner to upload the software package of the target version.

d.   Starting the upgrade: Choose **Device Upgrade** > **Create** > **Select manually**, set **Device type** to **ESS**, select the ESS to be upgraded, and set **Target Version** to the target version. Click **OK** to start the upgrade.

e.   After the upgrade is complete, the device automatically restarts.

☐ NOTE

If the software upgrade fails and **SOC too low** is displayed in **Current Status** on the software upgrade screen, you are advised to charge the battery to over 20% SOC before upgrading the software. Otherwise, the upgrade will fail because the battery health check is not passed.

After the software is upgraded successfully, wait for more than 10 minutes before performing the upgrade again. Otherwise, the upgrade will fail because the system initialization is not complete.

----End

7.2 Replacing a Power Meter

Prerequisites

- Tools: Phillips insulated torque screwdriver (M3 and M5) and flat-head insulated torque screwdriver (M2.5)

- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Remove the maintenance compartment cover and the upper left cover inside.

Figure 7-7 Removing the maintenance compartment cover and the upper left cover inside

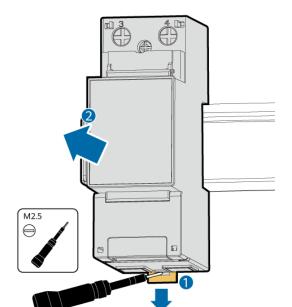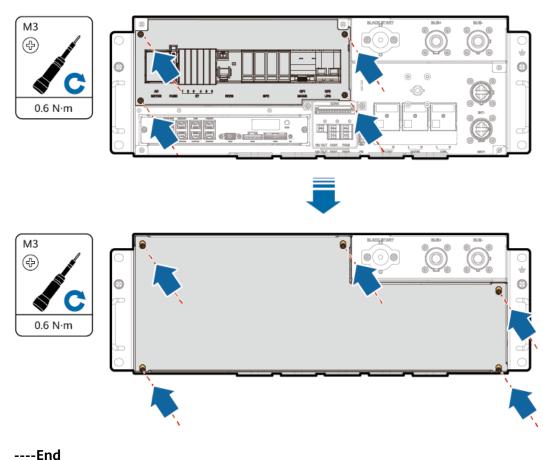**Step 2** Remove the faulty power meter.

Figure 7-8 Removing the faulty power meter

Step 3 After taking the faulty power meter out of the RCM, disconnect the cables from the faulty power meter and check whether the labels are intact. If not, confirm cables and prepare new labels.

Step 4 Connect the cables to a new power meter based on the cable labels (M5 Phillips screws, torque: 1.6 N·m; M2.5 flat-head screws).

Step 5 Arrange the cables and properly put them back inside the RCM. Fasten the meter to the upper part of the guide rail, push the meter, and clamp it to the guide rail.

Step 6 Install the upper left cover inside and cover of the maintenance compartment.

Figure 7-9 Installing the upper left cover inside and cover of the maintenance compartment

----End

Follow-up Procedure

Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

7.3 Replacing a Power Meter Fuse
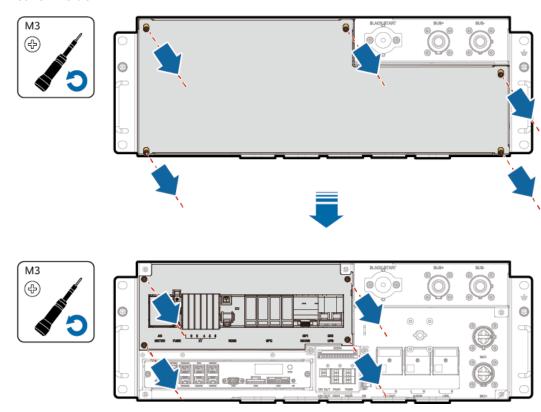
Prerequisites

- Tool: Phillips insulated torque screwdriver (M3)
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.
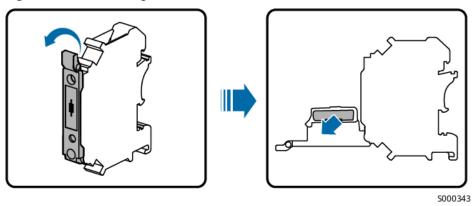
Procedure

Step 1 Remove the maintenance compartment cover and the upper left cover inside.

Figure 7-10 Removing the maintenance compartment cover and the upper left cover inside

Step 2 Open the fuse cover of the power meter and remove the faulty fuse.

Figure 7-11 Removing the fuse

Step 3 Install a new fuse and close the fuse cover of the power meter.

Step 4 Install the upper left cover inside and cover of the maintenance compartment.

Figure 7-12 Installing the upper left cover inside and cover of the maintenance compartment

----End

Follow-up Procedure

Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

7.4 Replacing an SPD

Prerequisites

- Tools: Phillips insulated torque screwdriver (M3) and surge protection module removal and insertion tool (delivered with the fixture)
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

⚠ **DANGER**
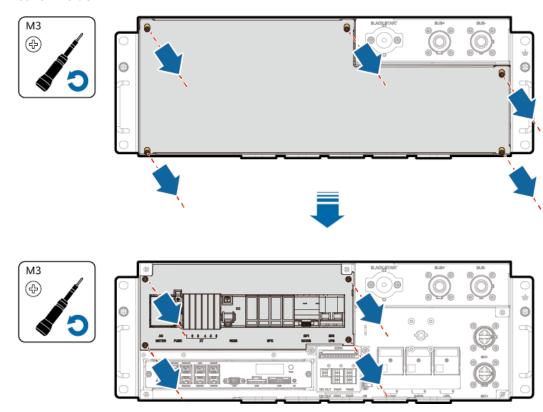
Do not replace the AC SPD during a thunderstorm.

Procedure

Step 1 Remove the maintenance compartment cover and the upper left cover inside.

Figure 7-13 Removing the maintenance compartment cover and the upper left cover inside

Step 2 Remove the faulty surge protection module from the AC SPD. If the indication window of a surge protection module turns red, the module is faulty.

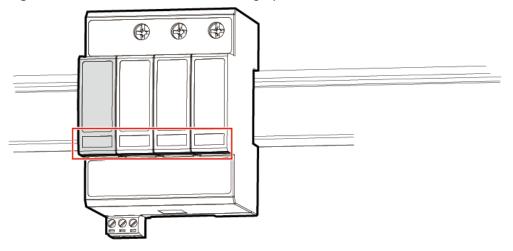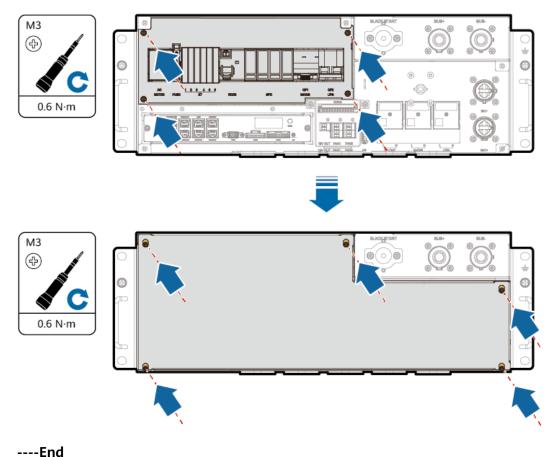**Figure 7-14** Indication windows of surge protection modules

Figure 7-15 Removing the faulty surge protection module

Step 3 Install a new surge protection module.

Step 4 Install the upper left cover inside and cover of the maintenance compartment.

Figure 7-16 Installing the upper left cover inside and cover of the maintenance compartment

----End

Follow-up Procedure

Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

7.5 Replacing a BCU

Prerequisites

- (Optional) To ensure device data security, log in to the FusionSolar app and clear device data.

  a. Enable the WiFi function of the cabinet. Press and hold the WiFi button on the cabinet door for 1 to 6 seconds.

  b. Log in to the FusionSolar app and access the local commissioning screen.

     📖 **NOTE**

     For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

  c. Clear the configuration data of the device. Choose **Maintenance** > **Factory Reset**, select **Restore BCU to factory settings** under **Component**, and tap **Clear All Data**. Then the device automatically restarts. Wait for 5 to 8 minutes.

     Table 7-2 Parameters

Parameter	Description
Restore Factory Defaults	Restore the factory defaults.
Clear All Data	Clear all historical data of the device.

  d. Restore the configuration data of the device. After device restart is complete, reconnect the mobile phone to the device. Return to the local commissioning screen, choose **Maintenance** > **Factory Reset**, select **Restore BCU to factory settings** under **Component**, and tap **Restore Factory Defaults**. Then the device automatically restarts. Wait for 5 to 8 minutes.

- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

- Tools: Phillips insulated torque screwdriver (M2 and M3), insulated torque socket wrench (M5 and 8# socket), SMA torque wrench, diagonal pliers, and cable ties

Procedure
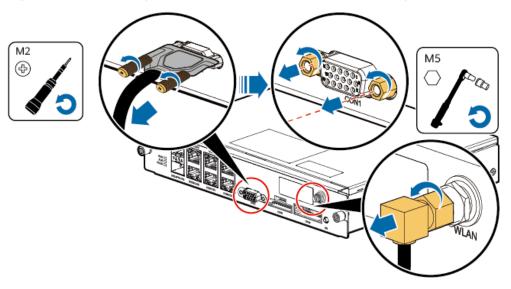
Step 1 Remove the maintenance compartment cover.

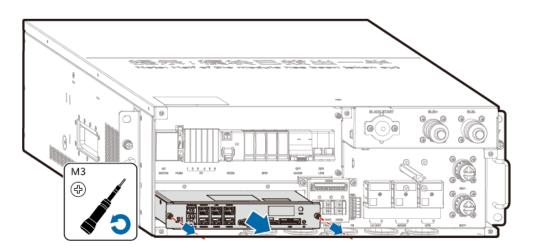**Figure 7-17** Removing the maintenance compartment cover

Step 2 Remove the communications cable and coupling nuts from the CON1 port.

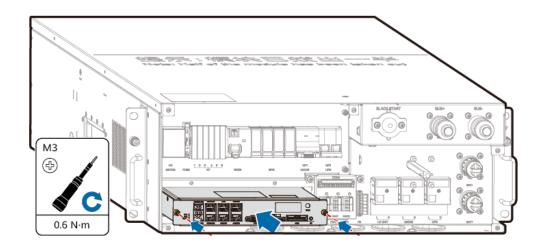**Figure 7-18** Removing the communications cable and coupling nuts

Step 3 Remove the faulty BCU.

Figure 7-19 Removing the faulty BCU
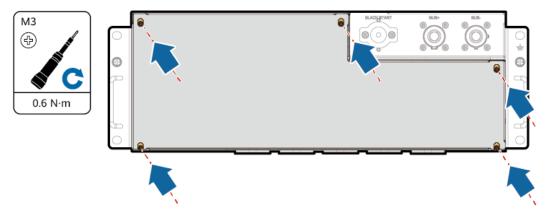
Step 4 Disconnect cables from the faulty BCU, and label the cables.

Step 5 Connect the cables to a new BCU based on the cable labels.

Step 6 Install the new BCU.

Figure 7-20 Installing the new BCU

Step 7 Install the coupling nuts to the CON1 port. Connect the communications cable.

Step 8 Install the RCM maintenance compartment cover.

Figure 7-21 Installing the maintenance compartment cover

----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.
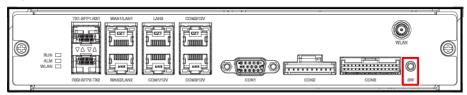
> ☐ **NOTE**
>
> In the off-grid scenario, the UPS must be configured and have power.

Step 2 Reset the app password and WiFi password on the FusionSolar app.

1. Press and hold the BCU reset button SW (RST) for 10 to 20 seconds to enter the 3-minute safety mode.

Figure 7-22 BCU reset button SW (RST)

2. Access the system settings of the mobile phone, disable the mobile data/cellular network, and connect to the ESS WiFi named as *ESS-device SN*.

3. Open the FusionSolar app, tap the overflow menu (::) in the upper right corner, tap **Device Commissioning**, connect to the ESS WiFi, and reset the app password.

4. Access the local commissioning screen, choose **Settings** > **Communication settings** > **Inverter WLAN settings**, change the SSID password (WiFi password), and log in again.

Step 3 Log in to the FusionSolar app or SmartLogger WebUI to check for alarms. If there is still an alarm, manually clear it.

Step 4 Upgrade the ESS software version.

> **NOTICE**
>
> ● After the device is replaced, you are advised to observe for 10 to 15 minutes to ensure that the new device is stable before manually upgrading the software.

1. **Method 1: Upgrade the ESS software version on the SmartLogger WebUI.**

   a. Querying the ESS software version: Log in to the SmartLogger WebUI and choose **Maintenance** > **Software Upgrade**.

   b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

   c. Uploading the upgrade package: On the SmartLogger WebUI, choose **Select a file**, select the target software package, and click **Upload**.

   d. Starting the upgrade: After the upload is complete, select the ESS with the software to be upgraded and click **Software Upgrade**.

   e. After the upgrade is complete, the device automatically restarts.

2. **Method 2: Upgrade the ESS software version on the FusionSolar app.**

   a. Log in to the FusionSolar app and access the local commissioning screen.

   > 📖 **NOTE**
   >
   > For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

   b. On the home screen, choose **Maintenance** > **Upgrade**. The **Upgrade** screen is displayed.

c. Tap the download icon in the upper right corner to check whether an upgrade package is pushed. If yes, select the software package of the target version and perform the upgrade.

d. After you tap **Update Now**, check that the ESS enters the upgrade status.

e. After the upgrade is complete, the device automatically restarts.

3. **Method 3: Upgrade the ESS software version on the SmartPVMS.**

a. Log in to the SmartPVMS client.

b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

c. Uploading the upgrade package: Choose **Plants** > **Update Management** > **Software Packages**. On the page that is displayed, click **Upload** in the upper right corner to upload the software package of the target version.

d. Starting the upgrade: Choose **Device Upgrade** > **Create** > **Select manually**, set **Device type** to **ESS**, select the ESS to be upgraded, and set **Target Version** to the target version. Click **OK** to start the upgrade.

e. After the upgrade is complete, the device automatically restarts.

📖 **NOTE**

If the software upgrade fails and **SOC too low** is displayed in **Current Status** on the software upgrade screen, you are advised to charge the battery to over 20% SOC before upgrading the software. Otherwise, the upgrade will fail because the battery health check is not passed.

After the software is upgraded successfully, wait for more than 10 minutes before performing the upgrade again. Otherwise, the upgrade will fail because the system initialization is not complete.

Step 5 Log in to the SmartLogger WebUI, choose **Maintenance** > **Device Mgmt.** > **Device Replacement** to access the device replacement page, and set parameters.

1. Select **Replace Device** from the **Operation Type** drop-down list.

2. Select **ESS** from the **Device Type** drop-down list.

3. Set **SN of Old Device** and **SN of New Device**.

4. Click **Submit**. The device will be restarted after the replacement is complete. Wait for 5 to 10 minutes.

Table 7-3 Parameters

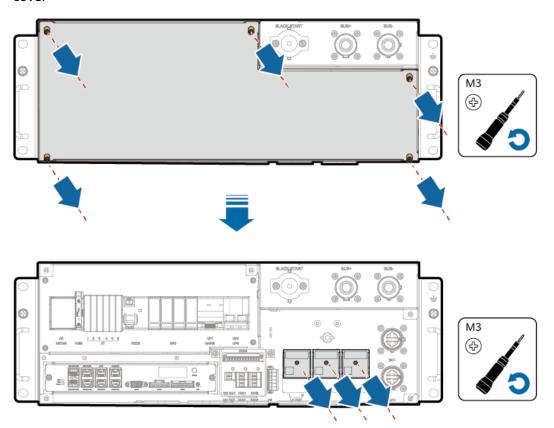| Parameter	Description
Operation Type	Select **Replace Device**.
Device Type	Select **ESS**.
SN of Old Device	Specify the SN of the faulty BCU.
SN of New Device	Specify the SN of the new BCU.

----End

7.6 Replacing an RCM Fan

Prerequisites

- Tools: Phillips insulated torque screwdriver (M3 and M4), flat-head insulated torque screwdriver (M3), insulated torque socket wrench (M8, including 13# socket), diagonal pliers, cable ties, and SMA torque wrench

- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

- At least two persons are required to replace an RCM fan.

Procedure

Step 1 Remove the maintenance compartment cover and cable protective cover.

Figure 7-23 Removing the maintenance compartment cover and cable protective cover

Step 2 Remove cables. Use a Phillips insulated torque screwdriver (M6) to remove the cables under the RCM cable protective cover. Check whether the labels are intact. If any label is missing, check the cable and prepare a label.
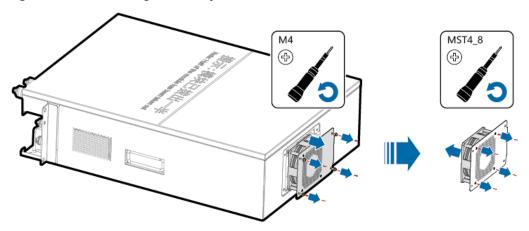
Step 3 Take the RCM out of the cabinet.

Figure 7-24 Taking the RCM out of the cabinet

Step 4 Remove the faulty RCM fan.
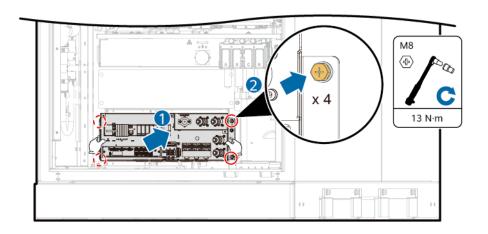
Figure 7-25 Removing the faulty RCM fan

Step 5 Disconnect cables from the faulty RCM fan, and label the cables.

Step 6 Connect the cables to a new RCM fan according to the cable labels.

Step 7 Install the new RCM fan.

Figure 7-26 Installing the new RCM fan

Step 8 Install the RCM.

Figure 7-27 Installing the RCM

Step 9 Install the cable protective cover and maintenance compartment cover.

Figure 7-28 Installing the cable protective cover and maintenance compartment cover

----End

Follow-up Procedure

Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

8 Replacing an LTMS

⚠️ **WARNING**

● Prevent waste from contacting the soil or flowing into the drainage ditch. Use transportation tools, recycling devices, and treatment or storage devices approved by authoritative departments for waste turnover or storage. Heating in an empty container may cause an explosion.

● Wear personal protective equipment because coolant can irritate your eyes, skin, and throat.

NOTICE

● Prevent nuts from falling off during removal and installation. After removing nuts, ensure that no residue is left to avoid short circuits.

● For removed cables, wrap cable terminals with insulation materials, and prevent falling off of foreign matter.

8.1 Replacing an LTMS

⚠️ **CAUTION**

● When moving and transporting the LTMS, keep it upright. Do not place it horizontally or upside down. If the package of the LTMS is damaged or the tilt indicator on the package has changed color, contact the Company's service engineers.
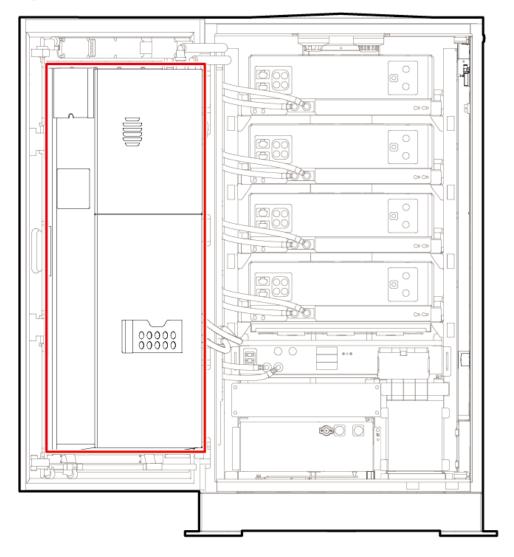

> **NOTICE**
>
> Before installing a new LTMS, check the following items:
>
> - Check whether the door frame is deformed.
> - Check whether there is any rubber strip residue on the sealing surface of the door. If yes, clear it.
> - Check whether the sealing rubber strips for LTMS flanges are intact.

Prerequisites

Figure 8-1 Position of the LTMS

- (Optional) To ensure device data security, log in to the FusionSolar app and clear device data.

  a. Enable the WiFi function of the cabinet. Press and hold the WiFi button on the cabinet door for 1 to 6 seconds.

  b. Log in to the FusionSolar app and access the local commissioning screen.

📖 **NOTE**

> For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

    c. Clear the configuration data of the device. Choose **Maintenance** > **Factory Reset**, select **Restore LCC to factory settings** under **Component**, and tap **Clear All Data**. Then the device automatically restarts. Wait for 5 to 8 minutes.

Table 8-1 Parameters

Parameter	Description
Restore Factory Defaults	Restore the factory defaults.
Clear All Data	Clear all historical data of the device.

    d. Restore the configuration data of the device. After device restart is complete, reconnect the mobile phone to the device. Return to the local commissioning screen, choose **Maintenance** > **Factory Reset**, select **Restore LCC to factory settings** under **Component**, and tap **Restore Factory Defaults**. Then the device automatically restarts. Wait for 5 to 8 minutes.

- Tools: insulated torque socket wrench (M6 and M12, including 10# and 18# sockets, socket depth ≥ 50 mm, with extension rods), M12 lifting lug (delivered with spare parts), claw hammer, adjustable wrench, Phillips insulated torque screwdriver (M3, M4, and M6), flat-head insulated torque screwdriver (M6 and M12), coolant filling/drainage machine (purchased on the configurator), waterproof insulated gloves, face mask, goggles, ladder, diagonal pliers, coolant, cable ties, and protective gloves

- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

- Forklift: minimum load-bearing capacity ≥ 500 kg, equipped with lifting chains.

- At least three persons are required to replace the LTMS.

Procedure

Step 1 Drain all the coolant from the cabinet. For details, see **19.4.1 Draining Coolant from the LTMS**.

Step 2 Disconnect the LTMS from the pipes.

    1. Disconnect the LTMS from the male connectors of the liquid cooling pipes.

    2. After removing the liquid cooling pipes from the pipe clamps, rotate the pipe clamps counterclockwise until they are removed from the cabinet, and record the installation positions of the pipe clamps (use the removed pipe clamps for a new LTMS).
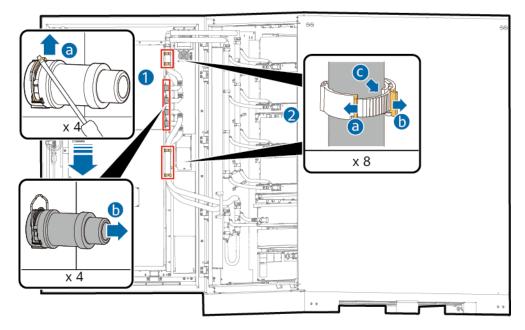
Figure 8-2 Disconnecting the LTMS from the pipes

Step 3 Remove the cables between the LTMS and the RCM.

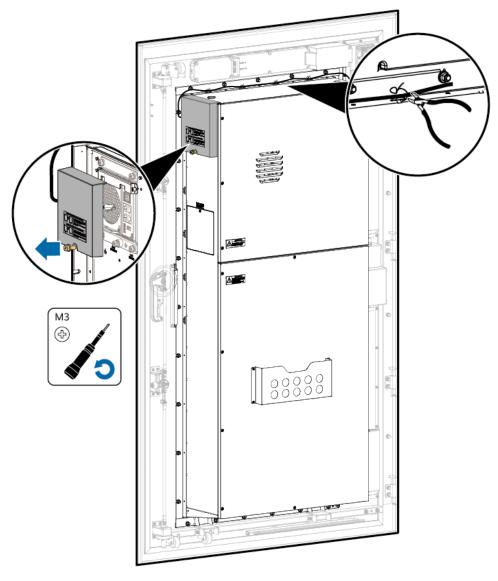1. Cut off the cable ties and remove the communications cable.

Figure 8-3 Removing the communications cable

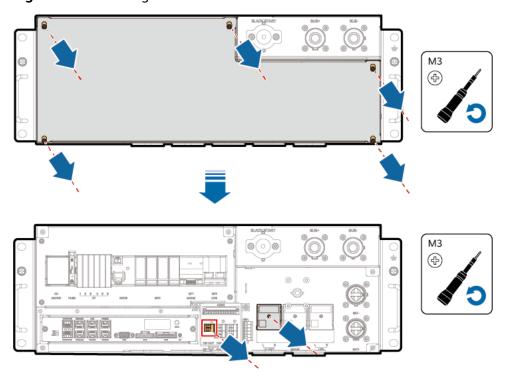2.   Remove the RCM maintenance compartment cover and cables.

Figure 8-4 Removing cables

3. Remove the PE cable.

Step 4 Remove the cable slot and baffle plate.

1. Remove the positioning sheet metal block for the pipe extending beyond the door.

2. Remove the cable slot.

3. Remove the cable baffle plate.

> ⚠ **CAUTION**
>
> – Use an insulated socket wrench with an extension bar longer than 40 mm.
> – During the operation, handle and collect screws with caution to prevent them from falling off.
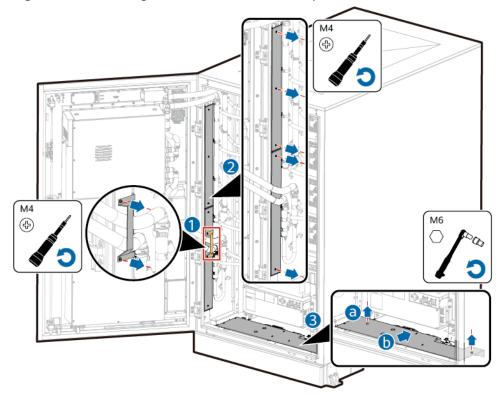

Figure 8-5 Removing the cable slot and baffle plate

Step 5 Hoist the faulty LTMS and remove it.

1. Install the lifting lugs and lifting sling, and cross the lifting sling over the forklift tynes. Slowly raise the tynes to bear the weight of the LTMS until the lifting sling is tightened.

2. Remove the screws that secure the LTMS.

3. Stably hold the LTMS, with one person standing on each of the left and right sides. Slowly raise the tynes to lift the faulty LTMS and slowly reverse the forklift to move the LTMS to a safe place.
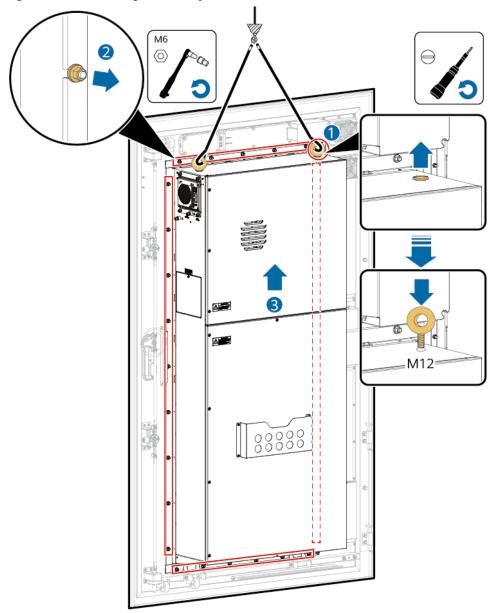
Figure 8-6 Removing the faulty LTMS

Step 6 Hoist the new LTMS and install it.

1. Hoist the new LTMS to the installation position. Stably hold the new LTMS, with one person standing on each of the left and right sides.

2. Roughly align the LTMS with the installation position using the forklift, move the LTMS, slowly align it with the screw installation positions using the forklift, and install the screws.

3. Remove the lifting lugs and install the plugs for the hoisting positions.

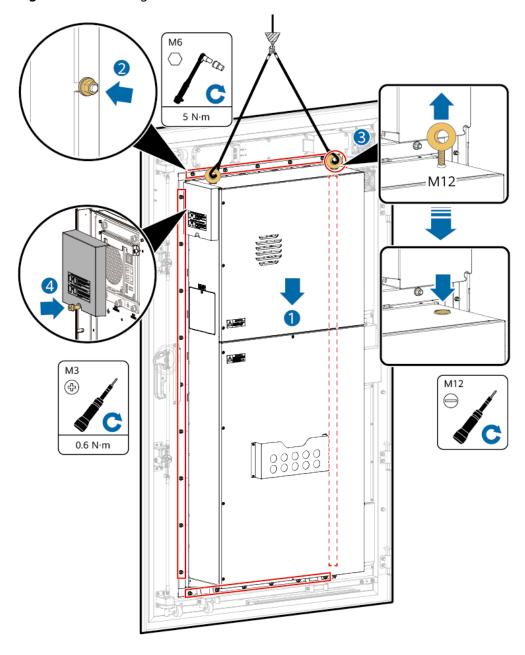4. Connect the communications cable and reinstall the protective cover for the main control module.

Figure 8-7 Installing the new LTMS

Step 7 Install the cable in the original route. Connect cables, pipe clamps, and liquid cooling pipes based on labels.

Step 8 Add coolant. For details, see **19.4 How Do I Use the Coolant Filling/Drainage Machine to Add or Drain Coolant?**
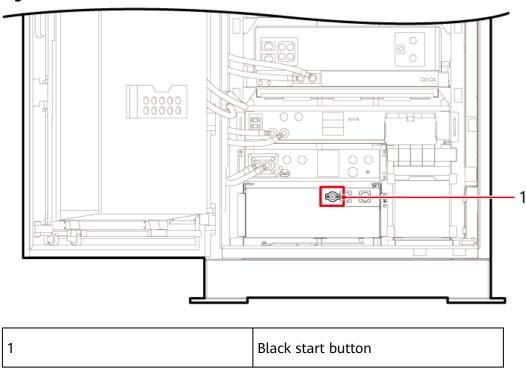
----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 (Optional) In the microgrid scenario, perform a black start.

1. Method 1: Use the SmartLogger to perform a black start. Log in to the SmartLogger WebUI, choose **Settings** > **Microgrid Control** > **Black Start**, and click **Starting**.

2. Method 2: Use the black start button in the ESS. Open the ESS door, hold down the black start button on the RCM in the ESS for more than 10 seconds, and close the door promptly.

Figure 8-8 Black start button

1	Black start button

Step 3 Log in to the FusionSolar app or SmartLogger WebUI to check for alarms. If there is still an alarm, manually clear it.

Step 4 Upgrade the ESS software version.

> **NOTICE**
>
> ● After the device is replaced, you are advised to observe for 10 to 15 minutes to ensure that the new device is stable before manually upgrading the software.

---

1. **Method 1: Upgrade the ESS software version on the SmartLogger WebUI.**

   a. Querying the ESS software version: Log in to the SmartLogger WebUI and choose **Maintenance** > **Software Upgrade**.

   b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

   c. Uploading the upgrade package: On the SmartLogger WebUI, choose **Select a file**, select the target software package, and click **Upload**.

   d. Starting the upgrade: After the upload is complete, select the ESS with the software to be upgraded and click **Software Upgrade**.

---

e.   After the upgrade is complete, the device automatically restarts.

2.   **Method 2: Upgrade the ESS software version on the FusionSolar app.**

a.   Log in to the FusionSolar app and access the local commissioning screen.

📖 **NOTE**

> For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

b.   On the home screen, choose **Maintenance** > **Upgrade**. The **Upgrade** screen is displayed.

c.   Tap the download icon in the upper right corner to check whether an upgrade package is pushed. If yes, select the software package of the target version and perform the upgrade.

d.   After you tap **Update Now**, check that the ESS enters the upgrade status.

e.   After the upgrade is complete, the device automatically restarts.

3.   **Method 3: Upgrade the ESS software version on the SmartPVMS.**

a.   Log in to the SmartPVMS client.

b.   Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

c.   Uploading the upgrade package: Choose **Plants** > **Update Management** > **Software Packages**. On the page that is displayed, click **Upload** in the upper right corner to upload the software package of the target version.

d.   Starting the upgrade: Choose **Device Upgrade** > **Create** > **Select manually**, set **Device type** to **ESS**, select the ESS to be upgraded, and set **Target Version** to the target version. Click **OK** to start the upgrade.

e.   After the upgrade is complete, the device automatically restarts.

📖 **NOTE**

> If the software upgrade fails and **SOC too low** is displayed in **Current Status** on the software upgrade screen, you are advised to charge the battery to over 20% SOC before upgrading the software. Otherwise, the upgrade will fail because the battery health check is not passed.
>
> After the software is upgraded successfully, wait for more than 10 minutes before performing the upgrade again. Otherwise, the upgrade will fail because the system initialization is not complete.

Step 5   Enable the WiFi function on the mobile phone, log in to the FusionSolar app, connect to the ESS, and restore device data.

1.   Log in to the FusionSolar app, access the local commissioning screen, and tap **Device Commissioning**.

2.   Choose **Settings** > **Data backup/restoration** > **LCC data restoration** and wait until data restoration is complete.

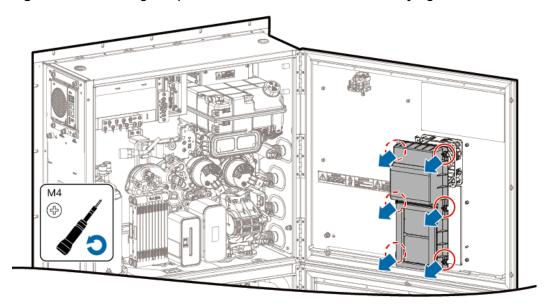**----End**

8.2 Replacing an LTMS Dehumidifying Fan

Prerequisites

- Tools: Phillips insulated torque screwdriver (M4 and M5), diagonal pliers, and cable ties
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Open the LTMS door.

Step 2 Remove the protective cover from the dehumidifying fan.

Figure 8-9 Removing the protective cover from the dehumidifying fan

Step 3 Disconnect the quick connector of the dehumidifying fan and check whether the labels are intact. If not, confirm cables and prepare new labels.
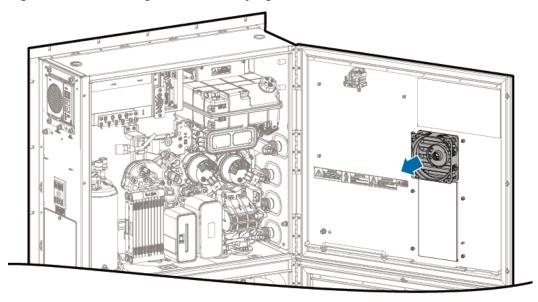
Step 4 Remove the faulty dehumidifying fan.

Figure 8-10 Removing the dehumidifying fan

Step 5 Install a new dehumidifying fan.

NOTICE

Ensure that the fan label faces the door panel.

Step 6 Connect the cables based on the labels.

Step 7 Install the protective cover for the dehumidifying fan and tighten the M4 Phillips screws to 0.6 N·m.

Step 8 Close the LTMS door and tighten the M5 Phillips screws to 3 N·m.

----End

8.3 Replacing an LTMS Outdoor Fan
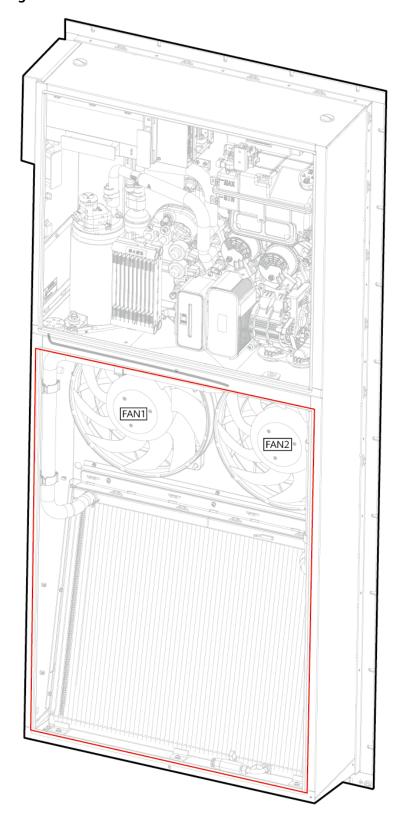
Prerequisites

Figure 8-11 Positions of the LTMS outdoor fans

- Tools: glass cement, cement gun, insulated torque socket wrench (M4 and M6, including 7# and 10# sockets), Phillips insulated torque screwdriver (M4,

M5, and M6), flat-head insulated torque screwdriver, diagonal pliers, and cable ties

- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Open the LTMS door.

Step 2 Remove the cables and NTC cable harness from the outdoor fan, and check whether the labels are intact. If not, confirm cables and prepare new labels. For details about how to remove the cable harness, see **8.9 Replacing an LTMS NTC Cable Harness**.

Step 3 Remove the faulty outdoor fan.

Figure 8-12 Removing the faulty outdoor fan (using FAN2 on the right as an example)

Step 4 Install a new outdoor fan and tighten the M6 screws to 3 N·m.
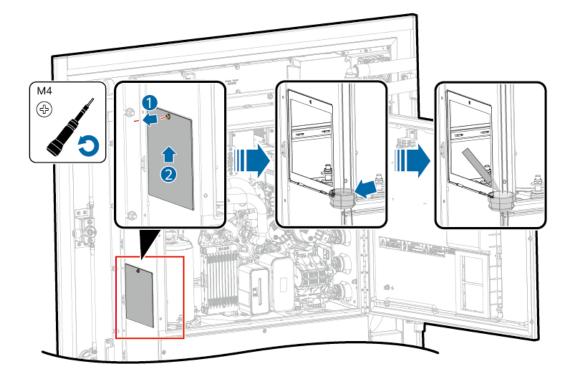
> **NOTICE**
>
> When installing the new outdoor fan, place the end of the cable in the lower left corner and reserve sufficient slack in the cable.

Step 5 Open the side door of the LTMS, route the cable harness through the cylindrical cable routing tool, and fill the cable holes with glass cement.

> **NOTICE**
>
> When applying glass cement, ensure that there is no gap between the cables and the cable holes.
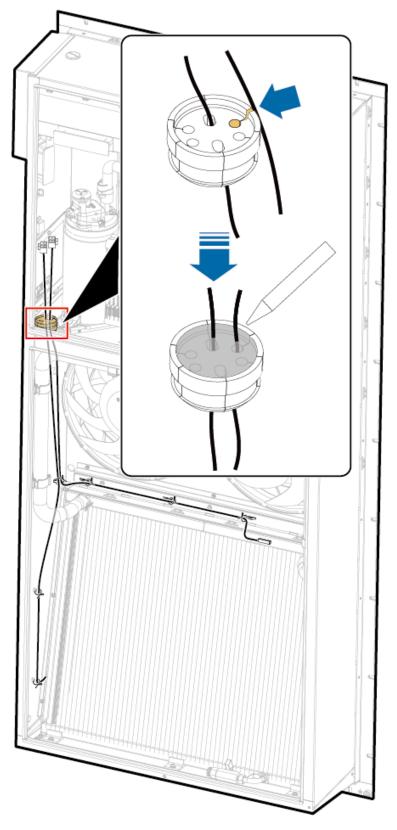
Figure 8-13 Applying glass cement

Figure 8-14 Filling cable holes with glass cement

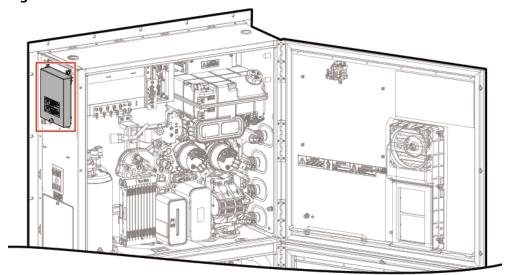**Step 6** Reinstall the pipes and cables, and properly bind the cables.

Step 7 Close the LTMS door and tighten the M5 Phillips screws to 3 N·m.

----End

8.4 Replacing an LTMS Main Control Module

Prerequisites

Figure 8-15 Position of the LTMS main control module

- (Optional) To ensure device data security, log in to the FusionSolar app and clear device data.

  a. Enable the WiFi function of the cabinet. Press and hold the WiFi button on the cabinet door for 1 to 6 seconds.

  b. Log in to the FusionSolar app and access the local commissioning screen.

     □ NOTE

     For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

  c. Clear the configuration data of the device. Choose **Maintenance** > **Factory Reset**, select **Restore LCC to factory settings** under **Component**, and tap **Clear All Data**. Then the device automatically restarts. Wait for 5 to 8 minutes.

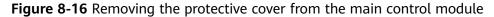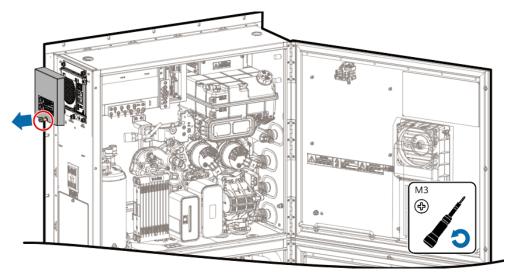**Table 8-2** Parameters

Parameter	Description
Restore Factory Defaults	Restore the factory defaults.
Clear All Data	Clear all historical data of the device.

  d. Restore the configuration data of the device. After device restart is complete, reconnect the mobile phone to the device. Return to the local commissioning screen, choose **Maintenance** > **Factory Reset**, select **Restore LCC to factory settings** under **Component**, and tap **Restore Factory Defaults**. Then the device automatically restarts. Wait for 5 to 8 minutes.

- Tool: Phillips insulated torque screwdriver (M3)
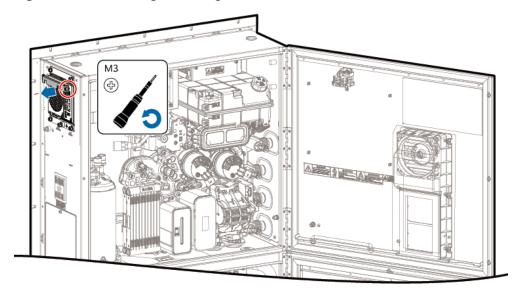- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Remove the protective cover from the LTMS main control module.

Figure 8-16 Removing the protective cover from the main control module

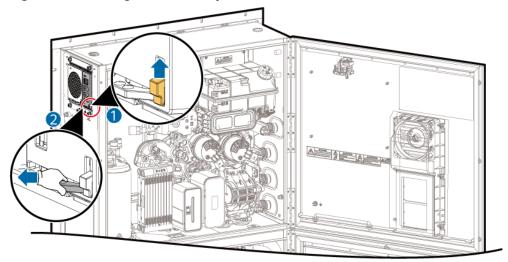**Step 2** Remove the fixing bracket from the LTMS main control module.

Figure 8-17 Removing the fixing bracket from the main control module

Step 3 Disconnect the cables from the faulty main control module and check whether the labels are intact. If not, confirm cables and prepare new labels.

Step 4 Turn the locking switch upward to unlock the faulty main control module, and remove the faulty main control module.

Figure 8-18 Taking out the faulty module

Step 5 Insert and lock a new main control module.

Step 6 Connect the cables based on the labels.

Step 7 Install the fixing bracket and protective cover for the LTMS main control module and tighten the M3 Phillips screws to 0.6 N·m.

----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 (Optional) In the microgrid scenario, perform a black start.

1. Method 1: Use the SmartLogger to perform a black start. Log in to the SmartLogger WebUI, choose **Settings** > **Microgrid Control** > **Black Start**, and click **Starting**.

2. Method 2: Use the black start button in the ESS. Open the ESS door, hold down the black start button on the RCM in the ESS for more than 10 seconds, and close the door promptly.
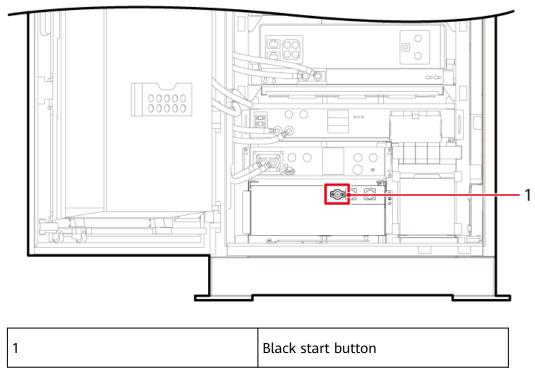
Figure 8-19 Black start button

1	Black start button

Step 3 Upgrade the ESS software version.

> **NOTICE**
>
> ● After the device is replaced, you are advised to observe for 10 to 15 minutes to ensure that the new device is stable before manually upgrading the software.

1. **Method 1: Upgrade the ESS software version on the SmartLogger WebUI.**

   a. Querying the ESS software version: Log in to the SmartLogger WebUI and choose **Maintenance** > **Software Upgrade**.

   b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

   c. Uploading the upgrade package: On the SmartLogger WebUI, choose **Select a file**, select the target software package, and click **Upload**.

   d. Starting the upgrade: After the upload is complete, select the ESS with the software to be upgraded and click **Software Upgrade**.

   e. After the upgrade is complete, the device automatically restarts.

2. **Method 2: Upgrade the ESS software version on the FusionSolar app.**

   a. Log in to the FusionSolar app and access the local commissioning screen.

      > **NOTE**
      >
      > For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

b. On the home screen, choose **Maintenance** > **Upgrade**. The **Upgrade** screen is displayed.

c. Tap the download icon in the upper right corner to check whether an upgrade package is pushed. If yes, select the software package of the target version and perform the upgrade.

d. After you tap **Update Now**, check that the ESS enters the upgrade status.

e. After the upgrade is complete, the device automatically restarts.

3. **Method 3: Upgrade the ESS software version on the SmartPVMS.**

a. Log in to the SmartPVMS client.

b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

c. Uploading the upgrade package: Choose **Plants** > **Update Management** > **Software Packages**. On the page that is displayed, click **Upload** in the upper right corner to upload the software package of the target version.

d. Starting the upgrade: Choose **Device Upgrade** > **Create** > **Select manually**, set **Device type** to **ESS**, select the ESS to be upgraded, and set **Target Version** to the target version. Click **OK** to start the upgrade.

e. After the upgrade is complete, the device automatically restarts.

◪ **NOTE**

If the software upgrade fails and **SOC too low** is displayed in **Current Status** on the software upgrade screen, you are advised to charge the battery to over 20% SOC before upgrading the software. Otherwise, the upgrade will fail because the battery health check is not passed.

After the software is upgraded successfully, wait for more than 10 minutes before performing the upgrade again. Otherwise, the upgrade will fail because the system initialization is not complete.

Step 4 Enable the WiFi function on the mobile phone, log in to the FusionSolar app, connect to the ESS, and restore device data.

1. Log in to the FusionSolar app, access the local commissioning screen, and tap **Device Commissioning**.

2. Choose **Settings** > **Data backup/restoration** > **LCC data restoration** and wait until data restoration is complete.
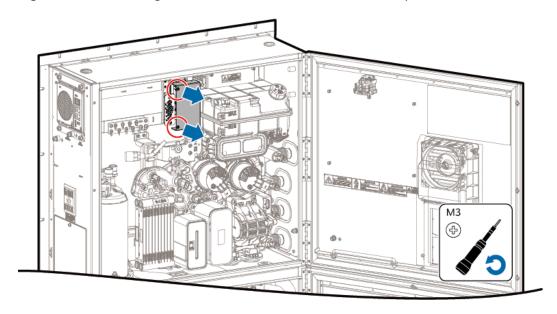
----End

8.5 Replacing an LTMS Main Control Backplane

Prerequisites

- Tool: Phillips insulated torque screwdriver (M3 and M5)
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.
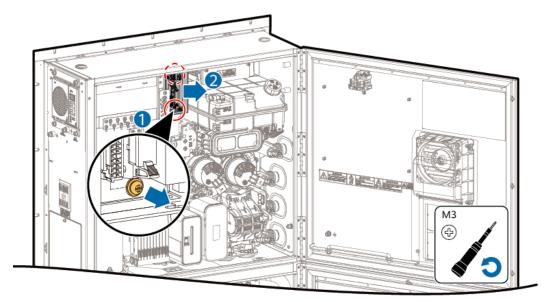
Procedure

Step 1 Remove the main control module from the LTMS. For details, see **8.4 Replacing an LTMS Main Control Module**.

Step 2 Open the LTMS door.

Step 3 Remove the cover from the main control backplane.

Figure 8-20 Removing the cover from the main control backplane

Step 4 Disconnect the cables from the faulty main control backplane and check whether the labels are intact. If not, confirm cables and prepare new labels.

Step 5 Remove the faulty main control backplane.

Figure 8-21 Removing the faulty main control backplane

Step 6 Install a new main control backplane and tighten the M3 Phillips screws to 0.6 N·m.

Step 7 Connect the cables based on the labels.

Step 8 Install the cover for the main control backplane and tighten the M3 Phillips screws to 0.6 N·m.

Step 9 Insert the LTMS main control module.

Step 10 Install the fixing bracket and protective cover for the LTMS main control module and tighten the M3 Phillips screws to 0.6 N·m.

Step 11 Close the LTMS door and tighten the M5 Phillips screws to 3 N·m.
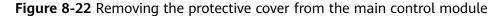
----End

8.6 Replacing the LTMS Drive and Auxiliary Power Module (Compressor Drive Module)
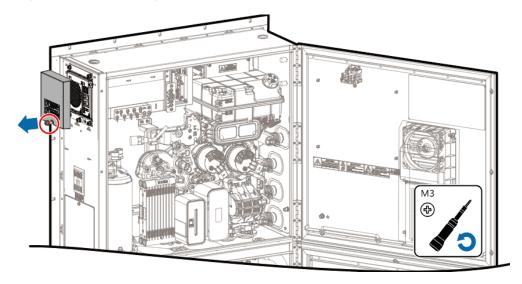
Prerequisites

- Tool: Phillips insulated torque screwdriver (M3)
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Remove the protective cover from the LTMS main control module.

Figure 8-22 Removing the protective cover from the main control module

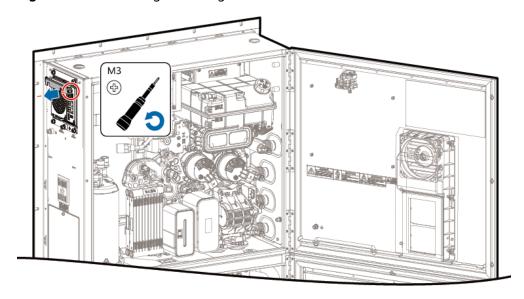**Step 2** Remove the fixing bracket from the LTMS main control module.

Figure 8-23 Removing the fixing bracket from the main control module

Step 3 Turn the locking switch upward to unlock the faulty drive and auxiliary power module, and remove the module.
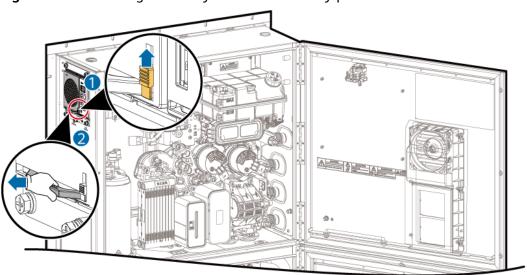
Figure 8-24 Removing the faulty drive and auxiliary power module

Step 4 Insert and lock a new drive and auxiliary power module.

Step 5 Install the fixing bracket and protective cover for the LTMS main control module and tighten the M3 Phillips screws to 0.6 N·m.

----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 Upgrade the ESS software version.

NOTICE

- After the device is replaced, you are advised to observe for 10 to 15 minutes to ensure that the new device is stable before manually upgrading the software.

1. **Method 1: Upgrade the ESS software version on the SmartLogger WebUI.**

   a. Querying the ESS software version: Log in to the SmartLogger WebUI and choose **Maintenance** > **Software Upgrade**.

   b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

   c. Uploading the upgrade package: On the SmartLogger WebUI, choose **Select a file**, select the target software package, and click **Upload**.

   d. Starting the upgrade: After the upload is complete, select the ESS with the software to be upgraded and click **Software Upgrade**.

   e. After the upgrade is complete, the device automatically restarts.

2. **Method 2: Upgrade the ESS software version on the FusionSolar app.**

   a. Log in to the FusionSolar app and access the local commissioning screen.

      NOTE

      For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

   b. On the home screen, choose **Maintenance** > **Upgrade**. The **Upgrade** screen is displayed.

   c. Tap the download icon in the upper right corner to check whether an upgrade package is pushed. If yes, select the software package of the target version and perform the upgrade.

   d. After you tap **Update Now**, check that the ESS enters the upgrade status.

   e. After the upgrade is complete, the device automatically restarts.

3. **Method 3: Upgrade the ESS software version on the SmartPVMS.**

   a. Log in to the SmartPVMS client.

   b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

   c. Uploading the upgrade package: Choose **Plants** > **Update Management** > **Software Packages**. On the page that is displayed, click **Upload** in the upper right corner to upload the software package of the target version.

   d. Starting the upgrade: Choose **Device Upgrade** > **Create** > **Select manually**, set **Device type** to **ESS**, select the ESS to be upgraded, and set **Target Version** to the target version. Click **OK** to start the upgrade.

   e. After the upgrade is complete, the device automatically restarts.

📖 **NOTE**

> If the software upgrade fails and **SOC too low** is displayed in **Current Status** on the software upgrade screen, you are advised to charge the battery to over 20% SOC before upgrading the software. Otherwise, the upgrade will fail because the battery health check is not passed.
>
> After the software is upgraded successfully, wait for more than 10 minutes before performing the upgrade again. Otherwise, the upgrade will fail because the system initialization is not complete.

----End

8.7 Replacing an LTMS Outdoor Heat Exchanger

Prerequisites

- Tools: Phillips insulated torque screwdriver (M4, M5, and M6), diagonal pliers, cable ties, clamp pliers (purchased by the customer; applicable to QC/T 621-compliant space-saving clamps), coolant filling/drainage machine (purchased on the configurator), waterproof insulated gloves, face mask, goggles, flat-head insulated torque screwdriver (M4), coolant, and protective gloves

- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Drain all the coolant from the cabinet. For details, see **19.4.1 Draining Coolant from the LTMS**.

Step 2 Open the LTMS door.

Step 3 Remove the outdoor fan cable and heat exchanger NTC cable harness bound to the outdoor heat exchanger. For details about how to remove the cable harness, see **8.9 Replacing an LTMS NTC Cable Harness**.

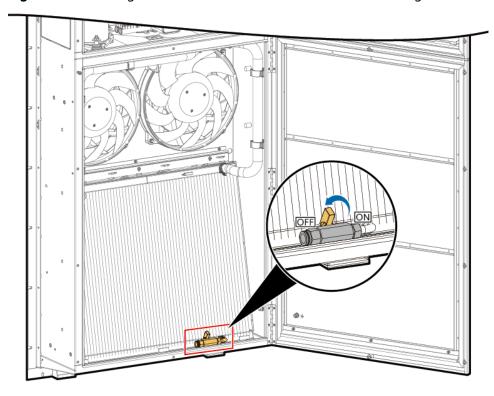**Step 4** Close the valve at the bottom of the heat exchanger.

Figure 8-25 Closing the valve at the bottom of the heat exchanger

Step 5 Remove the liquid cooling pipe of the heat exchanger from the pipe clamps.
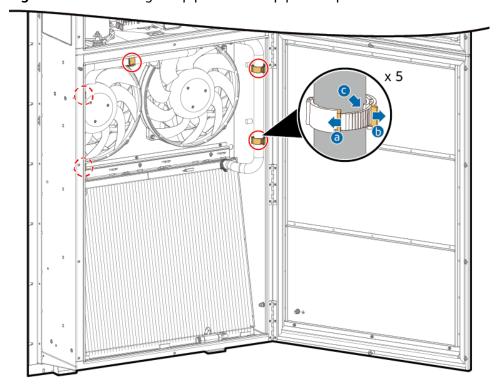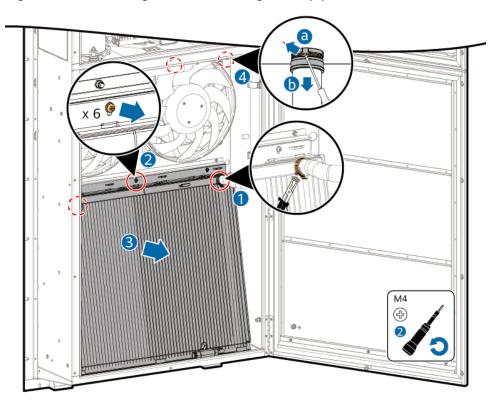
Figure 8-26 Removing the pipe from the pipe clamps

Step 6 Remove the faulty outdoor heat exchanger and pipes.

1. Use clamp pliers to loosen the clamp.

2. Remove the screws from the outdoor heat exchanger using the Phillips insulated torque screwdriver.

3. Disconnect the liquid cooling pipe of the heat exchanger from the LTMS.

4. Remove the faulty outdoor heat exchanger and its pipes.

Figure 8-27 Removing the heat exchanger and pipes

⚠️ **CAUTION**

When connecting pipes to and removing pipes from a heat exchanger, avoid cuts or scratches from the fins.

📖 **NOTE**

If it is difficult to pull out the snap spring, use the flat-head screwdriver to pry out the spring carefully. Use one hand to pinch the spring to prevent it from falling into the cabinet and use the other hand to pull out the spring.

Step 7 Install the new outdoor heat exchanger and new pipes and tighten the M6 Phillips screws to 5 N·m.

Step 8 Properly bind the outdoor fan cable and heat exchanger NTC cable harness to the outdoor heat exchanger. For details, see **8.9 Replacing an LTMS NTC Cable Harness**.

Step 9 Add coolant. For details, see **19.4 How Do I Use the Coolant Filling/Drainage Machine to Add or Drain Coolant?**

Step 10 Close the LTMS door and tighten the M5 Phillips screws to 3 N·m.

----End

8.8 Replacing an LTMS Filter Board
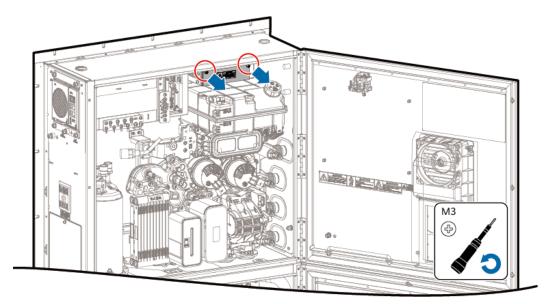
NOTICE

- Prevent nuts from falling off during removal and installation. After removing nuts, ensure that no residue is left to avoid short circuits.
- For removed cables, wrap cable terminals with insulation materials, and prevent falling off of foreign matter.

Prerequisites

- Tools: magnetic Phillips insulated torque screwdriver (M3, M4, and M5), diagonal pliers, and cable ties
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Open the LTMS door.

Step 2 Remove the front baffle plate of the filter board.

Figure 8-28 Removing the front baffle plate of the filter board

Step 3 Disconnect the cables and check whether the labels are intact. If not, confirm cables and prepare new labels.
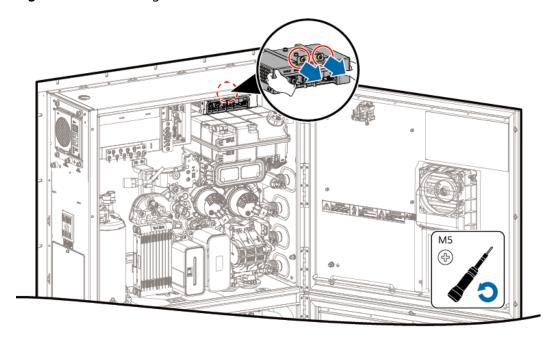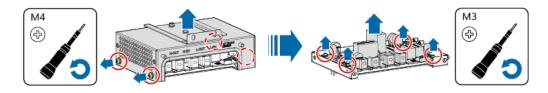
Step 4 Remove the filter board fasteners.

Figure 8-29 Removing the filter board fasteners

Step 5 Remove the faulty filter board.

Figure 8-30 Removing the faulty filter board

Step 6 Install a new filter board and tighten the M3 Phillips screws to 0.3 N·m.

Step 7 Connect the cables based on the labels.

Step 8 Install the sheet metal of the filter board and tighten the M4 Phillips screws to 1.6 N·m.

Step 9 Install the filter board and front baffle plate and tighten the M3 Phillips screws to 0.3 N·m.

Step 10 Close the LTMS door and tighten the M5 Phillips screws to 3 N·m.

----End

8.9 Replacing an LTMS NTC Cable Harness

Prerequisites

Figure 8-31 Position of the NTC cable harness for the heat exchanger

- Tools: glass cement, cement gun, Phillips insulated torque screwdriver (M4, M5, and M6), flat-head insulated torque screwdriver, cable ties, and diagonal pliers
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.
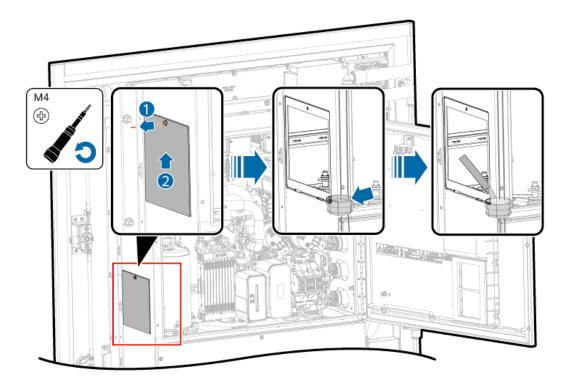
Procedure

Step 1 Open the LTMS door.

Step 2 Cut off cable ties.

Step 3 Use a flat-head screwdriver to remove the glass cement.

Step 4 Remove the cylindrical cable routing tool.

Step 5 Remove the faulty NTC cable harness and check whether the labels are intact. If not, confirm cables and prepare new labels.

Step 6 Insert the new NTC harness according to the cable labels.

Step 7 Bind the NTC cable harness properly.

Step 8 Open the side door of the LTMS, route the cable harness through the cylindrical cable routing tool, and fill the cable holes with glass cement.

> **NOTICE**
>
> When applying glass cement, ensure that there is no gap between the cables and the cable holes.
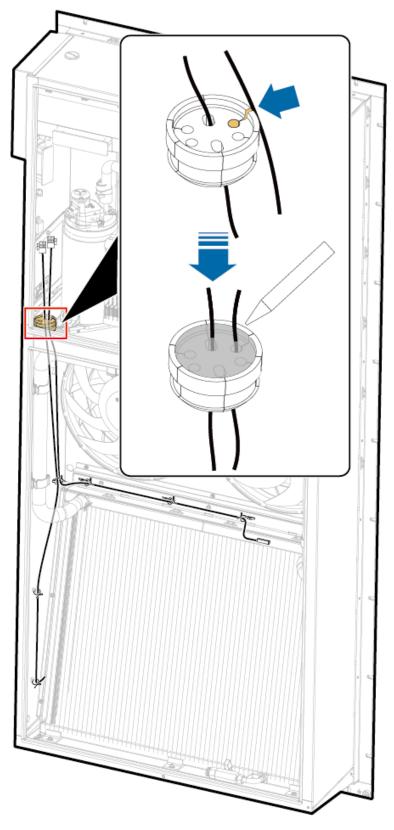
Figure 8-32 Applying glass cement

Figure 8-33 Filling cable holes with glass cement

Step 9 Reinstall the cylindrical cable routing tool in the cabinet.

Step 10 Close the LTMS door and tighten the M5 Phillips screws to 3 N·m.

----End

9 Replacing LTMS Pipes

⚠️ **WARNING**

- Prevent waste from contacting the soil or flowing into the drainage ditch. Use transportation tools, recycling devices, and treatment or storage devices approved by authoritative departments for waste turnover or storage. Heating in an empty container may cause an explosion.
- Wear personal protective equipment because coolant can irritate your eyes, skin, and throat.

⚠️ **CAUTION**

- The coolant drained from the ESS needs to be centrally disposed of by a waste collector that is recognized by relevant regulations.
- Uncontaminated containers can be reused. Containers that cannot be cleaned need to be centrally disposed of by a waste collector that is recognized by relevant regulations.
- Handle the liquid cooling pipe stop valve with caution to prevent foreign matter from falling into the stop valve, which will affect the sealing performance of the stop valve.
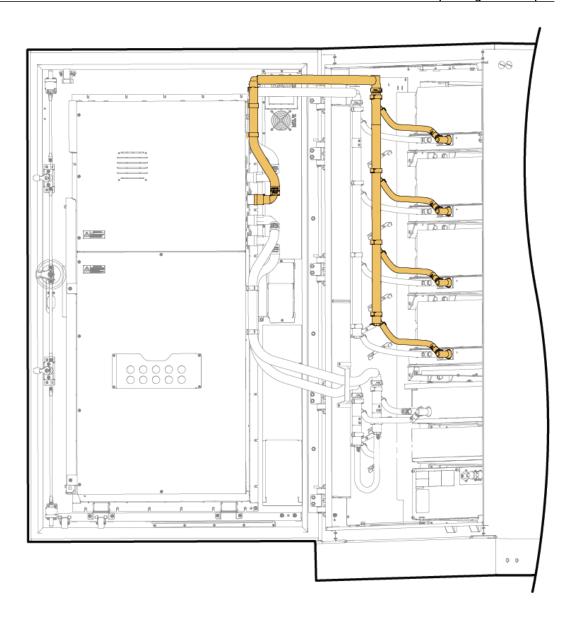

> **NOTICE**
>
> - When replacing a liquid cooling pipe (**9.1 Replacing a Battery Pack Coolant Return Pipe**, **9.2 Replacing a Battery Pack Coolant Supply Pipe**, or **9.3 Replacing a PCS/DCDC Pipe**), you only need to disconnect the male and female connectors of the stop valve by referring to the corresponding section. You do not need to remove the male connector of the stop valve.
> - Before installing a new liquid cooling pipe, scan the QR code to check that the pipe has passed the airtightness check.
> - A small amount of coolant may flow out when you remove or insert a pipe, which is normal. Prepare tissues to wipe away the coolant.
> - If a stop valve is not removed and inserted for more than three months, press the stop valve once or twice (you only need to press the stop valve and do not need to remove it) before removing and inserting it.
>
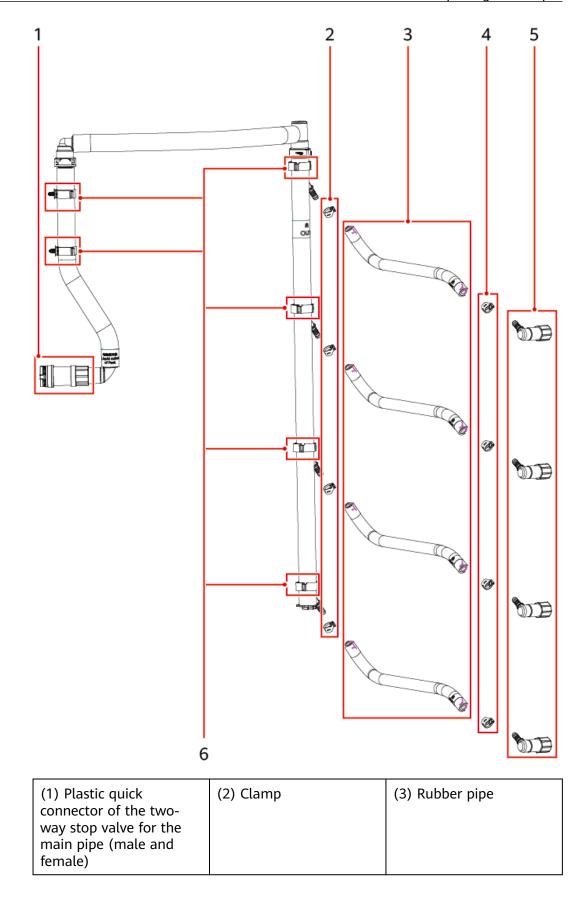> **Figure 9-1** Before the removal and insertion
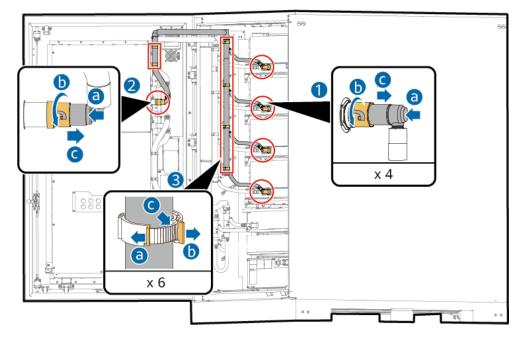>
>

9.1 Replacing a Battery Pack Coolant Return Pipe

Prerequisites

(1) Plastic quick connector of the two-way stop valve for the main pipe (male and female)	(2) Clamp	(3) Rubber pipe

(4) Clamp	(5) Plastic quick connector of the two-way stop valve for the branch pipe (female)	(6) Pipe clamp

- Tools: waterproof insulated gloves, face mask, goggles, coolant filling/drainage machine (purchased on the configurator), flat-head insulated torque screwdriver (M4), Phillips insulated torque screwdriver (M6), and coolant
- You have determined the leakage point on a pipe.
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Determine subsequent operations based on the ambient temperature.

- If the ambient temperature is higher than –10°C, skip this step and go to the next step.
- If the ambient temperature is less than or equal to –10°C, drain the coolant from the LTMS and battery pack. For details about how to drain the coolant from the LTMS and battery pack, see **19.4.1 Draining Coolant from the LTMS** and **19.4.2 Draining Coolant from the PACK/PCS/DCDC**, respectively.

Step 2 Remove the coolant return pipe from the battery pack.

1. Disconnect the female connectors of the pipe stop valves from the male connectors on the battery pack.
2. Disconnect the female connector of the pipe stop valve from the male connector on the LTMS.
3. Remove the pipe from the pipe clamps.

Figure 9-2 Removing the coolant return pipe from the battery pack

Step 3 Rotate the pipe clamps counterclockwise until they are removed from the cabinet and LTMS. Dispose of the pipe clamps.

Step 4 Install the coolant return pipe on the battery pack.

1. Install the new pipe by referring to the pipe position shown in the figure in step 2.

   📖 **NOTE**

   – Pipe clamps have been preinstalled on the pipes. You can directly insert the pipe clamps into the original holes. If the holes cannot be fully aligned, manually adjust the positions of the pipe clamps.

   – Install the pipe in strict accordance with the position shown in the figure. Do not install the pipe incorrectly or reversely.

2. Connect the new female connectors of the pipe stop valves to the old male connectors on the LTMS and battery pack.

Step 5 Add a proper amount of coolant. For details, see **19.4.3 Adding Coolant to the LTMS**.

----End

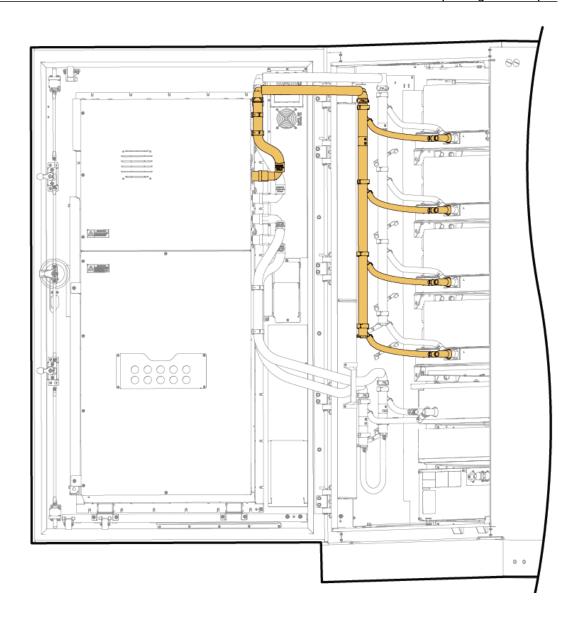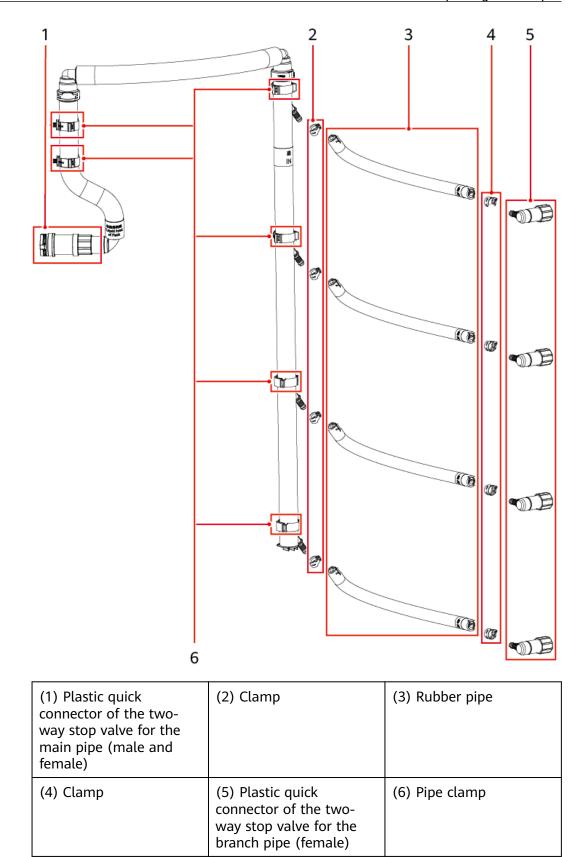## Follow-up Procedure

Check the running status of the liquid cooling pipe.

9.2 Replacing a Battery Pack Coolant Supply Pipe

Prerequisites

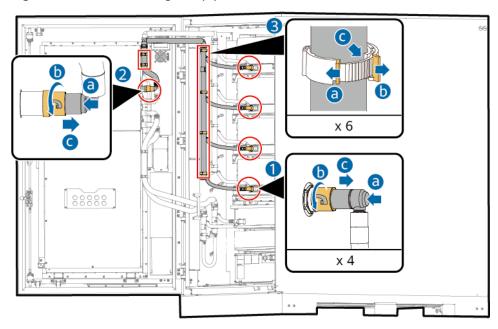| (1) Plastic quick connector of the two-way stop valve for the main pipe (male and female)	(2) Clamp	(3) Rubber pipe
(4) Clamp	(5) Plastic quick connector of the two-way stop valve for the branch pipe (female)	(6) Pipe clamp

- Tools: waterproof insulated gloves, face mask, goggles, coolant filling/drainage machine (purchased on the configurator), flat-head insulated torque screwdriver (M4), Phillips insulated torque screwdriver (M6), and coolant
- You have determined the leakage point on a pipe.
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Before replacing the battery pack coolant supply pipe, remove the battery pack coolant return pipe to reserve sufficient space for removing the coolant supply pipe. For details, see **9.1 Replacing a Battery Pack Coolant Return Pipe**.

Step 2 Determine subsequent operations based on the ambient temperature.
- If the ambient temperature is higher than –10°C, skip this step and go to the next step.
- If the ambient temperature is less than or equal to –10°C, drain the coolant from the LTMS and battery pack. For details about how to drain the coolant from the LTMS and battery pack, see **19.4.1 Draining Coolant from the LTMS** and **19.4.2 Draining Coolant from the PACK/PCS/DCDC**, respectively.

Step 3 Remove the coolant supply pipe from the battery pack.
1. Disconnect the female connectors of the pipe stop valves from the male connectors on the battery pack.
2. Disconnect the female connector of the pipe stop valve from the male connector on the LTMS.
3. Remove the pipe from the pipe clamps.

Figure 9-3 Disconnecting the pipe

Step 4 Rotate the pipe clamps counterclockwise until they are removed from the cabinet and LTMS. Dispose of the pipe clamps.

Step 5 Install the coolant supply pipe on the battery pack.

    1. Install the new pipe by referring to the pipe position shown in the figure in step 2.

    📖 **NOTE**

      – Pipe clamps have been preinstalled on the pipes. You can directly insert the pipe clamps into the original holes. If the holes cannot be fully aligned, manually adjust the positions of the pipe clamps.

      – Install the pipe in strict accordance with the position shown in the figure. Do not install the pipe incorrectly or reversely.

    2. Connect the new female connectors of the pipe stop valves to the old male connectors on the LTMS and battery pack.

Step 6 Add a proper amount of coolant. For details, see **19.4.3 Adding Coolant to the LTMS**.
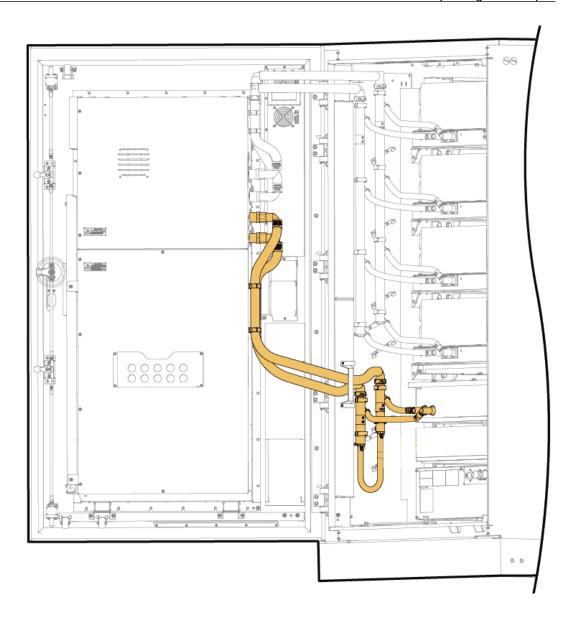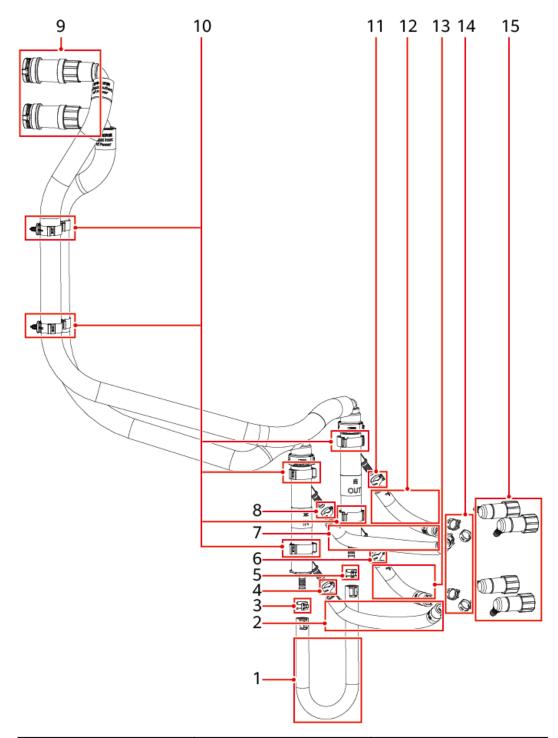
----End

Follow-up Procedure

Check the running status of the liquid cooling pipe.

9.3 Replacing a PCS/DCDC Pipe

Prerequisites

(1) Rubber pipe	(2) Rubber pipe	(3) Clamp
(4) Clamp	(5) Clamp	(6) Clamp
(7) Rubber pipe	(8) Clamp	(9) Plastic quick connector of the two-way stop valve for the main pipe (male and female)

(10) Pipe clamp	(11) Clamp	(12) Rubber pipe
(13) Rubber pipe	(14) Clamp	(15) Plastic quick connector of the two-way stop valve for the branch pipe (female)

- Tools: waterproof insulated gloves, face mask, goggles, Phillips insulated torque screwdriver (M4 and M6), flat-head insulated torque screwdriver (M4), coolant filling/drainage machine (purchased on the configurator), coolant, and protective gloves
- You have determined the leakage point on a pipe.
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Determine subsequent operations based on the ambient temperature.

- If the ambient temperature is higher than –10°C, skip this step and go to the next step.
- If the ambient temperature is less than or equal to –10°C, drain the coolant from the LTMS, DCDC, and PCS. For details about how to drain the coolant from the LTMS, DCDC, and PCS, see **19.4.1 Draining Coolant from the LTMS** and **19.4.2 Draining Coolant from the PACK/PCS/DCDC**, respectively.

Step 2 Remove the PCS/DCDC pipe.

1. Disconnect the female connectors of the PCS/DCDC pipe stop valves from the male connectors on the PCS/DCDC.
2. Disconnect the female connectors of the PCS/DCDC pipe stop valves from the male connectors on the LTMS.
3. Remove the positioning sheet metal block for the pipe extending beyond the door (tightened using M4 Phillips screws).
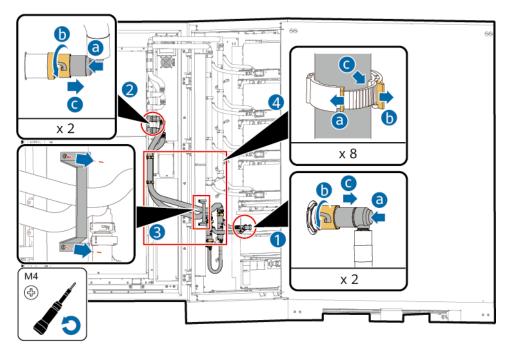4. Remove the pipe from the pipe clamps.

Figure 9-4 Disconnecting the pipe

Step 3 Rotate the pipe clamps counterclockwise until they are removed from the cabinet and LTMS. Dispose of the pipe clamps.

Step 4 Install the PCS/DCDC pipe.

1. Install the new pipe by referring to the pipe position shown in the figure in step 2.

   ☐ **NOTE**

   – Pipe clamps have been preinstalled on the pipes. You can directly insert the pipe clamps into the original holes. If the holes cannot be fully aligned, manually adjust the positions of the pipe clamps.

   – Install the pipe in strict accordance with the position shown in the figure. Do not install the pipe incorrectly or reversely.

2. Install the positioning sheet metal block for the pipe extending beyond the door and tighten the M4 Phillips screws to 1.6 N·m.

3. Connect the old female connectors of the PCS/DCDC pipe stop valves to the new male connectors on the LTMS and PCS/DCDC.

Step 5 Connect the female connectors of the stop valves of the battery pack coolant supply pipe to the male connectors on the LTMS and battery pack.

Step 6 Add a proper amount of coolant. For details, see **19.4.3 Adding Coolant to the LTMS**.

----End

Follow-up Procedure
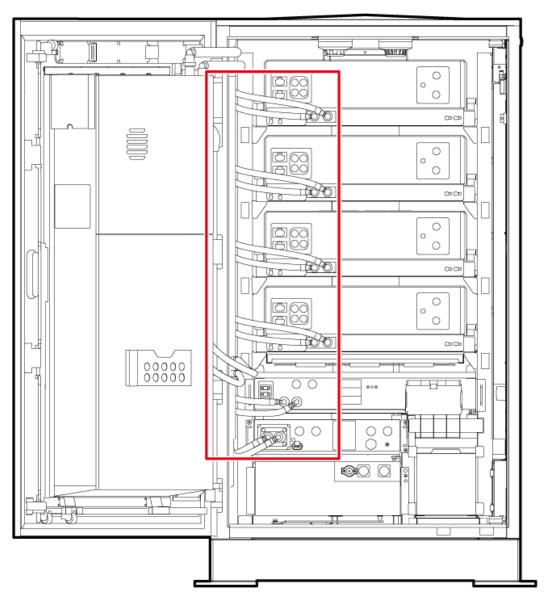
Check the running status of the liquid cooling pipe.

9.4 Replacing Male Connectors of the Liquid Cooling Pipe Stop Valves

9.4.1 Removing Male Connectors of the Liquid Cooling Pipes

Prerequisites

- Tools: waterproof insulated gloves, insulated torque socket wrench (including the socket with the following specifications: L = 27 mm, Φ ≤ 37 mm), flat-head insulated torque screwdriver (M4), Phillips insulated torque screwdriver (M6), face mask, goggles, coolant filling/drainage machine (purchased on the configurator), and protective gloves
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Drain all the coolant from the cabinet. For details, see **19.4.1 Draining Coolant from the LTMS**.

Step 2 After disconnecting the female connectors from the male connectors of the liquid cooling pipes, remove the male connectors of the stop valves on the LTMS and PACK/PCS/DCDC.

Figure 9-5 Removing the male connectors of the stop valves

----End

9.4.2 Installing Male Connectors of the Liquid Cooling Pipes
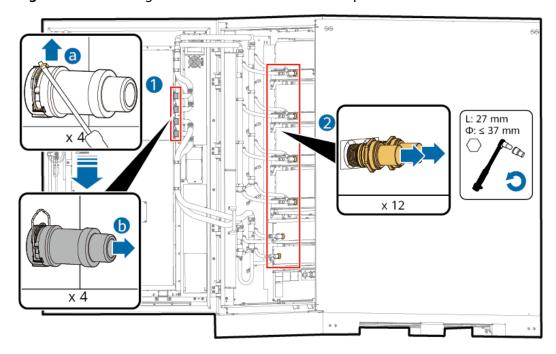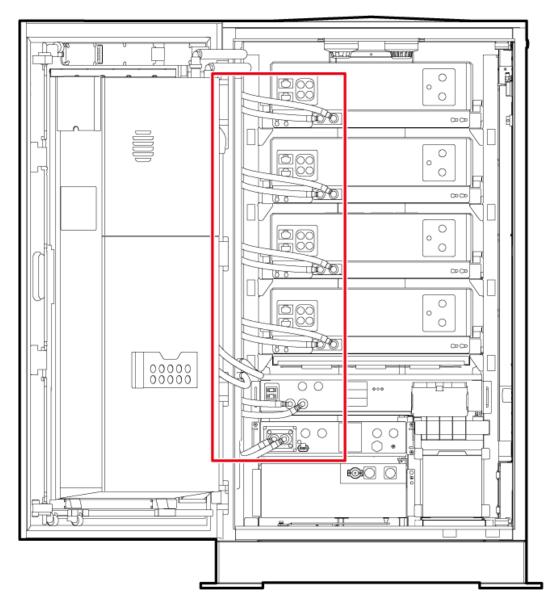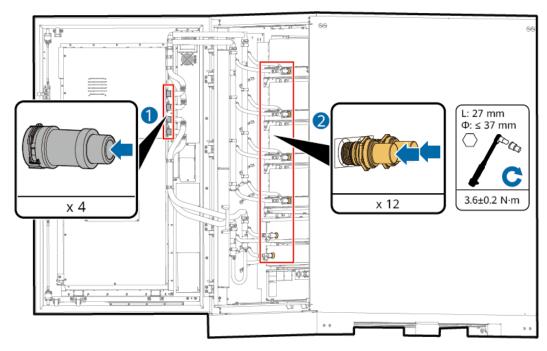
Prerequisites

- Tools: waterproof insulated gloves, insulated torque socket wrench (including the socket with the following specifications: L = 27 mm, Φ ≤ 37 mm), flat-head insulated torque screwdriver (M4), Phillips insulated torque screwdriver (M6), face mask, goggles, coolant filling/drainage machine (purchased on the configurator), and protective gloves
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Drain all the coolant from the cabinet. For details, see **19.4.1 Draining Coolant from the LTMS**.

Step 2 Install the male connectors of the stop valves on the LTMS and PACK/PCS/DCDC.

Figure 9-6 Installing the male connectors of the stop valves

----**End**
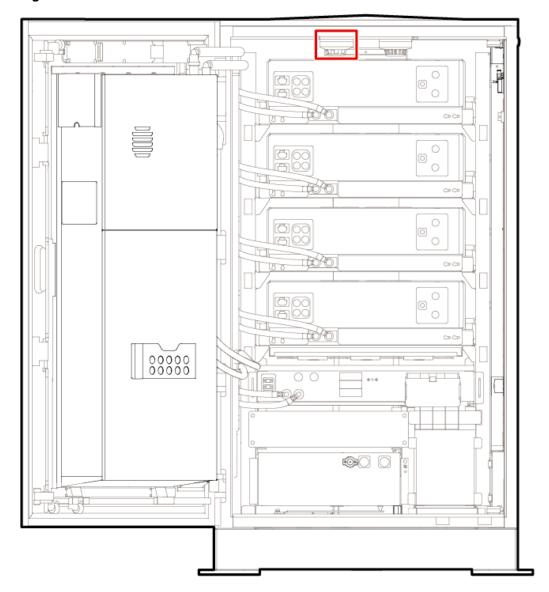
10 Replacing a Fire Suppression System

10.1 Replacing a Smoke Detector

Prerequisites

Figure 10-1 Position of the smoke detector

- Tools: Phillips insulated torque screwdriver (M4), flat-head insulated torque screwdriver (M2.5), and protective gloves
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Hold the faulty smoke detector by hand, and rotate it counterclockwise to remove it from the base.

Figure 10-2 Removing the smoke detector

Step 2 Use a Phillips insulated torque screwdriver (M4) and a flat-head insulated torque screwdriver (M2.5) to remove the cables from the faulty smoke detector and check whether the cable labels are intact. If not, confirm cables and prepare new labels.

Step 3 Remove the screws and then the base.

Step 4 Install a new base, and tighten the M4 Phillips screws to 1.6 N·m.

Step 5 Connect the cables based on the labels, and tighten the M2.5 flat-head screws to 0.4 N·m.

Step 6 Hold the new smoke detector by hand, and rotate it clockwise until it snaps into place.

----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 Log in to the FusionSolar app or SmartLogger WebUI to check for alarms. If there is still an alarm, manually clear it.

----End

10.2 Replacing a Heat Detector

Prerequisites

Figure 10-3 Position of the heat detector

- Tools: Phillips insulated torque screwdriver (M4), flat-head insulated torque screwdriver (M2.5), and protective gloves
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Hold the faulty heat detector by hand, and rotate it counterclockwise to remove it from the base.
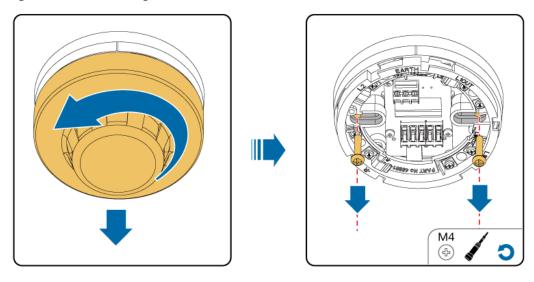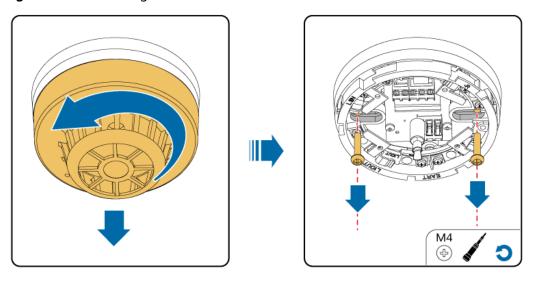
Figure 10-4 Removing the heat detector

Step 2 Use a Phillips insulated torque screwdriver (M4) and a flat-head insulated torque screwdriver (M2.5) to remove the cables from the faulty heat detector and check whether the cable labels are intact. If not, confirm cables and prepare new labels.

Step 3 Remove the screws and then the base.

Step 4 Install a new base, and tighten the M4 Phillips screws to 1.6 N·m.

Step 5 Connect the cables based on the labels, and tighten the M2.5 flat-head screws to 0.4 N·m.

Step 6 Hold the new heat detector by hand, and rotate it clockwise until it snaps into place.
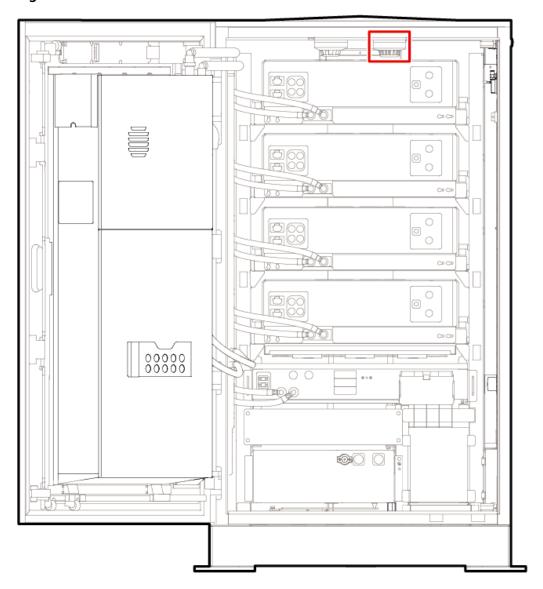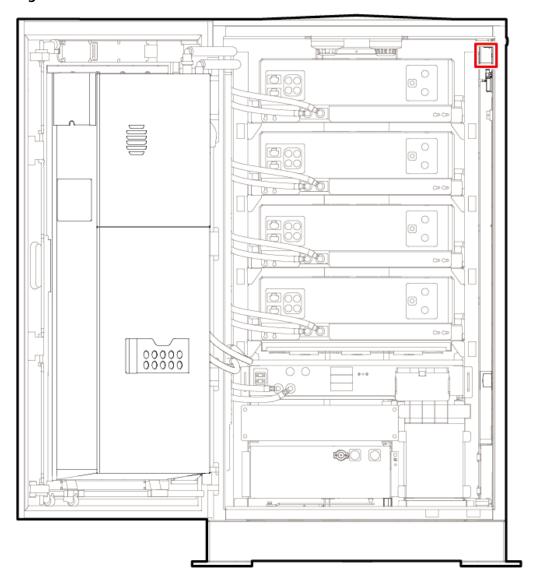
----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 Log in to the FusionSolar app or SmartLogger WebUI to check for alarms. If there is still an alarm, manually clear it.

----End

10.3 Replacing a CO Sensor

Prerequisites

Figure 10-5 Position of the CO sensor

- Tools: Phillips insulated torque screwdriver (M4), protective gloves
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Record the DIP switch settings.

CO Sensor Address	Toggle Switch 1	Toggle Switch 2	Toggle Switch 3	Toggle Switch 4
1	ON	OFF	OFF	OFF

Step 2 Disconnect the cables from the faulty CO sensor and check whether the labels are intact. If not, confirm cables and prepare new labels.

Step 3 Loosen the nuts and remove the faulty CO sensor.

Step 4 Set the DIP switches for a new CO sensor based on the recorded information.

Step 5 Install the new CO sensor

- Standard CO sensor:

  1. Remove the mechanical parts from the faulty CO sensor and install them to the new CO sensor.

Figure 10-6 Removing the mechanical parts of the CO sensor
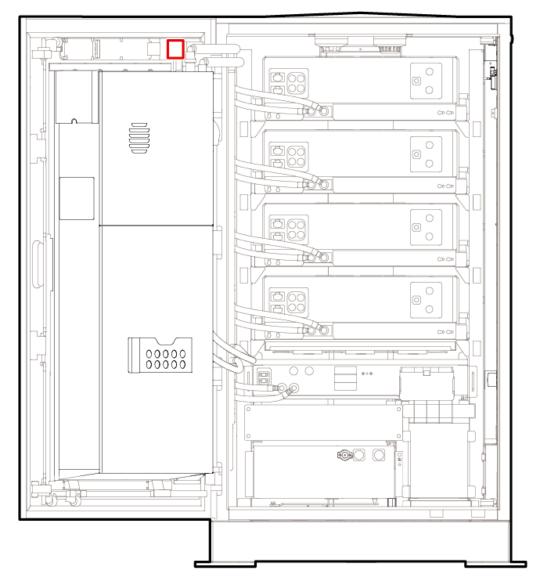
  2. Install the assembled new CO sensor in the cabinet. Tighten the M4 nuts to 1.6 N·m.

Step 6 Connect the cables based on the labels.

----End

10.4 Replacing a Fire Alarm Horn/Strobe

Prerequisites

Figure 10-7 Position of the fire alarm horn/strobe
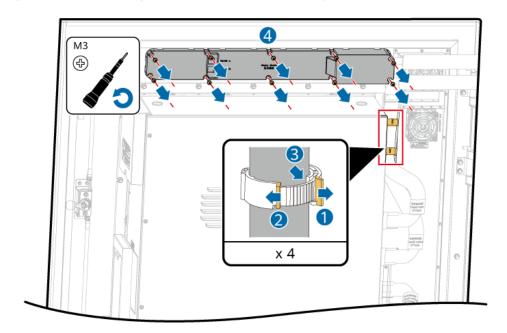
- Tools: Phillips insulated torque screwdriver (M3), protective gloves, and ladder
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.
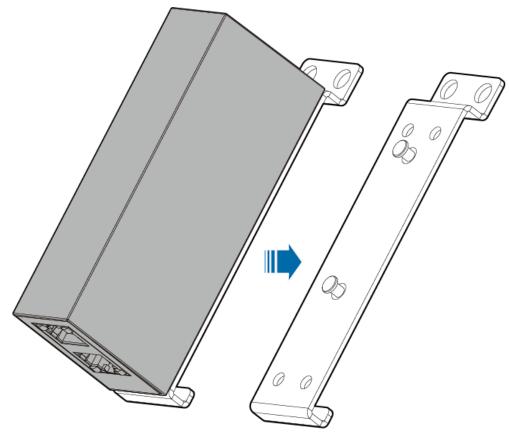
Procedure

Step 1 Disconnect cables between the display module and the faulty fire alarm horn/strobe and check whether the labels are intact. If not, confirm cables and prepare new labels.

Step 2 Remove the liquid cooling pipe shown in the figure from the four pipe clamps, gently pull the pipe outward to leave sufficient space, and remove the rear cover of the display module.

Figure 10-8 Removing the rear cover of the display module

Step 3 Remove the faulty fire alarm horn/strobe.

Figure 10-9 Removing the faulty fire alarm horn/strobe

Step 4 Install a new fire alarm horn/strobe and tighten the M3 Phillips screws to 0.6 N·m.

Step 5 Install the rear cover of the display module and tighten the M3 Phillips screws to 0.6 N·m.

Step 6 Reinstall the cables and secure the pipe clamps of the liquid cooling pipe.

----End

11 Replacing a Display Module

Prerequisites
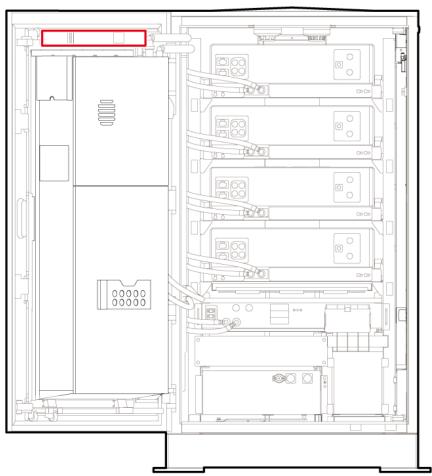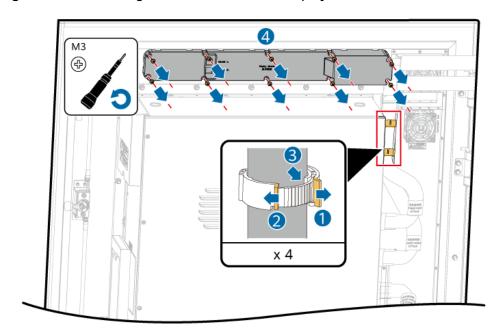
Figure 11-1 Position of the display module

- Tools: Phillips insulated torque screwdriver (M3), SMA torque wrench, protective gloves, sealant, diagonal pliers, cable ties, and ladder
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Disconnect cables between the display module and the faulty fire alarm horn/strobe and check whether the labels are intact. If not, confirm cables and prepare new labels.
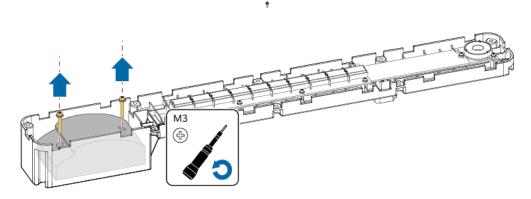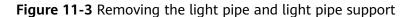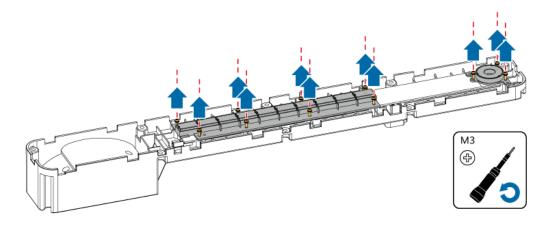
Step 2 Remove the liquid cooling pipe shown in the figure from the four pipe clamps, gently pull the pipe outward to leave sufficient space, and remove the rear cover of the display module.

Figure 11-2 Removing the rear cover of the display module
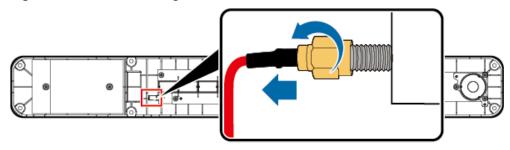
Step 3 Remove the light pipe and light pipe support from the display module.

Figure 11-3 Removing the light pipe and light pipe support
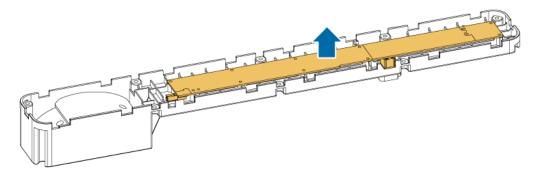
Step 4 Disconnect the cable from the control board of the faulty display module.

Figure 11-4 Disconnecting the cable
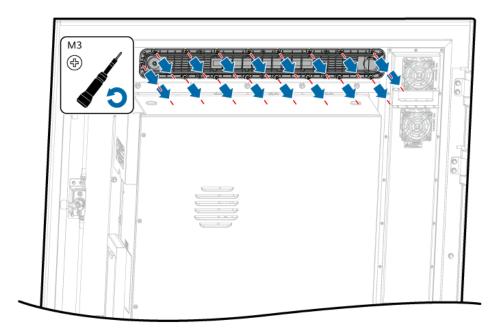
Step 5 Remove the control board of the faulty display module.

Figure 11-5 Removing the control board

Step 6 Remove the front panel of the display module. (Optional. If the front panel is faulty, perform steps **Step 6** to **Step 8** to replace the front panel.)

Figure 11-6 Removing the front panel of the display module

Step 7 (Optional) Apply sealant evenly.
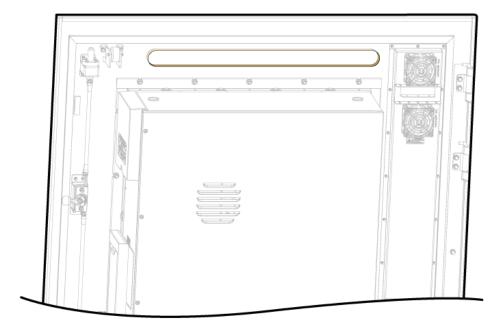
Figure 11-7 Applying sealant evenly

Step 8 (Optional) Install the front panel of the display module and tighten the M3 Phillips screws to 0.6 N·m.

Step 9 Apply sealant evenly to the rubber strips on the front panel of the display module outside the ESS cabinet door.

NOTICE

After the installation is complete, use lint-free cloth to remove sealant marks and ensure that there is no residual sealant.

Step 10 Install the new control board and light pipe and tighten the M3 Phillips screws to 0.6 N·m.

Step 11 Install the rear cover of the display module and tighten the M3 Phillips screws to 0.6 N·m.

**Step 12** Reinstall the cables and secure the pipe clamps of the liquid cooling pipe.

----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 Upgrade the ESS software version.

NOTICE

● After the device is replaced, you are advised to observe for 10 to 15 minutes to ensure that the new device is stable before manually upgrading the software.

1. **Method 1: Upgrade the ESS software version on the SmartLogger WebUI.**

   a. Querying the ESS software version: Log in to the SmartLogger WebUI and choose **Maintenance** > **Software Upgrade**.

   b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

   c. Uploading the upgrade package: On the SmartLogger WebUI, choose **Select a file**, select the target software package, and click **Upload**.

   d. Starting the upgrade: After the upload is complete, select the ESS with the software to be upgraded and click **Software Upgrade**.

   e. After the upgrade is complete, the device automatically restarts.

2. **Method 2: Upgrade the ESS software version on the FusionSolar app.**

   a. Log in to the FusionSolar app and access the local commissioning screen.

      ☐ **NOTE**

      > For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

   b. On the home screen, choose **Maintenance** > **Upgrade**. The **Upgrade** screen is displayed.

   c. Tap the download icon in the upper right corner to check whether an upgrade package is pushed. If yes, select the software package of the target version and perform the upgrade.

   d. After you tap **Update Now**, check that the ESS enters the upgrade status.

   e. After the upgrade is complete, the device automatically restarts.

3. **Method 3: Upgrade the ESS software version on the SmartPVMS.**

   a. Log in to the SmartPVMS client.

   b. Downloading the upgrade package: Log in to the Support-E website, search for the corresponding ESS software version on the **Software Download** tab page, and download the software package.

   c. Uploading the upgrade package: Choose **Plants** > **Update Management** > **Software Packages**. On the page that is displayed, click **Upload** in the upper right corner to upload the software package of the target version.

   d. Starting the upgrade: Choose **Device Upgrade** > **Create** > **Select manually**, set **Device type** to **ESS**, select the ESS to be upgraded, and set **Target Version** to the target version. Click **OK** to start the upgrade.

   e. After the upgrade is complete, the device automatically restarts.

☐ **NOTE**

If the software upgrade fails and **SOC too low** is displayed in **Current Status** on the software upgrade screen, you are advised to charge the battery to over 20% SOC before upgrading the software. Otherwise, the upgrade will fail because the battery health check is not passed.

After the software is upgraded successfully, wait for more than 10 minutes before performing the upgrade again. Otherwise, the upgrade will fail because the system initialization is not complete.

----End

12 Replacing a Travel Switch

Prerequisites

Figure 12-1 Position of the travel switch

- Tool: Phillips insulated torque screwdriver (M4)
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure
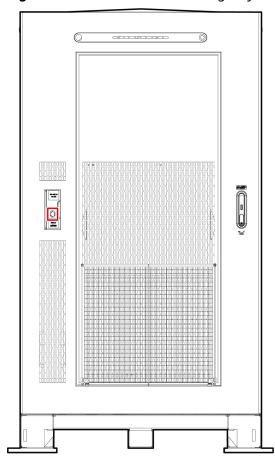
Step 1 Disconnect the cables from the faulty travel switch and check whether the labels are intact. If not, confirm cables and prepare new labels.

Step 2 Loosen the screws and remove the faulty travel switch.

Step 3 Install a new travel switch and tighten the M4 Phillips screws to 1.6 N·m.

Step 4 Connect the cables based on the labels.

----End

13 Replacing an Emergency Stop Switch

Prerequisites

Figure 13-1 Position of the emergency stop switch

- Tools: insulated torque socket wrench (M4, 7# socket), Phillips insulated torque screwdriver (M6), and flat-head insulated torque screwdriver (M3)

● You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Remove the screws.

Step 2 Remove the protective cover from the emergency stop switch.

Step 3 Record and remove the cables connected to the emergency stop switch.

Step 4 Use a flat-head screwdriver to carefully pry the snap spring.

Step 5 Remove the wiring component of the emergency stop switch.

Step 6 Rotate the knob fastener counterclockwise to release the emergency stop switch.

Step 7 Remove the emergency stop switch from the outside of the cabinet door.
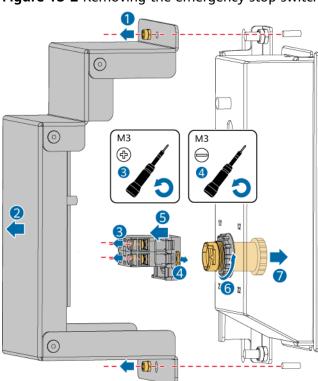
Figure 13-2 Removing the emergency stop switch

Step 8 Install a new emergency stop switch.

Step 9 Reinstall the cables to the emergency stop switch and bind them. Ensure that the silk screens on the cables are consistent with those on the emergency stop switch.
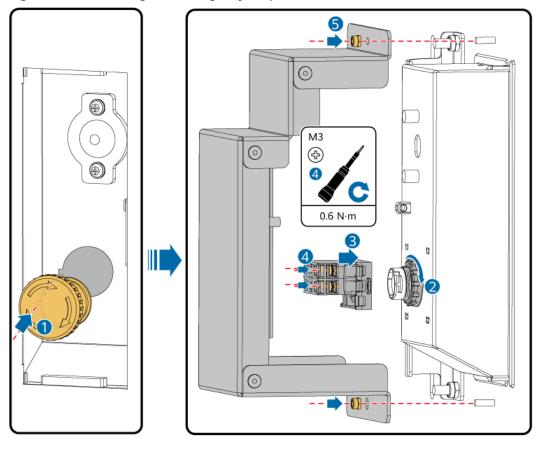
Figure 13-3 Installing the emergency stop switch
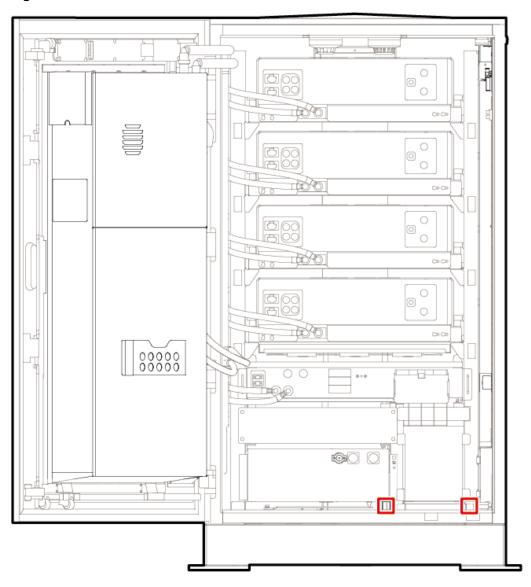
----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 Log in to the FusionSolar app or SmartLogger WebUI to check for alarms. If there is still an alarm, manually clear it.

----End

14 Replacing a Water Sensor

Prerequisites

Figure 14-1 Positions of the water sensors
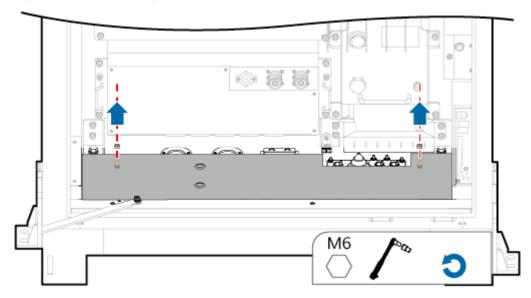
- Tools: Phillips insulated torque screwdriver (M3) and insulated torque socket wrench (M6, including 10# socket)
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Remove the cable baffle plate.

Figure 14-2 Removing the cable baffle plate

Step 2 Remove the faulty water sensor.

1. Remove the faulty water sensor.
2. Turn over the faulty water sensor.
3. Remove the screws from the faulty water sensor, remove the cables, and label the cables.
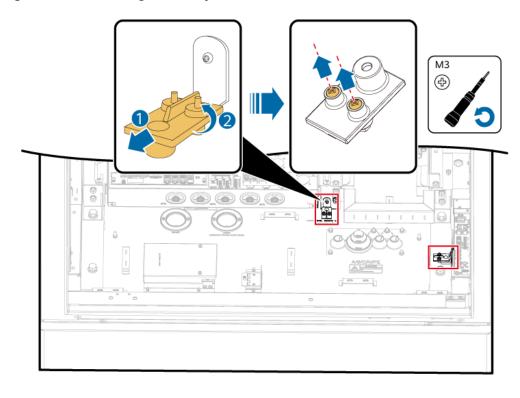
Figure 14-3 Removing the faulty water sensor

Step 3 Connect the cables to the new water sensor and tighten the M3 Phillips screws to 0.6 N·m.

Step 4 Install the water sensor.

Step 5 Install the cable baffle plate and tighten the M6 nuts to 5 N·m.
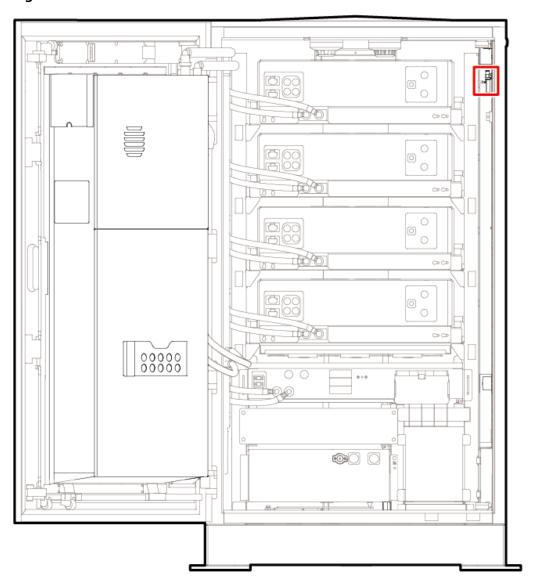
----End

Follow-up Procedure

Step 1 Power on the system. For details, see **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Step 2 Log in to the FusionSolar app or SmartLogger WebUI to check for alarms. If there is still an alarm, manually clear it.

----End

15 Replacing a Door Status Sensor

Prerequisites

Figure 15-1 Position of the door status sensor
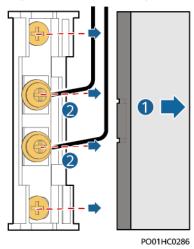
- Tool: Phillips insulated torque screwdriver (M3)
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Remove the enclosure of the faulty door status sensor.

Step 2 Remove the screws that secure the alarm cable, disconnect the alarm cable, and label the cable.

Step 3 Remove the faulty door status sensor.
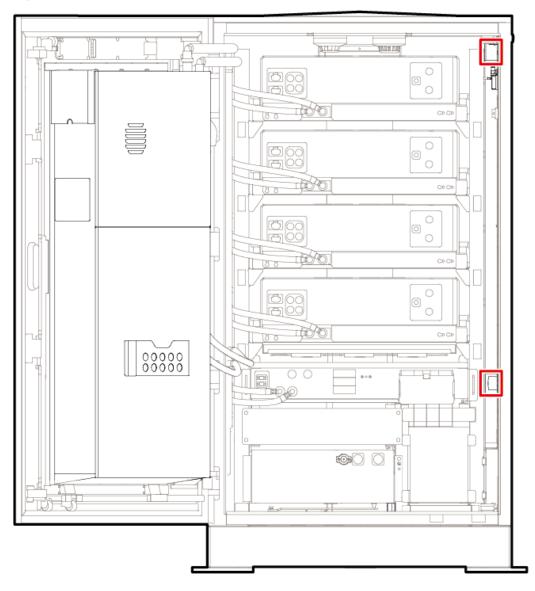
Figure 15-2 Removing the faulty door status sensor

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Step 4 Remove the enclosure of the new door status sensor, and then remove the screws from the alarm cable.

Step 5 Install a new door status sensor and tighten the M3 Phillips screws to 0.6 N·m.

Step 6 Connect the cables based on the labels.

Step 7 Install the enclosure of the new door status sensor.

----End

16 Replacing a T/H Sensor

Prerequisites

Figure 16-1 Positions of the T/H sensors

You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

Procedure

Step 1 Record the DIP switch settings.
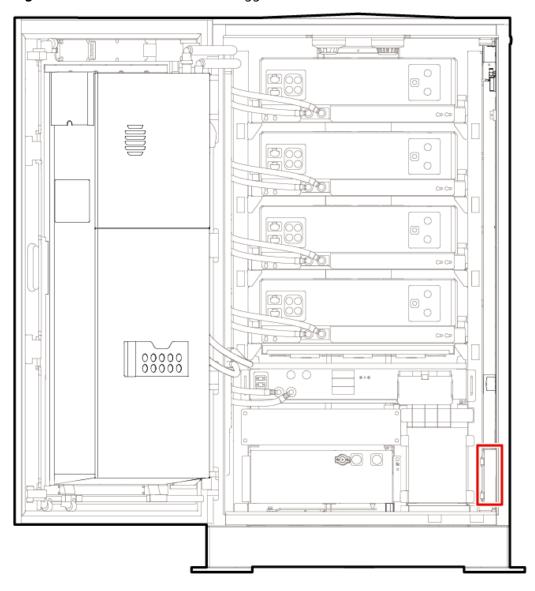
Table 16-1 DIP switch settings

T/H Sensor Address	Toggle Switch 1	Toggle Switch 2	Toggle Switch 3	Toggle Switch 4	Toggle Switch 5	Toggle Switch 6
56	OFF	OFF	OFF	ON	ON	ON

Step 2 Disconnect the cables from the faulty T/H sensor and check whether the labels are intact. If not, confirm cables and prepare new labels.

Step 3 Remove the faulty T/H sensor.

Step 4 Set the DIP switches for a new T/H sensor based on the recorded information.

Step 5 Install the new T/H sensor.

Step 6 Connect the cables based on the labels.

----End

17 (Optional) Replacing a SmartLogger

Prerequisites

Figure 17-1 Position of the SmartLogger

- Tools: Phillips insulated torque screwdriver (M3 and M4) and mini flat-head screwdriver.

- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.
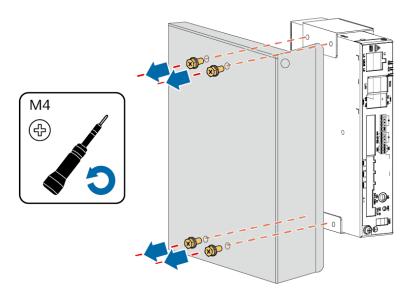
NOTICE

After opening the cabinet door, ensure ventilation and heat dissipation. Check the temperature inside the cabinet and the SmartLogger temperature before operation to prevent scalds.

Procedure

Step 1 Remove the SmartLogger protective cover and cables, and check whether the labels are intact. If not, confirm cables and prepare new labels.

Figure 17-2 Removing the SmartLogger protective cover

Step 2 Remove the faulty SmartLogger.
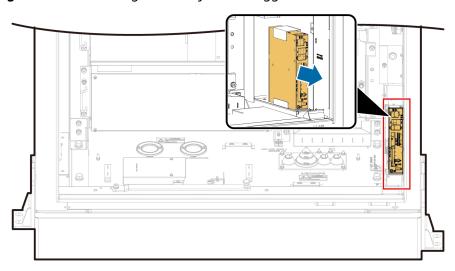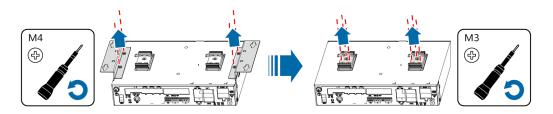
Figure 17-3 Removing the faulty SmartLogger

Step 3 Remove the conversion brackets from the new SmartLogger.

Figure 17-4 Removing the conversion brackets from the new SmartLogger

Step 4 Install the new SmartLogger.

Step 5 Connect the cables based on the labels.

Step 6 Install the SmartLogger protective cover and tighten the M4 Phillips screws to 1.6 N·m.

----End

18 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: ±10°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

⚠️ **DANGER**

- If a fire occurs, power off the system if it is safe to do so.
- Extinguish the fire with carbon dioxide, FM-200 or ABC dry powder fire extinguishers.
- Ask firefighters to avoid contact with high-voltage components during fire fighting to prevent the risk of electric shock.
- Overheating may cause battery deformation, faults, and leakage of corrosive electrolytes or toxic gases. Use respiratory protective equipment and keep a safe distance from the batteries to prevent skin irritation and chemical burns.

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.

Coolant Leakage

1. If the system is running, power it off while ensuring safety.

2. Check for possible leakage points, especially the joints of liquid cooling pipes, bends of moving pipes, and connecting points of two-way stop valves.

3. Replace the components (PACK, PCS, DCDC, LTMS, or liquid cooling pipes) at the leakage points.

4. Check whether any coolant contacts the RCM. If yes, replace the RCM promptly.

5. After the fault is rectified, clean the system, power on the system again, and check whether the system is normal. If any exception occurs, contact the Company's service engineers.

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. Do not enter the affected building or equipment area under any circumstances, and do not open the doors of the ESS. Isolate and monitor the site. Keep irrelevant personnel away from the site.

c. After calling the fire emergency service, remotely power off the system while ensuring your own safety.

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.

d. When a fire occurs, prevent the fire from spreading to nearby ESSs.

19 FAQ

19.1 How Do I Recycle Used Batteries?

NOTICE

- The Company does not recycle batteries. Contact local recycling agencies to handle batteries.
- If there are no such agencies in your area, you can contact the nearest foreign recycling agencies.

Step 1 Contact the nearest recycling agencies.

Step 2 Recycling agencies assess the costs.

Step 3 Recycling agencies carry out recycling, which can be done in two ways:

- Onsite recycling: Recycling agencies can visit your sites to recycle lithium batteries, but the price depends on actual conditions such as the distance and transportation expenses.
- Centralized recycling: You can collect all lithium batteries to be recycled in one place for the recycling agencies to handle.

NOTE

You need to cover the related transportation expenses.

Step 4 Recycling agencies handle recycling. The recycled lithium batteries are at the disposal of the recycling agencies.

----End

19.2 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 required paint that matches the color palette delivered with equipment.

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.
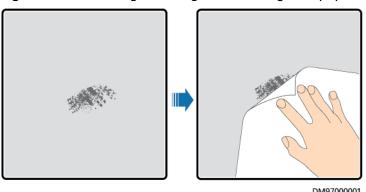
Table 19-1 Paint repair description

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. For a few scratches, smudges, or rust, manual paint spraying or brushing is recommended. 2. For many scratches or large-area smudges and rusts, use a paint spray gun. 3. The paint coating shall be thin and even. Paint drops are prohibited on the coating. The surface shall be smooth. 4. Leave the repainted area for about 30 minutes before performing any further operation.
Smudges and rust that cannot be removed			
Deep scratch (primer damaged, steel base material exposed)	Spray paint or paint, zinc-rich paint, 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	
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
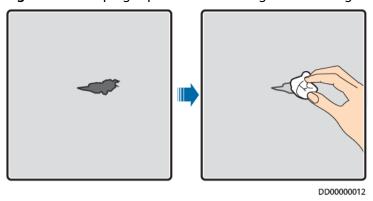
Step 1 Gently polish damaged areas using fine sandpaper to remove smudges or rust.

Figure 19-1 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 19-2 Wiping a polished or damaged area using anhydrous alcohol

Step 3 Apply zinc-rich paint on the damaged coat using a brush or paint sprayer.
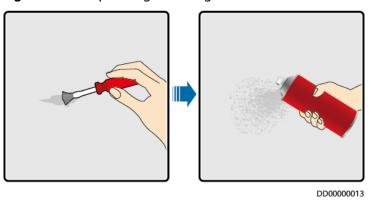
NOTICE

- 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 19-3 Repainting a damaged area

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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 19-2 Paint requirements

Item	Requirement
Primer thickness	60 μm
Intermediate coat thickness	120 μm
Top coat thickness	60 μm
Primer type	Epoxy zinc-rich paint
Intermediate coat type	Zinc-rich paint

Item	Requirement
Color number of the top coat	Obtain the color number based on the color palette delivered with the product.

 NOTE

The following is a paint model list provided by Huawei. The list may be updated from time to time and is for reference only. The cost of paint and technical services is subject to the local pricing standards.

Supplier	Position	Paint Model
Hempel	Equipment surface painting	Zinc-rich primer for pretreatment: HEMPADUR ZINC (shopprimer) 1536C/19830 Zinc-rich primer for the entire container: HEMPADUR ZINC (on line) 1536C/19830 Intermediate coat: HEMPADUR FAST DRY 15560/12170 Top coat: HEMPATHANE 55210/17630 (RAL9003)
	Logo	Red: HEMPATHANE 55210/57200 (RAL3020) Black: HEMPATHANE 55210-19990 (RAL9005)
CMP	Equipment surface painting	Zinc-rich primer for pretreatment: EPICON ZINC SC B-2 M (SHOP PRIMER) Zinc-rich primer for the entire container: EPICON ZINC SC B-2 M (ON LINE ZINC) Intermediate coat: EPICON SC PRIMER GREY CSC-9107 Top coat: UNYMARINE SC FINISH WHITE CSC-9205 (RAL-9003)
	Logo	Red: UNYMARINE SC MARKING RAL-3020 Black: UNYMARINE SC MARKING RAL-9005

19.3 How Can I Export Device Logs?

Currently, device logs can be exported on the SmartLogger or app.

Exporting Device Logs on the SmartLogger

You can export device logs on the SmartLogger. For details, see **SmartLogger3000 User Manual**.

Exporting Device Logs on the App

You can export device logs on the app. For details, see **FusionSolar App User Manual**.

19.4 How Do I Use the Coolant Filling/Drainage Machine to Add or Drain Coolant?

The coolant filling/drainage machine is used to add coolant to or drain coolant from the LTMS, battery pack, and PCS/DCDC. The following table lists the application scenarios.

Table 19-3 Application scenarios of the coolant filling/drainage machine

No.	Application Scenario	Operation	Coolant Drainage	Coolant Filling
1	The LTMS reaches its end of life (10th year).	Drain coolant from the ESS.	1. **19.4.1 Draining Coolant from the LTMS** 2. **19.4.2 Draining Coolant from the PACK/PCS/DCDC** 3. **8.1 Replacing an LTMS**	**19.4.3 Adding Coolant to the LTMS**
2	Coolant reaches its end of life (10th year).	Drain coolant from the ESS.	1. **19.4.1 Draining Coolant from the LTMS** 2. **19.4.2 Draining Coolant from the PACK/PCS/DCDC**	
3	The LTMS is faulty.	Replace the LTMS.	**19.4.1 Draining Coolant from the LTMS**	

No.	Application Scenario	Operation	Coolant Drainage	Coolant Filling
4	The outdoor heat exchanger of the LTMS is faulty.	Replace the faulty outdoor heat exchanger.	**19.4.1 Draining Coolant from the LTMS**	
5	Replace a liquid cooling pipe.	Replace the faulty pipe.	N/A (ambient temperature > –10°C) **19.4.1 Draining Coolant from the LTMS** (ambient temperature ≤ –10°C)	
6	The battery pack/PCS/DCDC is faulty.	Replace the faulty battery pack/PCS/DCDC.	N/A (ambient temperature > –10°C) **19.4.1 Draining Coolant from the LTMS** (ambient temperature ≤ –10°C)	
7	The LTMS coolant is below the MIN scale.	Add coolant.	N/A	

⚠ WARNING

Connect the power cable of the machine. The **AC 220V** and **DC 12V** ports cannot be connected to the power cable at the same time.

⚠ WARNING

- Wear personal protective equipment. Prevent waste from contacting the soil or flowing into the drainage ditch. Use transportation tools, recycling devices, and treatment or storage devices approved by authoritative departments for waste turnover or storage. Heating in an empty container may cause an explosion.
- Take protective measures because coolant can irritate your eyes, skin, and throat.

⚠ CAUTION

- The coolant drained from the ESS needs to be centrally disposed of by a waste collector that is recognized by relevant regulations.

- Uncontaminated containers can be reused. Containers that cannot be cleaned need to be centrally disposed of by a waste collector that is recognized by relevant regulations.

- Do not mix coolant from different brands without prior permission of the Company. Do not reuse the coolant drained during maintenance.

NOTICE

- After coolant is added or drained, ensure that the inlet and outlet pipes of the machine are cleaned and no coolant remains. Otherwise, the coolant service life may be affected after the residual coolant deteriorates.

- Ensure that the coolant bucket (≥ 20 L) is clean, dry, and free from contamination.

> **NOTICE**
>
> **LTMS power supply:**
>
> The ESS auxiliary power supply can be obtained directly from the mains or through the PCS terminal. There are three power supply scenarios:
>
> - In the on-grid scenario, if the PCS terminal is used, turn off the external switches. For details, see the off-grid scenario or the scenario with other stable power supplies.
>
> - Single ESS in off-grid mode:
>
>   - If the UPS has no power:
>
>   - If Huawei grid-forming inverters are used, the PV system can be used to supply power in grid forming mode.
>
>   - If other stable power supplies are used, the power supply specifications are as follows:
>
>   - Output voltage: 220 V AC
>
>   - Maximum output capability ≥ 500 W
>
>   - Maximum current: 25 A
>
>   - Continuous output current ≥ 20 A
>
>   - Battery capacity: ≥ 500 Wh
>
>   - If the UPS has power and the power supply specifications meet the preceding requirements, the UPS can supply power. Remove the power cable from the UPS power port on the RCM and connect it to the MAINS auxiliary power port. Remove cables from ports 1 and 2 of the short-circuiting bar on the terminal block and connect the cables to ports 2 and 3. Remove cables from ports 4 and 5 of the short-circuiting bar on the terminal block and connect the cables to ports 5 and 6. (Restore the cable connections after coolant filling or drainage is complete.)
>
> - Multiple ESSs in off-grid mode: Use other ESSs to supply power.
>
> **Power supply for the coolant filling/drainage machine:**
>
> - Before using the coolant filling/drainage machine, configure the power plug based on local laws and regulations and power distribution conditions.
>
> - If the coolant filling/drainage machine is powered by an external power supply, consider the actual environment and local conditions when selecting the external power supply to ensure the charging and use safety of the external power supply.
>
> - When the 12 V DC external power supply is used, the power specifications must meet the following requirements:
>
>   - Maximum output capability ≥ 150 W
>
>   - Output voltage: 12 V DC
>
>   - Maximum current: 15 A
>
>   - Continuous output current ≥ 10 A
>
>   - In the case of coolant filling or drainage for a single ESS, the battery capacity must be less than or equal to 76 Wh.

Figure 19-4 Appearance of the coolant bucket

≥ 20 L

19.4.1 Draining Coolant from the LTMS

Prerequisites

- Tools: Phillips insulated torque screwdriver (M6), non-absorbent insulated gloves, mask, and goggles
- You have prepared the coolant filling/drainage machine (including the machine power cable). You may purchase the machine from Huawei.
- You have prepared a clean coolant bucket (≥ 20 L) by yourself.
- You have prepared a 220 V three-phase plug or 12 V power connector for the machine power cable by yourself based on the actual power distribution conditions.

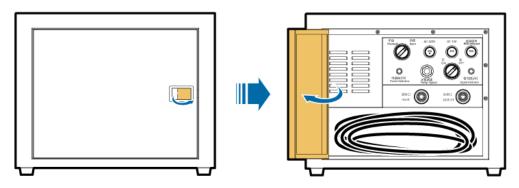> ⚠ **CAUTION**
>
> Do not use the same coolant bucket for old and new coolant. Otherwise, the coolant performance may deteriorate.

Procedure

Step 1 Open the machine door and take out the pipes and fittings.

Figure 19-5 Opening the machine

Step 2 Log in to the FusionSolar app or SmartLogger WebUI and select the **Draining** mode.

1. Method 1: Log in to the FusionSolar app and access the local commissioning screen.

   📖 **NOTE**

   > For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

   a. Choose **Settings** > **Cooling Parameters** > **Liquid Cooling Mode**. Select **Maintenance mode**.

   b. Tap **Maintenance mode** and select **Draining**.

2. Method 2: Log in to the SmartLogger WebUI.

   a. Choose **Monitoring** > **Running Param** > **Temperature control system**, click **Liquid cooling mode**, and set **Maintenance mode**.

   b. Select **Draining** from the **Maintenance mode** drop-down list.

Step 3 Open the ESS door and power off the ESS. For details, see **2.5 Powering Off the ESS**.

Step 4 Remove the screws from the LTMS and open the upper and lower door panels of the LTMS.

Step 5 Install the machine.

⚠️ WARNING

Connect the power cable of the machine. The **AC 220V** and **DC 12V** ports cannot be connected to the power cable at the same time.

⚠️ CAUTION

When connecting the coolant inlet pipe to the heat exchanger, avoid cuts or scratches from the fins.

---
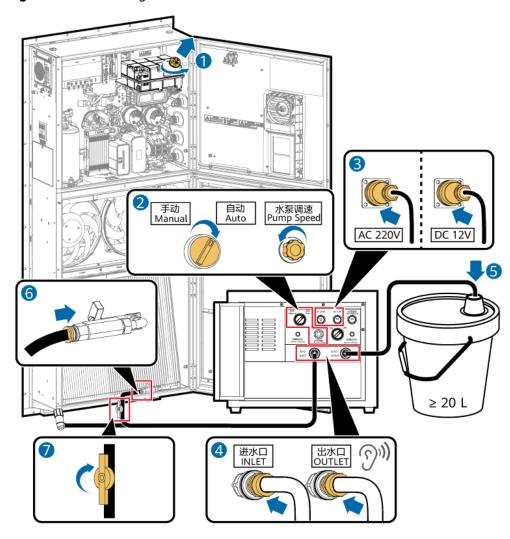
1. Open the pressure relief cover of the tank.
2. Set the machine to the **Auto** mode, and rotate the **Pump Speed** knob counterclockwise to the minimum level.
3. Connect the power cable to the **AC 220V** or **DC 12V** port.
4. Connect the coolant filling and drain pipes to the inlet and outlet of the machine. When you hear a click, the connectors snap into place properly.
5. Insert the outlet pipe into the bottom of the coolant bucket.
6. Connect the inlet pipe to the drain valve port at the bottom of the LTMS heat exchanger.

   📖 **NOTE**

   > Before connecting the coolant inlet pipe, check whether the port of the drain valve is dirty. If yes, use a cotton swab to clean it.

7.   Open the ball valve at the inlet pipe.

Figure 19-6 Installing the machine

Step 6 Drain the LTMS coolant.

1.   Set the machine to the **Manual** mode, and rotate the **Pump Speed** knob clockwise to the maximum level.

2.   Turn the power knob of the machine to **ON**.

3.   Open the drain valve at the bottom of the heat exchanger to drain coolant. If no coolant is drained from the drain pipe for 30s, the drainage is complete.
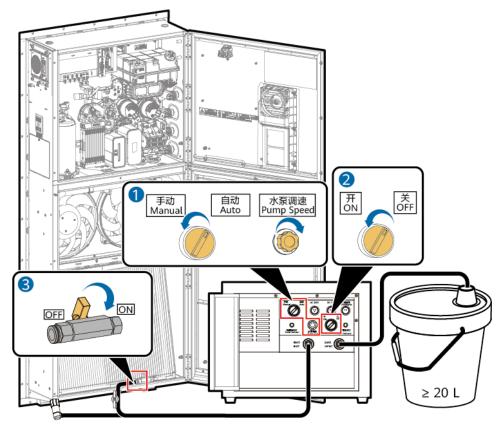
Figure 19-7 Draining coolant from the cabinet

Step 7 Remove the machine.

> **NOTICE**
>
> To continue to drain coolant from the battery pack/PCS/DCDC, perform **1** to **5**.

---

1. Turn the power knob of the machine to **OFF**.
2. Switch the machine to the **Auto** mode.
3. Close the drain valve at the bottom of the LTMS heat exchanger.
4. Close the ball valve at the inlet pipe.
5. Remove the inlet pipe from the drain valve at the bottom of the LTMS heat exchanger.
6. Turn off the power switch that supplies power to the machine and remove the power cable.
7. Remove the coolant filling and drain pipes connected to the machine.
8. Remove the outlet pipe from the coolant bucket.
9. Install the pressure relief cover of the tank.
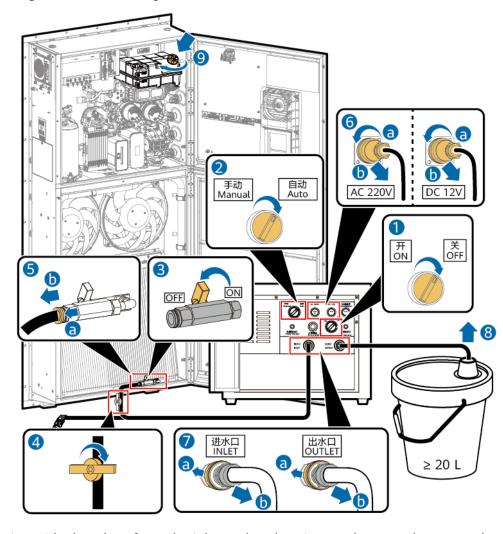
Figure 19-8 Removing the machine

Step 8 Drain residual coolant from the inlet and outlet pipes and ensure that no coolant remains. Clean the inlet and outlet pipes and dry the surface.

----End

19.4.2 Draining Coolant from the PACK/PCS/DCDC

The coolant filling/drainage machine supports coolant filling and drainage for a single battery pack/PCS/DCDC.

Prerequisites

- Tools: Phillips insulated torque screwdriver (M6), non-absorbent insulated gloves, mask, and goggles
- You have prepared the coolant filling/drainage machine (including the machine power cable). You may purchase the machine from Huawei.
- You have prepared a clean coolant bucket (≥ 20 L) by yourself.
- You have prepared a 220 V three-phase plug or 12 V power connector for the machine power cable by yourself based on the actual power distribution conditions.

⚠ CAUTION

Do not use the same coolant bucket for old and new coolant. Otherwise, the coolant performance may deteriorate.

Procedure

Step 1 Open the machine door and take out the pipes and fittings.

Figure 19-9 Opening the machine

Step 2 Log in to the FusionSolar app or SmartLogger WebUI and select the **Draining** mode.

1. Method 1: Log in to the FusionSolar app and access the local commissioning screen.

    📖 **NOTE**

    For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

    a. Choose **Settings** > **Cooling Parameters** > **Liquid Cooling Mode**. Select **Maintenance mode**.

    b. Tap **Maintenance mode** and select **Draining**.

2. Method 2: Log in to the SmartLogger WebUI.

    a. Choose **Monitoring** > **Running Param** > **Temperature control system**, click **Liquid cooling mode**, and set **Maintenance mode**.

    b. Select **Draining** from the **Maintenance mode** drop-down list.

Step 3 Open the ESS door and power off the ESS. For details, see **2.5 Powering Off the ESS**.

Step 4 Remove the screws from the LTMS and open the upper and lower door panels of the LTMS.

Step 5 Open the pressure relief cover of the tank.
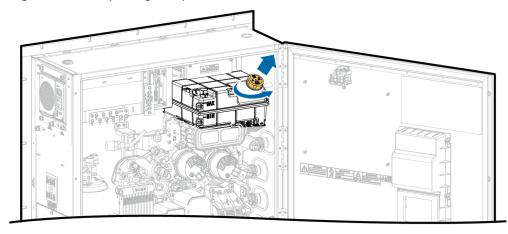
Figure 19-10 Opening the pressure relief cover of the tank

Step 6 Install the machine.

1. Set the machine to the **Auto** mode, and rotate the **Pump Speed** knob counterclockwise to the minimum level.

2. Connect the power cable to the **AC 220V** or **DC 12V** port.

3. Connect the coolant filling and drain pipes to the inlet and outlet of the machine. When you hear a click, the connectors snap into place properly.

4. Insert the outlet pipe into the bottom of the coolant bucket.

5. Remove the coolant outlet connector **OUT** of the battery pack/PCS/DCDC, and connect the quick connector of the machine to the original position. Remove the coolant inlet connector **IN**, and connect the auxiliary pipe connector to the original position. Ensure that the auxiliary pipe connector is vertically upward.

6. Close the ball valve at the inlet pipe.
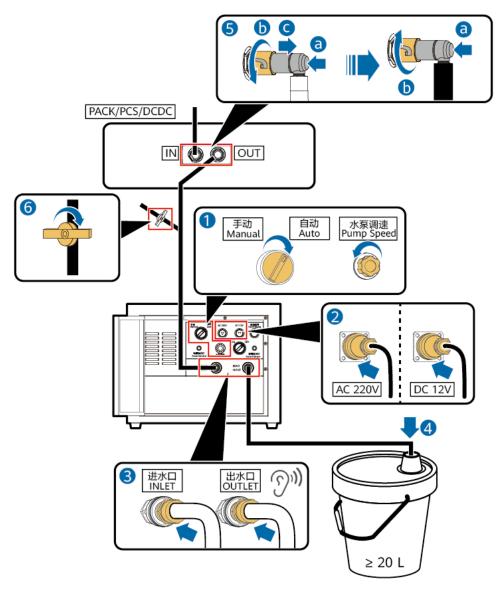
Figure 19-11 Installing the coolant filling/drainage machine for the battery pack/PCS/DCDC

Step 7 Drain coolant from the battery pack/PCS/DCDC.
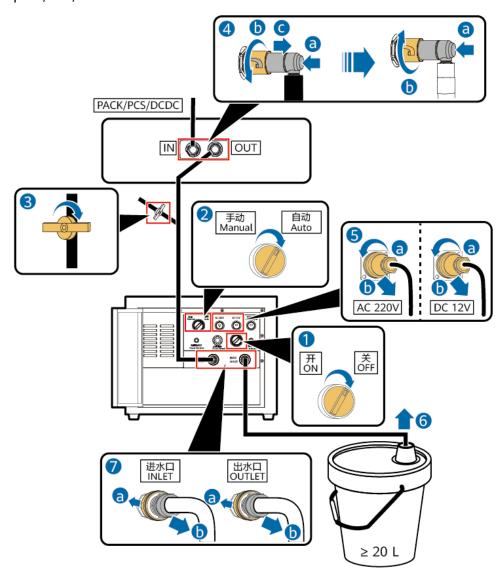
1. Set the machine to the **Manual** mode, and rotate the **Pump Speed** knob clockwise to the maximum level.

2. Turn the power knob of the machine to **ON**.

3. Drain coolant. If no coolant is drained from the drain pipe for 30s, the drainage is complete.

Step 8 If coolant needs to be drained from multiple components, repeat **5** in **Step 6** to **Step 7** to drain coolant from the battery pack/PCS/DCDC from top to bottom.

Step 9 Remove the machine.

1. Turn the power knob of the machine to **OFF**.

2. Switch the machine to the **Auto** mode.

3. Ensure that the ball valve at the inlet pipe is closed.

4. Remove the pipes, and reinstall the pipe connectors **OUT** and **IN** of the battery pack or PCS.

5. Turn off the power switch that supplies power to the machine and remove the power cable.

6. Remove the outlet pipe from the coolant bucket.

7. Remove the coolant filling and drain pipes connected to the machine.

Figure 19-12 Removing the coolant filling/drainage machine for the battery pack/PCS/DCDC

Step 10 Install the pressure relief cover of the tank.

Figure 19-13 Installing the pressure relief cover of the tank

Step 11 Add coolant to the LTMS. For details, see **19.4.3 Adding Coolant to the LTMS**.

----End

19.4.3 Adding Coolant to the LTMS

⚠️ **CAUTION**

● Do not mix coolant from different brands without prior permission of the Company. Do not reuse the coolant drained during maintenance.

NOTICE

● If the coolant filling process is manually interrupted, the process must be restarted from step 6 when it is resumed.

● During coolant filling, ensure that the pipe port in the coolant bucket can extract coolant in real time and avoid pipe hanging in the bucket.
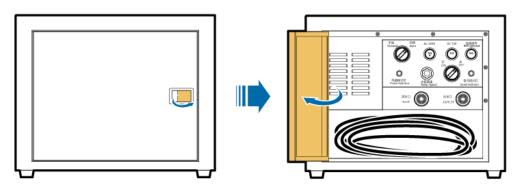
Prerequisites

● Tools: flat-head insulated torque screwdriver (M4), Phillips insulated torque screwdriver (M6), non-absorbent insulated gloves, mask, and goggles

● You have prepared the coolant filling/drainage machine (including the machine power cable and signal cable). You may purchase the machine from Huawei.

● You have prepared an appropriate amount of coolant based on site requirements (all coolant in the ESS ≤ 20 L). Purchase coolant from the Company. Coolant of different brands cannot be used together.

Procedure

Step 1 Open the machine door and take out the pipes and fittings.

Figure 19-14 Opening the machine

Step 2 Log in to the FusionSolar app or SmartLogger WebUI and select the **Refilling** mode.

1. Method 1: Log in to the FusionSolar app and access the local commissioning screen.

   ☐ **NOTE**

   > For details about how to log in to the FusionSolar app and access the local commissioning screen, see **FusionSolar App and SUN2000 App Device Commissioning Guide**.

   a. Choose **Settings** > **Cooling Parameters** > **Liquid Cooling Mode**. Select **Maintenance mode**.
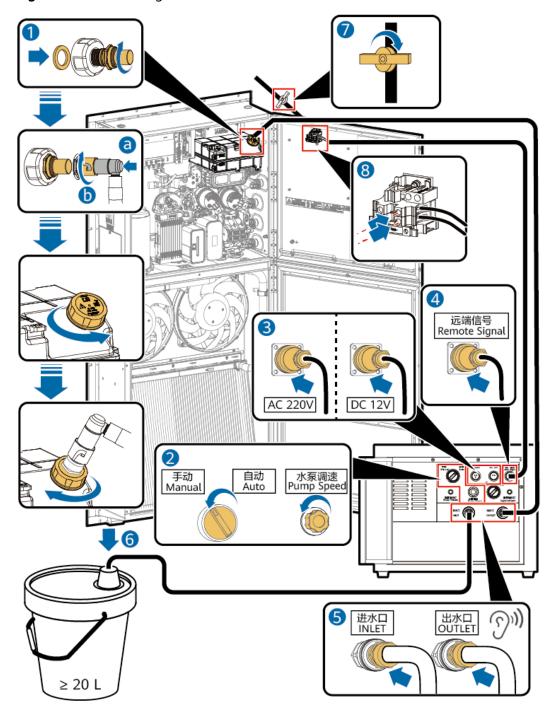
   b. Tap **Maintenance mode** and select **Refilling**.

2. Method 2: Log in to the SmartLogger WebUI.

   a. Choose **Monitoring** > **Running Param** > **Temperature control system**, click **Liquid cooling mode**, and set **Maintenance mode**.

   b. Select **Refilling** from the **Maintenance mode** drop-down list.

Step 3 Open the ESS door and keep the AC MAINS powered on.

Step 4 Remove the screws from the LTMS and open the upper and lower door panels of the LTMS.

Step 5 Install the machine.

1. After installing the machine and connecting the pipe, remove the pressure relief cover from the tank and install the cover fixture for coolant filling in the original position. If the cover fixture for coolant filling is lost or damaged, ensure that the coolant filling pipe is not inserted into the tank beyond the tank port edge for more than 4 cm during coolant filling. Place the pipe port at the tank port and secure it.

2. Set the machine to the **Manual** mode, and rotate the **Pump Speed** knob counterclockwise to the minimum level.

3. Connect the power cable to the **AC 220V** or **DC 12V** port.

4. Connect the communications cable.

5. Connect the coolant filling and drain pipes to the inlet and outlet of the machine. When you hear a click, the connectors snap into place properly.

6. Insert the inlet pipe into the coolant bucket to ensure that coolant can be extracted.

7. Ensure that the ball valve at the outlet pipe is closed.

8. Connect the other end of the communications cable to the LTMS signal port.

Figure 19-15 Installing the machine

Step 6 Set the machine to the **Auto** mode, and rotate the **Pump Speed** knob clockwise to the middle position.
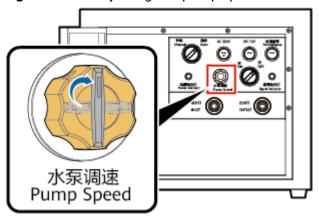
Figure 19-16 Adjusting the pump speed to the middle position

Step 7 Turn the power knob of the machine to **ON**.

Step 8 Check whether coolant is being filled properly. The coolant is filled automatically. A complete coolant filling process for a single ESS takes about 45 minutes.

⚠️ **CAUTION**

During the first 3 minutes, observe carefully to check whether the coolant filling process is normal. If the coolant overflows, stop the process immediately and contact the Company's service engineers.

Step 9 After the refilling is complete, check that **Coolant Replacement Status** is **Completed** on the FusionSolar app or SmartLogger WebUI.

Step 10 (Optional) If all coolant in the LTMS is replaced, click **Confirm Coolant Replacement** to update the coolant replacement time.

Step 11 Remove the machine.

1. Turn the power knob of the machine to **OFF**.
2. Remove the machine and install the pressure relief cover of the tank.
3. Turn off the power switch that supplies power to the machine and remove the power cable.
4. Remove the communications cable from the machine and LTMS signal port.
5. Remove the coolant filling and drain pipes connected to the machine.
6. Remove the outlet pipe from the coolant bucket.
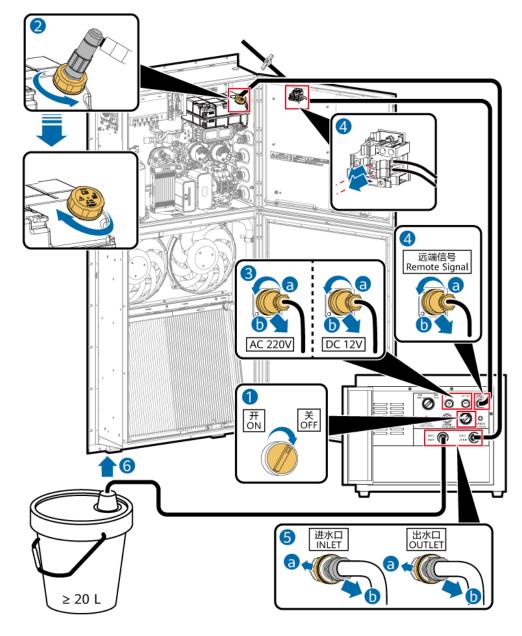
Figure 19-17 Removing the machine

Step 12 Drain residual coolant from the inlet and outlet pipes and ensure that no coolant remains. Clean the inlet and outlet pipes and dry the surface.

----End

19.5 How Do I Enable the Manual Exhaust Function of the LTMS?

Prerequisites

Log in to the SmartLogger WebUI/FusionSolar app/management system and check whether a pump exception alarm is generated. If yes, manually clear the

alarm before manually exhausting air. If the alarm cannot be manually cleared, power off and restart the system.

Procedure

⚠️ **CAUTION**

Before and after exhausting air, check the LTMS tank to ensure that the coolant level is above the MIN level. If the coolant level is below the MIN level, refill coolant. For details, see **19.4.3 Adding Coolant to the LTMS**.

Step 1 Log in to the SmartLogger WebUI and set the **Shutdown** mode.

1. Choose **Monitoring** > **Running Param** > **Basic Parameters**.
2. Select **Shutdown** from the **ESS startup/shutdown** drop-down list and click **Submit**.

Step 2 Set the liquid cooling mode to manual diagnostic mode.

1. Choose **Monitoring** > **Running Param** > **Temperature control system**.
2. Select **Diagnostic mode** from the **Liquid cooling mode** drop-down list and click **Submit**.
3. Select **Manual** from the **Diagnostic mode** drop-down list, and click **Submit**.

Step 3 Set the battery temperature control mode to **Natural cooling**.

1. Choose **Monitoring** > **Running Param** > **Temperature control system**.
2. Select **Natural cooling** from the **Battery temperature control mode for diagnosis** drop-down list, and click **Submit**.

Step 4 Manually set the circulating pump status to start exhausting air.

1. Choose **Monitoring** > **Running Param** > **Temperature control system**.
2. Set **Setting status of circulating pump 1** and **Setting status of circulating pump 2** to **80**.
3. Select **Setting status of circulating pump 2**, click **Submit**, and run the system for 1 minute.
4. Select **Setting status of circulating pump 1** and **Setting status of circulating pump 2**, click **Submit**, and run the system for more than 45 minutes.

Step 5 After the air exhaust is complete, restore the mode and restart the system.

1. Choose **Monitoring** > **Running Param** > **Temperature control system**.
   a. Set **Setting status of circulating pump 1** and **Setting status of circulating pump 2** to **0**.
   b. Select **Automatic** from the **Liquid cooling mode** drop-down list and click **Submit**.
2. Choose **Monitoring** > **Running Param** > **Basic Parameters**. Select **Running** from the **ESS startup/shutdown** drop-down list.

----End

19.6 How Do I Fill Refrigerant?

- Tools: Phillips insulated torque screwdriver (M6), vacuum pump, pressure gauge, electronic balance, rubber pipe, and protective gloves
- Materials: R134a refrigerant, R134a low-pressure valve quick connector, R134a high-pressure valve quick connector (complying with SAE J639), and nitrogen cylinder
- You have shut down the ESS. For details about how to shut down the ESS, see **2.5 Powering Off the ESS**.

⚠️ **CAUTION**

- Refrigerant filling must be performed under the guidance of professional maintenance personnel.
- Ensure that the refrigerant filling devices and pipes are clean and free of visible dirt before connection.
- The models of the R134a low-pressure valve quick connector and R134a high-pressure valve quick connector shall comply with SAE J639. Avoid needle valve deviation caused by excessive ejector rod length. It is recommended that non-adjustable filling ports be used.

19.6.1 Refrigerant R134a

⚠️ **CAUTION**

Do not use poor-quality refrigerant. Using poor-quality refrigerant will shorten the service life of sealing rings and components and cause refrigerant leakage. The supplier is not responsible for any device damage caused by low-quality refrigerant.

Verify that the refrigerant is authentic in the following ways:

1. Contact the refrigerant producer to confirm the refrigerant authenticity.
2. As shown in **Figure 19-18**, place the refrigerant in an indoor place with constant temperature and humidity for 24 hours. Then, use a thermometer to measure the temperature of the refrigerant tank outer surface and connect a pressure gauge to the pressure tank to measure the internal pressure. Find the saturation pressure corresponding to the measured outer surface temperature from **Table 19-4**. If the deviation between the saturation pressure and the measured internal pressure is greater than 0.1 MPa, the refrigerant does not meet the requirements and needs to be replaced.

Figure 19-18 Checking the refrigerant

DT53000205
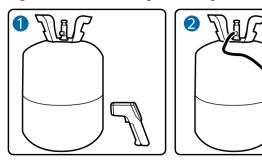
Table 19-4 Mapping between temperatures and R134a saturation pressure

Temperature (℃)	Saturation Pressure – Gauge Pressure (bar)	Temperature (℃)	Saturation Pressure – Gauge Pressure (bar)	Temperature (℃)	Saturation Pressure – Gauge Pressure (bar)
0	2.93	19	5.54	38	9.63
1	3.04	20	5.72	39	9.9
2	3.15	21	5.9	40	10.17
3	3.26	22	6.08	41	10.44
4	3.38	23	6.27	42	10.72
5	3.5	24	6.46	43	11.01
6	3.62	25	6.65	44	11.3
7	3.75	26	6.85	45	11.6
8	3.88	27	7.06	46	11.9
9	4.01	28	7.27	47	12.21
10	4.15	29	7.48	48	12.53
11	4.29	30	7.7	49	12.85
12	4.43	31	7.93	50	13.18
13	4.58	32	8.15	51	13.51
14	4.73	33	8.39	52	13.85
15	4.88	34	8.63	53	14.2
16	5.04	35	8.87	54	14.55
17	5.21	36	9.12	55	14.92
18	5.37	37	9.37	–	–

19.6.2 Injecting Nitrogen for Pressure Preservation

Prerequisites
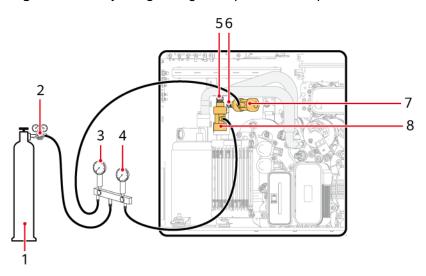
> **NOTICE**
>
> - Refrigerant pipes have been connected.
> - The measurement range of the pressure gauge must be greater than or equal to 2.6 MPa, and the pressure resistance of the rubber pipe must be greater than or equal to 3 MPa.
> - During pressure preservation, do not remove the rubber pipes and pressure gauges; otherwise, nitrogen may leak.

Procedure

Step 1 Inject nitrogen from the suction pipe needle valve and discharge pipe needle valve at the same time.

Figure 19-19 Injecting nitrogen to preserve the pressure

(1) Nitrogen cylinder	(2) Reducing valve	(3) Electronic pressure gauge (precision: ≥ 0.001 MPa; measurement range: ≥ 2.6 MPa)	(4) Electronic pressure gauge (precision: ≥ 0.001 MPa; measurement range: ≥ 2.6 MPa)

(5) Discharge pipe needle valve	(6) Suction pipe needle valve	(7) R134a low-pressure valve quick connector	(8) R134a high-pressure valve quick connector

Step 2 Open the pressure gauge and reducing valve, inject 2.5±0.1 MPa nitrogen, preserve the pressure for at least 30 minutes, and check that the pressure drop is less than 0.05 MPa.

Step 3 If the pressure preservation is unqualified, apply soapy water or use a halogen leak detector to check for any leakage and repair it. If the pressure preservation is qualified, expel the nitrogen from the needle valves.

----End

19.6.3 Vacuumizing and Precharging Refrigerant

⚠️ **CAUTION**

During the LTMS commissioning, ensure that no comburent substance (such as air or additive) enters the refrigerant system. The supplier is not liable for any risks and losses caused due to violation.

19.6.3.1 Refrigerant Charge Amount

Table 19-5 Refrigerant charge amount

Refrigerant Charge Amount	LunaTMS2000-H008SG00
Standard amount (kg)	0.41

19.6.3.2 Vacuumizing
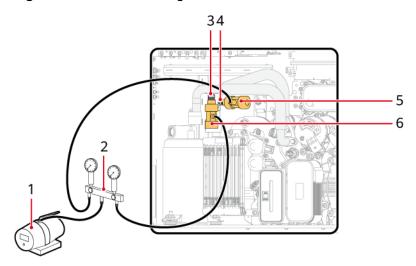
Prerequisites

ℹ️ **NOTICE**

- Before vacuumizing, check that the refrigerant pipe system has passed the air tightness test and does not leak.
- Before vacuumizing, ensure that all connectors on the equipment are tightened.
- Ensure that the system is vacuumized completely. If the vacuumization is not performed or is not performed completely, the system may experience high pressure.

Procedure

Step 1 Connect the pressure gauge and vacuum pump to the suction pipe needle valve and discharge pipe needle valve, and start vacuumizing.

Figure 19-20 Vacuumizing

(1) Vacuum pump	(2) Pressure gauge	(3) Discharge pipe needle valve
(4) Suction pipe needle valve	(5) R134a low-pressure valve quick connector	(6) R134a high-pressure valve quick connector

Step 2 In the beginning, the vacuum pump makes loud noises and exhausts white gas from the discharge vent. After 10 minutes, if it still exhausts white gas, observe it for another 10 minutes because the cooling system may not be sealed properly or there may be too much residual refrigerant or water in the cooling system.

Step 3 After 20 minutes, the pressure gauge pointer shall be in the negative area and the vacuum pump makes small noise. Close and open the pressure gauge alternately for several times. The position of the pressure gauge pointer and the sound made by the vacuum pump shall not change obviously. Otherwise, the cooling system may not be sealed properly.

> **NOTE**
>
> If the cooling system is not properly sealed, apply soapy water or use a halogen leak detector to check for and repair any leakage.

Step 4 Vacuumize the cooling system for more than 40 minutes after checking that the cooling system does not leak. The pressure displayed on the vacuum pump shall be less than or equal to 60 Pa (absolute pressure). When the pressure stops dropping, vacuumize for another 10 minutes.

Step 5 After vacuumization is complete, close all valves of the pressure gauge and the vacuum pump without disconnecting the pump, and preserve the pressure for 10 minutes. Ensure that the pressure of the cooling system is less than or equal to 350 Pa (absolute pressure).

📖 **NOTE**

> If the minimum reading of the pressure gauge is greater than 60 Pa (absolute pressure), ensure that the pointer stays at the smallest scale of the pressure gauge during vacuumization and preserve the pressure for 1 hour. Then check that the pressure does not rise.

----End

19.6.3.3 Precharging the Refrigerant

Prerequisites

Before charging refrigerant, ensure that air is exhausted from the pipe connected to the refrigerant cylinder.

Context
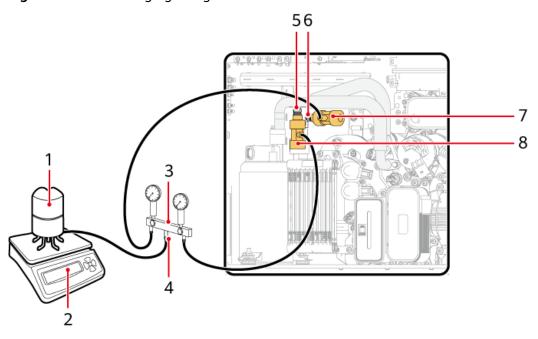
⚠️ **CAUTION**

- When charging refrigerant, you are advised to use a safety valve to prevent refrigerant leakage during the removal of a rubber pipe, which may cause frostbite.
- Wear antifreeze gloves when performing refrigerant related operations.
- Charge the refrigerant (R134a) immediately after checking that the cooling system does not leak and the vacuum level meets the requirements.

Procedure

Step 1 Take off the vacuum pump from the vacuumizing device, and replace the vacuum pump with a refrigerant cylinder.

Figure 19-21 Precharging refrigerant

(1) Refrigerant cylinder	(2) Electronic balance	(3) Pressure gauge	(4) Connection nut
(5) Discharge pipe needle valve	(6) Suction pipe needle valve	(7) R134a low-pressure valve quick connector	(8) R134a high-pressure valve quick connector

Step 2 Slightly open the refrigerant cylinder valve and slightly loosen the connection nut of the pressure gauge and rubber pipe. Observe for more than 10s. Tighten the nut when refrigerant mist is released from the nut.

Step 3 Put the refrigerant cylinder upside down on the electronic balance. Clear the reading on the balance.

Step 4 Open all pressure gauge valves and the refrigerant cylinder valve to charge refrigerant.

NOTICE

Do not move the hose or refrigerant cylinder when charging refrigerant. Otherwise, the reading on the electronic balance will be affected.

Step 5 The precharge amount must be less than or equal to the total charge amount. If the total refrigerant amount cannot be fully precharged, charge the remaining amount of refrigerant during power-on and commissioning. For details, see **19.6.4 (Optional) Charging the Remaining Refrigerant**.

Step 6 After the refrigerant is charged, close all pressure gauge valves and the refrigerant cylinder valve.

📖 **NOTE**

Tighten the needle valve bonnets when the charge is complete. Check whether a needle valve leaks by applying soap bubbles to the valve vent or using a halogen leak detector. If leakage occurs, the condensing pressure and compressor load will increase, which may damage the compressor and affect the cooling effect. In that case, contact technical support.

----End

19.6.4 (Optional) Charging the Remaining Refrigerant

Prerequisites
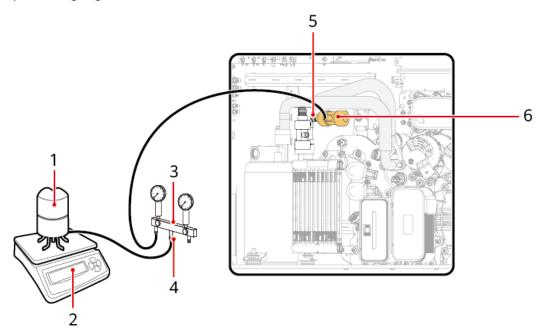
- Before starting the compressor, ensure that the unit switch is turned on.
- Remove the refrigerant cylinder after ensuring that no more refrigerant needs to be charged.
- Charge refrigerant to the standard amount. Otherwise, the devices may be damaged.
- The ESS has been powered on. For details, see the ESS power-on section in **LUNA2000-(107-215) Series Smart String ESS User Manual**.

Procedure

Step 1 To prevent refrigerant from flowing back, remove the pipe between the discharge pipe needle valve and the pressure gauge when refrigerant is pre-filled.

Figure 19-22 Removing the pipe between the discharge pipe needle valve and the pressure gauge

(1) Refrigerant cylinder	(2) Electronic balance	(3) Pressure gauge	(4) Connection nut
(5) Suction pipe needle valve	(6) R134a low-pressure valve quick connector	-	-

Step 2 Log in to the SmartLogger WebUI.

Step 3 Choose **Monitoring** > **ESS** > **Running Info > Temperature control system**.

1. Select **Diagnostic mode** from the **Liquid cooling mode** drop-down list.

2. Select **Manual** from the **Diagnostic mode** drop-down list.

3. Select **Active cooling** from the **Battery temperature control mode for diagnosis** drop-down list.

4. Set **Setting status of compressor** to **3000** rpm.

5. Click **Submit**.

6. Continue to fill refrigerant until the optimal value is reached based on the current pressure and temperature of the system.

Step 4 Wait for 15 minutes, choose **Monitoring** > **ESS** > **Running Info > Temperature control system**, and check whether **Discharge pressure of refrigerant system** and **Suction pressure of refrigerant system** are within normal ranges according to **Table 19-6**.

Table 19-6 Normal suction and discharge pressure ranges

Outdoor Ambient Temperature	Discharge Pressure Range	Suction Pressure Range
Below 15°C	0.5–1.2 MPa	0.03–0.8 MPa
15–35°C	0.6–2 MPa	
35–45°C	1–2.6 MPa	

NOTICE

If the suction pressure and discharge pressure are not within the normal range, check the following items:

● Charge refrigerant in an amount exactly as standard charge required. If the refrigerant is overfilled, the discharge pressure will be high. If the refrigerant is underfilled, the suction pressure and discharge pressure will be low.

● The air intake and exhaust vents of the unit must not be blocked. If the air intake vent and air exhaust vent are blocked, the discharge pressure will be high.

Step 5　Choose **Monitoring** > **ESS** > **Running Info** > **Temperature control system**.

1. Select **Diagnostic mode** from the **Liquid cooling mode** drop-down list.

2. Select **Manual** from the **Diagnostic mode** drop-down list.

3. Select **Active cooling** from the **Battery temperature control mode for diagnosis** drop-down list.

4. Set **Setting status of compressor** to **0** rpm based on the component location.

5. Click **Submit**.

Step 6　Ensure that no alarm is generated for the LTMS, set **Diagnostic mode** to **Auto**, and click **Submit**.

----End

A 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

B Digital Power Customer Service

https://digitalpower.huawei.com/robotchat/

C Acronyms and Abbreviations

A

App   application

B

BCU   battery control unit

BMU   battery monitoring unit

D

DCDC   DC-DC Converter

E

EPO   emergency power-off

ESR   Energy Storage Rack

ESS   energy storage system

F

FPC   Flexible Printed Circuit

I

I/O   Input&Output

M

MBUS   monitoring bus

N

NTC   negative temperature
                                         coefficient

P

PACK   battery pack

PCS   Power Converter System

PTC   positive temperature
                                         coefficient

R

RCCB   residual current circuit
                                         breaker

RCM   Rack Control Module

S

SOC   state of charge

U

UPS   uninterruptible power
                                         system