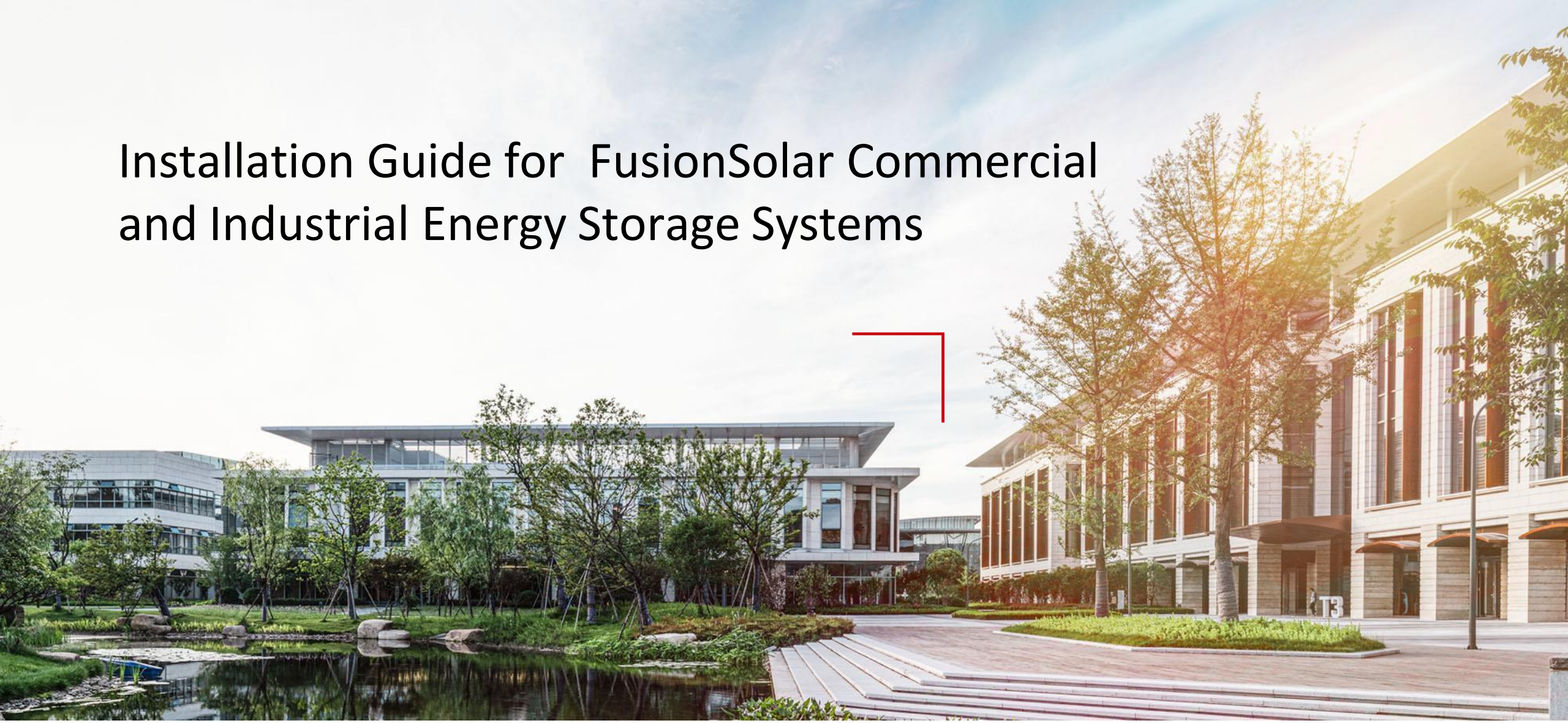
Installation Guide for FusionSolar Commercial and Industrial Energy Storage Systems



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Contents

System Introduction — Product Functions and Features

Product Functions:

The ESS consists of a power control module and lithium battery modules. It stores and releases electricity controlled by the Smart Rack Controller (also referred to as rack controller). The input and output ports of the ESS are high-voltage direct current (HVDC) ports.

- Battery charge: The Smart Power Control System (also referred to as Smart PCS) is connected to the rack controller and send commands to charge batteries.
- Battery discharge: When the grid power is insufficient for the loads, the system controls the batteries to supply power to the loads through the Smart PCS.

Product Features:

The ESS consists of the power supply and distribution system, monitoring system, environment control system, and fire suppression system. It features safety, reliability, fast deployment, low cost, high energy efficiency, and intelligent management.

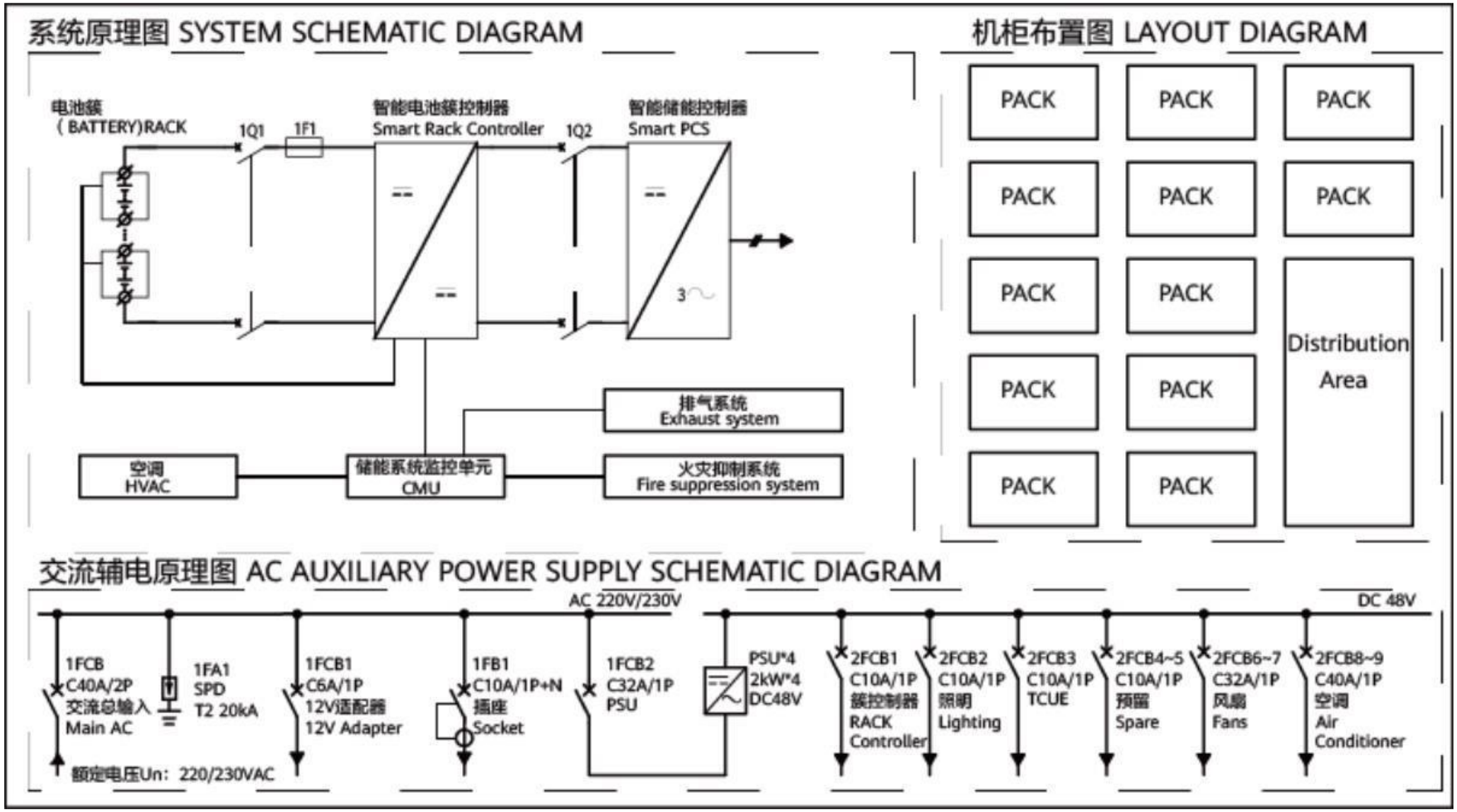
Pack-level optimization

1. This design fully leverages the battery pack capacity in the battery racks.
2. Battery packs can be directly replaced by onsite personnel without the need for professional technicians or manual SOC calibration, reducing the replacement time.

System Introduction — Operating Modes

Operating Mode	Description
Running	In this mode: ◆ The ESS charges and discharges the batteries. ◆ The ESS enters shutdown mode after detecting a fault or receiving a shutdown command. ◆ The ESS enters standby mode after receiving a standby command.
Standby	The ESS enters standby mode after receiving a standby command. In this mode: ◆ The ESS continuously performs status check and enters operating mode once the operating requirements are met. ◆ The ESS enters shutdown mode when receiving a shutdown command or detecting a fault after startup.
Shutdown	◆ In standby or operating mode, the ESS enters shutdown mode after detecting a fault or receiving a shutdown command. ◆ In shutdown mode, the ESS enters operating mode after detecting a startup command or that faults are cleared.

System Introduction — Schematic Diagram



Battery circuit diagram of the LUNA2000-200KWH-2H1

System Introduction — Typical ESS-only Scenario 1.1: (ESS Low-Voltage Grid Connection) 0.5C ESS, Max. 500 kW/1MWh

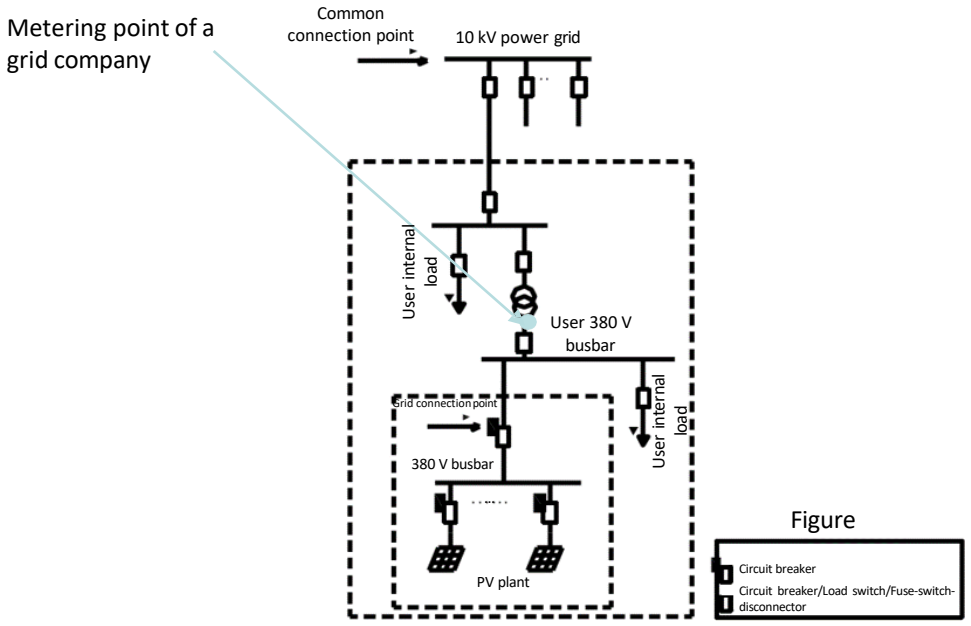
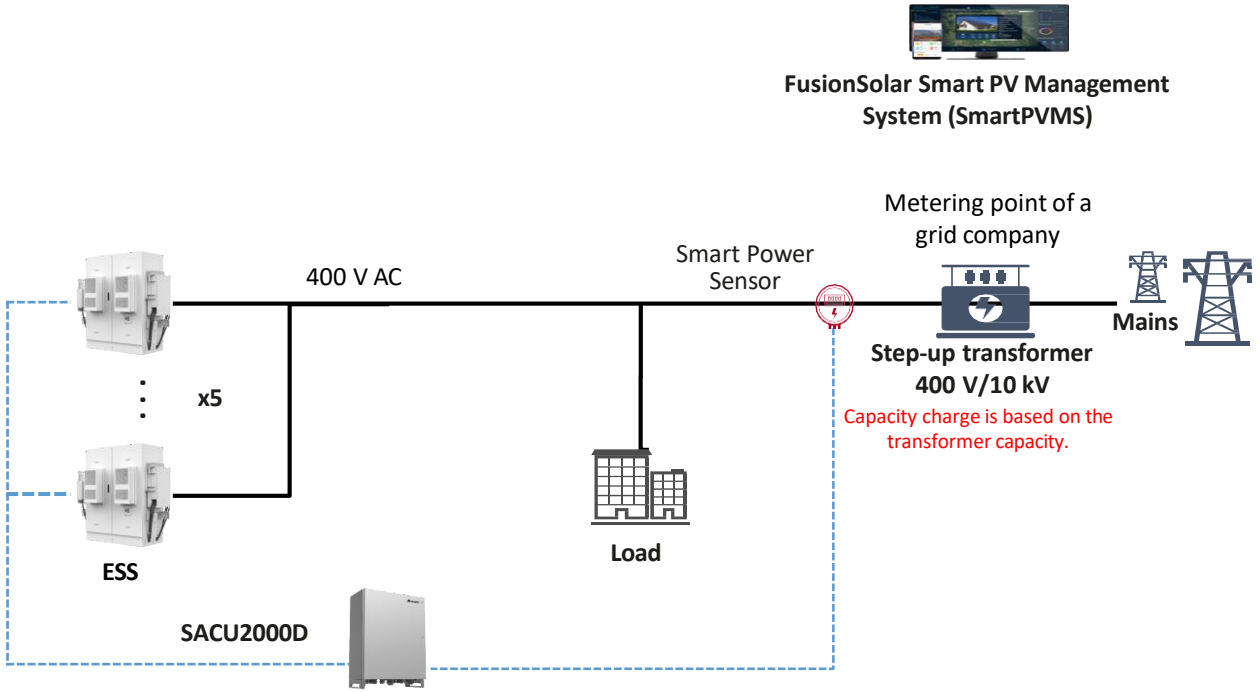


Figure 17-2 Main electrical wiring diagram of XGF380-7-2 scheme principle



- Scenario characteristics: ESSs are mainly used for peak staggering, and support scheduled charge and discharge as well as capacity control at the grid connection point.
- Independent mains is the first choice for the auxiliary power supply of ESSs, and the 400 V AC bus power supply is the second choice.
- In the C&I scenario, meters at the grid connection point can only be self-developed C&I meters: DTSU666-H and YDS60-80. Customers need to purchase CT (*XXX* A/5 A or 1 A) with the minimum accuracy class 0.5s.
- Maximum communication distance: 1000 m for RS485 cables, 400 m for single-core MBUS cables, 1000 m for multi-core MBUS cables, 100 m for FE cables, and 10 km for optical cables (with 1000M optical modules) or 12 km for optical cables (with 100M optical modules)
- In the ESS-only scenario, only one SmartLogger and one grid connection point are supported. A maximum of four ESSs are supported.
- To prevent excessive parallel cross current, the cable between the Smart PCS and the parallel connection point must be at least 6 m long.
- In maximum self-consumption and TOU modes, the SmartLogger prevents the ESSs from feeding power to the grid.

System Introduction — Typical PV+ESS Scenario 2.1: (PV Low-Voltage Grid Connection, ESS Low-Voltage Grid Connection) 0.5C ESS, Max. 500 kW/1MWh

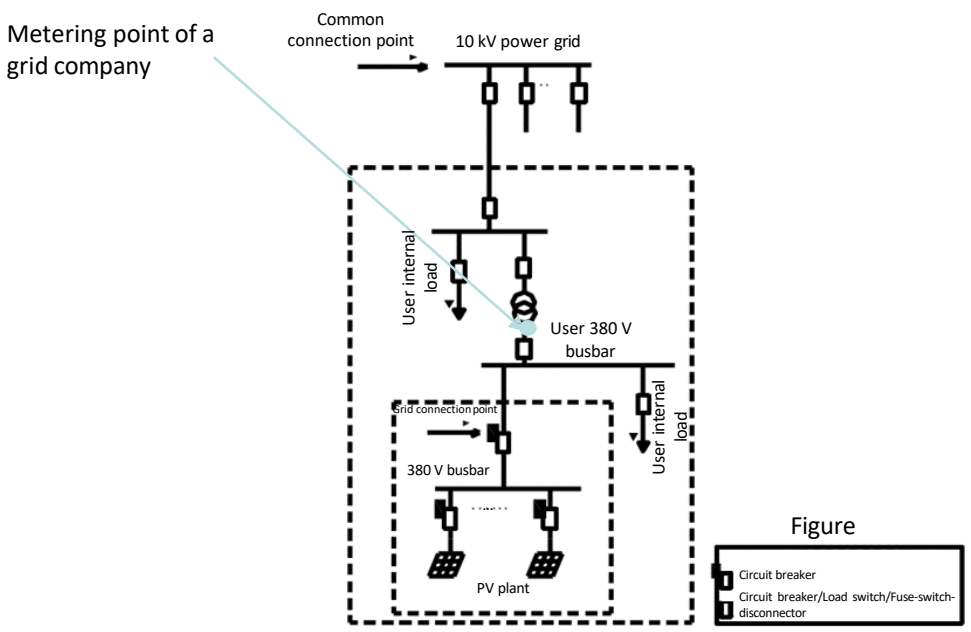
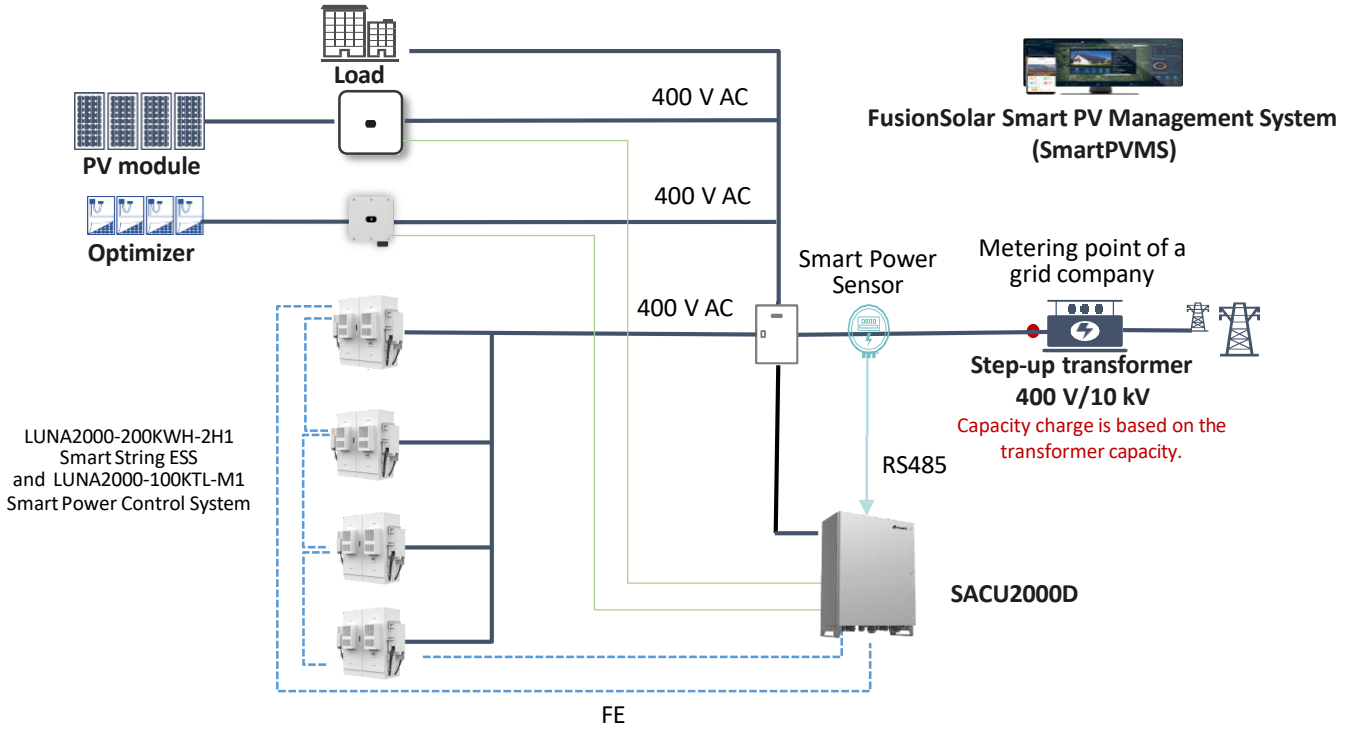


Figure 17-2 Main electrical wiring diagram of XGF380-7-2 scheme principle



- Scenario characteristics: The ESS capacity is close to the PV capacity. ESSs are mainly used for maximum self-consumption and peak staggering as well as capacity control at the grid connection point.
- Independent mains is the first choice for the auxiliary power supply of ESSs, and the 400 V AC bus power supply is the second choice.
- Maximum communication distance: 1000 m for RS485 cables, 400 m for single-core MBUS cables, 1000 m for multi-core MBUS cables, 100 m for FE cables, and 10 km for optical cables (with 1000M optical modules) or 12 km for optical cables (with 100M optical modules)
- The ESS-only system scenario supports only one SmartLogger and one grid connection point. A maximum of four ESSs, four PCSs, 30 PV inverters (only M3 and V5 inverters are supported at TR5), and 115 optimizers are supported.
- In low-voltage coupling scenarios of PV and ESS, the cable between the inverter and the parallel connection point must be at least 10 m long and the cable between the Smart PCS and the parallel connection point must be at least 6 m long to prevent excessive parallel circulating current.

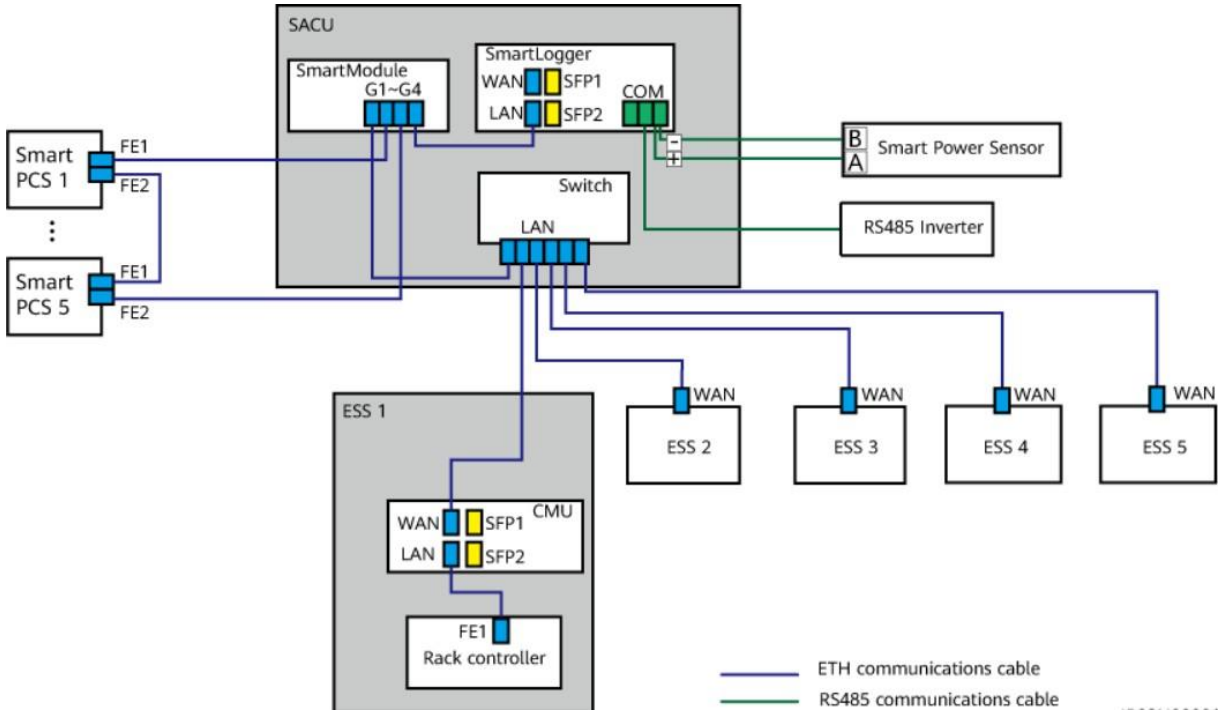
System Introduction — standard configurations

1MWh/500 kW standard configurations

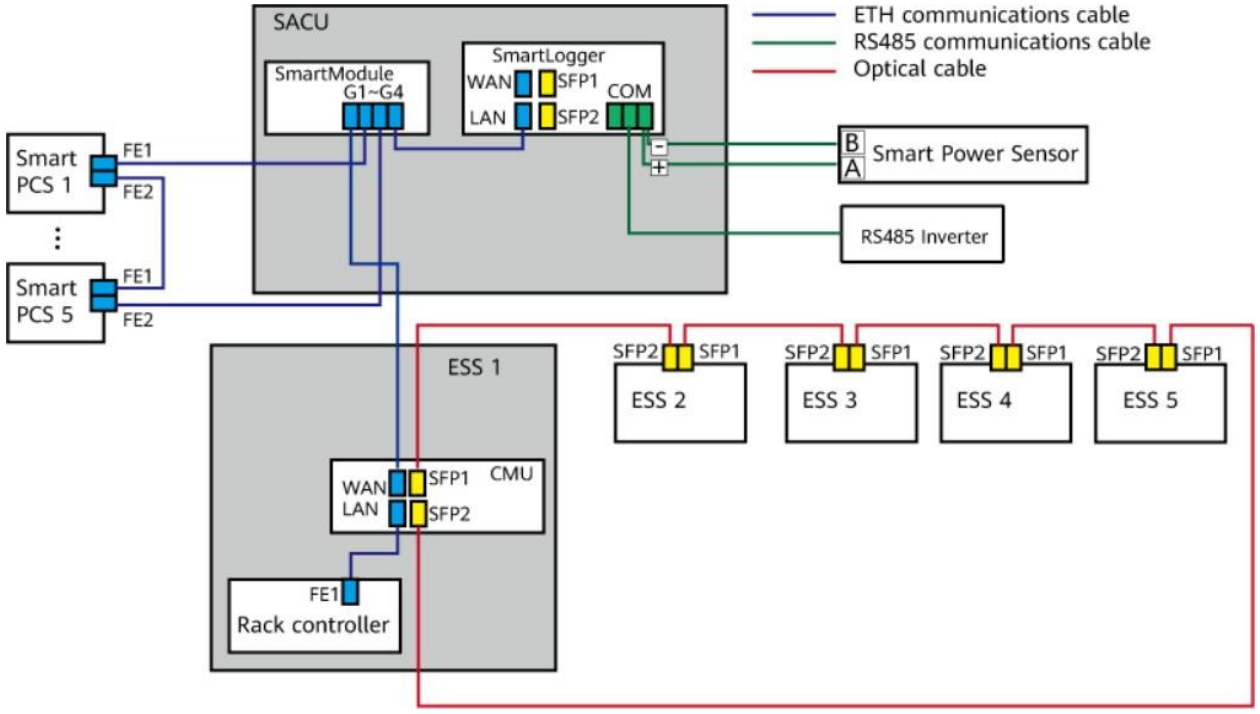
No.	Item	Recommended Model/Specifications	Quantity	Source
1	ESS	LUNA2000-200KWH-2H1	5	Purchased from the Company
2	Smart PCS	LUNA2000-100KTL-M1	5	Purchased from the Company
3	Rack controller	-	5	Purchased from the Company
4	SACU	SmartACU2000D-D-00	1	Purchased from the Company
5	Smart power	DTSU666-H or YDS60-80	1PCS	Purchased from the Company /Prepared by the customer
6	Power distribution cabinet	The specifications should comply with the Smart PCS specifications, auxiliary power supply specifications, actual application scenarios, and local laws and regulations.	1	Prepared by the customer
7	Inverter	•SUN2000-(100KTL, 110KTL, 115KTL)-M2 •SUN2000-(20KTL, 29.9KTL, 30KTL, 36KTL, 40KTL)-M3 •SUN2000-(50KTL-ZHM3, 50KTL-M3) •SUN2000-(20KTL-M3, 33KTL-NH, 40KTL-NH) •SUN2000-50KTL-NHM3 •SUN2000-(75KTL, 100KTL, 110KTL, 125KTL) series •SUN2000-111KTL-NHM0	Configured based on the capacity requirements	Prepared by the customer

System Introduction — Communication Networking Diagram

Communication networking diagram (FE communication) (the LAN switch is optional)

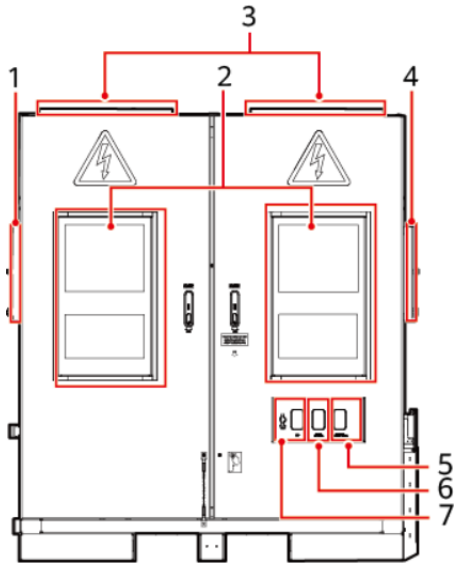


Communication networking diagram (fiber ring network)



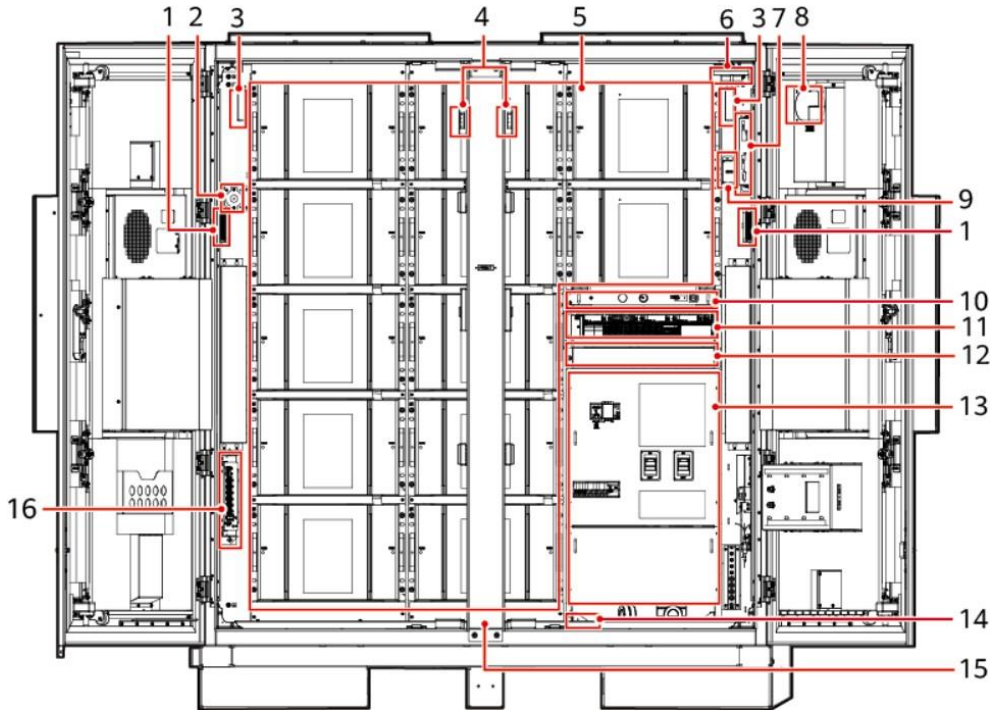
Note:
Third-party access: Only the YDS60-80 is supported. The EMS supports only the 104 protocol.

System Introduction — ESS



No.	Description	Maximum Quantity Configured for an ESS	Description
1	Installation position of the Smart PCS	1	Where the Smart PCS is installed.
2	Air conditioner	2	Air conditioners on the ESS cabinet door
3	Pressure relief windows	2	If an explosion occurs inside the equipment, the windows are open to release pressure.
4	Installation position of the rack controller	1	Where the rack controller is installed.
5	Emergency stop switch	1	Used for emergency stop of the rack controller.
6	Fire alarm/horn strobe	1	Generates alarms for internal devices when abnormal temperature or smoke occurs.
7	USB port	1	Where a smart USB-WLAN adapter (USB-Adapter2000-C) is installed for local maintenance.

System Introduction — Component Positions in the ESS



(1)	Light	(2)	Black start button	(3)	CO sensor	(4)	Door status sensors
(5)	Installation position of battery packs	(6)	Smoke detector	(7)	Exhaust controller	(8)	Exhaust module
(9)	T/H sensor	(10)	Installation position of the rack mounted fire extinguishing system	(11)	Embedded power subrack	(12)	CMU and installation position of the SmartModule
(13)	Power distribution area	(14)	Water sensor	(15)	Adjustable column	(16)	I/O expansion board

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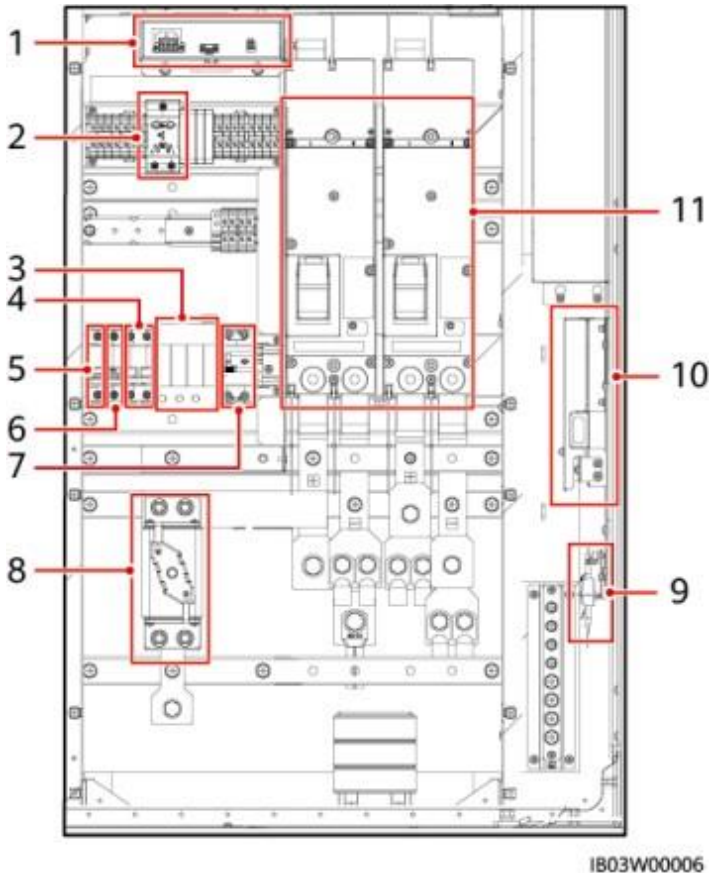
System Introduction — Power Distribution Area

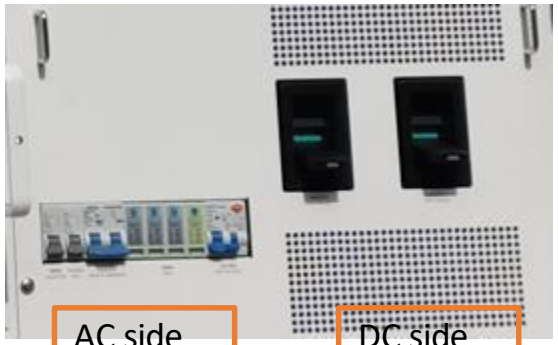


(1)	12 V adapter	(2)	220 V O&M socket (1XD1)
(3)	AC SPD (1FA1)	(4)	AC main switch (1FCB)
(5)	12 V adapter switch (1FCB1)	(6)	PSU switch (1FCB2)
(7)	220 V maintenance socket switch (1FB1)	(8)	Fuse (1F1)
(9)	Fiber adapter	(10)	Fiber management tray
(11)	DC switches (1Q1 and 1Q2)		

System Introduction — Photos of Main Components

Exhaust module

Control module



AC/DC circuit breaker

ESS abort button

ESS abort button

Audible and visual alarm device

Air conditioner in the ESS

Fire suppression device

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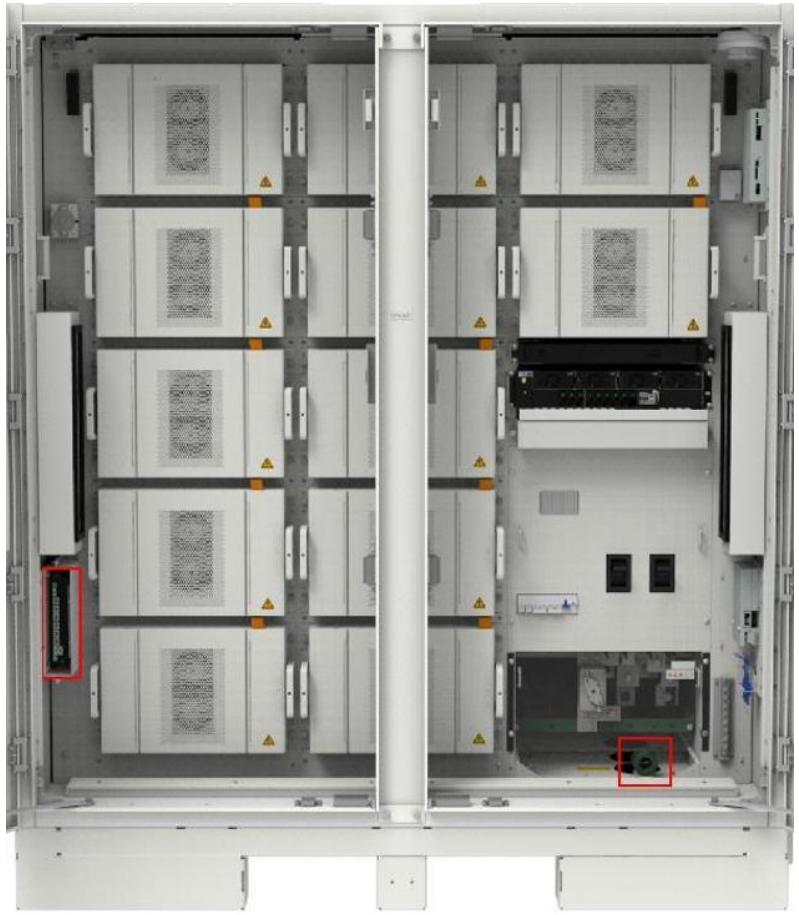
System Introduction — Photos of Main Components



Battery rack

Battery pack

Smoke sensor

Temperature and humidity sensor

CO sensor

Door status sensor system

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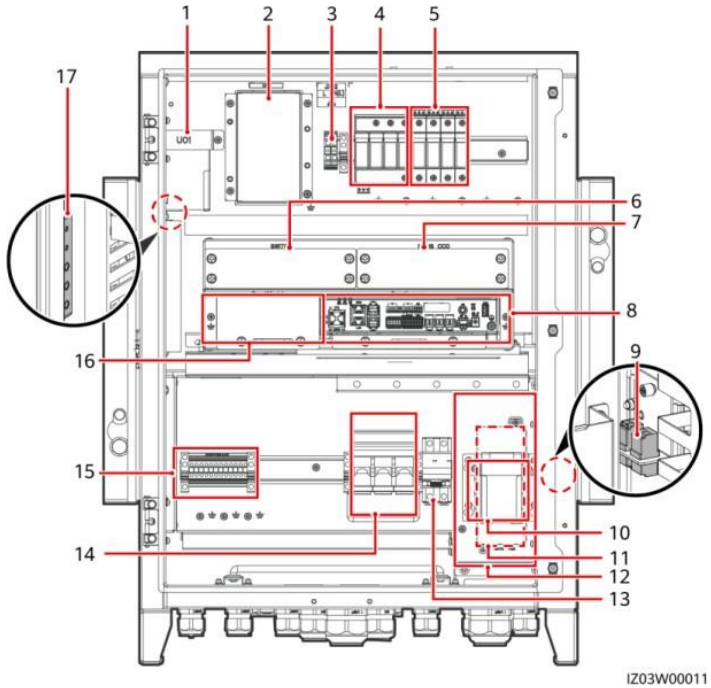
System Introduction — Photos of Main Components

Smart PCS

Rack controller

SACU

System Introduction — SACU



(1)	Power adapter of the SmartLogger (U01)	(2)	Position for the 24 V DC power module (U02)	(3)	AC input terminal of the 24 V power module (JX02)
(4)	Single-phase SPD (F03)	(5)	Three-phase SPD 1 (F01)	(6)	Position for the Ethernet switch (SWITCH)
(7)	Position for the SmartMBUS CCO (MBUS CCO)	(8)	SmartLogger3000 (SmartLogger)	(9)	Optical fiber adapter (OFA01, OFA02)
(10)	Position for the PoE SPD	(11)	Position for the PoE module (POE)	(12)	Access terminal box (ATB)
(13)	Single-phase input switch (QF03)	(14)	Three-phase input switch (FU01)	(15)	RS485 communications terminal (JX01)
(16)	Position for the SmartModule1000A01	(17)	PE bar		

System Introduction — Smart PCS Cable Selection

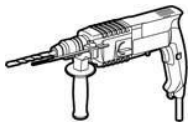
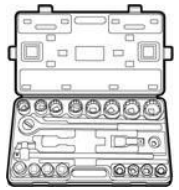
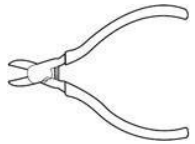
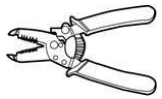
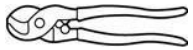
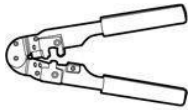
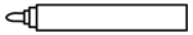
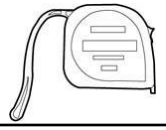
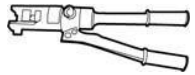
No.	Item	Type	Specifications	Source
1	Ground cable for the rack controller	Single-core outdoor copper cable	≥ 25 mm2	Prepared by the customer
2	Auxiliary AC power cable (with external grid power supply)	Two-core (L, N)/Three-core (L, N, PE) outdoor copper/copper-clad aluminum/aluminum alloy cable	6–25 mm2	Prepared by the customer
3	Single-phase AC input power cable (without external grid power supply)	Two-core/Three-core outdoor copper/copper-clad aluminum/aluminum alloy cable	6–25 mm2	Prepared by the customer
4	PE cable	Single-core outdoor copper cable and M10 OT/DT terminal	Conductor cross-sectional area ≥ S/2 [1] (S indicates the conductor cross-sectional area of the AC power cable.)	Prepared by the customer
5	AC power cable (either one)	Three-core (L1, L2, L3) outdoor cable and M12 OT/DT terminal (L1, L2, L3)	• Conductor cross-sectional area: 70–240 mm^2 • Cable outer diameter: 30–65 mm	Prepared by the customer
6		Single-core outdoor cable and M12 OT/DT terminal	• Conductor cross-sectional area: 70–240 mm^2 • Cable outer diameter: 15–35 mm	Prepared by the customer
7	FE communications cable	CAT 5E outdoor shielded network cable (internal resistance ≤ 1 ohms/10 m) and the shielded RJ45 connector	• Conductor cross-sectional area: 0.2 mm^2 • Cable outer diameter: 4.5–7.5 mm	The cable delivered with the device is 1.2 m long. You can also prepare a cable according to site requirements.

Note [1]: The value is valid only if the conductors of the PE cable and AC power cable are made of the same material. If the materials are different, ensure that the conductor cross-sectional area of the PE cable produces a conductance equivalent to that of the area S/2. The specifications of the PE cable are subject to this table or calculated according to IEC 60364-5-54.

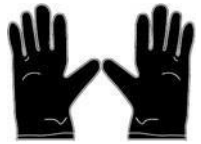
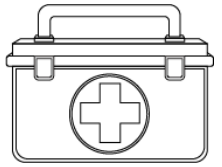
Contents

Personal Protection Equipment (PPE) Preparation

System installation tools

Hammer drill (drill bits: Φ14 mm and Φ16 mm) 	Socket wrench set 	Torque wrench (including an extension rod) 	Diagonal pliers 
Wire strippers 	Screwdriver suite Head: 0.6 mm x 3.5 mm 	Rubber mallet 	Utility knife 
Cable cutter 	RJ45 crimping tool 	Vacuum cleaner 	Multimeter DC voltage range ≥ 1500 V DC 
Marker 	Steel measuring tape 	Digital or bubble level 	Hydraulic pliers 
Heat shrink tubing 	Heat gun 	Cable tie 	Safety ladder 
Crane 	Lifting rope 	-	-

PPE

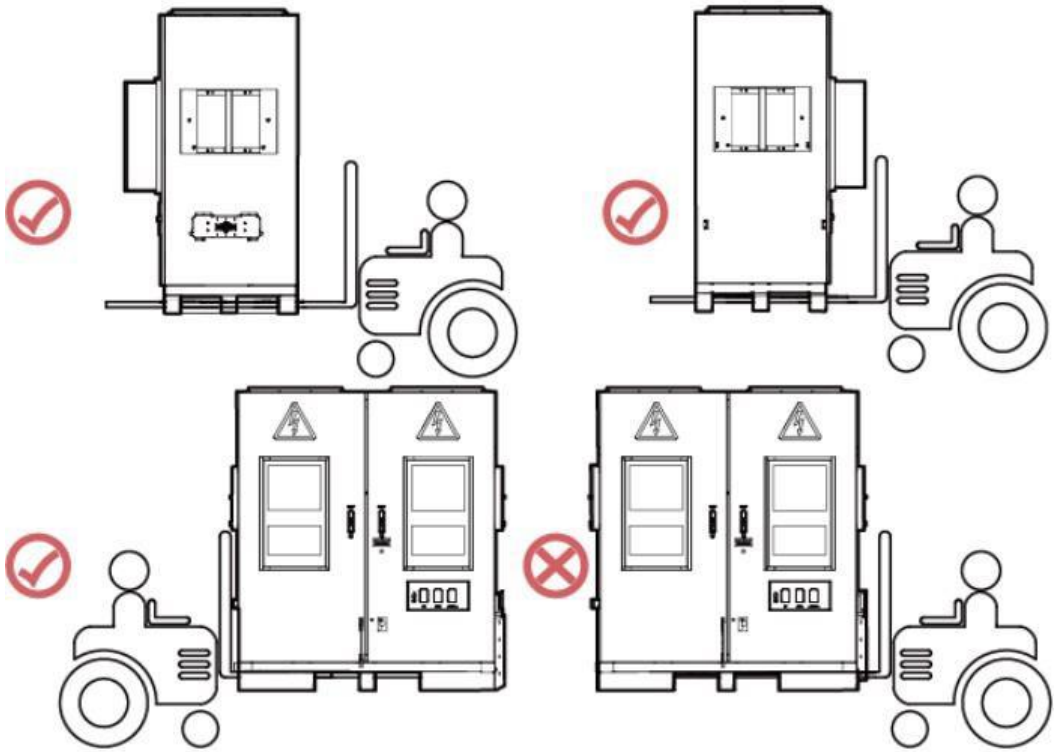
Safety gloves 	Safety goggles 	Dust mask 	Safety shoes 
Reflective vest 	Safety helmet 	Medical kit 	Workwear 

Note:
Before installing, commissioning, maintaining, and operating the system, comply with EHS regulations and wear appropriate PPE.

System Installation — Forklift Requirements

Forklift Requirements:

- Do not move the ESS after battery packs are installed.
- Before using a forklift, ensure that the forklift has a load-bearing capacity of at least 1 t.
- It is recommended that the length of the tynes be greater than or equal to 1.2 m, the width be 80 cm to 160 cm, and the thickness be 25 cm to 70 cm.
- 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.

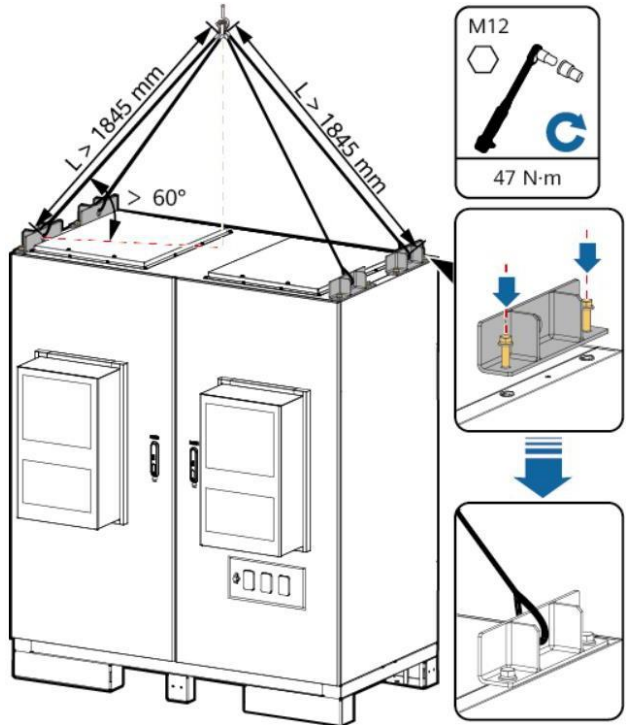


System Installation — Hoisting Requirements

Hoisting Requirements

Stage	Precautions
Before installation	Crane hoisting capacity ≥ 2 t, working radius ≥ 2 m. If the onsite environment does not meet the required working conditions, ask a professional to assess the conditions.
	Only trained and qualified personnel are allowed to perform hoisting operations.
	Check that hoisting tools are complete and in good condition.
	Ensure that the hoisting tools are secured to a load-bearing object or wall.
	When the equipment is used outdoors, it is recommended that you hoist the equipment when the weather is good and there is no wind.
	Ensure that the crane and steel ropes meet the requirements before the hoisting.
	All doors of the equipment are closed and locked.
	Ensure that the steel hoisting ropes are securely connected.
	It is recommended that the equipment be hoisted from left to right or from right to left.
During installation	Do not allow any unauthorized person to enter the hoisting areas and do not stand under the crane arm.
	Ensure that the crane is properly located and avoid long-distance hoisting.
	Keep the cabinet stable and horizontal during hoisting, and ensure that the diagonal gradient of the cabinet is less than or equal to 5 degrees.
	Ensure that the angle between two ropes is less than or equal to 90 degrees.
	Lift and land the cabinet slowly to prevent shock to equipment inside it.
	Remove the ropes after ensuring that the cabinet is placed evenly on the cabinet base.
	Do not drag steel ropes or lifting appliances. Do not collide with the equipment.
	Secure the cabinet you have hoisted before hoisting another cabinet.

- Before hoisting, ensure that the crane and hoisting ropes meet the load-bearing requirements.
- When installing or removing the hoisting equipment, do not drag it on the cabinet to prevent scratches.
- Do not hoist or move the ESS after battery packs are installed.



Checking Before Installation — Unpacking the ESS

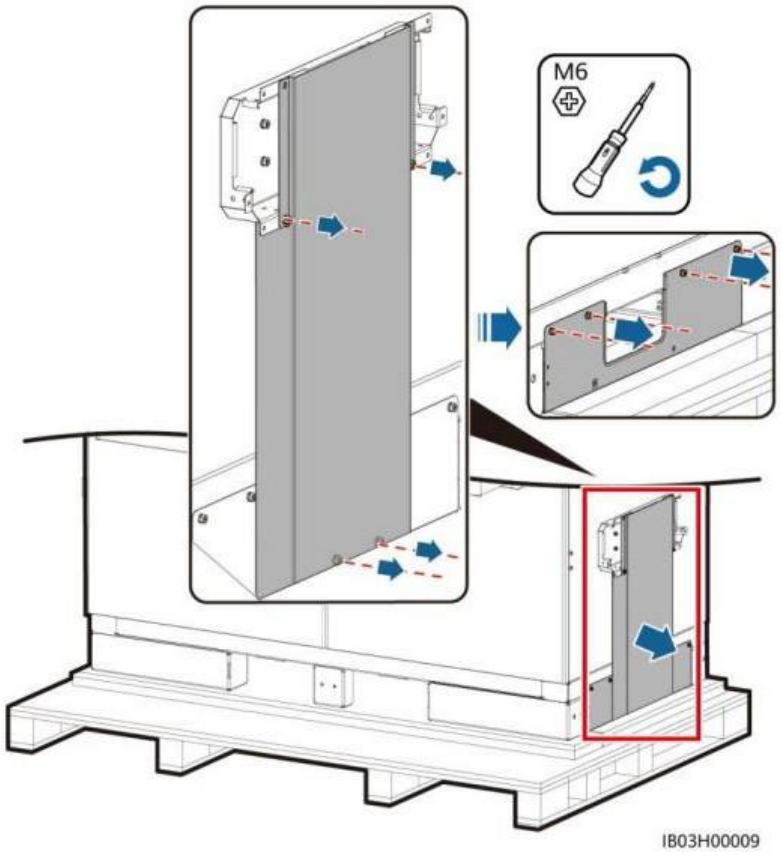
Note:

After the ESS is installed, perform the following operations:

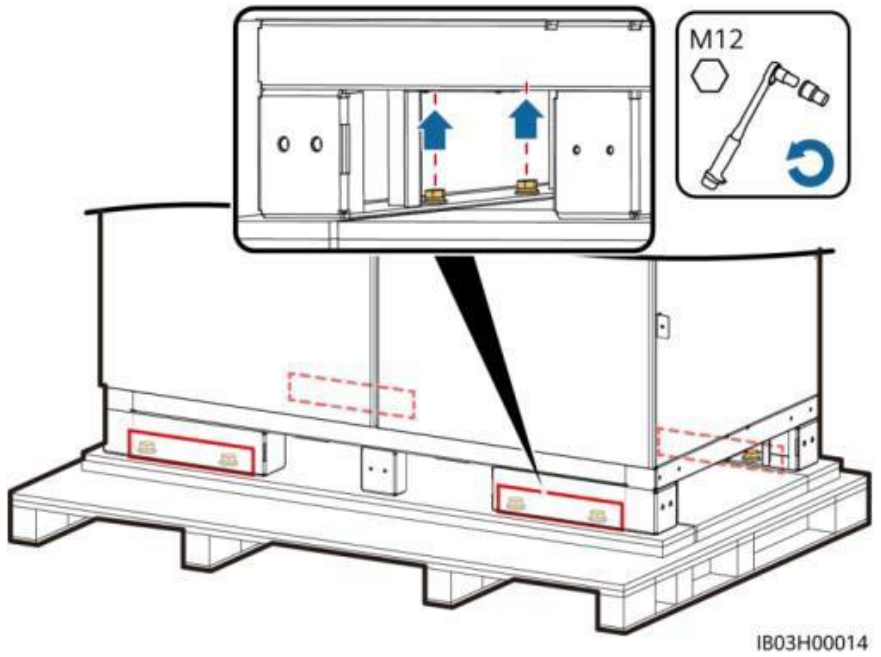
- Check the installed ESS. If any anomaly is found, take photos and confirm with the customer or general contractor.
- Obtain the keys to the ESS doors and check the materials.
- Before installation, unpack and inspect the ESS together with the customer or general contractor. If any issue is found during the inspection, take photos and record them (confirm whether the ESS is picked up by the customer or delivered by the Company).
- Unpack and check the ESS according to the material list.

System Installation — Installation with the Forklift/Crane

1. Remove the pallet.



2. Remove the baffle plate from the bottom of the ESS.



Note:

- Remove the cable trough cover of the rack controller on the right before removing the bottom pallet.

Equipment Installation Foundation — ESS Installation Check

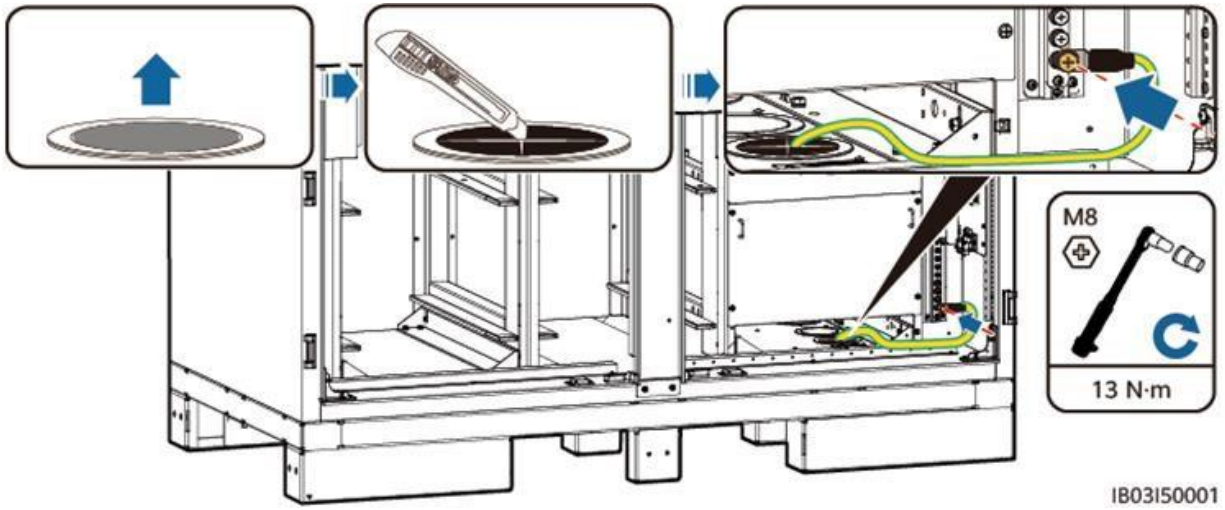
Before securing the ESS, check that the load-bearing points of the ESS are closely fitted to the foundation and that the foundation levelness deviation is less than 3 mm.

Leveling spacer

Note:

- Check that the doors of the ESS can be properly opened and closed.
- After the ESS is leveled, use expansion screws to secure it.
- Do not install battery packs in the ESS before the ESS is secured.

Cable Connection — Installing PE Cables



Item	Category	Conductor Cross-Sectional Area	Outer Diameter	Terminal	Source
PE cable	Single-core outdoor copper/copper-clad aluminum/aluminum alloy cable	25–50 mm^2	15–17.6 mm	M8 OT/DT terminal	Prepared by the customer
The specifications of the PE cable are subject to this table or calculated according to IEC 60364-5-54.					

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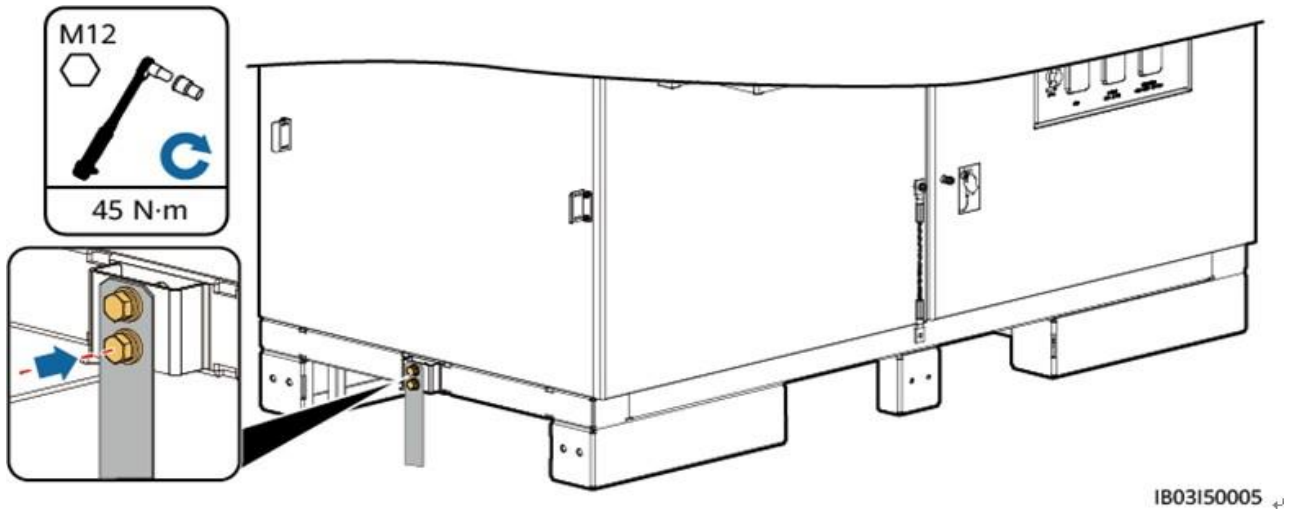
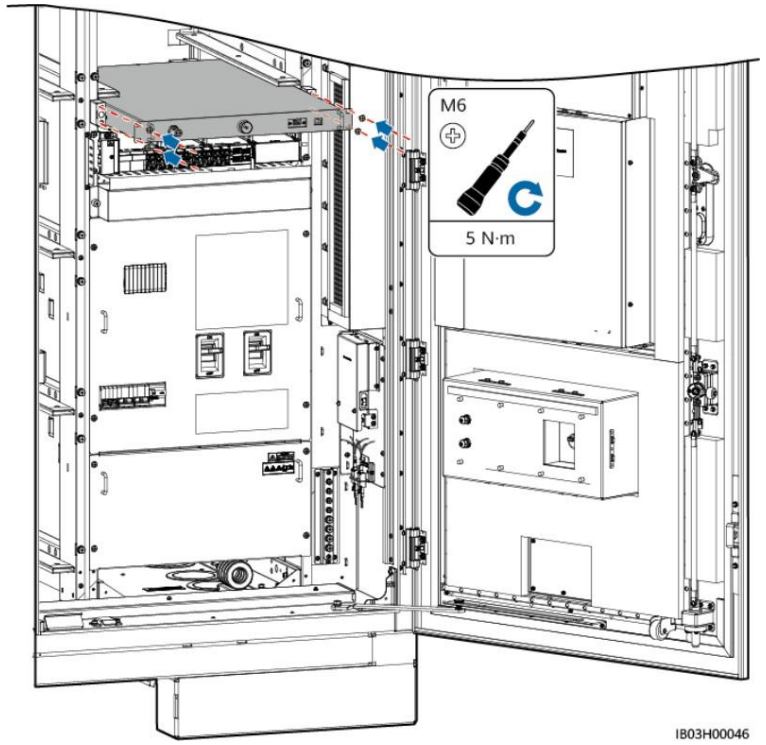
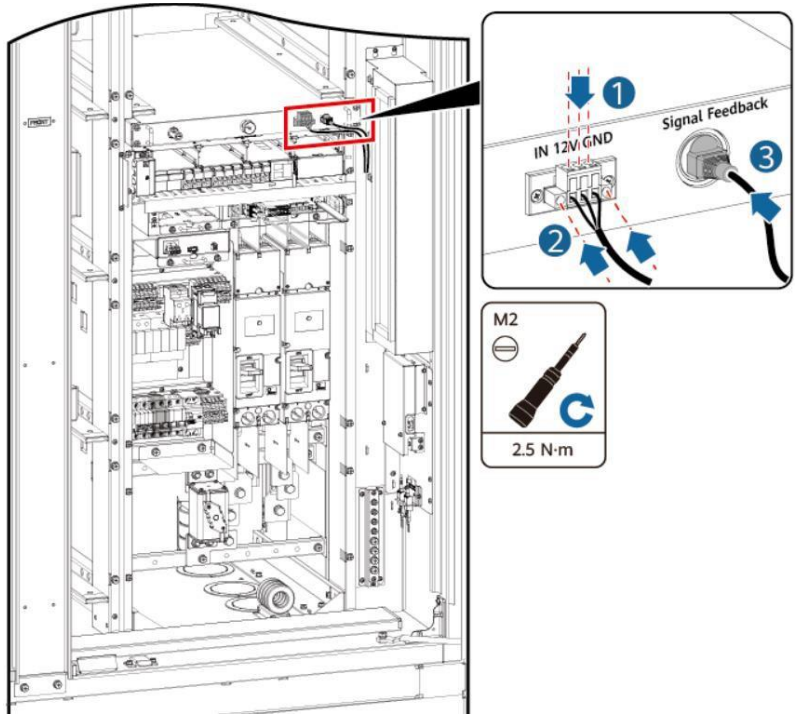
Cable Connection — Installing PE Cables (Optional)



Item	Category	Conductor Cross-Sectional Area	Outer Diameter	Terminal	Source
PE cable	Single-core outdoor copper/copper-clad aluminum/aluminum alloy/hot-dip galvanized flat steel cable	25–50 mm^2	15–17.6 mm	M8 OT/DT terminal	Prepared by the customer
The specifications of the PE cable are subject to this table or calculated according to IEC 60364-5-54.					

Equipment Installation– Installing the Rack Mounted Fire Extinguishing System





Note:

- Ensure that the rack mounted fire extinguishing system is intact.
- Confirm that the pressure gauge pointer is in the green area before installation.

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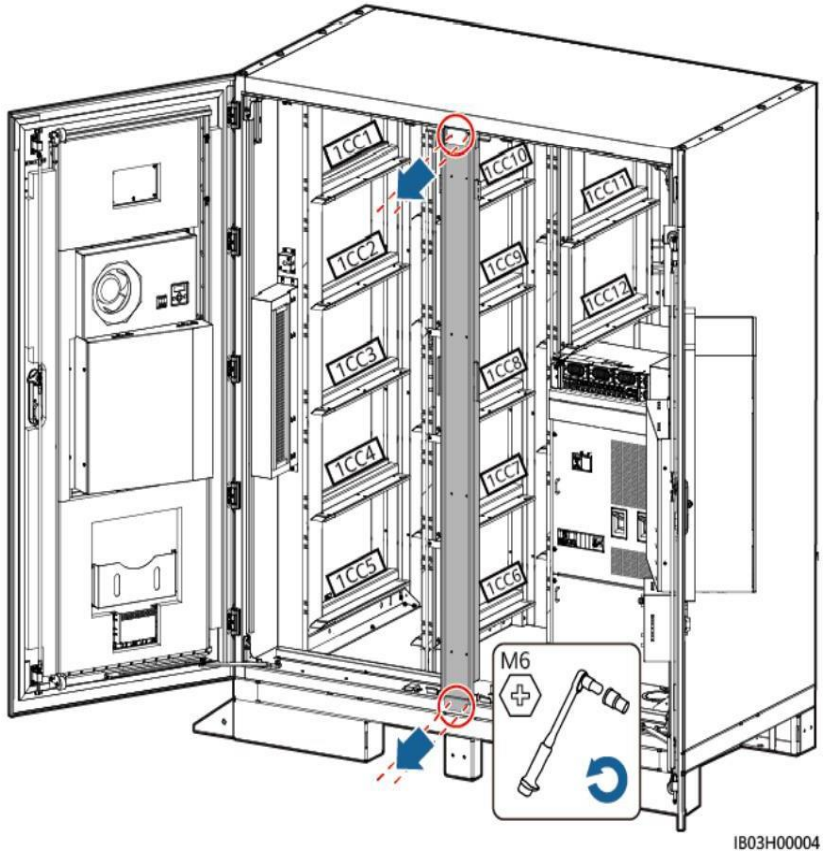
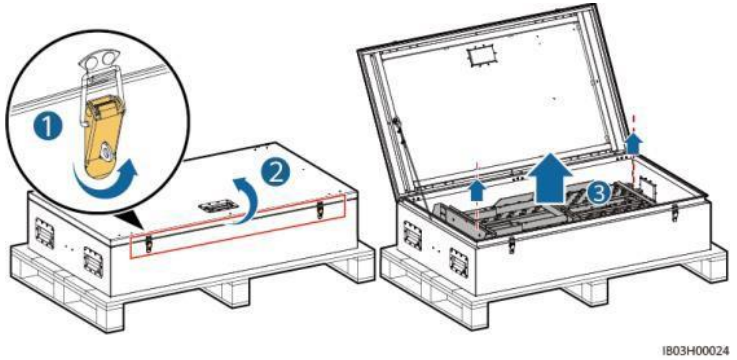
Equipment Installation — Installing the Battery Pack

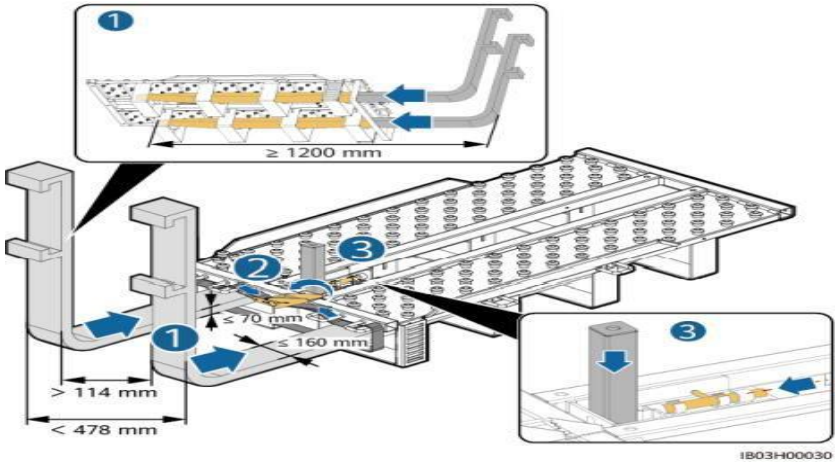
Step 1 Remove the column in the middle.



Step 2 Take out the installation kit.



Step 3 Insert the installation kit into the forklift and secure it.



Note:

- Do not move the battery pack after it is installed.

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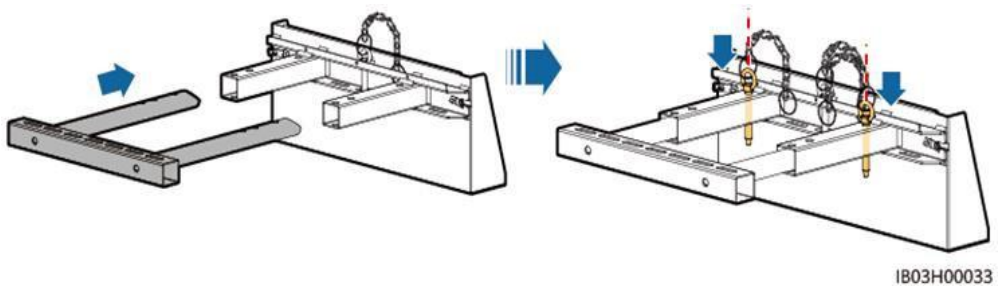
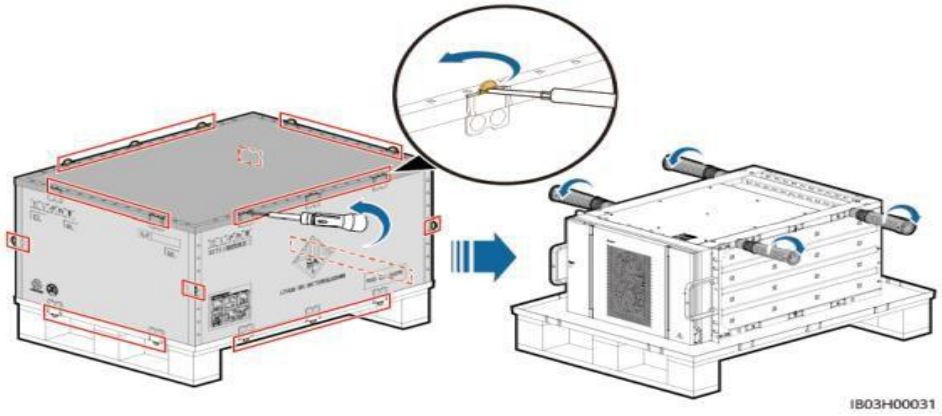
Equipment Installation — Installing the Battery Pack

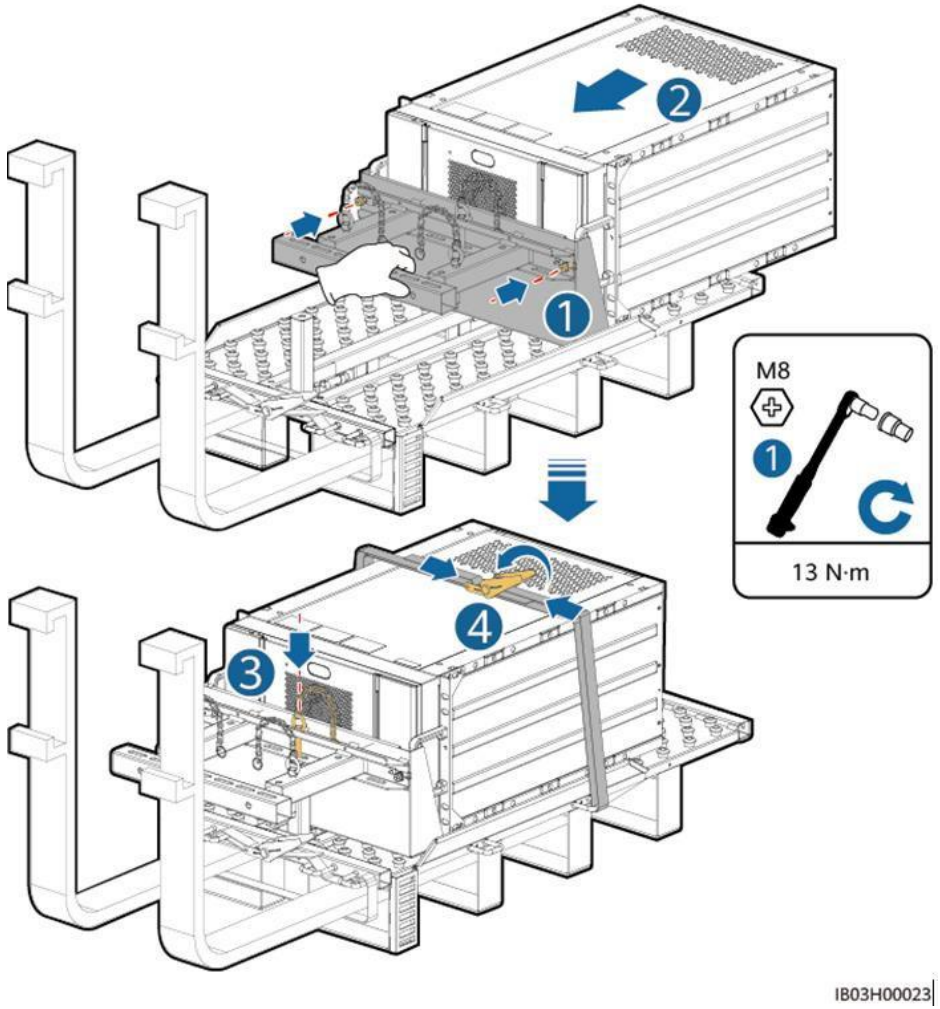
Step 4 Install the battery pack operation handle.



Step 5 Take out the battery pack.



Step 6 Install and secure the battery pack on the installation kit.



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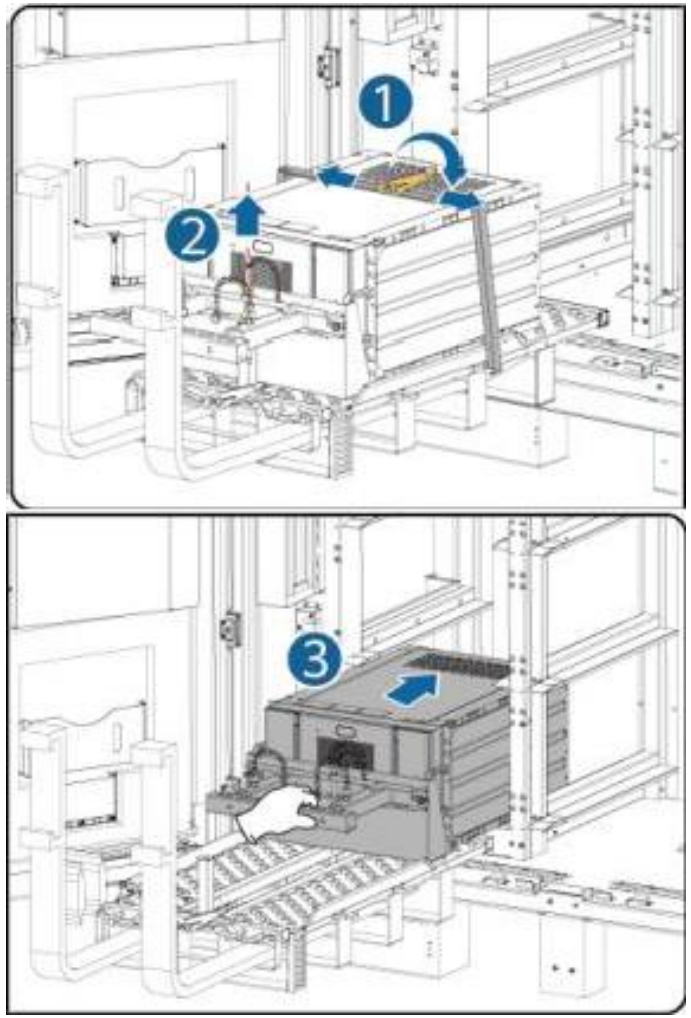
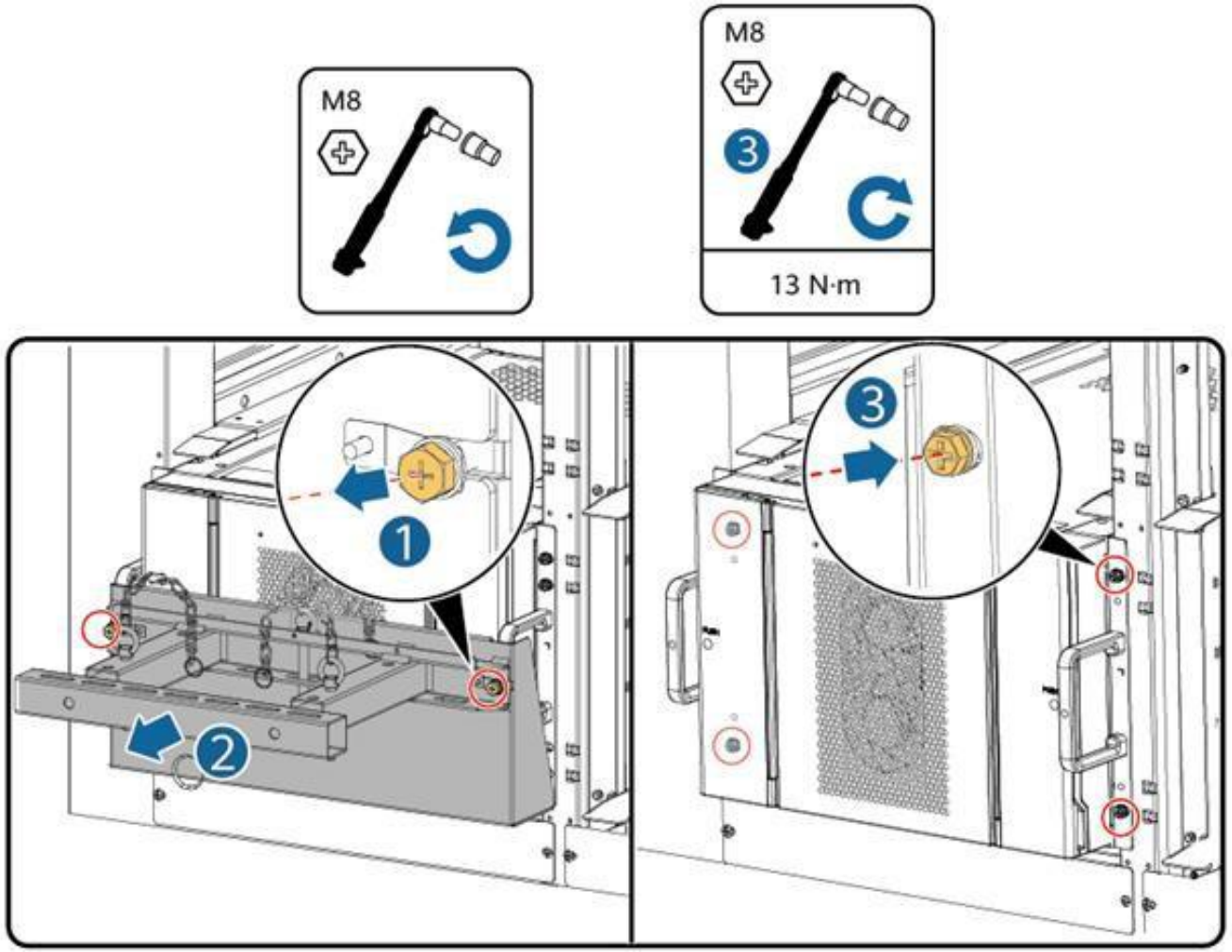
Equipment Installation — Installing the Battery Pack

Step 7 Install the battery pack in the ESS.



Step 8 Secure the battery pack.



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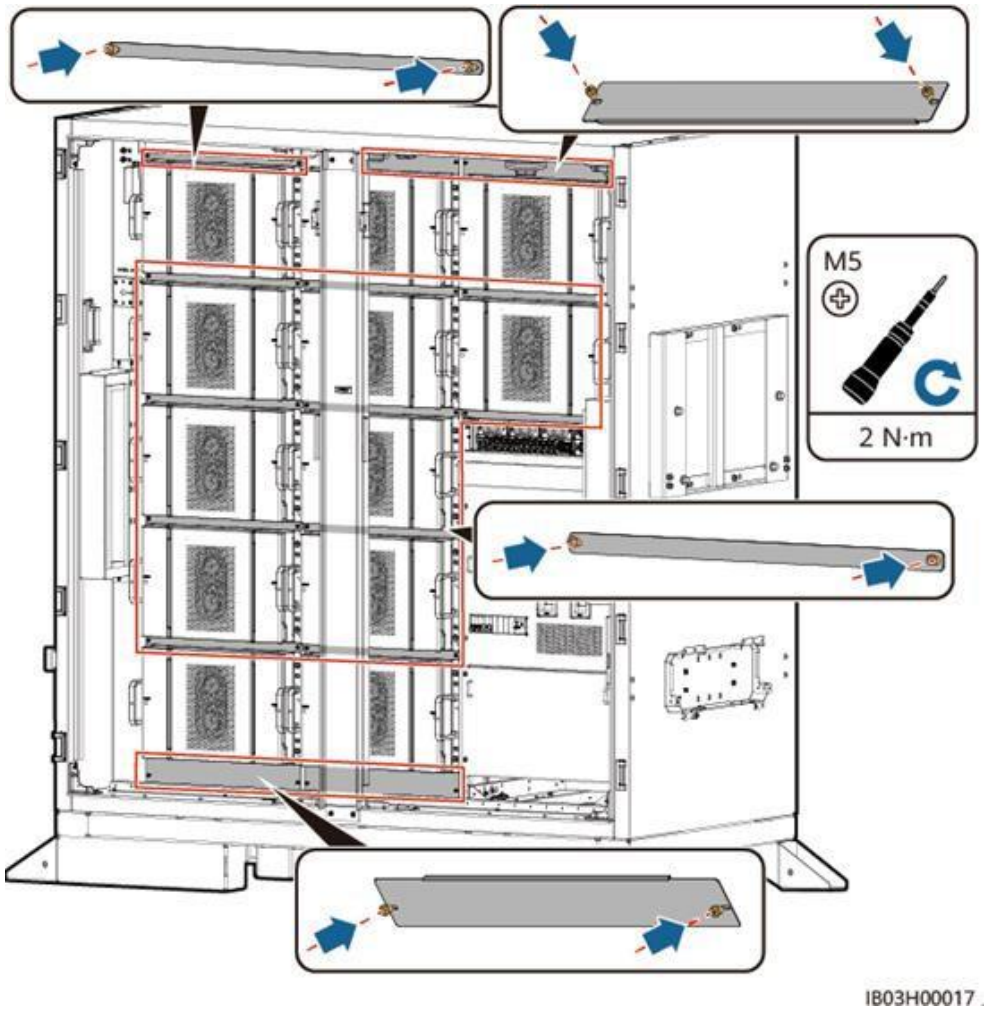
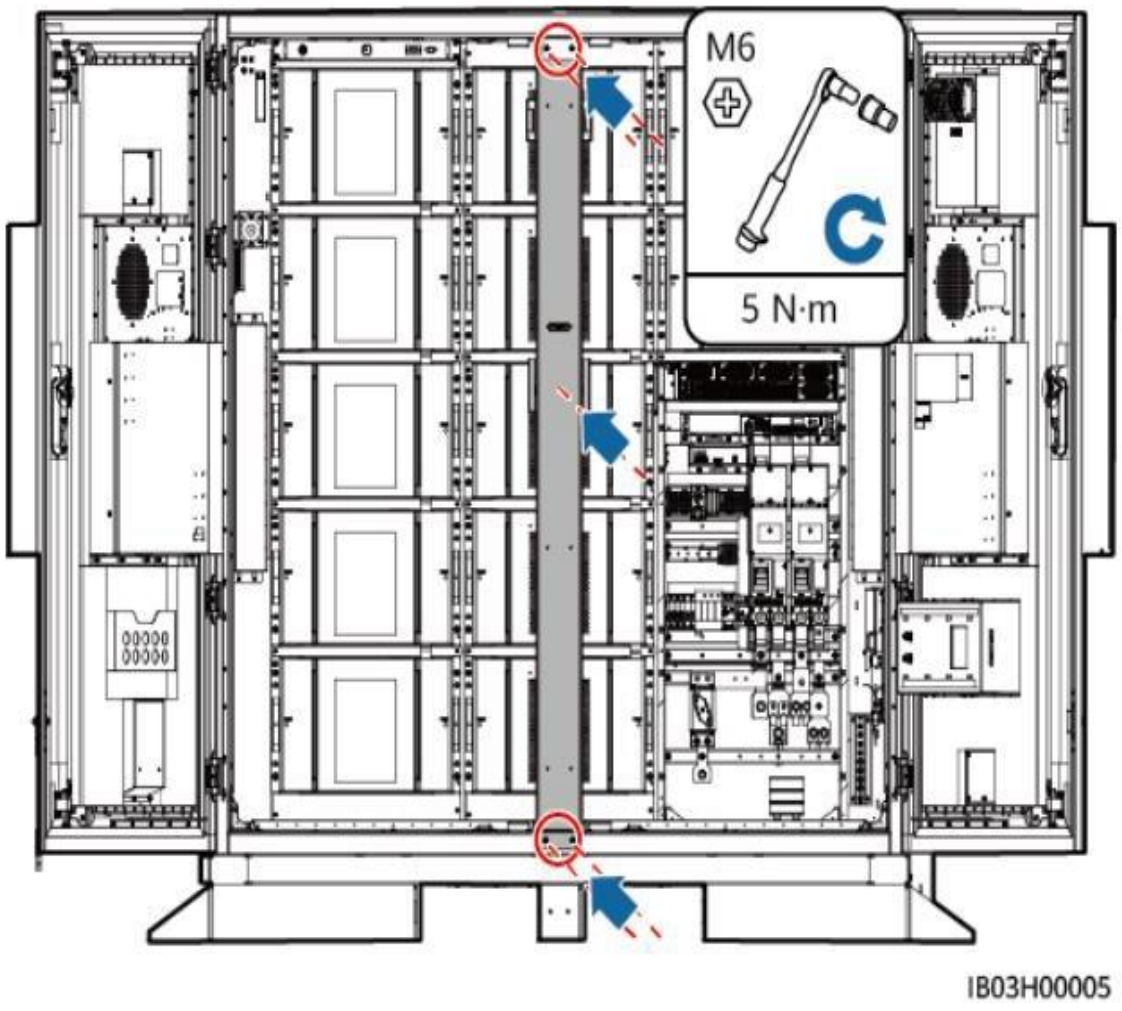
Equipment Installation — Installing the Battery Pack

Step 9 Install air channel plates between battery packs.



Step 10 Install the columns of the ESS.



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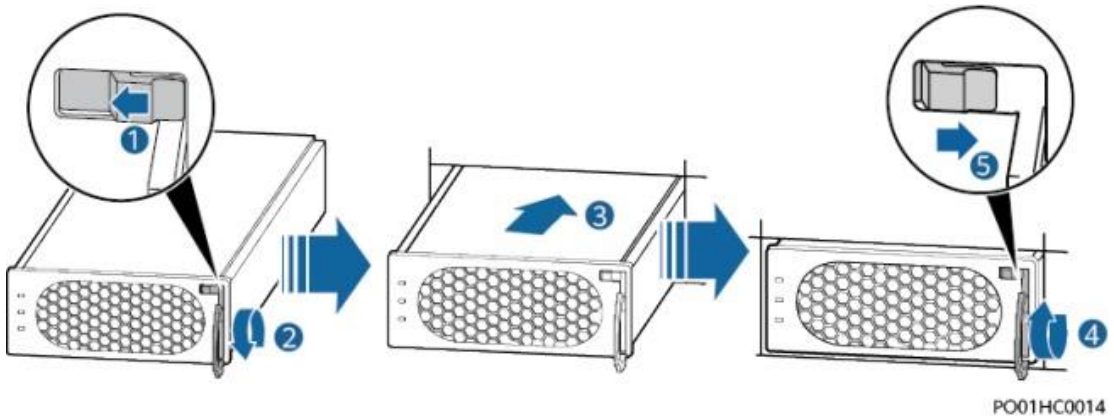
Equipment Installation — Installing the PSU

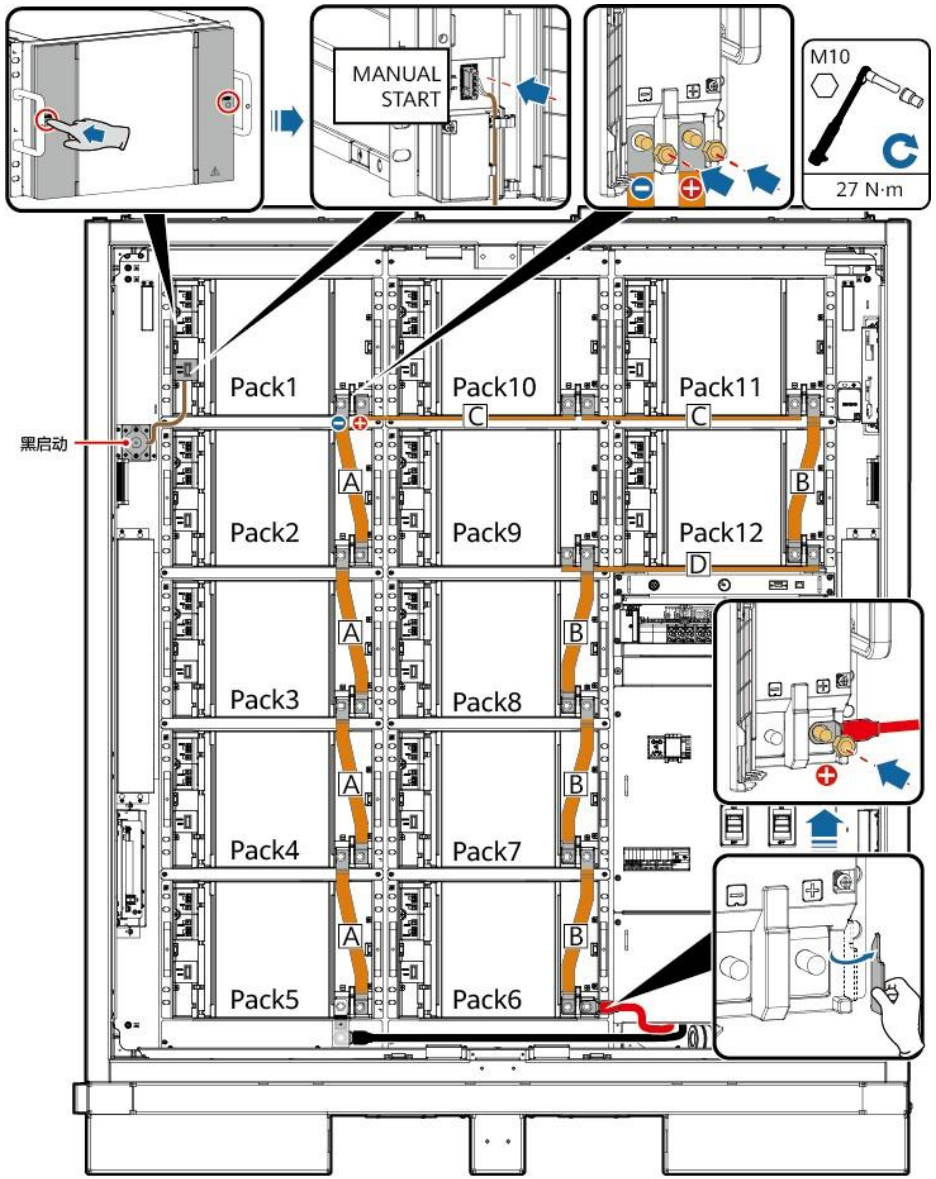
1. Push the locking latch leftwards and pull out the handle.
2. Gently push the power supply unit (PSU) into its slot along the guide rails.
3. Push the handle upwards.
4. Push the locking latch rightwards to lock the handle.



Note:

- The PSU must be installed within 24 hours before it is powered on. If the PSU cannot be powered on in time, place it in a dry indoor environment without corrosive gases.

Cable Connection — Battery Copper Bars



Note:

Install copper bars for battery packs, and connect the battery rack general output power cable and black start cable.

- Four types of copper bars are included with the equipment and are identified by the silkscreens A, B, C, and D printed on the front. Copper bars are installed in the sequence of Pack5-4-3-2-1-10-11-12-9-8-7-6.
- When installing copper bar C, keep away from communications cables and fan power cables of battery packs to prevent cables from being squeezed.
- Install and check nuts according to the recommended torque of 27 N·m.
- Mark the nuts whose torque has been verified using a marker.
- If the battery protective cover is abnormal or difficult to close, adjust the gap between copper bars by moving them upwards or downwards. Do not forcibly close the battery protective cover.

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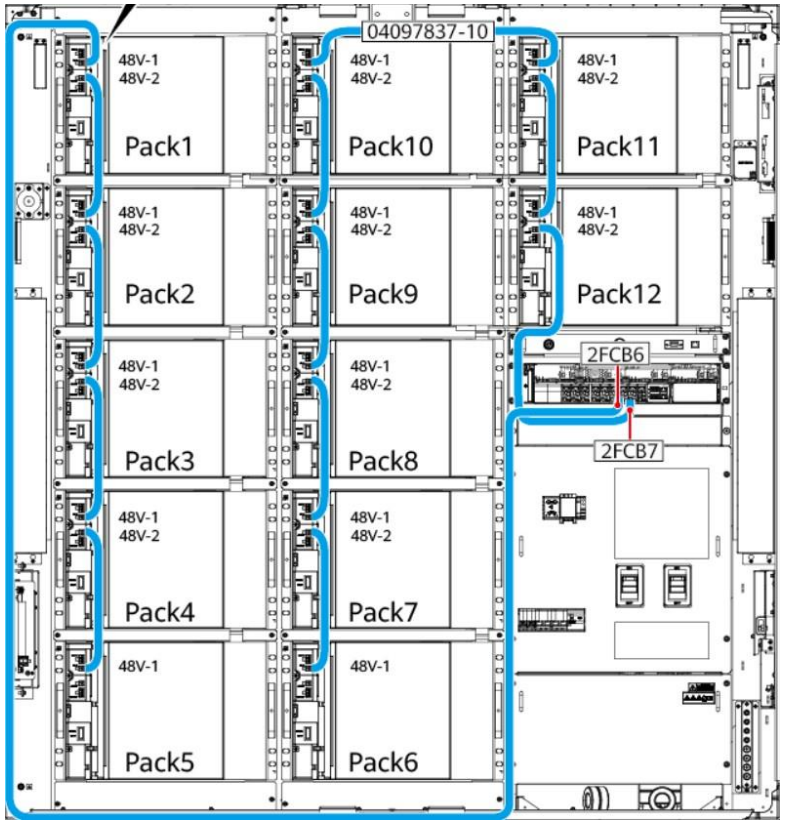
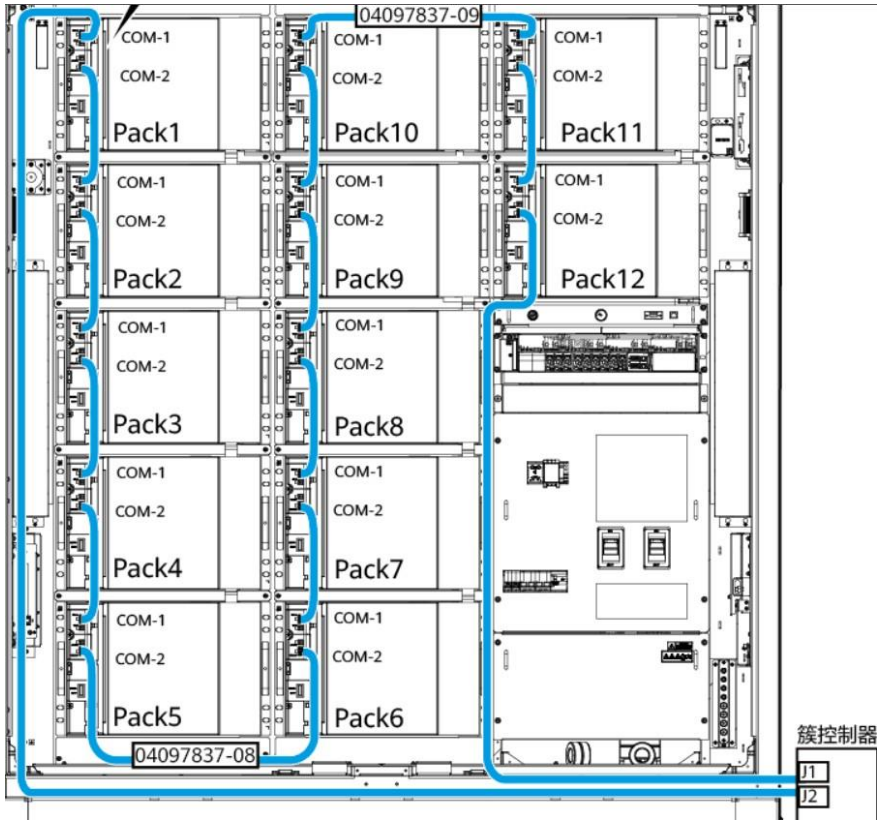
Cable Connection — Installing 48 V Cables

Connecting 48 V cables to battery packs



Connecting COM port cables to battery packs



Note:

- Cables are routed through the cable troughs. COM cables and 48 V cables are routed in parallel without crossing each other.
- Cables to 2FCB6 and 2FCB7 are preinstalled before delivery.
- Cables to COM-1 on Pack1 and COM-2 on Pack12 are reserved before delivery.

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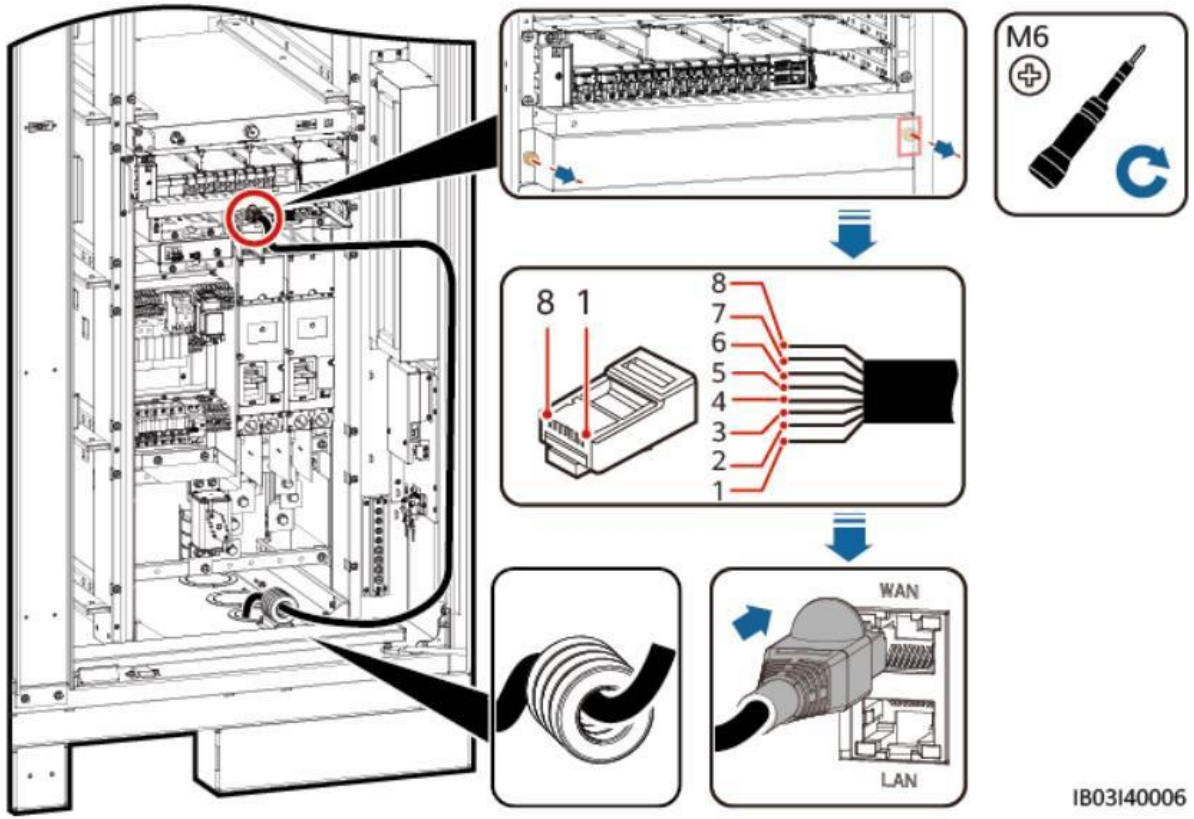
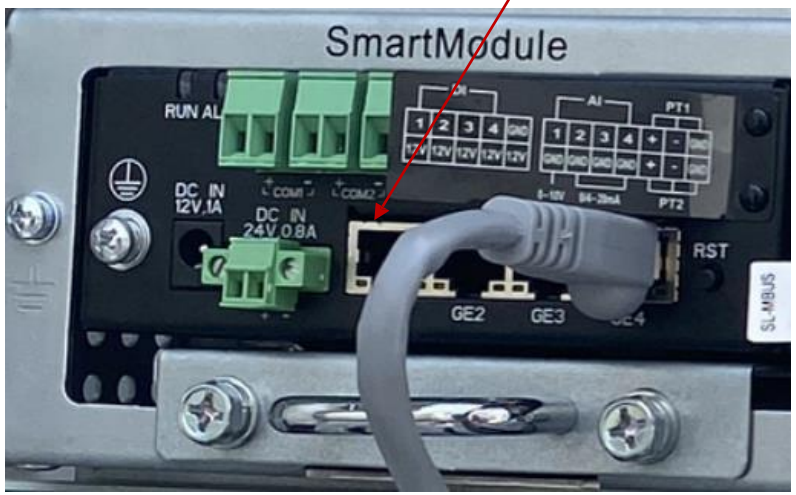
Installing a FE Communications Cable

Connect the FE communications cable to the **WAN** port on the CMU. Connect the other end to the SmartModule in the data acquisition cabinet and bind the cables.



You are advised to connect the other end of the CMU cable to the GE1 port on the SmartModule in the communications cabinet.



Note:

- The communications cable needs to be routed through the magnetic ring at the cable hole at the bottom.

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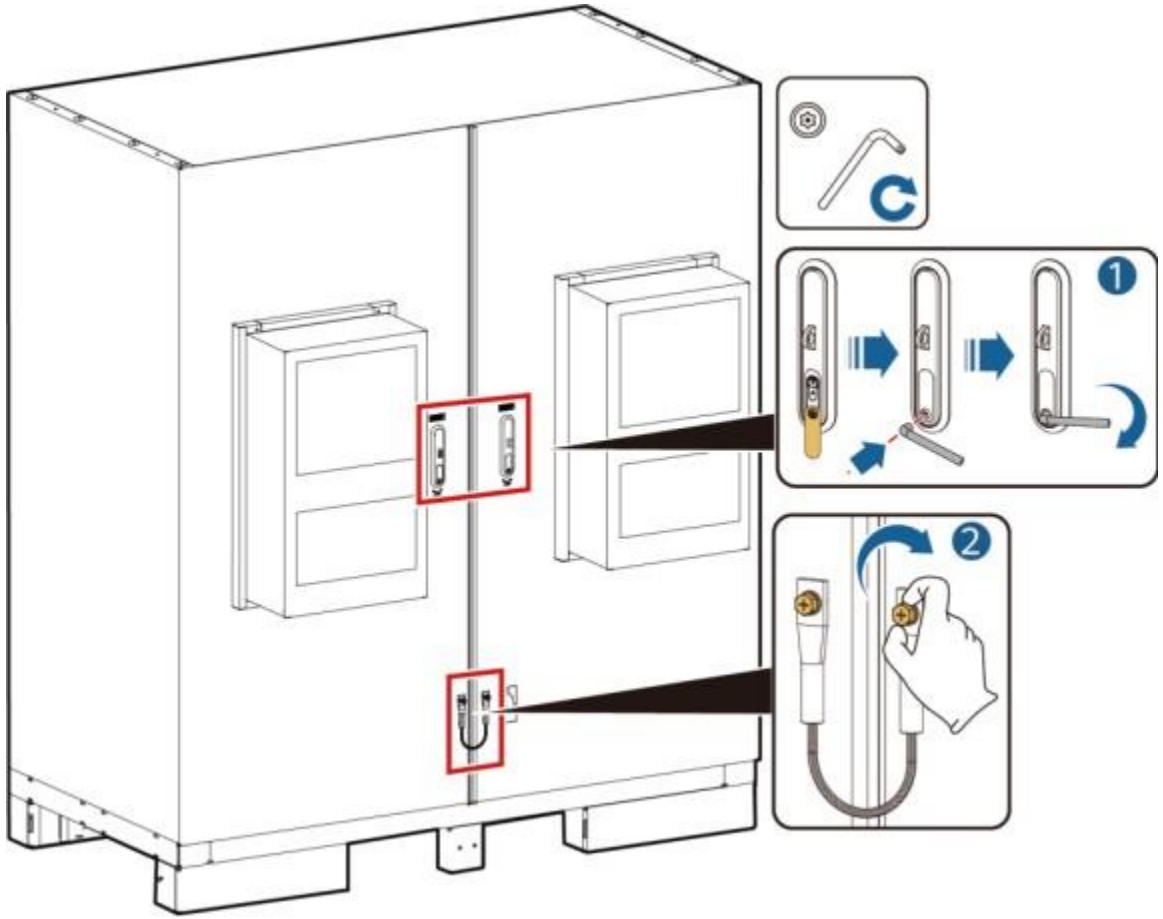
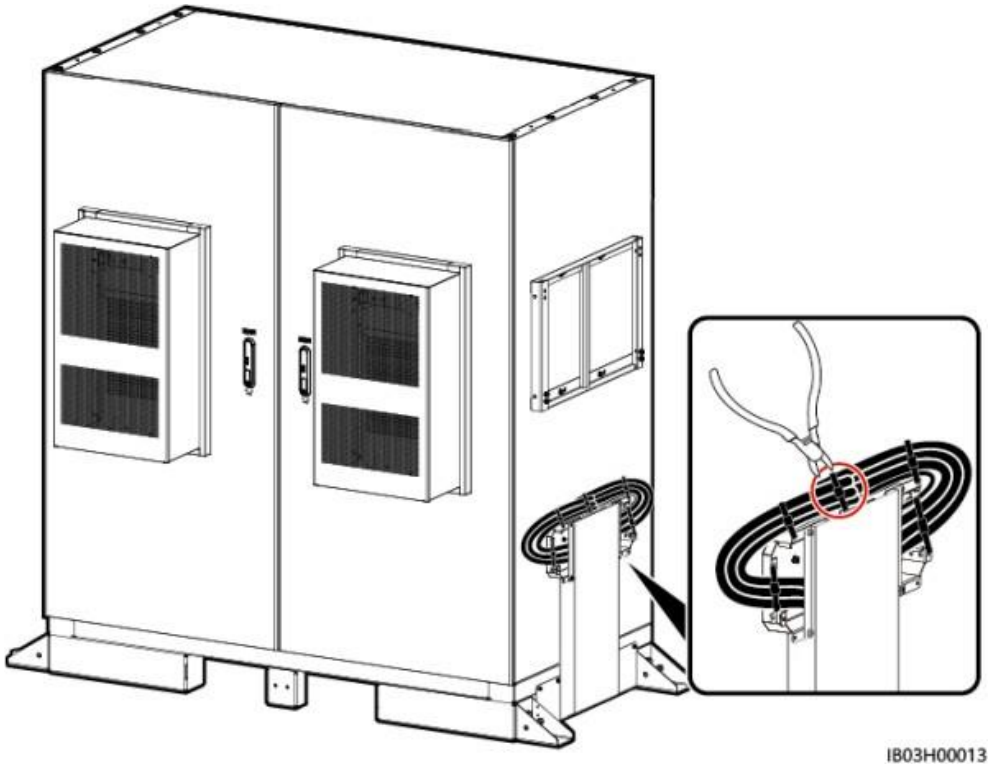
Closing ESS Doors

After the installation is complete, close the ESS doors and secure the safety rope.

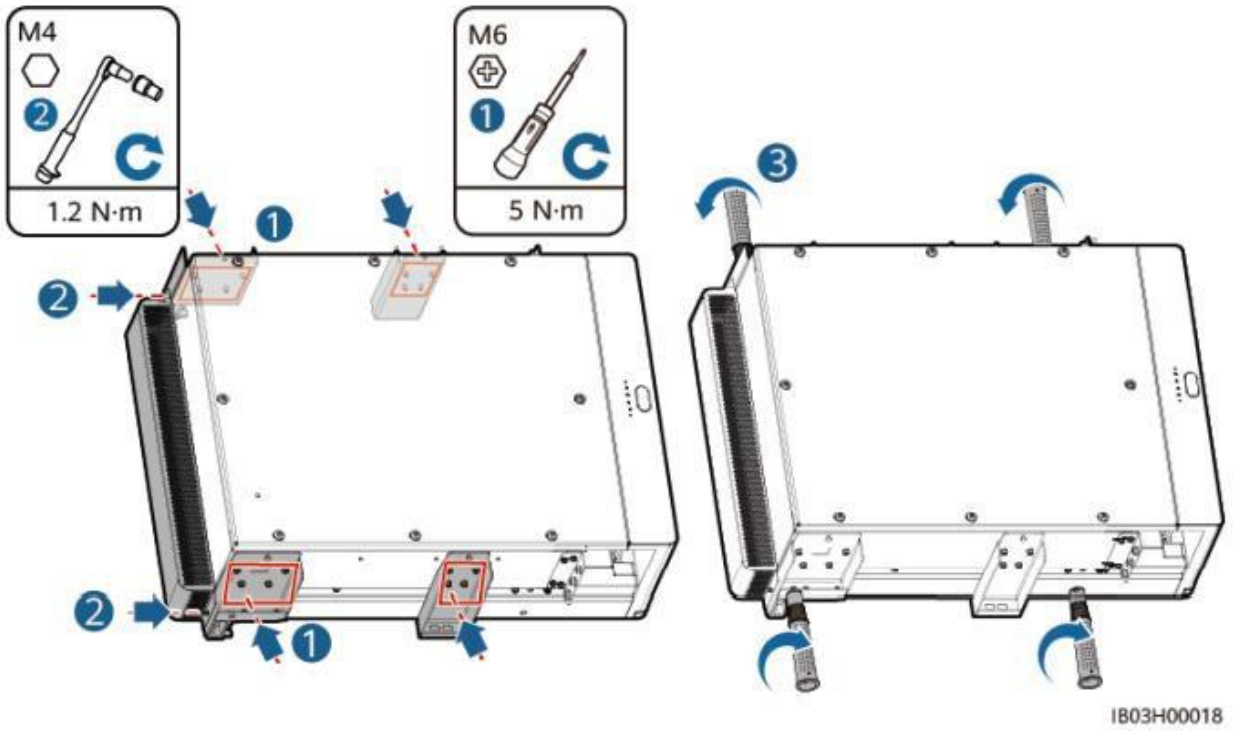


Equipment Installation — Installing Rack Controllers

Step 1 Remove cables bound on the outside of the ESS.



Step 2 Install the mounting ears, rainproof canopy, and lifting handles to the rack controller.

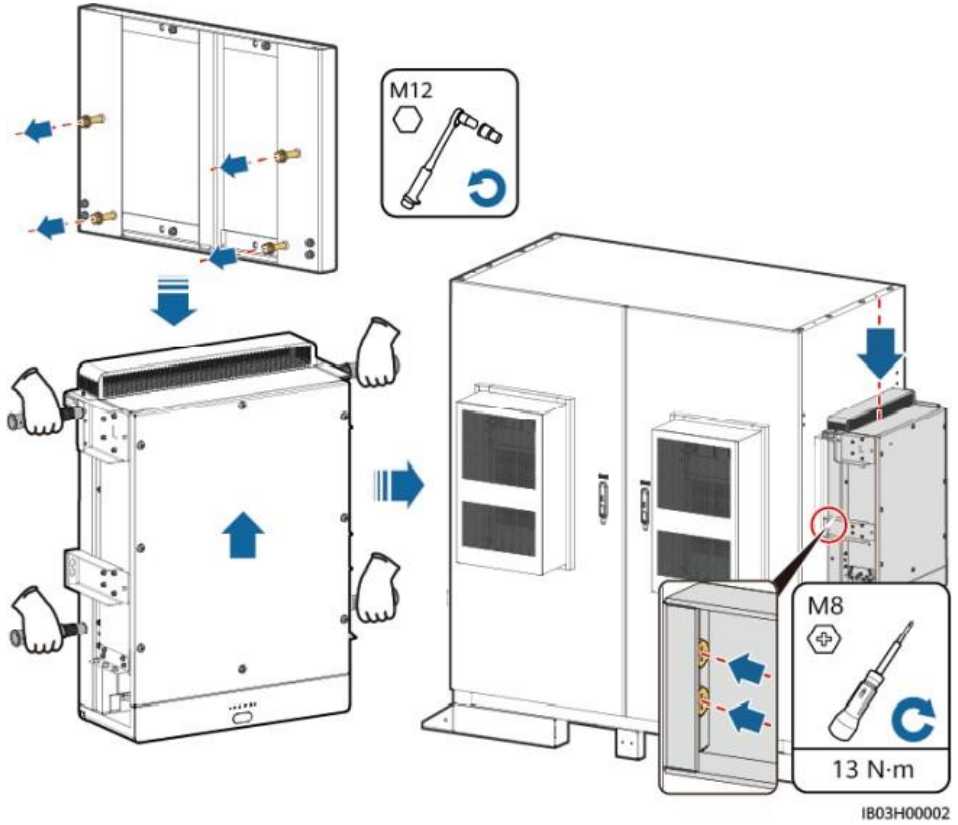


Note:

- The mounting ears, rainproof canopy, and lifting handles of the rack controller are delivered with the product.

Equipment Installation — Installing Rack Controllers

Step 3 Install the rack controller on the installation kit of the ESS.

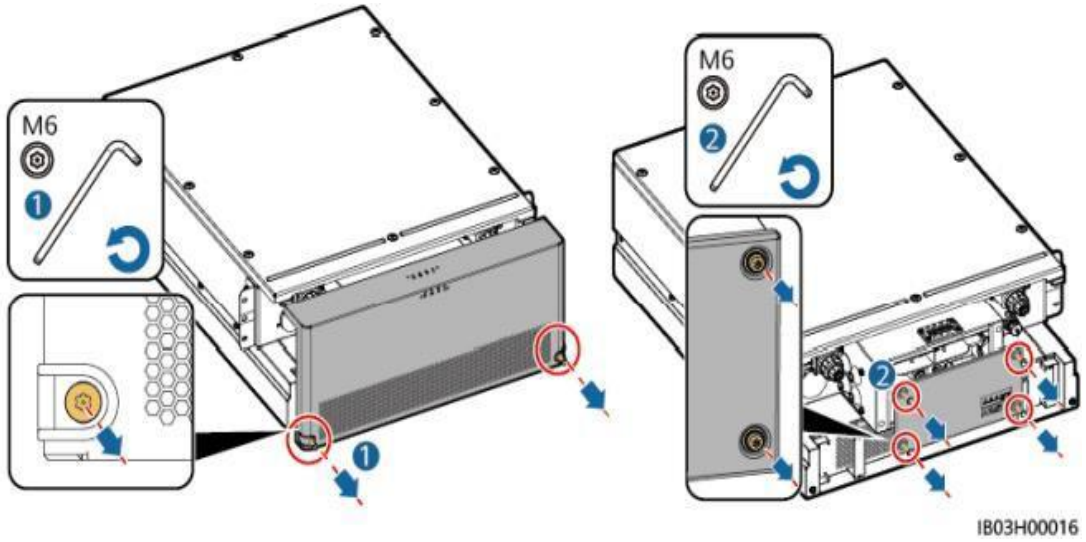


Note:

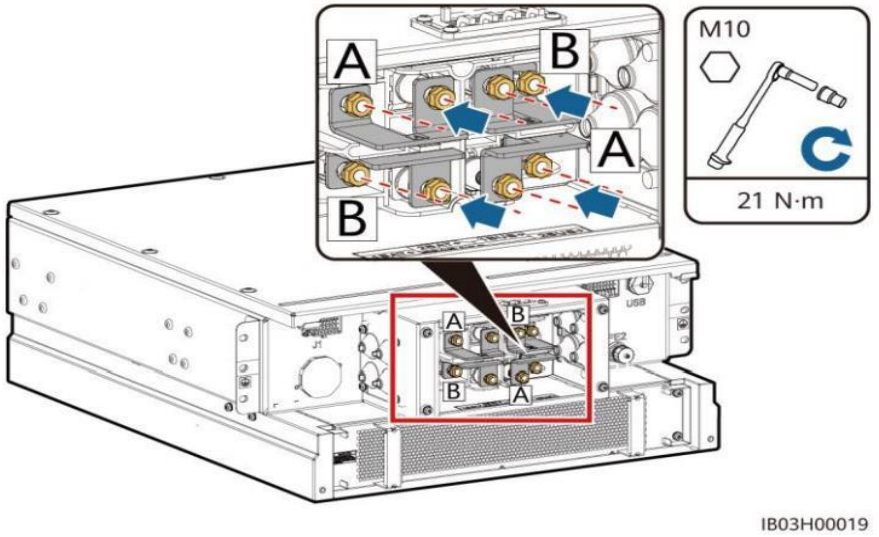
- When lifting the rack controller, align the screw holes on both sides before securing it.
- When using the lifting handles, hold the handle end closer to the equipment.
- It is recommended that mounting ears and cable trough covers be installed after cables are installed.

Equipment Installation — Installing Rack Controller Short-Circuit Copper Bars

Step 1 Remove the decorative cover and maintenance compartment cover from the rack controller.

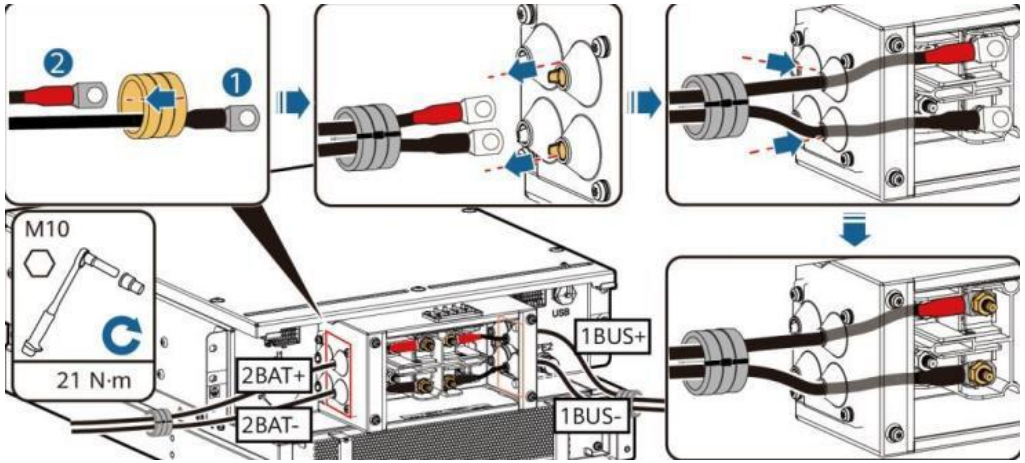


Step 2 Install the short-circuit copper bars delivered with the product.



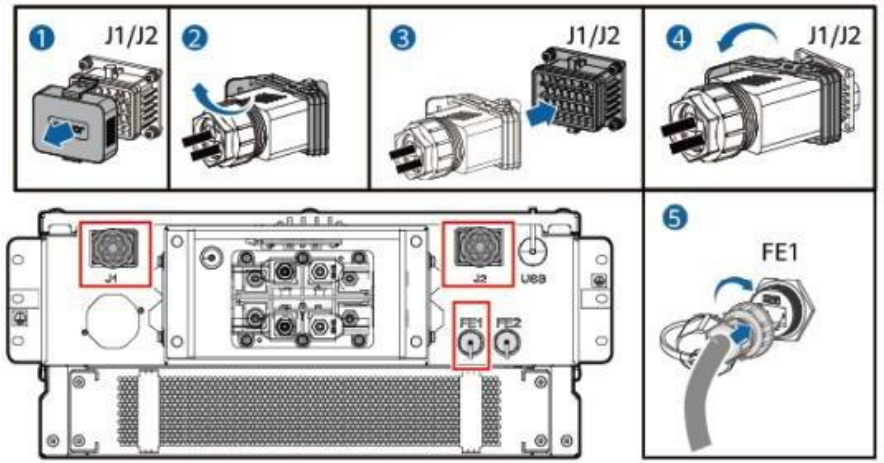
Cable Connection — Connecting Cables to the Rack Controller

Step 1 Connect the preinstalled cables to the BAT/BUS ports.



Cable Label	Wiring Terminal
107-1F1:2→TA1:2BAT+	2BAT+
108-1Q2:1→TA1:1BUS+	1BUS+
109-1Q1:4→TA1:2BAT-	2BAT-
111-1Q2:3→TA1:1BUS-	1BUS-

Step 2 Connect the preinstalled cables to J1, J2, and FE1 ports.



Note:

- Do not remove the cover from an unused pagoda connector.
- The positive and negative power lines should be routed through the magnetic rings in turn.

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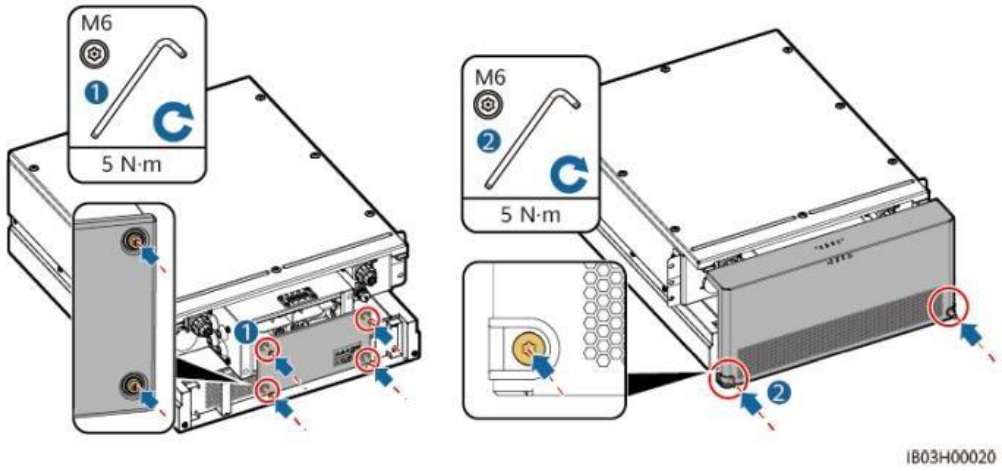
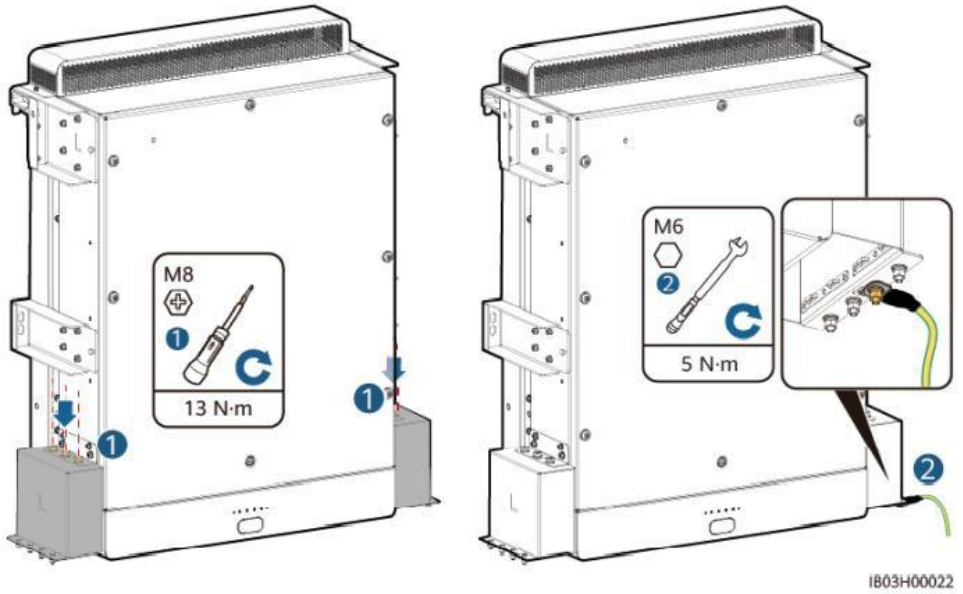
Cable Connection — Connecting Cables to the Rack Controller

Step 3 Install the decorative cover and maintenance compartment cover to the rack controller.



Step 4 Install the protective cover delivered with the product and connect the PE cable.



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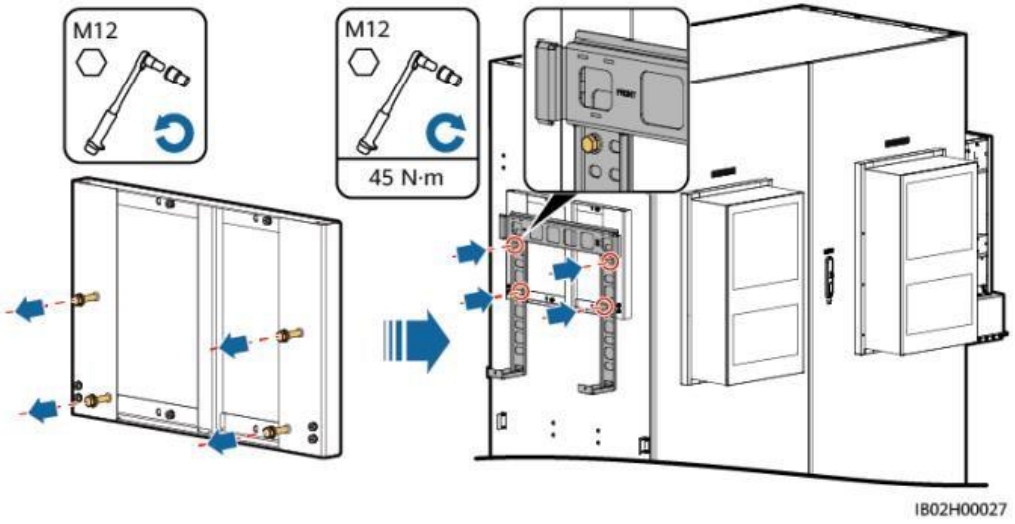
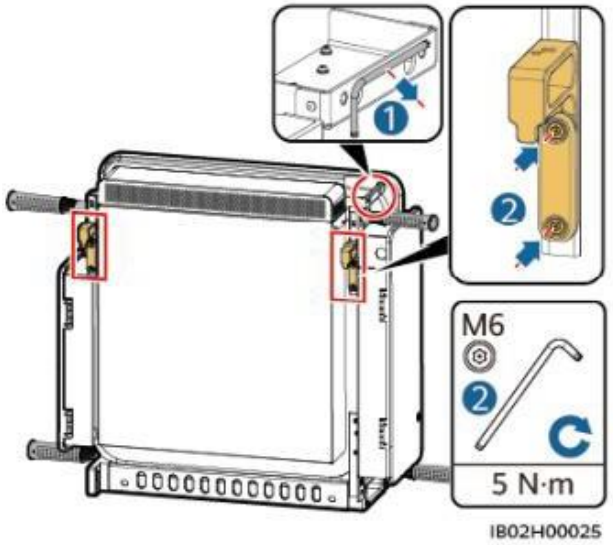
Equipment Installation — Installing the Smart PCS

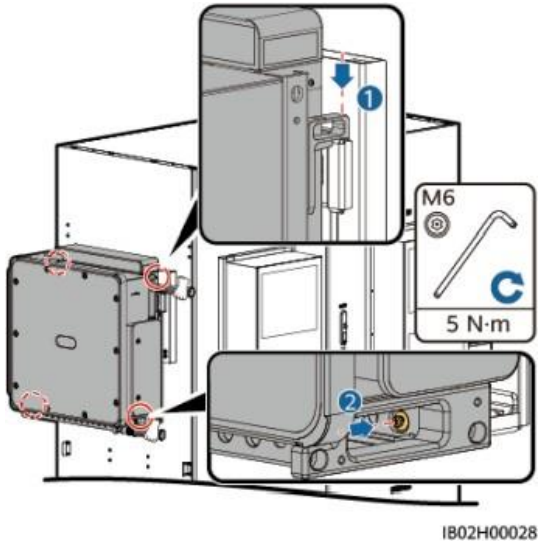
Step 1 Install the installation kit.



Step 2 Install mounting ears and lifting handles.



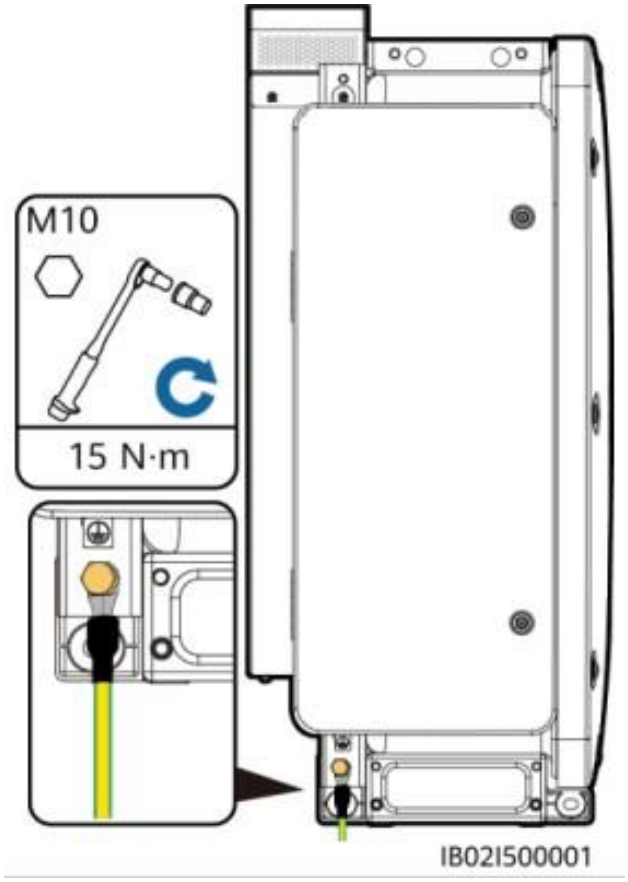
Step 3 Secure the Smart PCS.



Note:

- Install the support and mounting ears before transportation. The installation kit is delivered with the Smart PCS.
- During installation, place the Smart PCS on the support, clamp the mounting ears, and secure the screws at the bottom.
- At least four persons are required to move the Smart PCS.
- When using the lifting handles, hold the handle end closer to the equipment.

Cable Connection — Installing the PE Cable



Note:

- It is recommended that the Smart PCS be grounded locally. The ground points of all Smart PCSs in the same array need to be connected to ensure equipotential connection to PE cables.(e.g.multiple devices are connected to the same ground grid.)
- The ground point in the AC maintenance compartment serves only as the equipotential connection point of the protective ground point and cannot replace the protective ground point of the enclosure.

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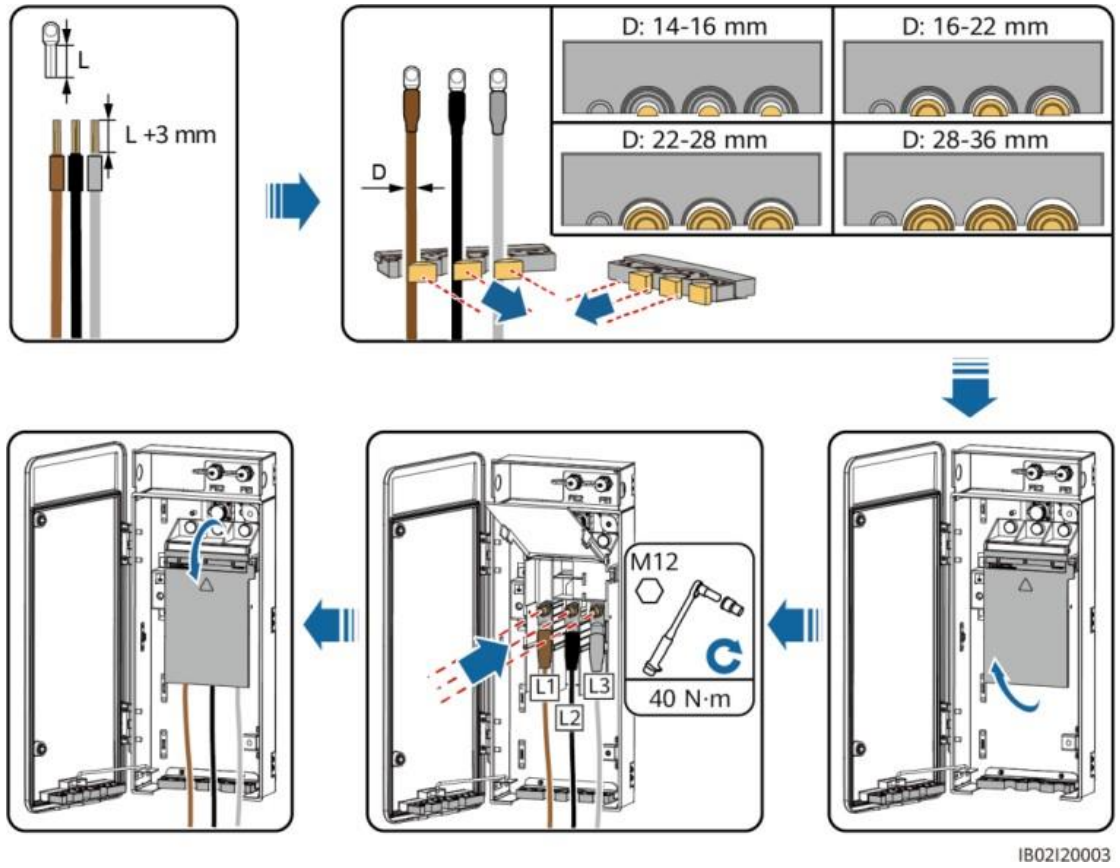
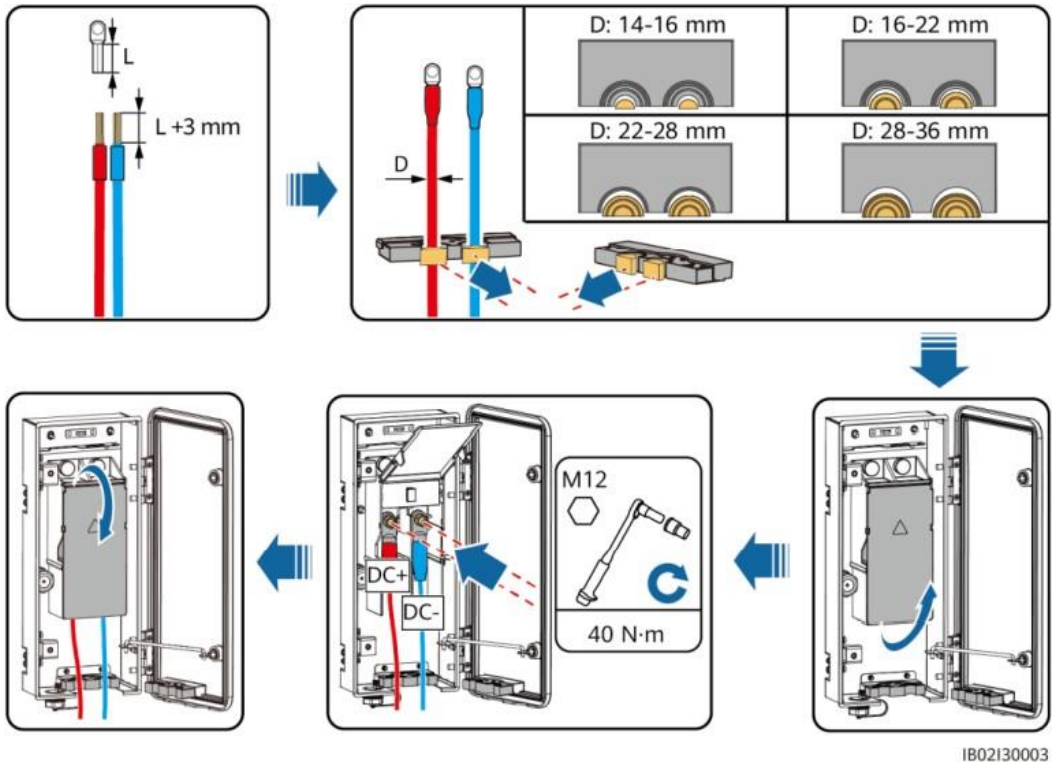
Cable Connection — Connecting AC Power Cables to the Smart PCS



Note:

- Remove the rubber rings according to the cable diameter range, and ensure that the crimping module is not damaged. Otherwise, the protection level of the device will be affected.
- Ensure that the AC power cables are connected securely. Otherwise, the Smart PCS may fail to operate, or be overheated in operation due to unreliable connection, which will damage the terminal block.

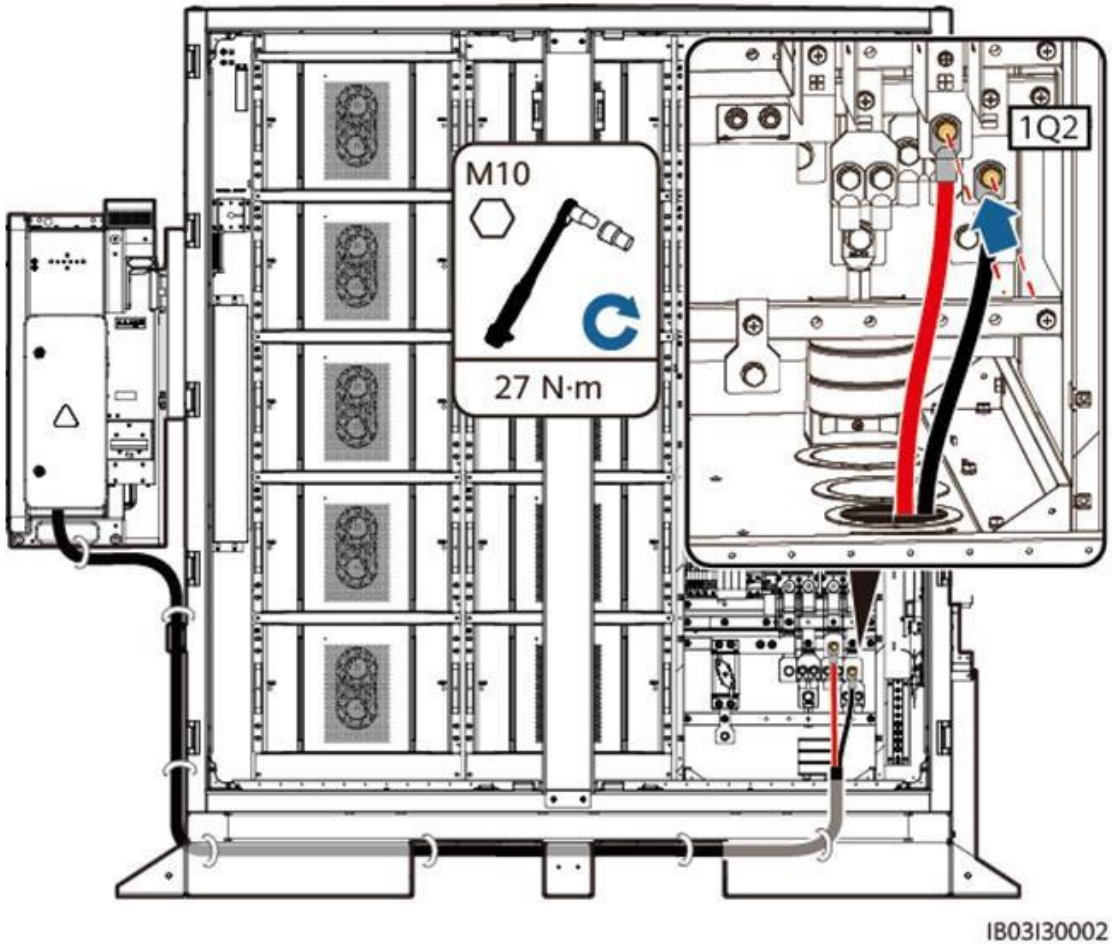
Cable Connection — Connecting DC Power Cables to the Smart PCS

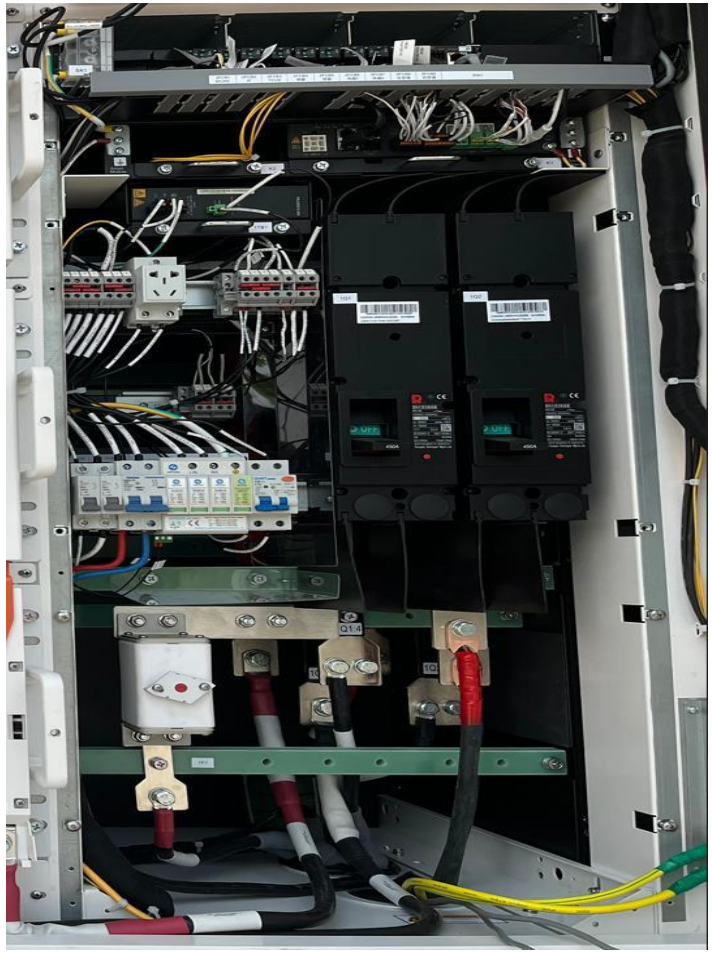


Note:

- Before connecting DC power cables, check the polarity of the cables and label them.
- Remove the rubber rings according to the cable diameter range, and ensure that the crimping module is not damaged. Otherwise, the protection level of the device will be affected.
- Ensure that the DC power cables are connected securely. Otherwise, the Smart PCS may fail to operate, or be overheated in operation due to unreliable connection, which will damage the terminal block.

Cable Connection — Connecting DC Power Cables to the Smart PCS





Note:

- Reserve sufficient length of the cable and add angle steel in the middle of the foundation to support the cable and reduce the stress that the cable bears.

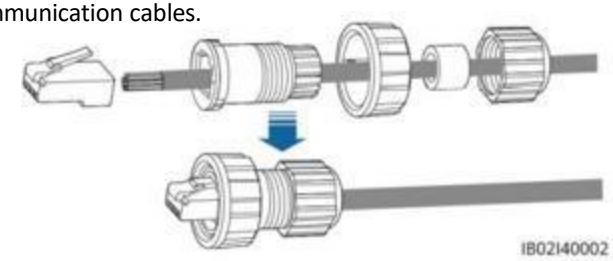
Checking Cable Connection

Note:

- The screw assembly whose model is subject to the delivery should be tightened according to the corresponding standard torque.
- Partially tighten the nuts of the AC/DC input power cables to a torque of 40 N·m when securing the cables.
- AC input power cables are laid out according to the design, routed to the wiring positions on the corresponding switches, and labeled.
- After connecting the AC power cables, ensure that the OT terminals are properly attached to and level with the copper bar and that the AC power cables point vertically downwards.
- After cables are connected, all cable holes need to be sealed with firestop putty. (If the rubber rings are properly sealed, skip this step.)

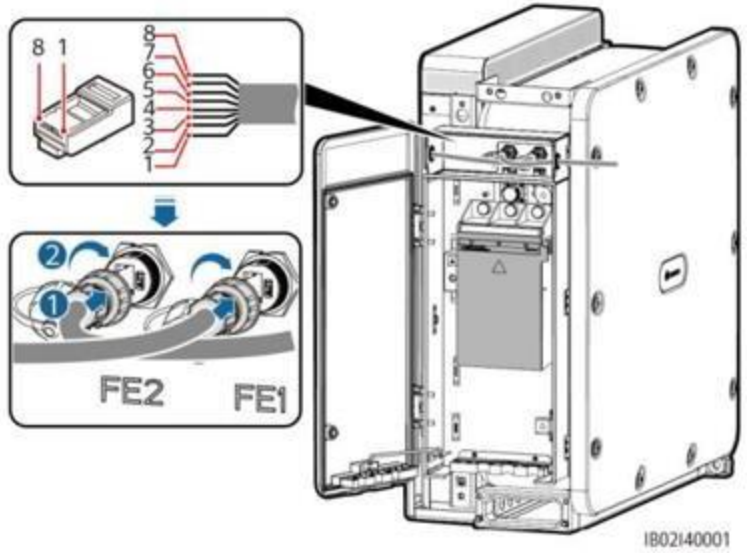
Cable Connection — Connecting FE Cables

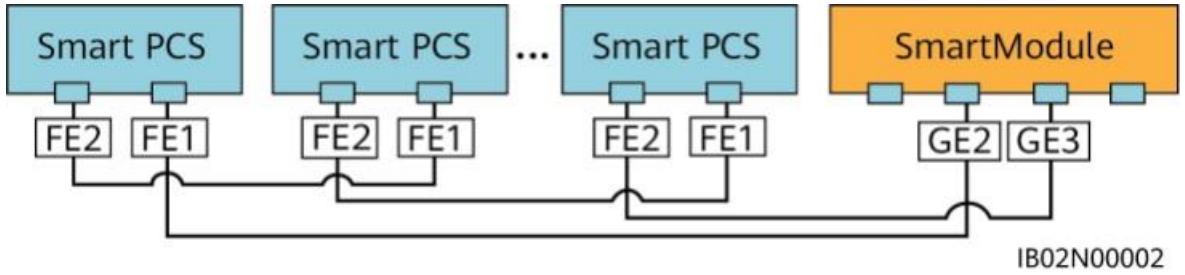
1. Prepare FE communication cables.



2. Connect FE communication cables.

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



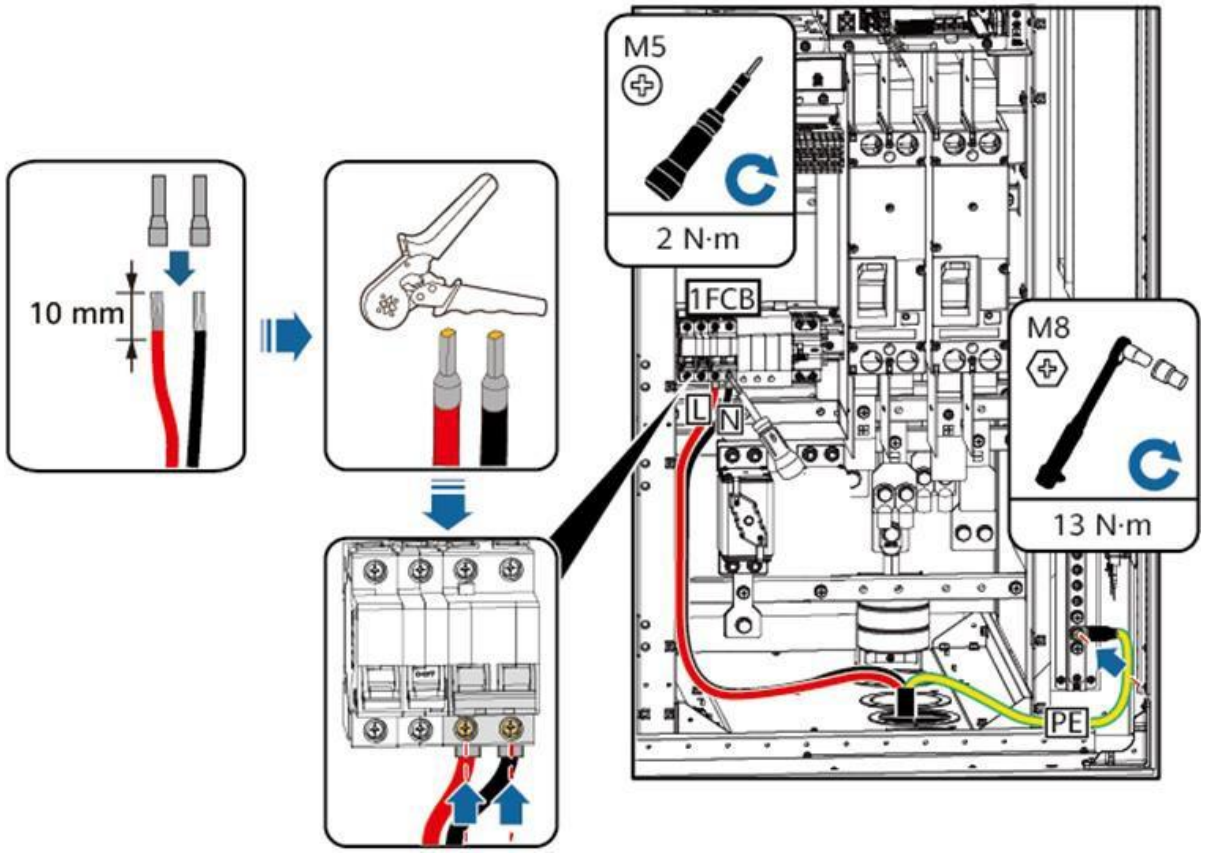


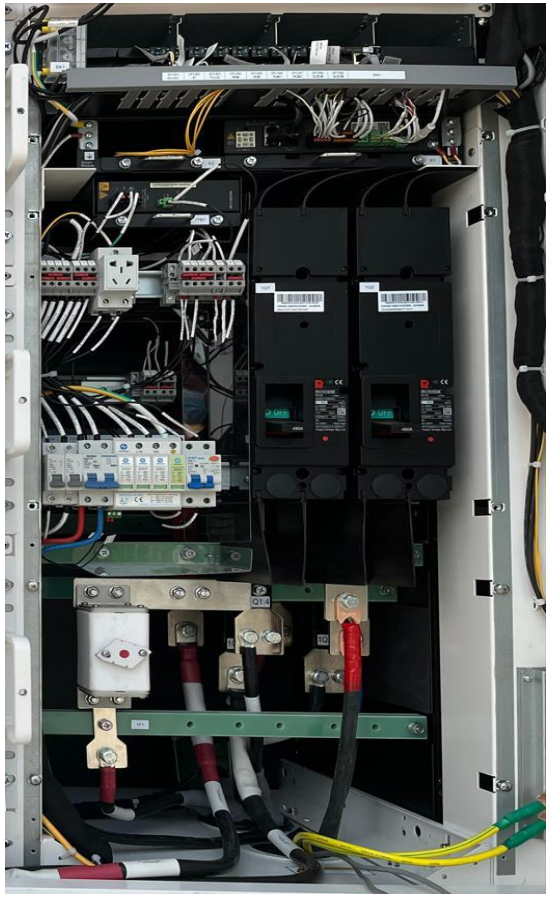
Note:

Before preparing FE cables, install waterproof connectors.

- The Smart PCS is connected to the SmartModule through FE communications cables. Ensure that the FE ports on the two ends are connected to GE2 and GE3 of the SmartModule.
- For multiple Smart PCSs, connect all Smart PCSs in hand-in-hand mode through FE communications cables into a ring network.
- The FE communications cables delivered with the Smart PCS are 1.2 m long. Use the original cable if possible.

Cable Connection — Installing Single-Phase AC Input Power Cables



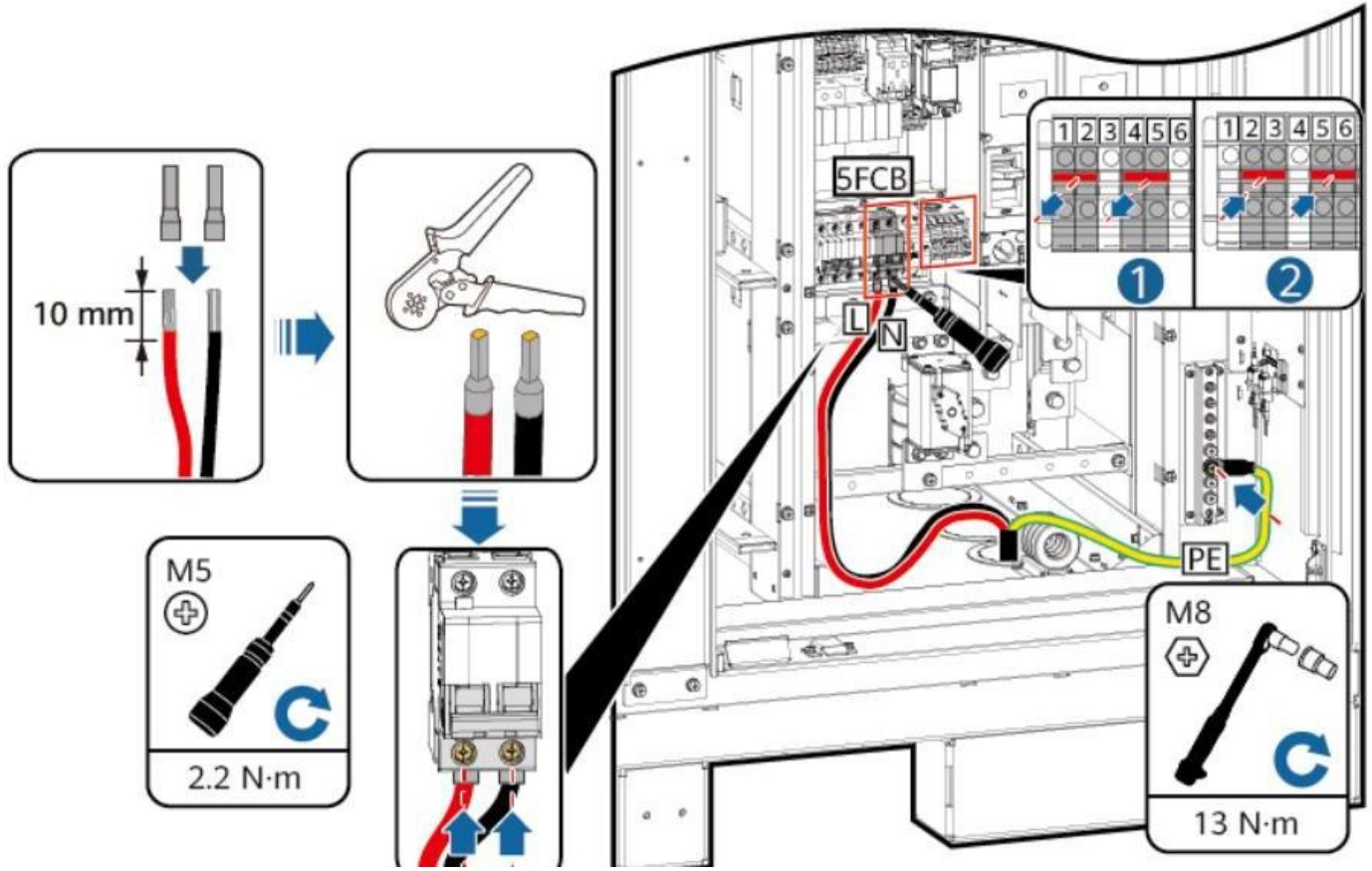


Note:

- The bending radius of the cables should be greater than 15D. Bind cables from the left side using cable ties.
- Route the AC power cables through the cable hole at the bottom and connect the cables to the miniature circuit breaker (MCB).
- Use cord end terminals when connecting AC power cables.

Cable Connection — Installing Single-Phase AC Input Power Cables(UPS Cable Connection Scenario)

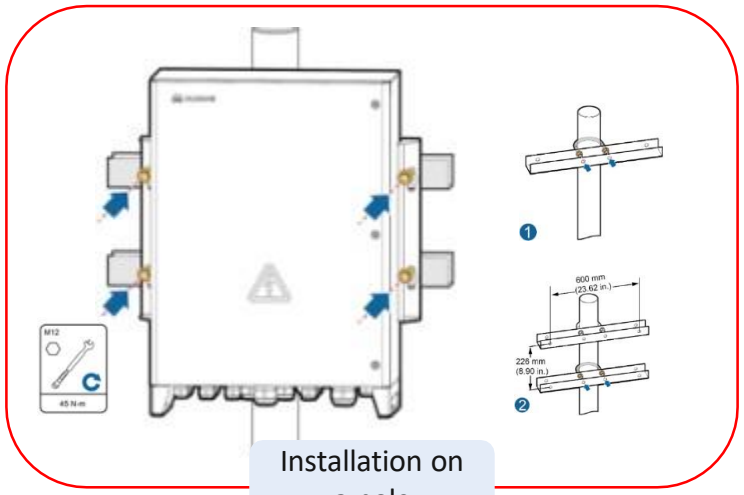
1. Remove the short-circuiting bar from 1–2 and insert it to 2–3 on the XU terminal block.
2. Remove the short-circuiting bar from 4–5 and insert it to 5–6 on the XU terminal block.
3. Connect the cable.



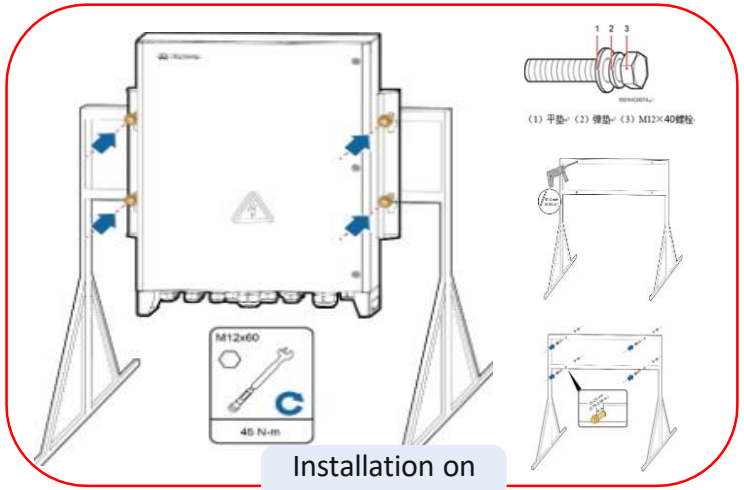
Note:

- According to the actual situation, if the UPS or other reliable backup power supply is used, you can change the connection mode of the single-phase AC input power cable according to the preceding steps.
- Recommended UPS input switch specifications: 230/400 V AC 32 A/2P.
- The power supply contains the CMU, black startup board, door status sensor and fire extinguishing system.

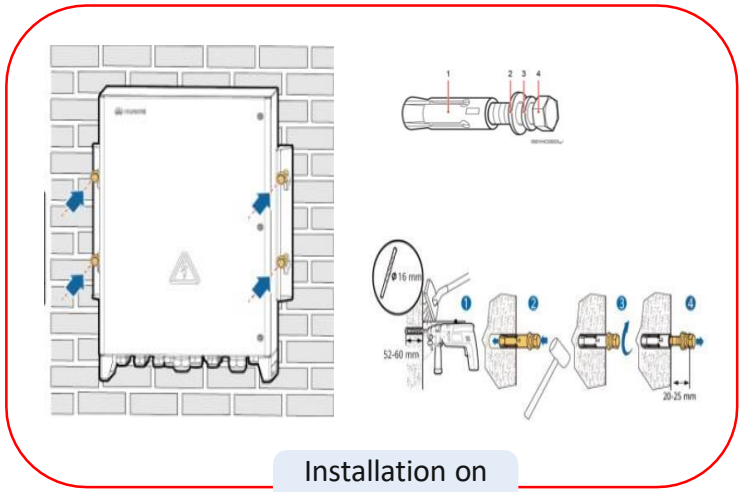
Communication cabinet installation



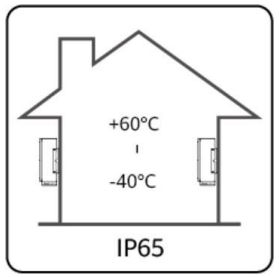
Installation on a pole

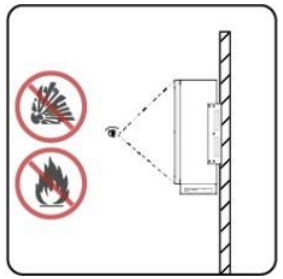


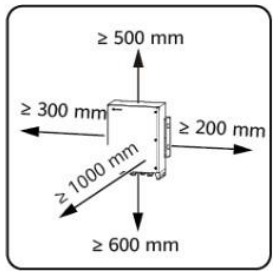
Installation on a support

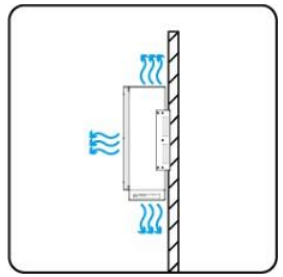


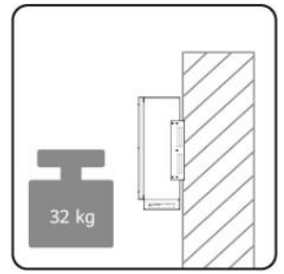
Installation on a wall











Note:

- The SACU can be installed on a pole, support, or wall.
- If the SACU is installed on a support, ask the customer to prepare a support in advance. Huawei does not provide the support.

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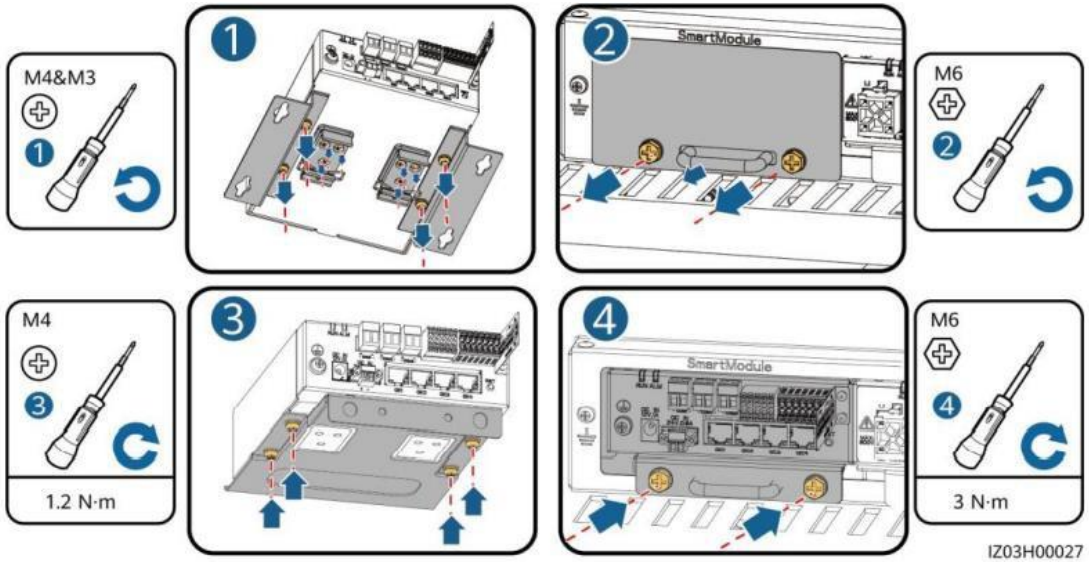
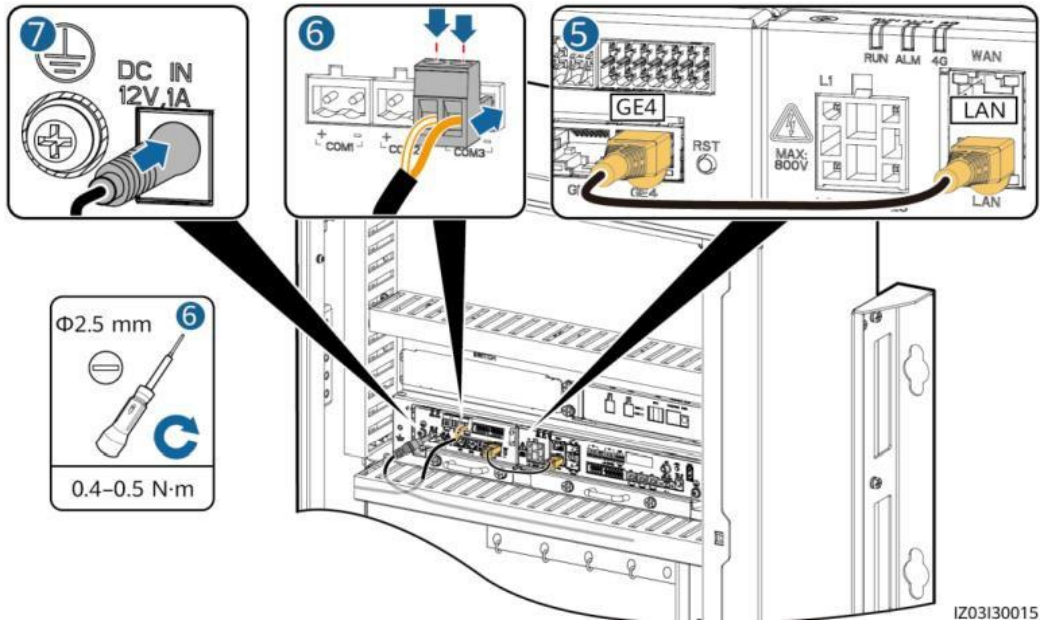
Communication cabinet installation— Installing the SmartModule

Procedure:

1. Remove the mounting ears and guide rail–mounting kit from the SmartModule.
2. Remove the panel at the position where the SmartModule is to be installed from the cabinet and take out the mounting kit.
3. Secure the mounting kit to the SmartModule.
4. Install the SmartModule.



5. Connect the GE4 port on the SmartModule to the LAN port on the SmartLogger using the network cable delivered with the SmartModule.
6. Connect the preinstalled RS485 cable to the COM port on the SmartModule based on the label.
7. Connect the preinstalled power cable to the "12V, 1A" port on the SmartModule based on the cable label.



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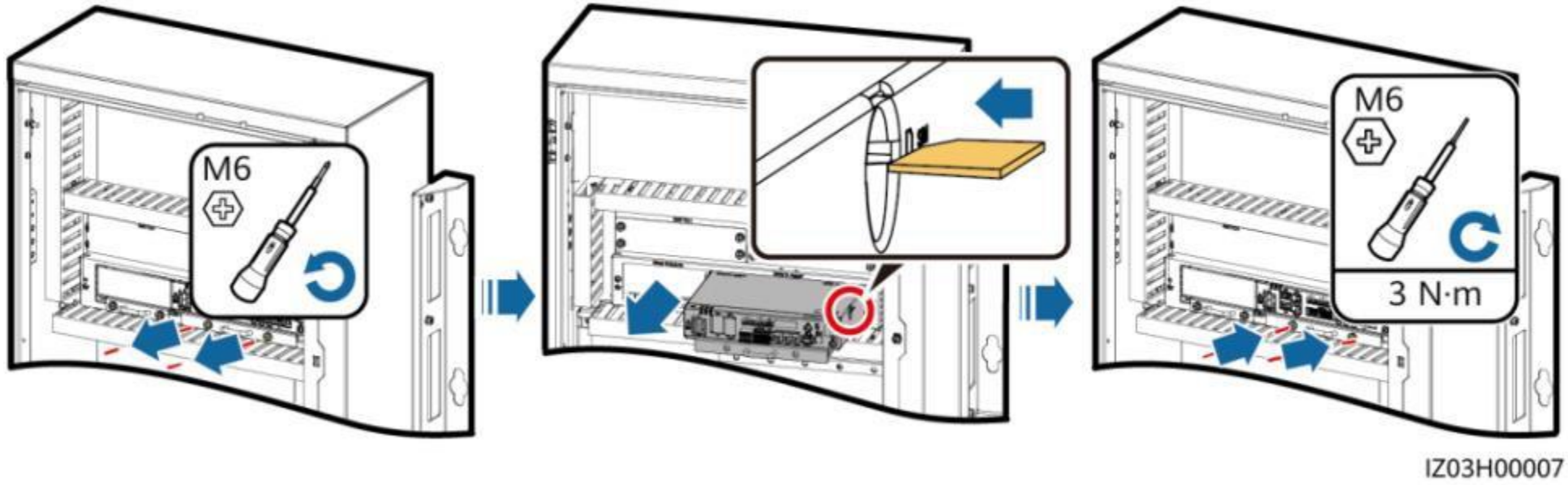
Communication cabinet installation— Installing the SIM Card (Optional)

Procedure:

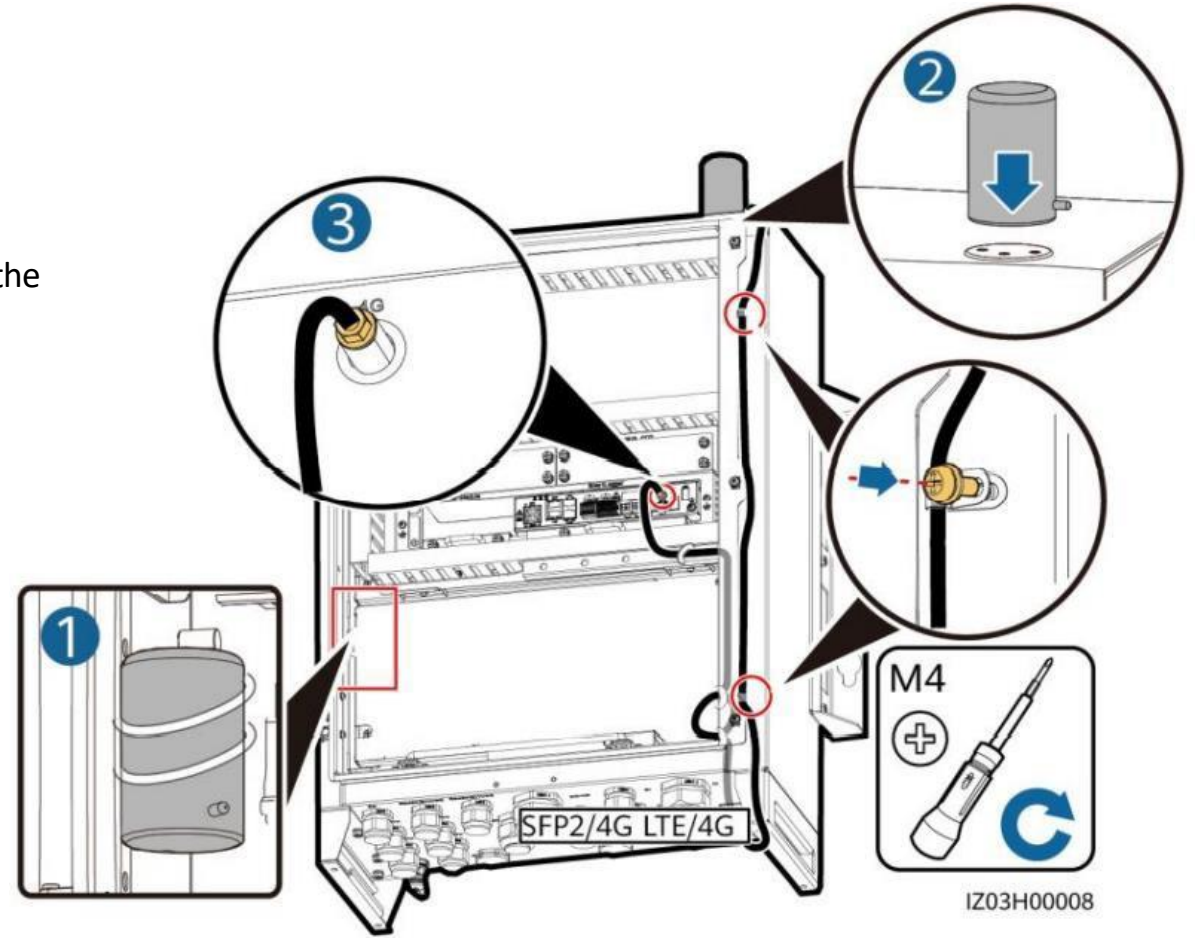
1. Remove the cables preinstalled on the SmartLogger and label the cables.
2. Take the SmartLogger out of the installation position.
3. Install the SIM card, and reinstall and secure the SmartLogger.
4. Reconnect the cables based on the labels.



Communication cabinet installation— Installing the 4G Antenna (Optional)

Procedure:

1. Remove the 4G antenna bound inside the cabinet.
2. Install the 4G antenna on the cabinet.
3. Connect the cable of the 4G antenna to the 4G port of the SmartLogger.

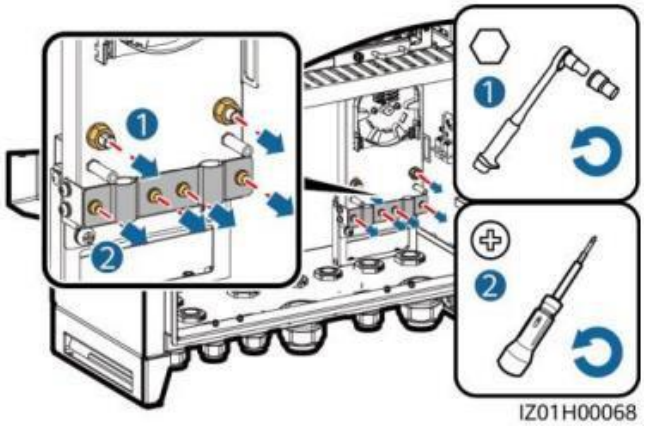


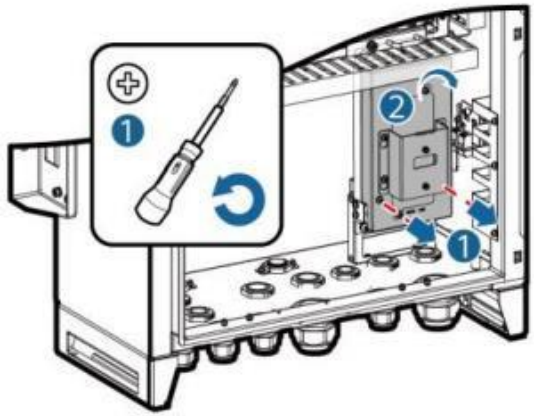
Note:
Secure the cable using the supplied cable clips. The cable is long and should be bound in the cabinet after installation.

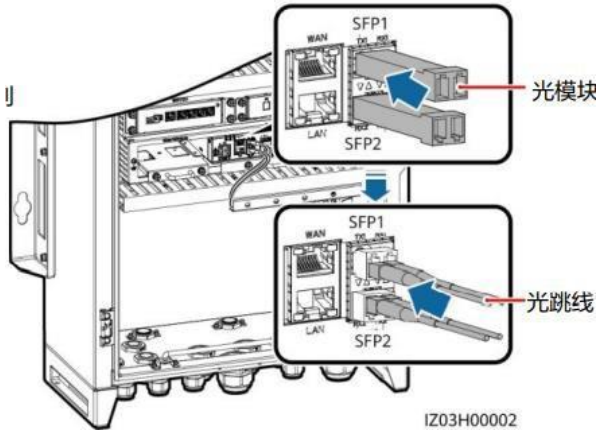
Cable Connection — Connecting the Communications Cables for the Fiber Ring Network

Procedure:

1. Remove the ATB cover and optical cable fastener.
2. Insert the optical module into the SFP1 and SFP2 ports of the SmartLogger.
3. Connect preinstalled optical jumpers to the optical modules.







Note:

- Pay attention to the directions of the optical modules. The label of the optical module on the SFP1 port faces upwards, whereas the label of the optical module on the SFP2 port faces downwards.
- Connect two optical cables in a ring optical network, and connect one optical cable in a star optical network.
- As optical cables are hard, prepare optical cables before routing them into the cabinet.
- Only professionals are allowed to connect optical cables.

Contents

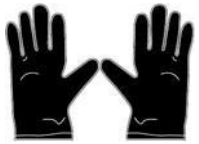
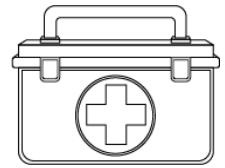
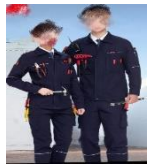
EHS Management and Personal Protection Requirements on the Construction Site

Personnel qualification requirements

Certification for special operations is a must.

1. Personnel who engage in special onsite operations must obtain the certificate in advance, and must receive relevant safety technical training and disclosure according to the specifications before operations.
2. Personnel who operate electrical equipment and connect cables must obtain the valid national electrician operation certificate.
3. Special operations such as hoisting, forklifting, welding, and working aloft must comply with laws and regulations and performed with guardians.
4. Before installing the ESS, personnel must participate in the technical training and disclosure provided by Huawei or its certified partners.

Personal protection requirements

Safety gloves 	Safety goggles 	Dust mask 	Safety shoes 
Reflective vest 	Safety helmet 	Medical kit 	Workwear 

Prohibitions on the construction site

1. Do not work under the influence of alcohol.
2. Do not enter the operation site without wearing PPE.
3. Do not perform equipment installation operations with power-on. Safety protection must be taken for inspection and maintenance operations.
4. Do not occupy fire passages. Do not dismantle or stop safety protection facilities and fire suppression equipment without authorization.
5. During operations, remove conductive objects such as watches, bracelets, bangles, rings, and necklaces to prevent electric shock.

Six Steps for C&I ESS Quality Management –

Proactive Prevention and Process Control

① Technical disclosure by the manufacturer

Design files

- Checking technical requirements
- Making up for missing items

Foundation check

- Plane position
- Curing strength

Technical disclosure

- Key construction points
- Technical difficulties

Disclosure reports

- Onsite disclosure
- Signing in the written form

② Quality check before power-on

Grounding and testing

- Leakage point check
- Meeting resistance

Cable routing and turning

- Cable trough depth and width
- Soft soil or sand and covers

Bolt torque and standard paint

- Torque meeting the standard
- Re-test mark

Cabinet cable hole sealing

- Firestop putty and adhesive
- Dense and no leakage points

③ System commissioning and defect elimination

④ Engineering-to-maintenance training

⑤ Completion report signing

⑥ Engineering-to-maintenance report

Quality Management Requirements on the Installation Process — Civil

Construction & Electricity

Foundation construction

Requirements for constructing the concrete foundation for equipment:

- The installation space meets the maintenance requirements. (The distance between the Smart PCS and the rack controller or the distance between the Smart PCS and the wall must be **greater than or equal to 1.2 m**, the distance between the front of the ESS must be **greater than or equal to 5 m**, and the distance between the back sides of two ESSs or between the back side of the ESS and the wall must be **greater than or equal to 1000 mm**.)
- The foundation concrete must have no **cellular, crack, exposed steel bar**, or other defects.
- When the foundation is delivered, the strength must be at least **75% of the design strength**.
- Any dimensional deviation that affects structural performance and service function is not allowed.
- The foundation must be marked with axes and elevations, and the allowable deviations should be in accordance with the following table:

Check Item	Scope	Allowed Deviation (mm)
Flatness	Full length	5
Verticality	Full height	5

Cable routing

VS

Requirements for cable routing:

- When routing cables, ensure that cables are free from twist, crushed armor layer, broken protection layer, and serious scratches on the surface.
- **Soft soil or sand with a thickness of greater than or equal 100 mm** should be laid on the top and bottom of the directly-buried cables, and **protection plates should be placed**. The coverage width of the protection plates should exceed **50 mm on each side of the cables**.
- Before backfilling soil for directly-buried cables, ensure the cables pass concealed work acceptance and then compact the backfilling soil layer by layer. There should be **no stones and other hard objects** in soft soil or sand.
- Directly-buried cables should be buried below the local maximum frozen soil layer, with **a minimum buried depth of at least 0.7 m**.
- Directly-buried cables should be protected by steel pipes if they are routed through a wall, out of the ground, and through a road. The mouth of the steel pipes should have cable sheath or be made into a flared mouth.

Equipment grounding

Requirements for equipment grounding:

- Each equipment should **have a separate PE cable connected to the grounding main line**. Several electrical devices that require grounding must not be connected in series to one PE cable.
- The overlapping length of two flat steel sheets should be **twice the width of the flat steel sheets** (at least three edges are welded).
- The overlapping length of a round steel bar and a flat steel sheet should be six times the diameter of the round steel bar.
- The welding surface of hot galvanized flat steel sheets, round steel bars, and angle steel sheets should **be protected against corrosion and rust**.

Cable Connection Quality Requirements — Tidy and Non-crossing Cables, and Torque for Fastening Bolts Meeting Requirements

Cable connection

&

Requirements for cable connection:

- Cables of the same type in the ESS should be bound together. Cables of different types are **at least 30 mm away from each other**. Cables are **at least 30 mm** away from heat-generating components or heat source areas.
- Cables cannot be tangled to ensure good performance. Cables should be laid straight and **crossovers of cables should be avoided**.
- Prepare cable **labels** which indicate the ID, model, specifications, position in the drawing, and start and end construction point of each cable. Mark two ends of each cable clearly in the same way. **The cable labels must be easy to read.**
- All covers of metal troughs and protective edges **must be sanded without burrs** to protect cables.
- Cut pagoda connectors for cable holes in and out of the power distribution cabinet **based on the cable diameter** to meet fireproof, moisture-proof, and rodent-proof requirements. 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 from entry.

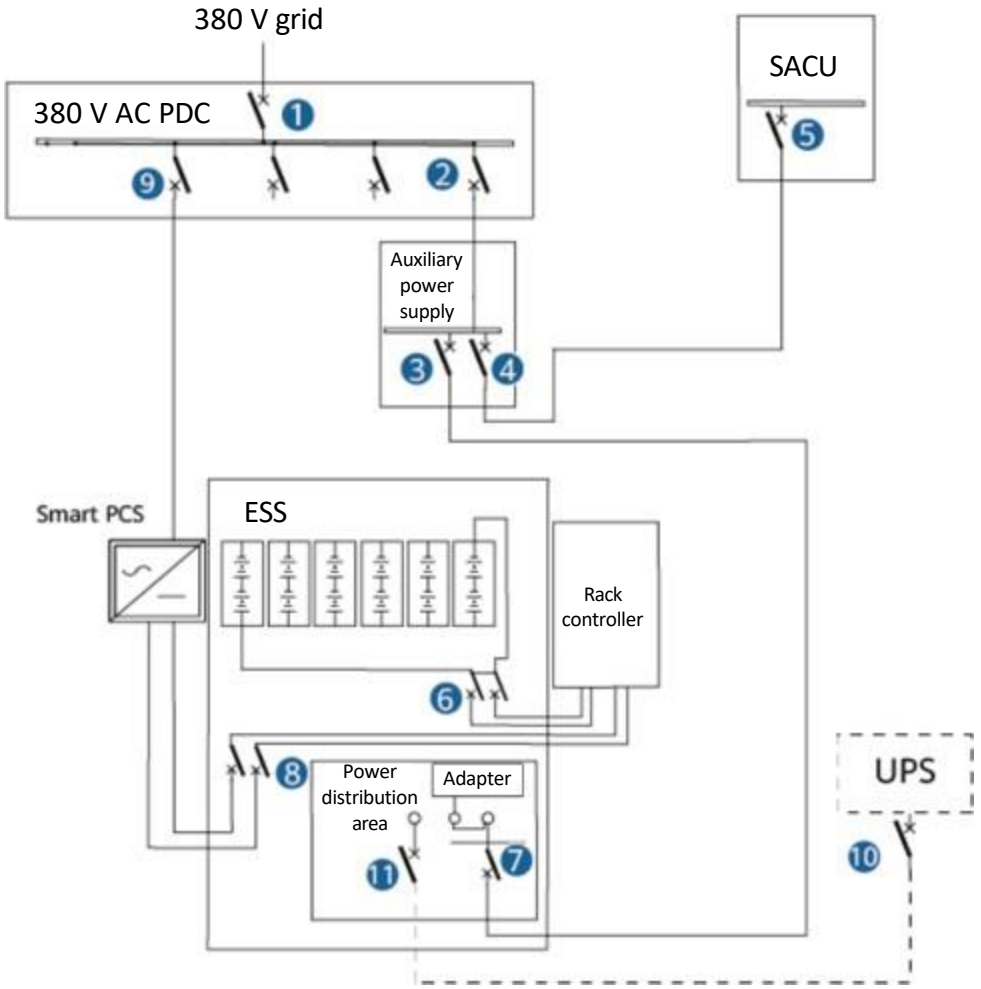
Copper bar connection

Requirements for copper bar connection:

- Copper bars used for installing the ESS are delivered to the site along with the equipment. Use the copper bars delivered with the ESS to install the ESS. **Do not use copper bars from ESSs of different models.**
- When installing a nut, **manually** insert the nut into the stud, and then use a **socket wrench** to completely secure the nut in place. This prevents the screw thread from being stuck or stripped due to the deviation of the nut position.
- **Four** types of copper bars are included with the equipment and are identified by the silkscreens **A, B, C, and D** printed on the front. Different specifications correspond to different positions. Install copper bars based on location requirements. When installing **copper bar C**, keep away from communications cables and fan power cables of battery packs to prevent cables from being squeezed.
- The bolt torque is **27 N·m**. After all copper bar connecting bolts are tightened according to the torque standard, mark the torque. The inspector re-inspects the copper bar connecting bolts according to 80% of the torque standard and marks them with **a red marker**.

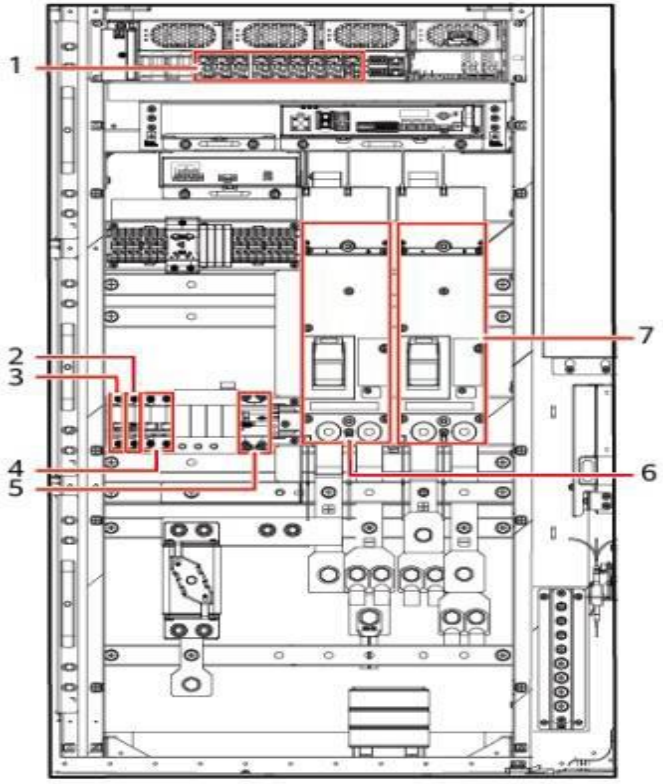
Contents

System Power-On — Power-on Process



Step	Item		Remarks
1	Powering on the AC power distribution cabinet connected to the grid		As shown in ①
2	Powering on the auxiliary power supply	(Optional) Powering on the UPS	As shown in ⑩ and ⑪
		Powering on the 220 V AC auxiliary power supply	As shown in ②, ③, and ④.
3	Powering on the SACU		As shown in ⑤
4	Powering on the ESS	Powering on the DC circuit breakers of battery racks	As shown in ⑥
5		Powering on the auxiliary power supply (turning on the AC switches and then the DC switches)[a]	As shown in ⑦
6		Powering on the output DC circuit breakers	As shown in ⑧
7	Powering on the AC side of the Smart PCS	Powering on the battery side of the AC power distribution cabinet	As shown in ⑨
Note a: Before turning on the internal switch of the ESS auxiliary power supply, check that the AC auxiliary power supply voltage is within the normal range (220 V±10%).			

System Power-On



1. 48 V DC power distribution switches
2. PSU switch (1FCB2)
3. 12 V adapter switch (1FCB1)
4. AC main switch (1FCB)
5. 220 V maintenance socket switch (1FB1)
6. DC switch (1Q1, on the battery rack side)
7. DC switch (1Q2, on the Smart PCS DC side)

Power on the system as follows:

- Prerequisites
  - You have completed the power-on check.
  - You have put on insulated gloves.
- Procedure
  - Turn on the DC switch 1Q1 (as shown in No. 6).
  - Use a multimeter to check whether the AC voltage is within the allowed range (220 V±10%) (as shown in No. 4).
  - Turn on the AC main switch 1FCB (as shown in No. 4).
  - Turn on all switches in the power distribution system of the ESS.
    1. Turn on the 12 V adapter switch 1FCB1 (as shown in No. 3).
    2. Turn on the PSU switch 1FCB2 (as shown in No. 2).
    3. Turn on the 220 V maintenance socket switch 1FB1 (as shown in No. 5).
    4. On the embedded power subrack (SK1), turn on the DC/DC switch 2FCB1, DC light power switch 2FCB2, TCUE power switch 2FCB3, fan 1 switch 2FCB6, and fan 2 switch 2FCB7, air conditioner 1 switch 2FCB8, and air conditioner 2 switch 2FCB9 in sequence.
  - Turn on the DC switch 1Q2 (as shown in No. 7).

System Power-Off

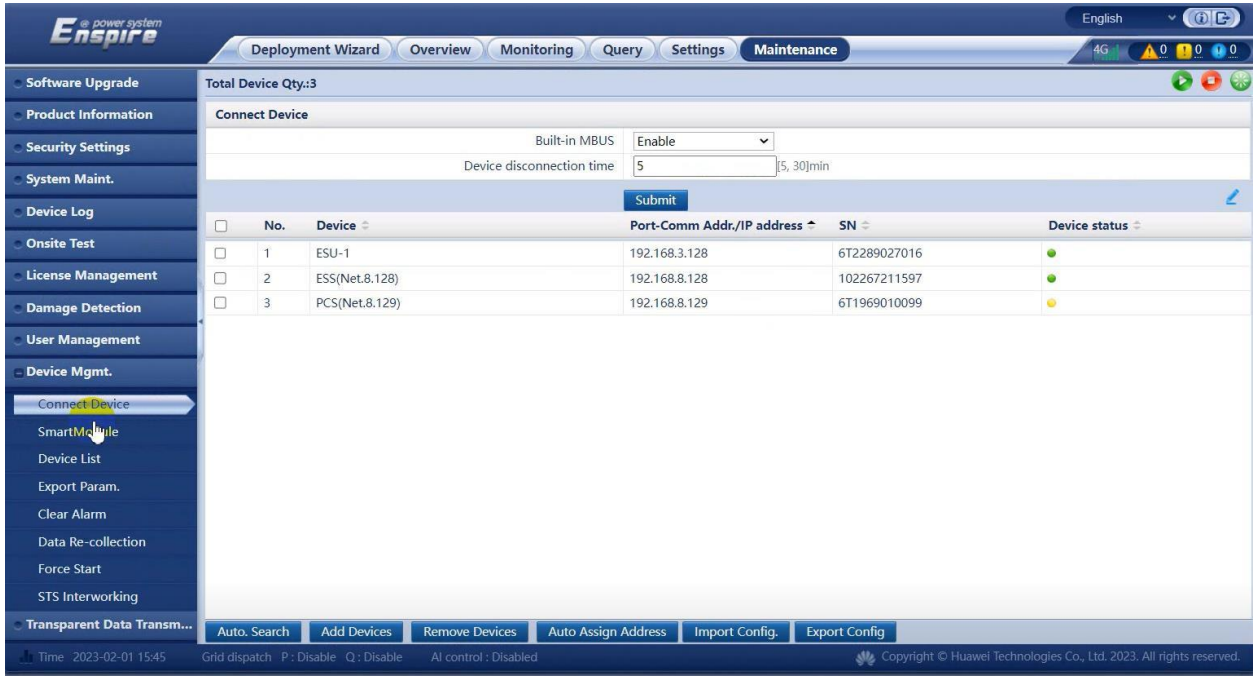
Delivering a Shutdown Command on the SmartLogger

Prerequisites:

The system is in grid-tied mode and running with power.

Procedure:

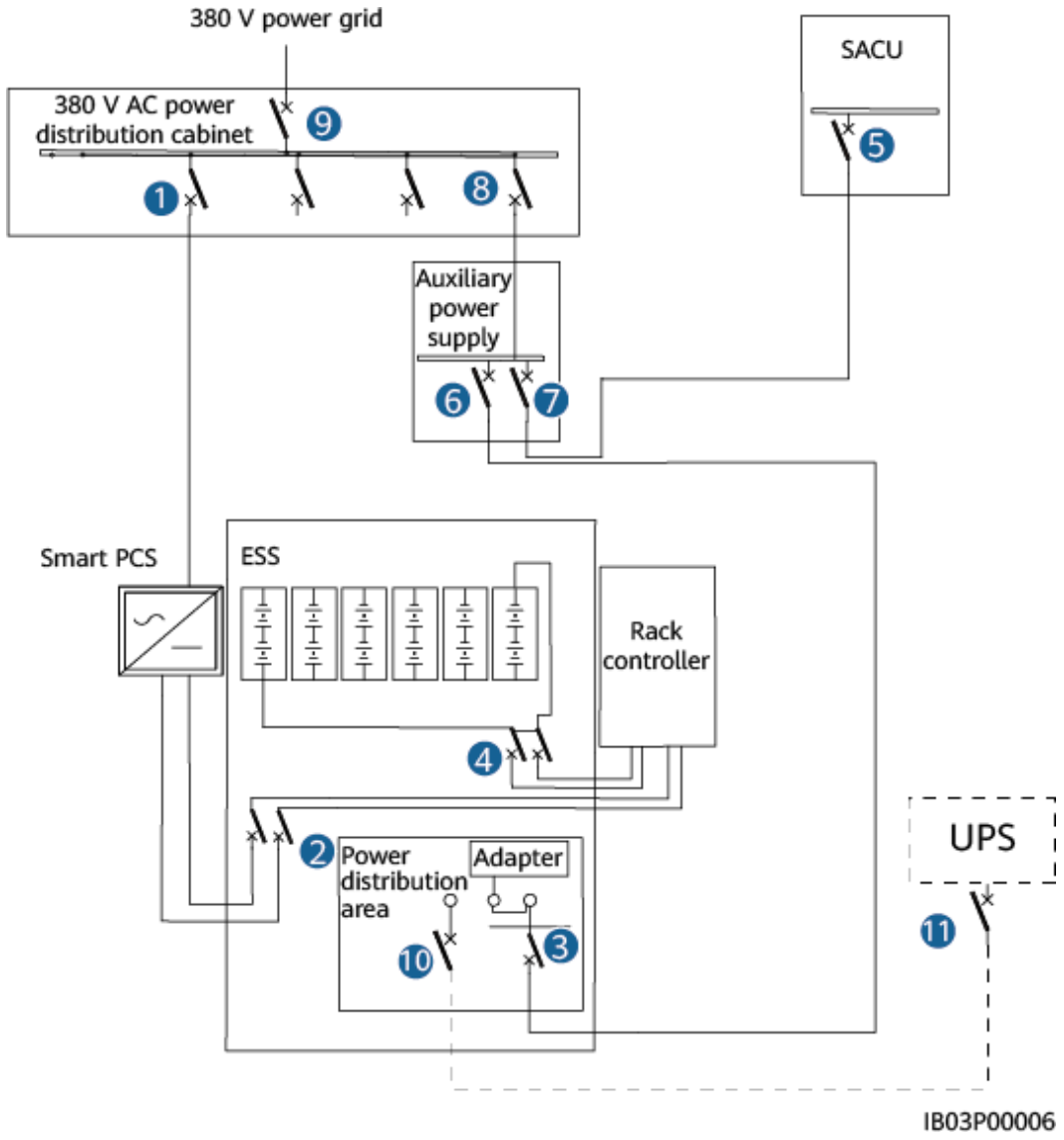
1. Log in to the SmartLogger WebUI, choose **Maintenance** > **Connect Device**, and click  to send a shutdown command to the Smart PCS and Smart Rack Controller.
2. Choose **Monitoring** > **PCS** > **Running Info**. Check the device status, active power, and DC voltage to verify that the shutdown is successful.
3. Choose **Monitoring** > **CMU** > **Running Info**. Check the rated power and total output voltage of the rectifiers to ensure that the shutdown is successful.



Note:

All operations must be performed by qualified personnel.

System Power-Off –Power-Off Process



Step	Item		Remarks
1	Powering off the AC side of the Smart PCS	Powering off the battery side of the AC power distribution cabinet	As shown by (1)
2	Powering off the ESS	Powering off the output DC circuit breakers	As shown by (2)
3		Powering off the auxiliary power supply (turn off the AC switches and then the DC switches)	As shown by (3)
4		Powering off the DC circuit breakers of battery racks	As shown by (4)
5	Powering Off the Smart Array Controller		As shown by (5)
6	Powering off the auxiliary power supply disconnection	Powering off the 220 V AC auxiliary power supply	As shown by (6), (7), and (8)
7		(Optional) Powering off the UPS	As shown by (10) and (11)
8	Powering off the AC power distribution cabinet connected to the grid		As shown by (9)

System Power-Off

Powering Off the Smart PCS

- Log in to the SmartLogger WebUI, CMU WebUI, FusionSolar app, or management system and send a shutdown command to the ESS.
- Wear proper personal protective equipment (PPE).
- Turn off the AC switch between the Smart PCS and the grid.
- Open the AC maintenance compartment door, install a support bar, and use a multimeter to check the voltage between the AC terminal block and the ground. Ensure that the AC side of the Smart PCS is powered off.
- Turn off DC switch 1Q2 in the ESS.
- Open the DC maintenance compartment door, install a support bar, and use a multimeter to check the voltage between DC terminal blocks. Ensure that the DC side of the Smart PCS is powered off.

Powering off the ESS

- Turn off all switches in the power distribution system of the ESS.
  1. On the embedded power subrack (SK1), turn off the DC/DC switch 2FCB1, DC light power switch 2FCB2, TCUE switch 2FCB3, fan 1 switch 2FCB6, fan 2 switch 2FCB7, air conditioner 1 switch 2FCB8, and air conditioner 2 switch 2FCB9 in sequence.
  2. Turn off switch 1FB1 of the 220 V maintenance socket.
  3. Turn off PSU switch 1FCB2.
  4. Turn off 12 V adapter switch 1FCB1.
- Turn off AC main switch 1FCB.
- Turn off DC switch 1Q1.

Powering Off the Power Supply Loop of the AC Power Distribution Cabinet

- Turn off the switches between the AC power distribution cabinet and the ESS.
- Turn off the switch between the AC power distribution cabinet and the Smart Array Controller.

Thank you.

Bring digital to every person, home, and organization for a fully connected, intelligent world.

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