DCBOX DC LV Panel

User Manual

Issue	02
Date	2022-01-10

HUAWEI TECHNOLOGIES CO., LTD.

Trademarks and Permissions


and other Huawei trademarks are trademarks of Huawei Technologies Co., Ltd.
All other trademarks and trade names mentioned in this document are the property of their respective holders.

Notice

The purchased products, services and features are stipulated by the contract made between Huawei and the customer. All or part of the products, services and features described in this document may not be within the purchase scope or the usage scope. Unless otherwise specified in the contract, all statements, information, and recommendations in this document are provided "AS IS" without warranties, guarantees or representations of any kind, either express or implied.

The information in this document is subject to change without notice. Every effort has been made in the preparation of this document to ensure accuracy of the contents, but all statements, information, and recommendations in this document do not constitute a warranty of any kind, express or implied.

Huawei Technologies Co., Ltd.

Address: Huawei Industrial Base
Bantian, Longgang
Shenzhen 518129
People's Republic of China

Website: https://e.huawei.com

About This Document

Purpose

This document describes the installation, electrical connections, and maintenance of DCBOX-9/5-H0 DC LV Panel (DCBOX). Before installing and operating the DCBOX, ensure that you are familiar with the features, functions, and safety precautions provided in this document.

Intended Audience

This document is intended for plant operating personnel and qualified electricians.

Symbol Conventions

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

Symbol	Remarks
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.
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.

Symbol	Remarks
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 updates made in previous issues.

Issue 02 (2022-01-10)

Updated **2.3 Appearance**.

Updated **4 Tools**.

Updated **5.3 Installing the DCBOX and Smart PCS**.

Updated **6.1 Cable Routing and Preparation**.

Updated **6.2 Connecting the DCBOX Ground Cable**.

Added **8.3.1 Replacing a Smart PCS**.

Updated **9 Technical Specifications**.

Issue 01 (2021-08-31)

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

Contents

1 Safety Information

1.1 General Safety

Statement

Before installing, operating, and maintaining the equipment, carefully read this document and observe all safety instructions provided herein and written on the equipment itself.

The information provided under the "NOTICE", "CAUTION", "WARNING", and "DANGER" headings within this manual is not intended to cover all applicable safety policies, and instead acts as a supplement to the comprehensive safety information provided. The Company will not be liable for any consequences that may arise due to violations of general safety requirements or safety standards concerning the design, production, and usage of the equipment.

Ensure that the equipment is used in environments that meet its design specifications. Otherwise, the equipment may become faulty, and any resulting malfunction, component damage, personal injury, or property damage will not be covered under the warranty.

Follow local laws and regulations when installing, operating, or maintaining the equipment. The safety instructions in this document are considered supplementary to local laws and regulations.

The Company will not be liable for any consequences in any of the following circumstances:

- Operation beyond the conditions specified in this document
- Installation or use in environments which are not specified in relevant international or national standards
- Unauthorized modifications to the product or software code or removal of the product
- Failure to follow the operation instructions and safety precautions on the product and in this document
- Equipment damage due to force majeure, such as earthquakes, fire, and storms

- Damage during transportation by the customer due to failure to comply with transportation requirements
- Storage conditions that do not meet the requirements specified in this document

General Requirements

DANGER

Ensure that power is off during installation.

- 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, and performing outdoor installation) in harsh weather conditions such as lightning, rain, snow, and level 6 or stronger wind.
- After installing the equipment, remove idle packing materials such as cartons, foam, plastics, and cable ties from the equipment area.
- 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 re-enter the building or affected area until it has been deemed safe by qualified professionals.
- Do not obscure, damage, or block any warning labels on the equipment.
- Tighten screws to the specified torque using the appropriate tools when installing the equipment.
- Ensure that you are aware of the system's composition and working principles, as well as any relevant local standards.
- Repaint any scratched surfaces caused during equipment transportation or installation in a timely manner. Scratched equipment should not be exposed to an outdoor environment for extended periods.
- Do not open equipment panels.

Personal Safety

- 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.
- Use tools correctly to prevent personal injury or equipment damage.
- Do not touch the equipment while it is in use, as the enclosure is hot.

1.2 Personnel Requirements

- Installation or maintenance personnel must be well trained, fully understand all safety precautions, and be able to correctly perform all operations.
- 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 operate the equipment, including operators, trained personnel, and professionals, should possess all relevant local or nationally required qualifications for special operations (including high-voltage operations, working at heights, and operation of special equipment).
- Only professionals or authorized personnel should replace equipment or components (including software).

NOTE

- Professionals: personnel who are trained or experienced in equipment operations and fully understand the potential hazards involved in equipment installation, operation, and maintenance
- Trained personnel: personnel who are technically trained, have the required experience, are aware of potential hazards during certain operations, and are able to take protective measures to minimize any hazards to themselves and others
- Operators: operations personnel who may come in contact with the equipment, but excluding trained personnel and professionals

1.3 Electrical Safety

Grounding

- 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.
- Do not damage the ground conductor.
- Do not operate the equipment in the absence of a properly installed ground conductor.
- 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.

General Requirements

DANGER

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

- Ensure that all electrical connections comply with local electrical standards.
- Ensure that the cables you prepared meet local regulations.
- Use dedicated insulated tools when performing high-voltage operations.

AC and DC Power

DANGER

Do not install or remove power cables with power on. Transient contact between the core of the power cable and the conductor will generate electric arcs or sparks, which may cause fire or personal injury.

- Before connecting cables, switch off the disconnector on the upstream equipment to cut off the power supply if people may contact energized components.
- Before connecting a power cable, check that the label on the power cable is correct.
- If the equipment has multiple inputs, disconnect all the inputs before operating the equipment.

Cabling

- When routing cables, ensure that a distance of at least 30 mm exists between the cables and heat-generating components or areas. This prevents damage to the insulation layer of the cables.
- Bind cables of the same type together. When routing cables of different types, ensure that they are at least 30 mm away from each other.
- Ensure that the cables are properly connected and insulated, and meet specifications.

1.4 Installation Environment Requirements

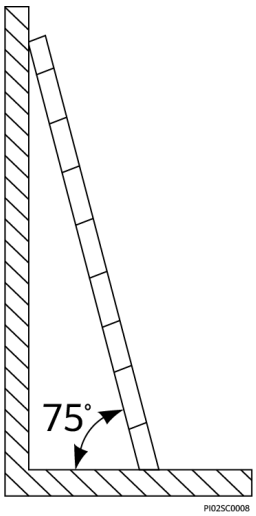
- Ensure that the equipment is installed in a well ventilated environment.
- To prevent fire due to high temperature, ensure that the ventilation vents or heat dissipation system are not blocked when the equipment is running.
- Do not expose the equipment to flammable or explosive gas or smoke. Do not perform any operation on the equipment in such environments.

1.5 Mechanical Safety

Using Ladders

- Use wooden or fiberglass ladders when you need to perform live working at heights.
- When a step ladder is used, ensure that the pull ropes are secured and the ladder is held firm.
- Before using a ladder, check that it is intact and confirm its load bearing capacity. Do not overload it.
- Ensure that the wider end of the ladder is at the bottom, or protective measures have been taken at the bottom to prevent the ladder from sliding, and that the ladder is securely positioned.

- The recommended angle for a ladder against the floor is 75 degrees, as shown in the following figure. An angle ruler can be used to measure the angle.



- When climbing a ladder, take the following precautions to reduce risks and ensure safety:
  - Keep your body steady.
  - Do not climb higher than the fourth rung of the ladder from the top.
  - Ensure that your body's center of gravity does not shift outside the legs of the ladder.

Drilling Holes

When drilling holes into a wall or floor, observe the following safety precautions:

- Wear goggles and protective gloves when drilling holes.
- When drilling holes, protect the equipment from shavings. After drilling, clean up any shavings that have accumulated inside or outside the equipment.

Moving Heavy Objects

- Be cautious to avoid injury when moving heavy objects.
- When moving the equipment by hand, wear protective gloves to prevent injuries.

1.6 Maintenance and Replacement

DANGER

High voltage generated by the equipment during operation may cause an electric shock, which could result in death, serious injury, or serious property damage. Prior to maintenance, power off the equipment and strictly comply with the safety precautions in this document and relevant documents.

- Maintain the equipment with sufficient knowledge of this document and using proper tools and testing equipment.
- Prior to maintenance, power off the equipment.
- If the switch needs to be turned off for maintenance, attach a prominent label on the switch to prevent other personnel from turning on the switch.
- Place temporary warning signs or erect fences to prevent unauthorized access to the maintenance site.
- If the equipment is faulty, contact your retailer.
- The equipment can be powered on only after all faults are rectified. Failing to do so may escalate faults or damage the equipment.

2 Introduction

2.1 Model Description

Figure 2-1 Model

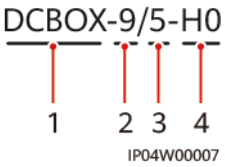


Table 2-1 Model description

No.	Description
1	Product name: DC LV Panel
2	Maximum number of Smart Rack Controllers that can be connected
3	Maximum number of Smart Power Control Systems (Smart PCSs) that can be connected
4	Product family with an input voltage level of 1500 V DC

2.2 Functions and Features

Functions

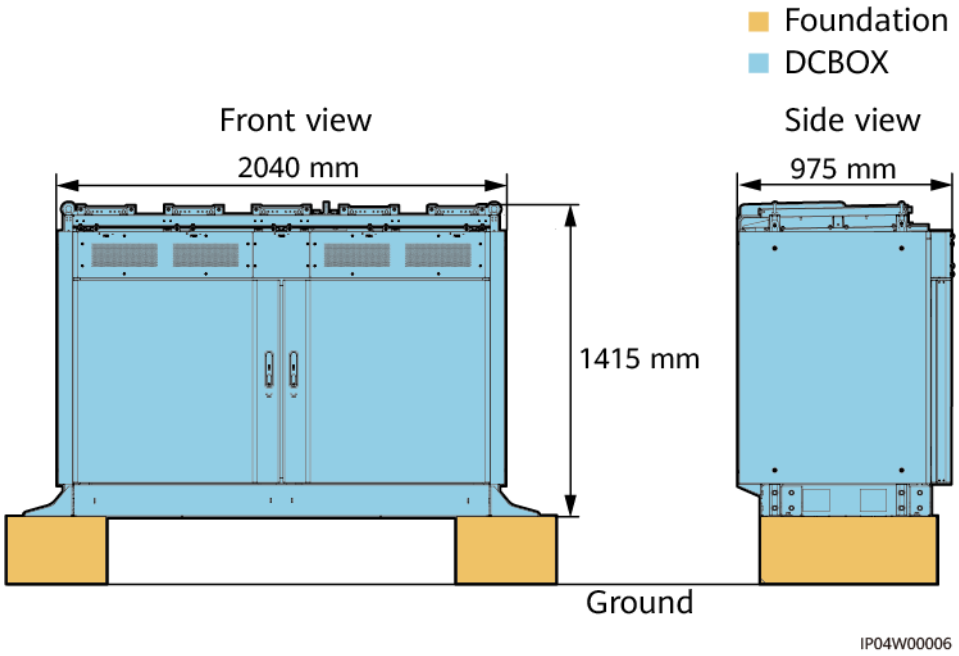
The DCBOX is a DC low-voltage (LV) panel used in energy storage. It provides DC buses for the Smart PCS and the Smart Rack Controller in the Smart String Energy Storage System (Smart ESS) to enable bidirectional power supply between the power grid and batteries.

Features

- High capacity: The DCBOX supports a maximum of nine Smart Rack Controllers connected to five Smart PCSs and a maximum of 1 MW power combination.
- Easy installation: The Smart PCS has been installed on the top of the DCBOX to save installation space. DC input power cables have been preinstalled for the Smart PCS to facilitate installation.
- Free cooling: The DCBOX has a natural air channel to dissipate heat.

2.3 Appearance

Figure 2-2 Appearance



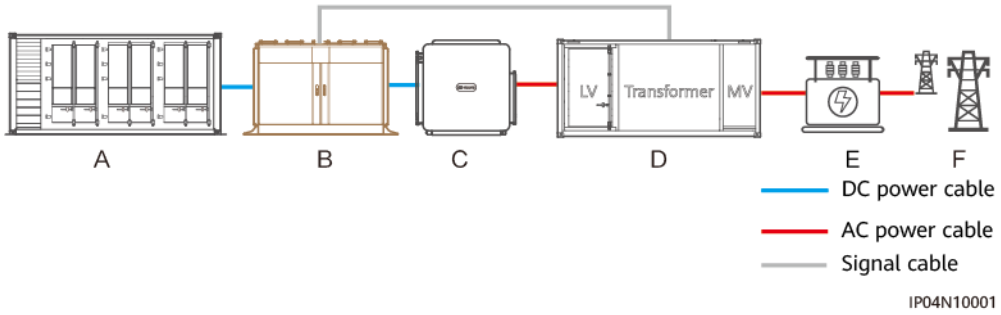
NOTE

Contact your product managers to obtain the foundation design requirements.

2.4 Typical Application

The DCBOX is used in energy storage.

Figure 2-3 Networking application



(A) ESS (B) DCBOX (C) Smart PCS

(D) Smart Transformer Station (STS) (E) Step-up transformer (F) Power grid

2.5 Typical Cable Connections

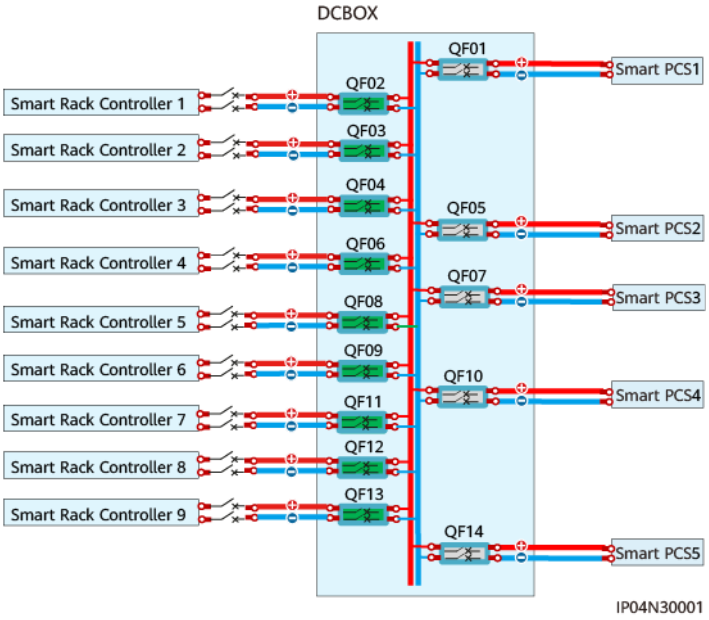
The DCBOX can connect to a maximum of nine Smart Rack Controllers. The Smart Rack Controllers are in the ESS.

Table 2-2 Cable connections

Number of Smart Rack Controllers Connected	MCCB in the DCBOX	
	Smart Rack Controller Connections	Smart PCS Connections[a]
1	QF03	QF01, QF05, QF07, QF10, QF14
2	QF03, QF08	
3	QF03, QF08, QF12	
4	QF02, QF08, QF09, QF12	
5	QF02, QF04, QF08, QF09, QF12	
6	QF02, QF04, QF08, QF09, QF12, QF13	
7	QF02, QF03, QF04, QF08, QF09, QF12, QF13	
8	QF02, QF03, QF04, QF06, QF08, QF09, QF12, QF13	
9	QF02, QF03, QF04, QF06, QF08, QF09, QF11, QF12, QF13	
a: The DC power cables connected to the Smart PCS are preinstalled in the DCBOX before delivery.		

The following figure shows the cable connections of nine Smart Rack Controllers.

Figure 2-4 Cable connections of nine Smart Rack Controllers



3 Transportation and Storage

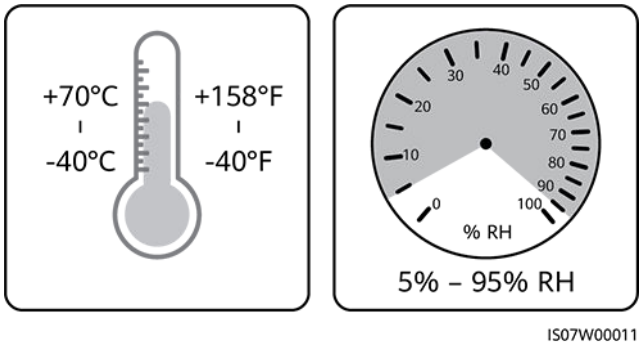
Transportation Requirements

- Select a proper transportation tool based on the dimensions and weight of the equipment (see **9 Technical Specifications**).
- Do not stack the equipment.
- Place the equipment horizontally during transportation.
- Prevent collisions or scratches during transportation.
- Requirements for road transportation: Before transporting the equipment, conduct road survey to identify any obstacles in the transportation route to ensure that the vehicle can pass through the transportation route safely. Survey information: road condition, height limit, actual height, width limit, actual width, weight limit, traffic restrictions, and obstacles.
- Requirements for waterway transportation: The waterway should meet the requirements of full-load voyage.

Storage Requirements

- Close the cabinet door.
- The ambient temperature and humidity are suitable for the storage.

Figure 3-1 Temperature and humidity requirements



- Store the equipment in a clean and dry place and protect it from dust and water vapor corrosion.
- If the equipment will be stored for a long time, place a dehydrating breather in the cabinet.

Service Description

The following services and operations are outside the product delivery scope (unless otherwise agreed in the contract):

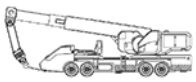
- Transporting the equipment to the construction site.
- Preparing a crane for unloading the equipment at the construction site
- Preparing the concrete foundation for installing the equipment
- Installing the equipment and connecting cables at the construction site

4 Tools

NOTE

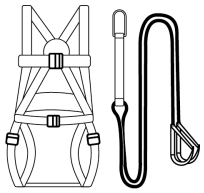
- The tool pictures are for reference only.
- The tool tables may not list out some tools required onsite. Onsite installation personnel and the customer need to prepare the tools based on site requirements.

Transportation Equipment

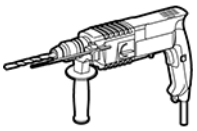
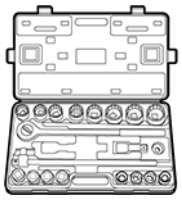
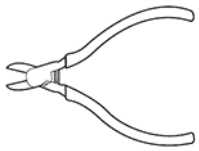
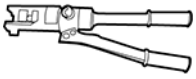
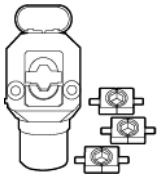
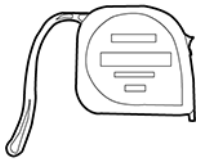
 Crane Hoisting capability ≥ 3 t; operation radius ≥ 2 m	 Lifting rope and fastener Length of the lifting rope ≥ 19.4 m	 Step ladder

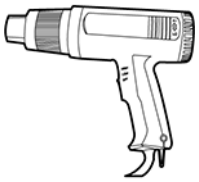
Personal Protective Equipment (PPE)

 Safety gloves	 Safety helmet	 Insulation shoes

 Reflective vest	 Safety goggles	 Safety belt

Installation Tools

 Hammer drill with a Φ16 mm drill bit	 Vacuum cleaner	 Rubber mallet
 Torque wrench	 Socket wrench	 Diagonal pliers
 Utility knife	 Wire stripper	 Marker
 Hydraulic pliers	 Hydraulic crimping tool	 Steel measuring tape

 Heat-shrink tubing	 Heat gun	 Cable tie

5 Installation

5.1 Determining the Installation Position

Site Requirements

The DCBOX should be installed in an outdoor site that meets the following conditions:

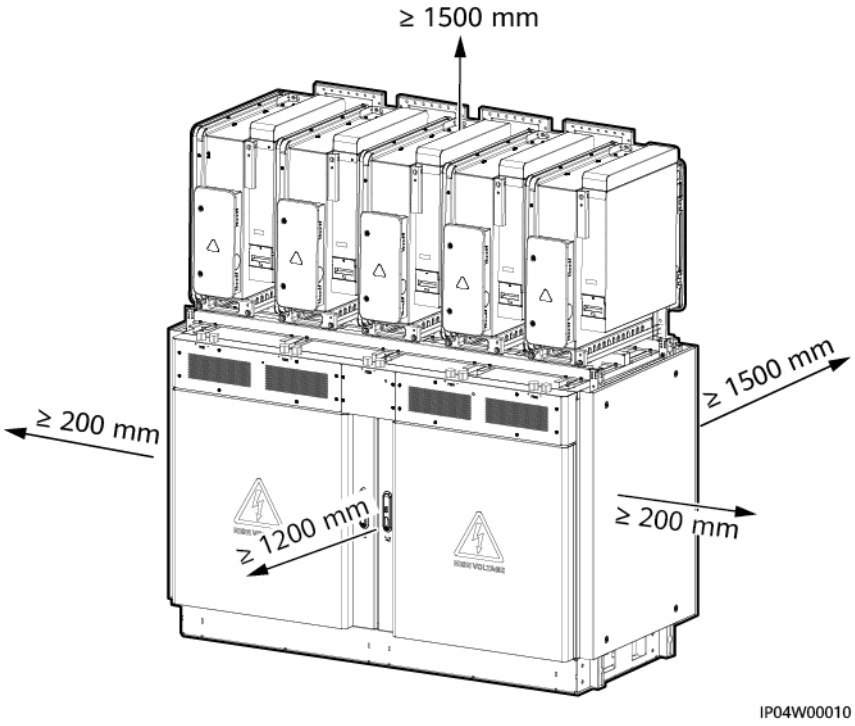
- The site should not be located in a low-lying land. The horizontal level of the site should be above the highest water level of that area.
- The ground should be solid without spongy or soft soil, and should not be prone to water accumulation or subsidence.
- The site is in a well-ventilated area.
- The site is in a stable area far away from high-levels of vibration, noise, and electromagnetic interference.
- The site is not above any underground facilities.
- The anti-corrosion level of the equipment is C5 Medium. Therefore, the site must be a class C or higher environment but not a class D or E environment.
- The site is far away from dust, oil, smoke, harmful gases, and corrosive, flammable, or explosive objects.
- The site is at least 500 m away from any airports, landfills, and water areas.
- The site is an open area and at least 10 m away from any obstacles in all directions.
- The site is at least 50 m away from residential areas.
- The site temperature is within the range of –30°C to +60°C. If the temperature exceeds 55°C, the equipment must be installed in a shaded area.

NOTE

- Class C environment: Outdoor areas more than 500 m away from the sea. If a site is near a pollution source, it must be 1500–3000 m away from heavy pollution sources, such as smelteries, coal mines, and thermal power plants; 1000–2000 m away from medium pollution sources involving chemicals, rubber, and galvanization; or 500–1000 m away from light pollution sources, such as packing houses, tanneries, boiler rooms, slaughterhouses, landfills, and sewage treatment plants.
- Class D environment: Sea environments or outdoor areas within 500 m away from the sea. If a site is near a pollution source, it is within 1500 m away from heavy pollution sources such as smelteries, coal mines, and thermal power plants, within 1000 m away from medium pollution sources such as chemical, rubber, and galvanization industries, or within 500 m away from light pollution sources such as packing houses, tanneries, boiler rooms, slaughterhouses, landfill sites, and sewage treatment plants.
- Class E environment: Special environments, such as underground or underwater environments.

Installation Clearance Requirements

Figure 5-1 Installation clearance requirements



5.2 Checking Before Installation

Checking the Outer Packing

Before unpacking the equipment, check the outer packing for damage, such as holes and cracks, and check the equipment model. If any damage is found or the equipment model is not what you requested, do not unpack the equipment and contact your retailer as soon as possible.

NOTE

You are advised to remove the outer packing within 24 hours before installing the equipment.

Checking Deliverables

After unpacking the equipment, check that the deliverables are intact and complete, and free from any obvious damage. If any item is missing or damaged, contact your retailer.

NOTE

For details about the number of accessories delivered with the equipment, see the *Packing List* in the packing case.

5.3 Installing the DCBOX and Smart PCS

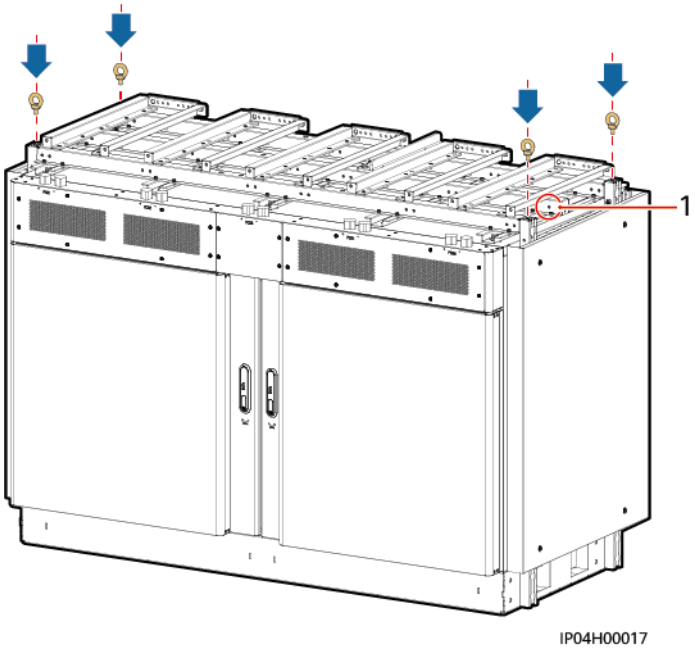
Installing the DCBOX

Step 1 Install lifting eyes.

NOTE

After the equipment is in place, remove and store the lifting eyes. The lifting eyes might be rusted if not removed.

Figure 5-2 Installing lifting eyes



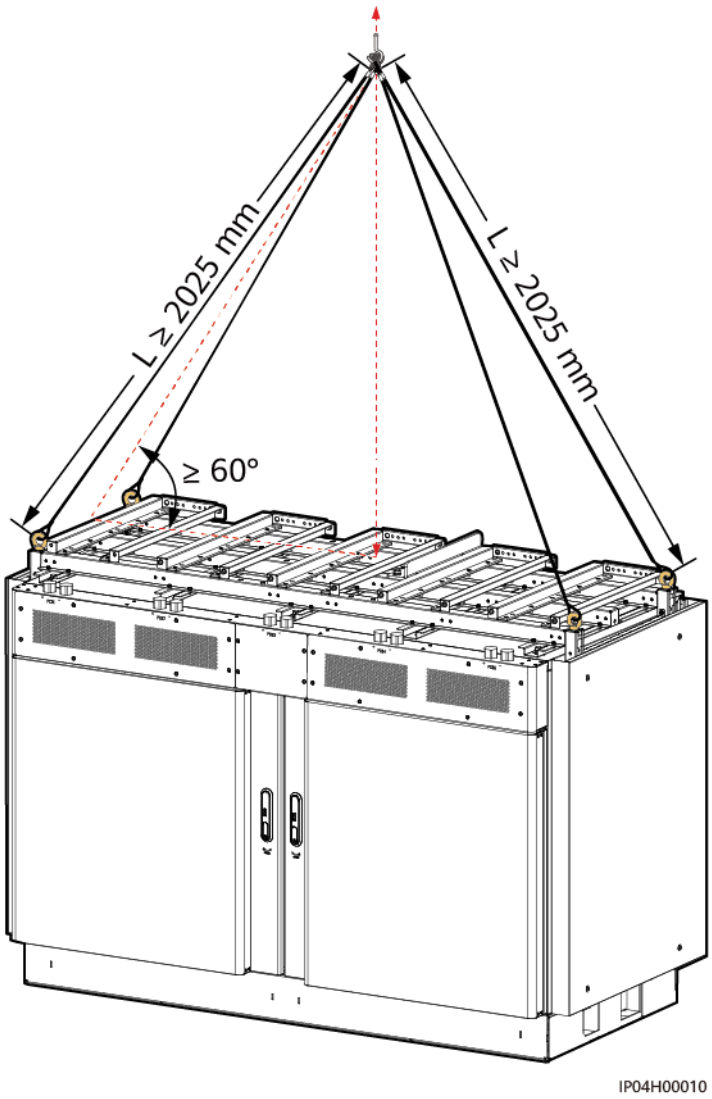
(1) Lifting eye binding position

Step 2 Hoist the DCBOX to the installation position.

NOTE

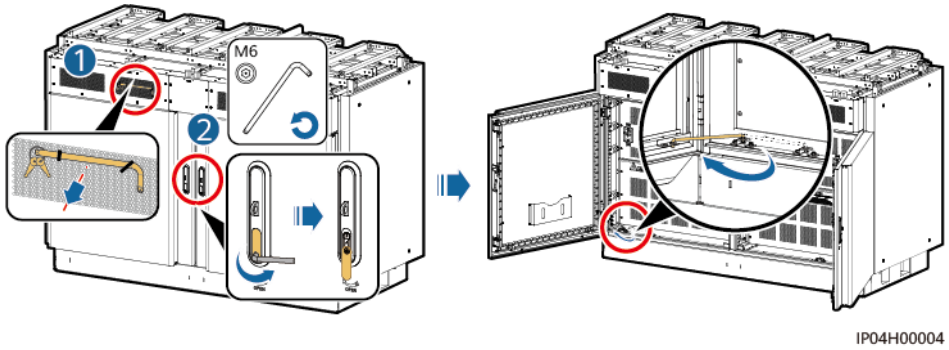
After the equipment is in place, remove and store the lifting eyes. The lifting eyes might be rusted if not removed.

Figure 5-3 Hoisting



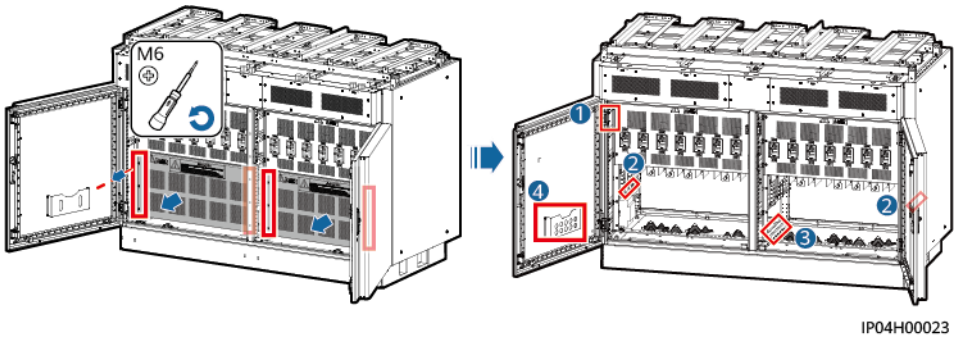
Step 3 Open the cabinet door.

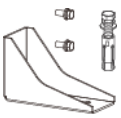
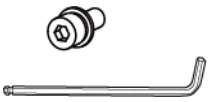
Figure 5-4 Opening the cabinet door



Step 4 Take out the mounting kits.

Figure 5-5 Binding positions



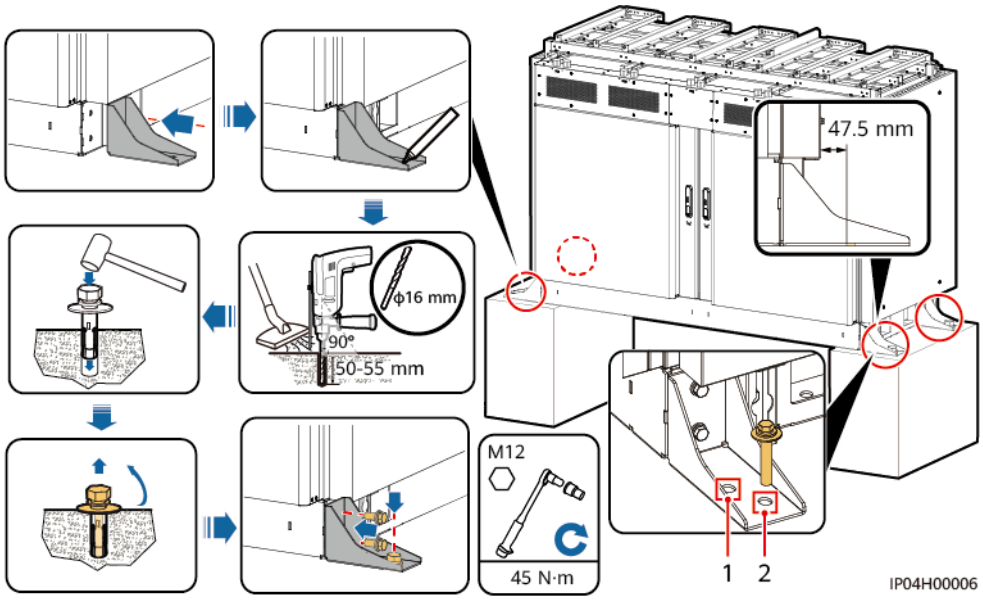
(1) Spacer	(2) Smart PCS fastener	(3) Angle bracket	(4) Smart PCS fastening screws and tool
			

Step 5 Drill holes into the foundation and secure the DCBOX.

NOTICE

- To avoid inhaling dust and prevent dust from falling into your eyes, wear safety goggles and a dust mask when drilling holes.
- Clean up the dust in or around the holes with a vacuum cleaner and check the positions of the holes. If the holes are inaccurately positioned, drill new holes properly.
- After the bolts, spring washers, and flat washers have been removed from the expansion bolts, ensure that the upper surface of the expansion tube is level with the ground. This ensures that the DCBOX is positioned stably.
- If the DCBOX is not positioned stably, use a spacer to level the DCBOX before securing it.

Figure 5-6 Securing the DCBOX



(1) Spare hole	(2) Expansion bolt hole

----End

Installing the Smart PCS

CAUTION

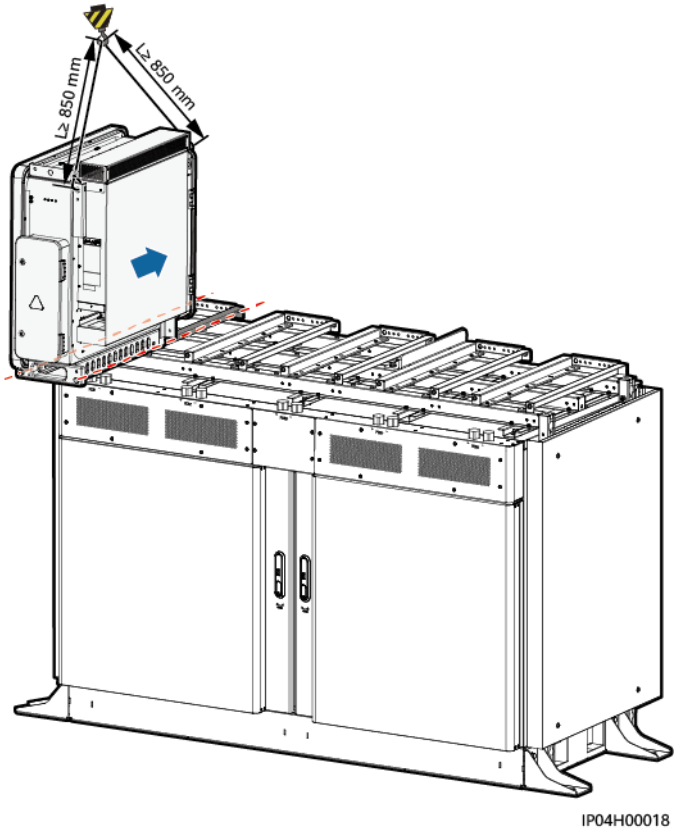
- Before installing the Smart PCS, ensure that the DCBOX has been securely installed.
- Do not stand on the top of the DCBOX.
- Do not manually lift the Smart PCS to avoid personal injury.
- Before installing the Smart PCS, unbind the DC power cables preinstalled on the top of the DCBOX. The preinstalled DC power cables in the positions where no Smart PCS will be installed must be removed from the MCCB in the cabinet and bound. The cables outside the cabinet must remain intact.

NOTE

- A maximum of five Smart PCSs can be installed on the top of the DCBOX. If less than five Smart PCSs will be installed, install them from left to right. Otherwise, the Smart PCS fasteners cannot be used.
- The installation method of all Smart PCSs is the same. Install the Smart PCS according to the direction shown in the figure. This section uses one Smart PCS as an example.

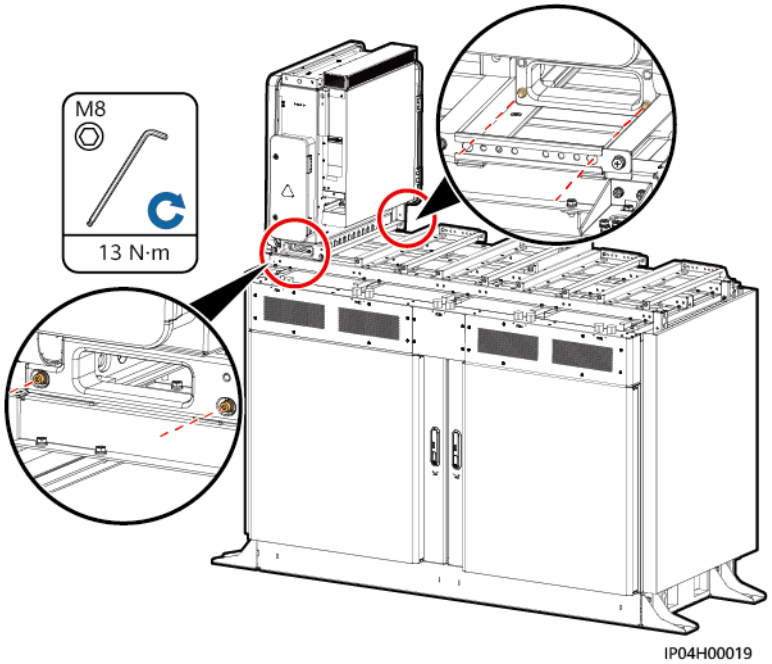
Step 1 Hoist the Smart PCS to the top of the DCBOX and push the Smart PCS in place along the guide rails.

Figure 5-7 Installing the Smart PCS



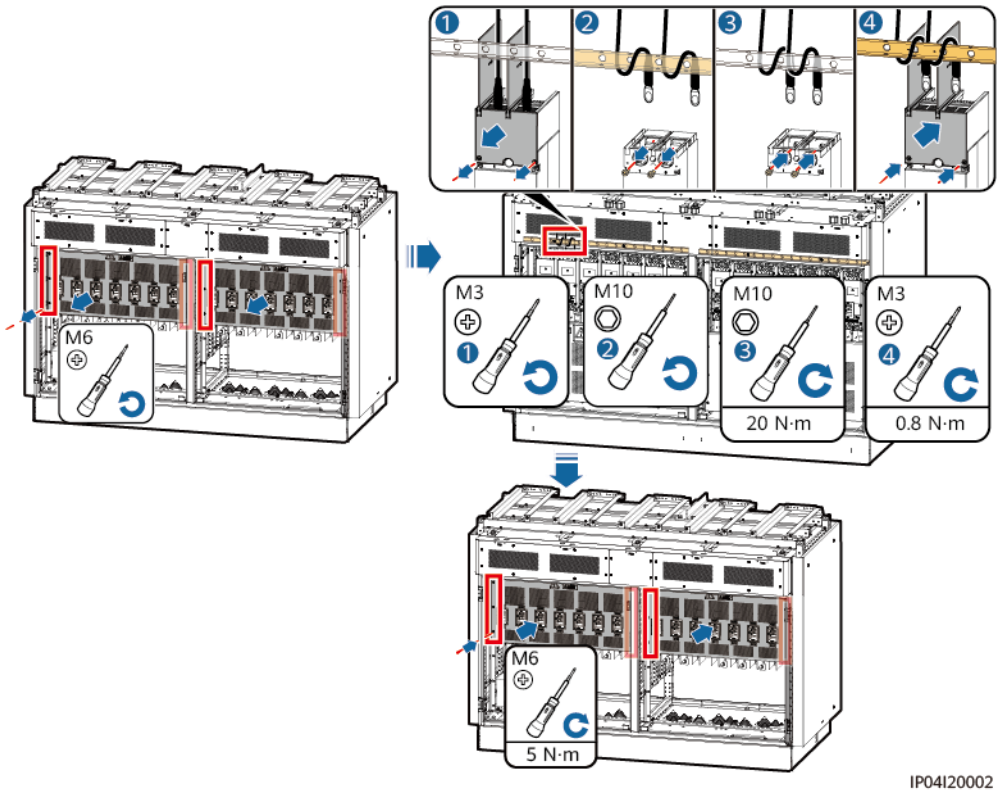
Step 2 Secure the Smart PCS using the screws included with the equipment.

Figure 5-8 Securing the Smart PCS



Step 3 (Optional) Remove the preinstalled DC power cables.

Figure 5-9 Removing the cables



----End

6 Connecting Cables

DANGER

Before connecting cables, ensure that the upstream and downstream devices of the DCBOX and Smart PCS are powered off. Otherwise, high voltages of the DCBOX and Smart PCS may cause electric shocks.

WARNING

- The equipment damage caused by incorrect cable connections is not covered under any warranty.
- Only certified electricians are allowed to connect cables.
- Wear proper PPE at all time when connecting cables.
- Before connecting cables to ports, leave enough slack to reduce the tension on the cables and prevent poor cable connections.

NOTE

The cable colors shown in the electrical connection diagrams provided in this chapter are for reference only. Select cables in accordance with local cable specifications (green-and-yellow cables are only used for PE).

6.1 Cable Routing and Preparation

The DCBOX

NOTICE

Connect the DC power cables between Smart Rack Controllers and the DCBOX along the shortest route.

Figure 6-1 Cable routing

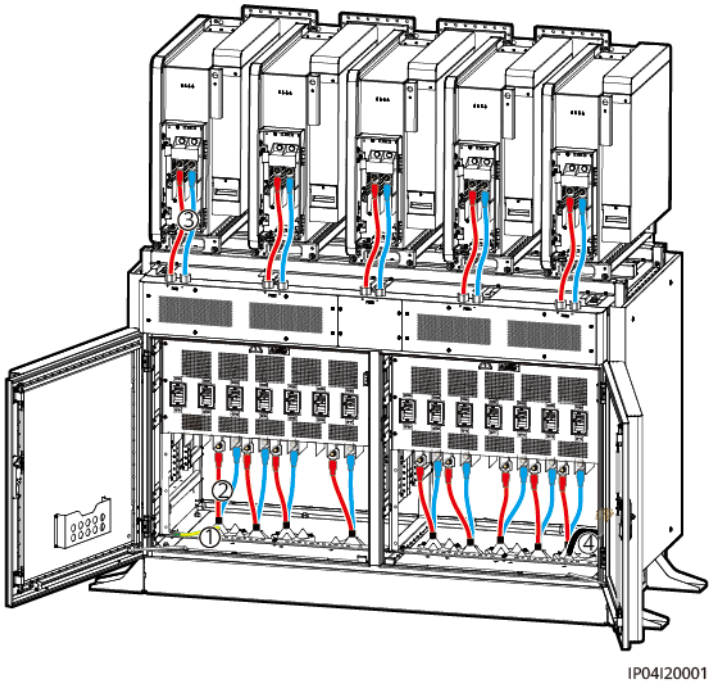


Table 6-1 Cable specifications

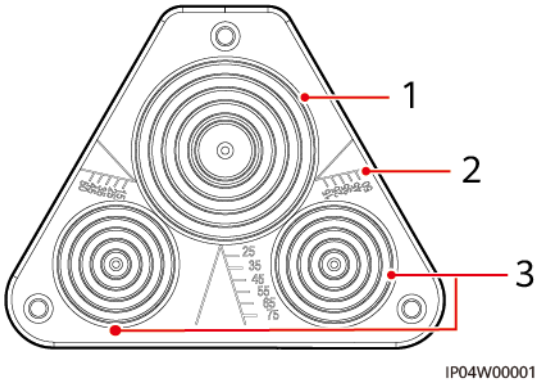
No.	Cable Description	Cable Type	Cable Specifications	Source
1	DCBOX ground cable	Single-core outdoor copper cable	Conductor cross-sectional area ≥ S/2 (S indicates the conductor cross-sectional area in No. 2)	Prepared by the customer
2	DC power cable between the Smart Rack Controller and the DCBOX[a]	Single-core outdoor cable	• Conductor cross-sectional area: 185–400 mm^2 • Cable outer diameter: 25–47 mm • M12 DT terminal	Prepared by the customer
		Two-core outdoor cable	• Conductor cross-sectional area: 240–400 mm^2 • Cable outer diameter: 25–68 mm • M12 DT terminal	
3	DC power cable between the DCBOX and the Smart PCS	-	-	Preinstalled before delivery

No.	Cable Description	Cable Type	Cable Specifications	Source
4	Door status sensor signal cable	Two-core outdoor cable	Conductor cross-sectional area: 1–2.5 mm^2	Prepared by the customer

Note a:

- Each DC power cable between the Smart Rack Controller and the DCBOX corresponds to a set of pagoda connectors. Select the holes based on the cable type.
- Use the vacant holes for the DCBOX ground cable and the door status sensor signal cable.

Figure 6-2 A set of pagoda connectors



(1) Large hole, for two-core outdoor DC power cables	(2) Pagoda diameter. Cut the pagoda thread according to the cable cross-sectional area.	(3) Small hole, for single-core outdoor DC power cables

NOTE

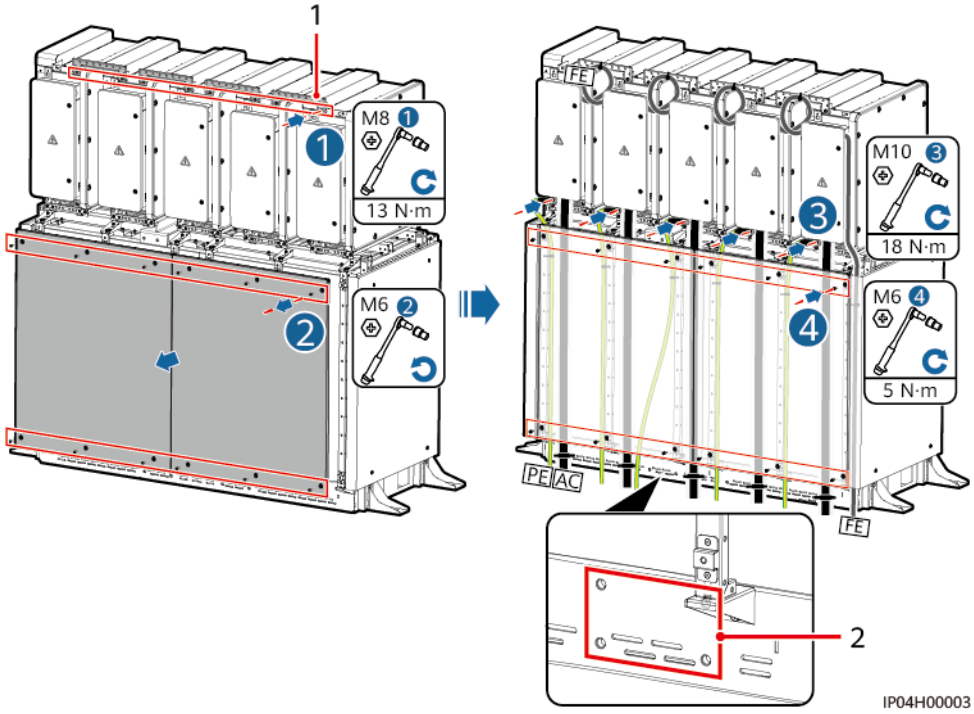
This section describes only the DCBOX cable routing scheme. For details about how to connect DCBOX cables, see the corresponding section.

Smart PCS

NOTICE

- The stripped sheath end of the Smart PCS AC power cable must be in the AC maintenance compartment of the Smart PCS.
- When routing cables, do not interfere with the holes for securing the base of the maintenance engineering installation kit.

Figure 6-3 Cable routing



(1) Smart PCS fastener	(2) Holes for securing the base of the maintenance engineering installation kit.

NOTE

This document describes only the cable routing scheme for the Smart PCS. For details about the cable specifications, see the corresponding user manual or quick guide.

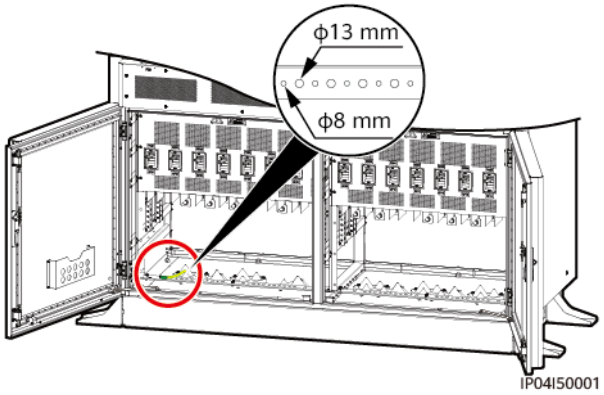
6.2 Connecting the DCBOX Ground Cable

Step 1 Connect the ground cable.

NOTE

The ground copper bar is included with the DCBOX. You need to prepare the ground screws.

Figure 6-4 Connecting the ground cable



----End

6.3 Connecting DC Power Cables Between Smart Rack Controllers and the DCBOX

NOTE

A maximum of nine DC power cables can be connected. The connections of all DC power cables are the same. This section uses one DC power cable as an example.

Step 1 Prepare cables.

Figure 6-5 Single-core cable

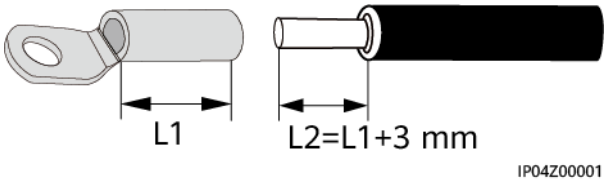
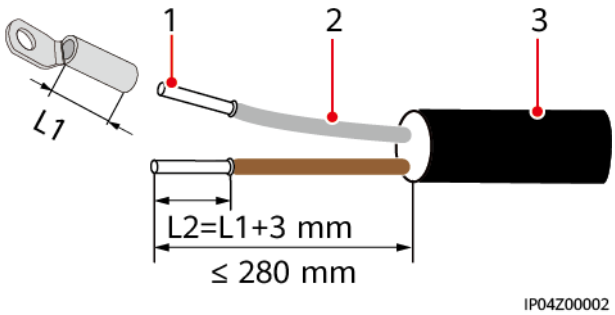


Figure 6-6 Two-core cable



(1) Core wire	(2) Insulation layer	(3) Jacket

Step 2 Connect cables through correct cable holes.

NOTE

If the shield layer grounding of the DC power cables is required, you need to prepare the ground screws.

Figure 6-7 Single-core cable

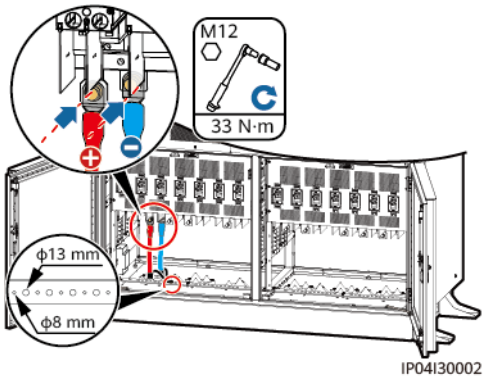
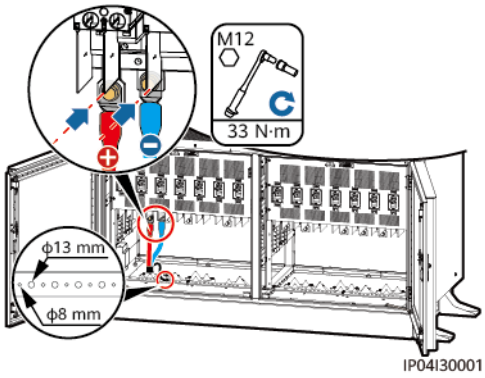


Figure 6-8 Two-core cable

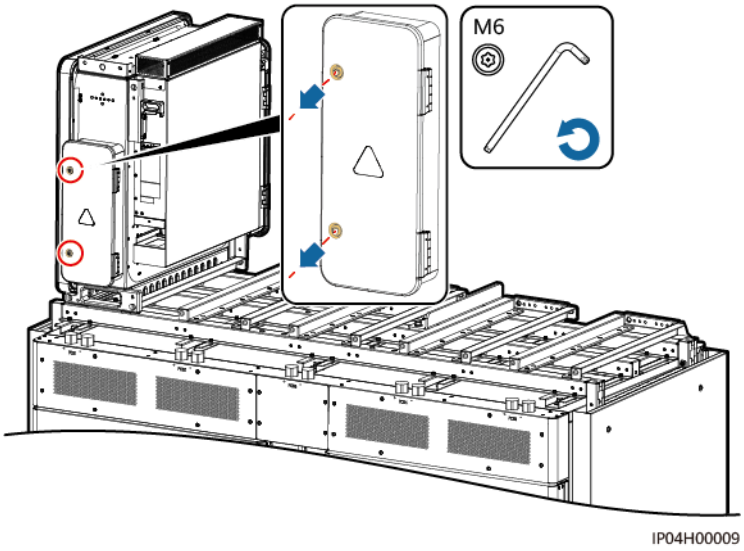


----End

6.4 Connecting DC Power Cables Between the DCBOX and the Smart PCS

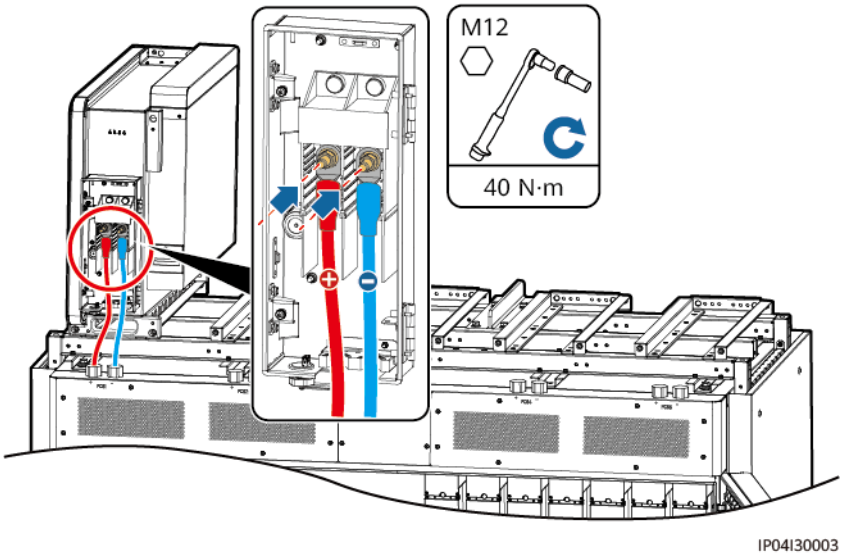
Step 1 Open the maintenance compartment of the Smart PCS.

Figure 6-9 Opening the maintenance compartment door



Step 2 Connect the preinstalled DC power cable to the Smart PCS.

Figure 6-10 Connecting cables

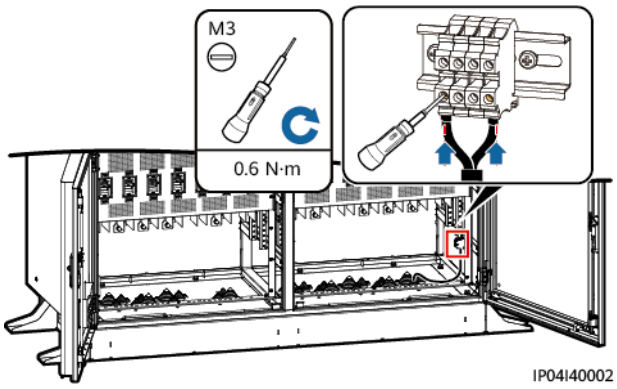


----End

6.5 Connecting the Signal Cable for the Door Status Sensor

Step 1 Connect the signal cable to the door status sensor.

Figure 6-11 Connect the signal cable



----End

6.6 Closing the Cabinet Door

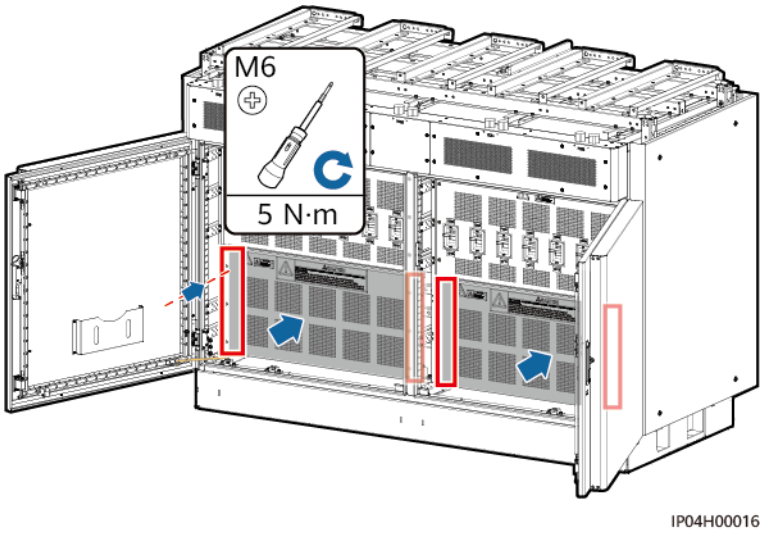
Prerequisites

- Cables are securely and correctly connected.
- There is no foreign matter in the cabinet.
- The pagoda connectors are sealed with firestop putty.

Procedure

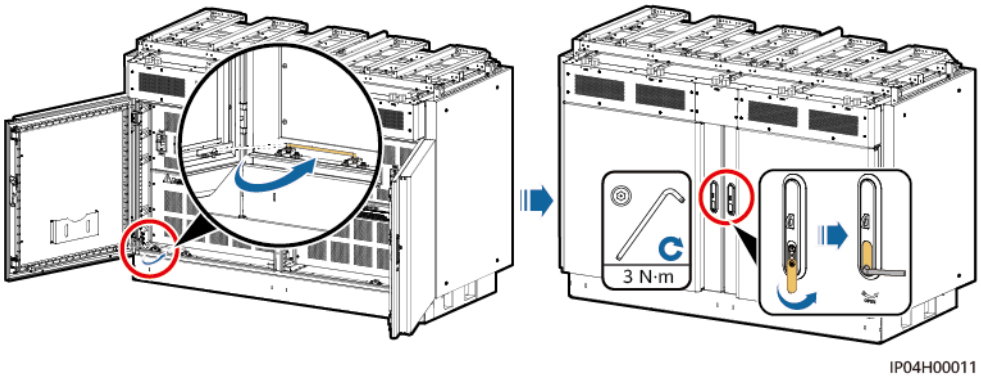
Step 1 Install the MCCB protective plate.

Figure 6-12 Installing the MCCB protective plate



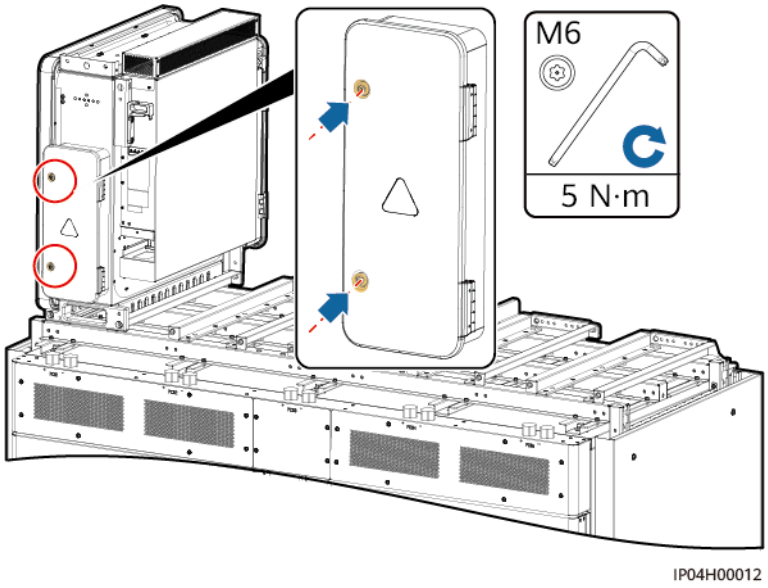
Step 2 Adjust the support bar and close the cabinet door.

Figure 6-13 Closing the DCBOX cabinet door



Step 3 Close the maintenance compartment door of the Smart PCS.

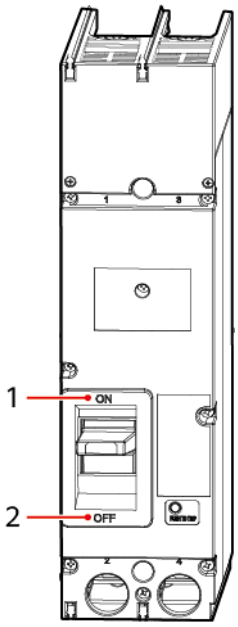
Figure 6-14 Closing the maintenance compartment door of the Smart PCS



----End

7 MCCB Operation Description

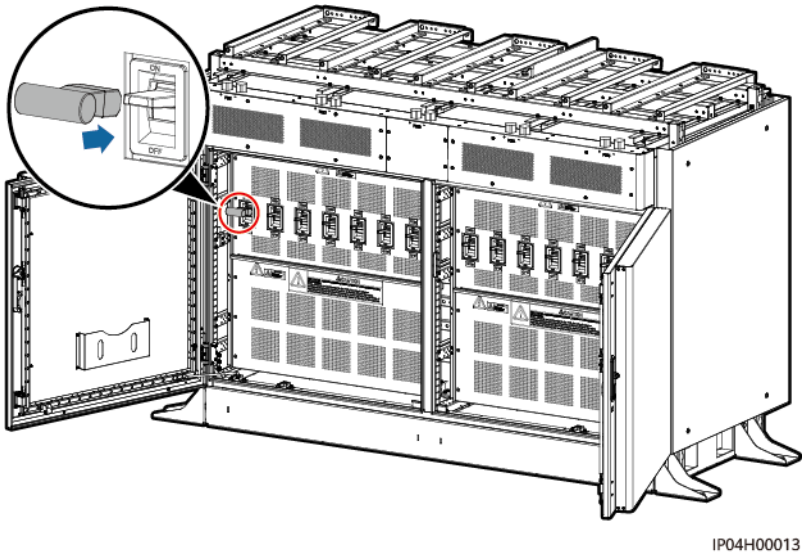
Figure 7-1 MCCB appearance



(1) ON: Switch on the MCCB.	(2) OFF: Switch off the MCCB.

To switch on or off the MCCB, use the delivered circuit breaker handle extension.

Figure 7-2 Switching on or off the MCCB



8 Maintenance

8.1 Routine Maintenance

To ensure that the DC LV Panel can operate properly for a long time, perform routine maintenance on it according to this section.

Prerequisites

CAUTION

- Before cleaning the system, connecting cables, and checking the grounding reliability, power off the system.
- If you need to open the cabinet door under rainy or snowy weather conditions, take protective measures to prevent rain or snow from entering the cabinet. If such protective measures cannot be taken, do not open the cabinet door under such conditions.

Table 8-1 Maintenance table

No.	Check Item	Check Method	Maintenance Interval
1	System running status and equipment condition	Check whether the equipment and its internal components are damaged.	Once a month
		Check that the warning signs are clear. If they are not, promptly replace them.	

No.	Check Item	Check Method	Maintenance Interval
		Check the equipment for corrosion and paint peeling. If corrosion or paint peeling has occurred, repaint the area.	
2	Cable connections	Check that the cables are securely connected.	6 months after the first commissioning and once every 2 years after that
		Check whether the cables are intact.	
3	Cleanness of the air inlet and outlet of the Smart PCS	Check whether the air inlet and outlet are dusty. If necessary, clean them using tools.	Once every 6 to 12 months

8.2 Troubleshooting

Symptom	Possible Causes	Troubleshooting Suggestions
The DC circuit breaker on the Smart PCS side trips.	1. The Smart PCS is faulty. 2. The cable between the circuit breaker and the Smart PCS is faulty. 3. The circuit breaker is overheating due to loose wiring terminals. 4. The circuit breaker is faulty.	1. Check whether the Smart PCS is faulty. If it is, switch on the circuit breaker after the fault has been rectified. 2. Test the cable insulation of the tripped circuit breaker using an insulation tester. If the insulation value is low, check and repair the cable. Switch on the circuit breaker after the fault has been rectified. 3. Check that circuit breaker wiring terminals are secure. 4. If the preceding exceptions are not found, switch on the circuit breaker. If the circuit breaker trips again, replace the DC circuit breaker. 5. If the replaced circuit breaker still trips, contact your retailer or Huawei technical support.

Symptom	Possible Causes	Troubleshooting Suggestions
The DC circuit breaker on the ESS side trips.	1. An internal fault has occurred in the ESS. 2. The cable between the circuit breaker and the ESS is faulty. 3. The circuit breaker is overheating due to loose wiring terminals. 4. The DC circuit breaker is faulty.	1. Check whether the fault is in the ESS container. If it is, switch on the circuit breaker after the fault has been rectified. 2. Test the cable insulation of the tripped circuit breaker using an insulation tester. If the insulation value is low, check and repair the cable. Switch on the circuit breaker after the fault has been rectified. 3. Check that circuit breaker wiring terminals are secure. 4. If the preceding exceptions are not found, switch on the circuit breaker. If the circuit breaker trips again, replace the DC circuit breaker. 5. If the replaced circuit breaker still trips, contact your retailer or Huawei technical support.

8.3 Replacing Components

8.3.1 Replacing a Smart PCS

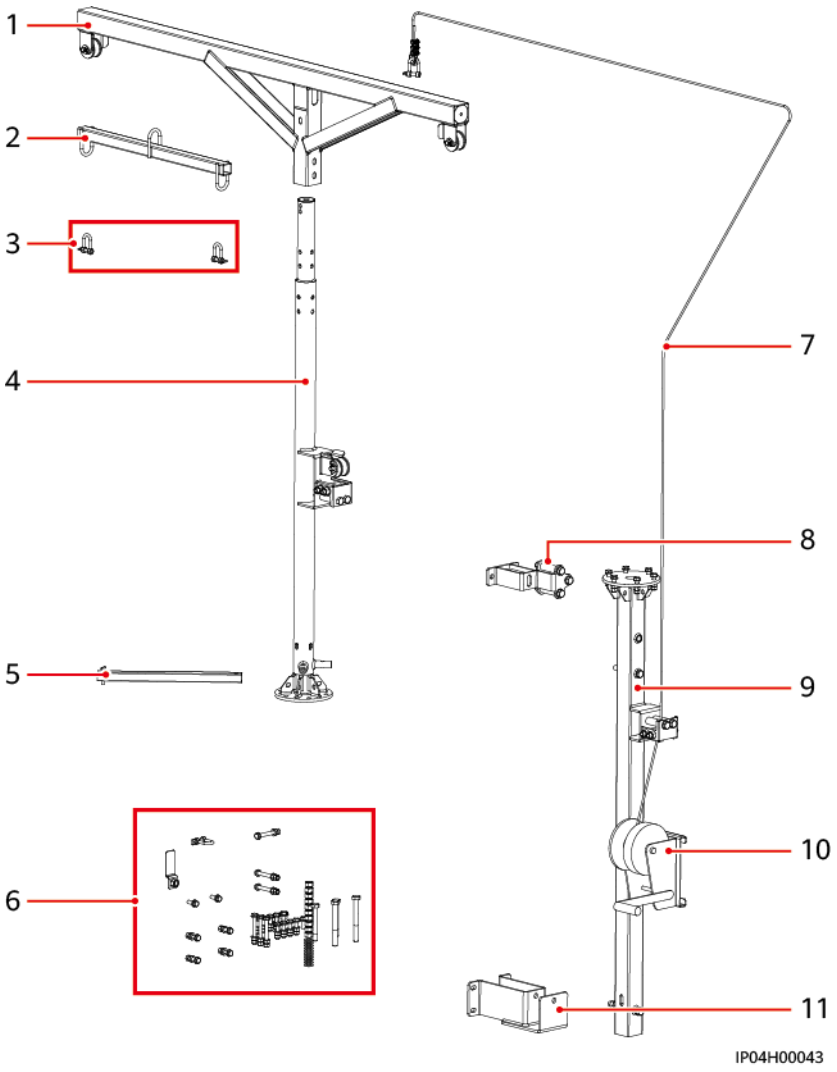
8.3.1.1 Assembling a Manual Jib Crane

NOTE

- Do not use the manual jib crane on rainy days. If it comes in contact with water, dry it to prevent rust.
- Pack the manual jib crane into an iron box and store it in a dry place indoors after use. If rust occurs on the parts, remove the rust immediately and apply oil.

Appearance

Figure 8-1 Appearance

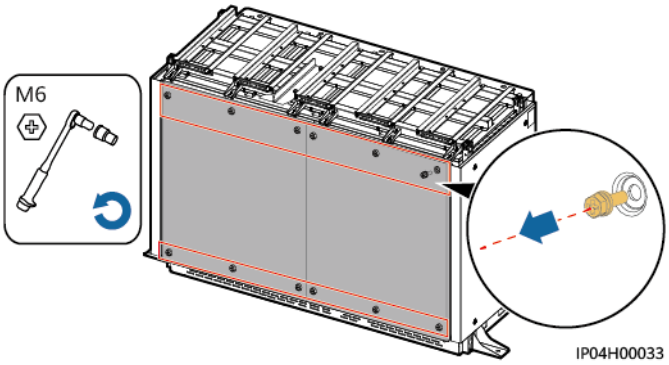


(1) Boom	(2) Movable hoist	(3) Shackle	(4) Round pillar
(5) Operating rod	(6) Fastener	(7) Steel rope	(8) Middle fastener
(9) Square pillar	(10) Winch	(11) Base	-

Procedure

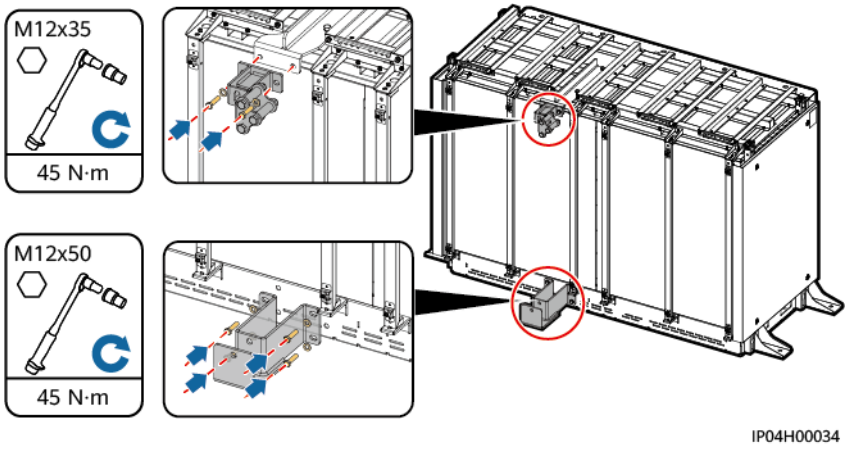
Step 1 Remove the thermal insulation plate from the rear of the DCBOX.

Figure 8-2 Remove the thermal insulation plate from the rear of the DCBOX



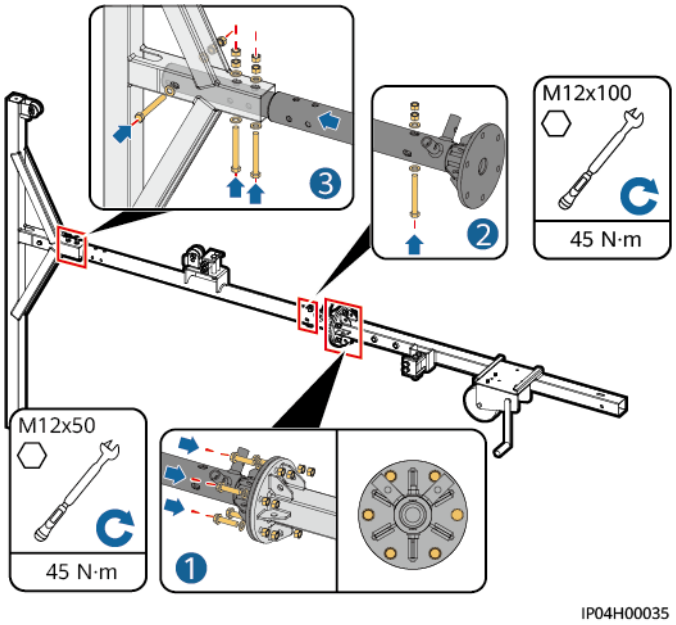
Step 2 Install a connection base to the DCBOX.

Figure 8-3 Install a connection base to the DCBOX



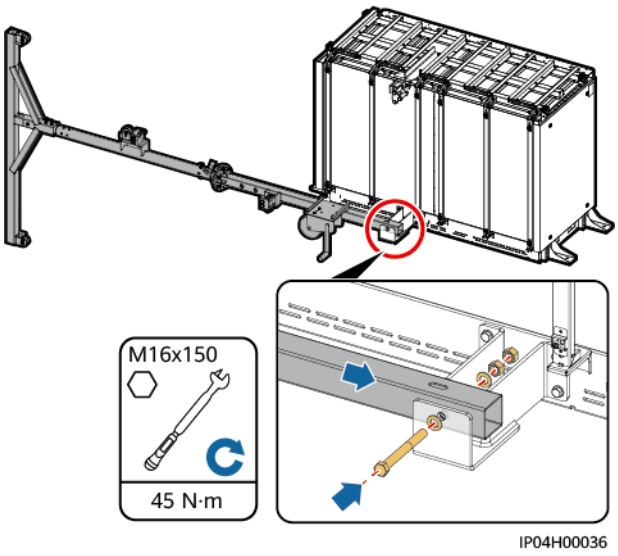
Step 3 Assemble the boom, round pillar, and square pillar of the manual jib crane.

Figure 8-4 Assemble the boom, round pillar, and square pillar of the manual jib crane



Step 4 Secure the manual jib crane to the base.

Figure 8-5 Secure the manual jib crane to the base



Step 5 Install the steel rope.

Figure 8-6 Installing the steel rope

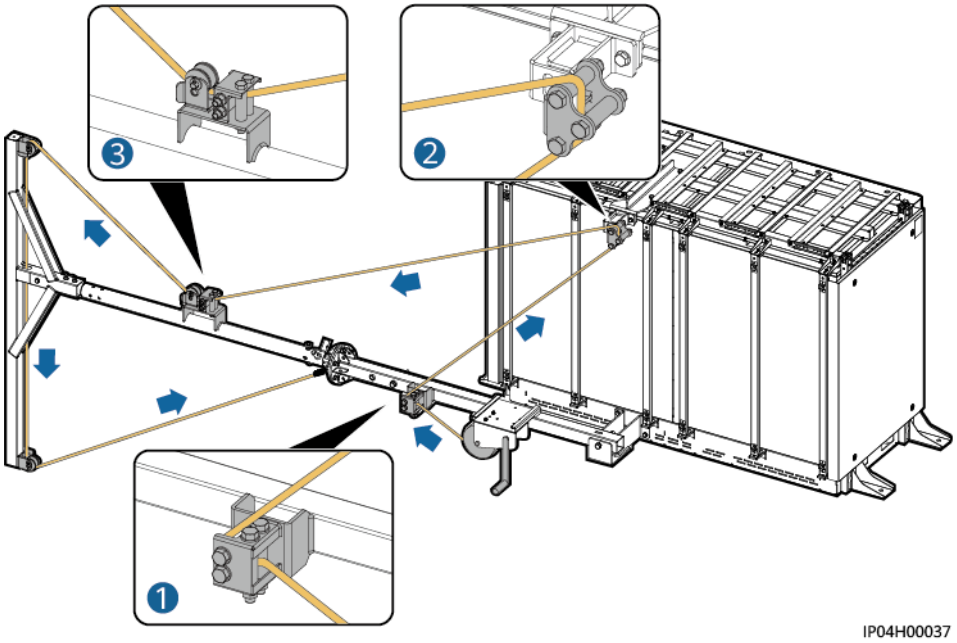
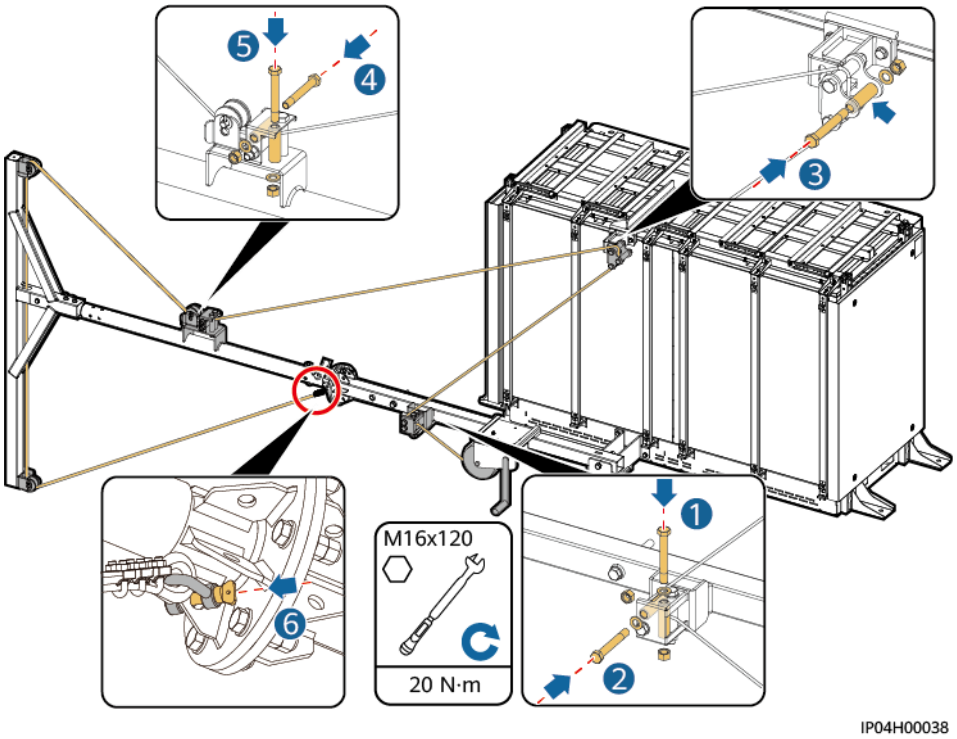


Figure 8-7 Installing the steel rope

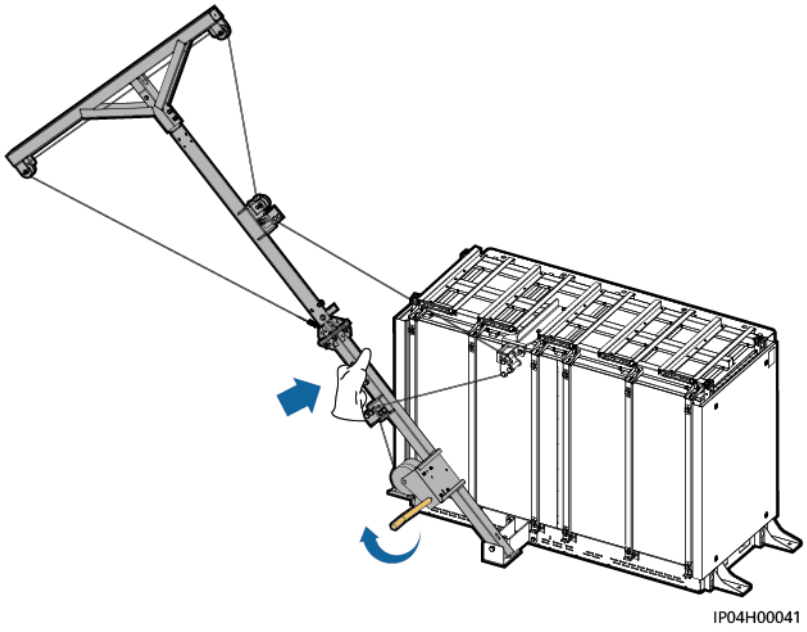


Step 6 Rotate the winch handle.

NOTICE

- Keep irrelevant people away from the equipment. Only operators are allowed to access the equipment. Set up temporary warning signs or fences to isolate the operation area.
- Ensure that the manual jib crane does not swing back and forth during operation. Otherwise, the Smart PCS may be damaged.

Figure 8-8 Rotate the winch handle

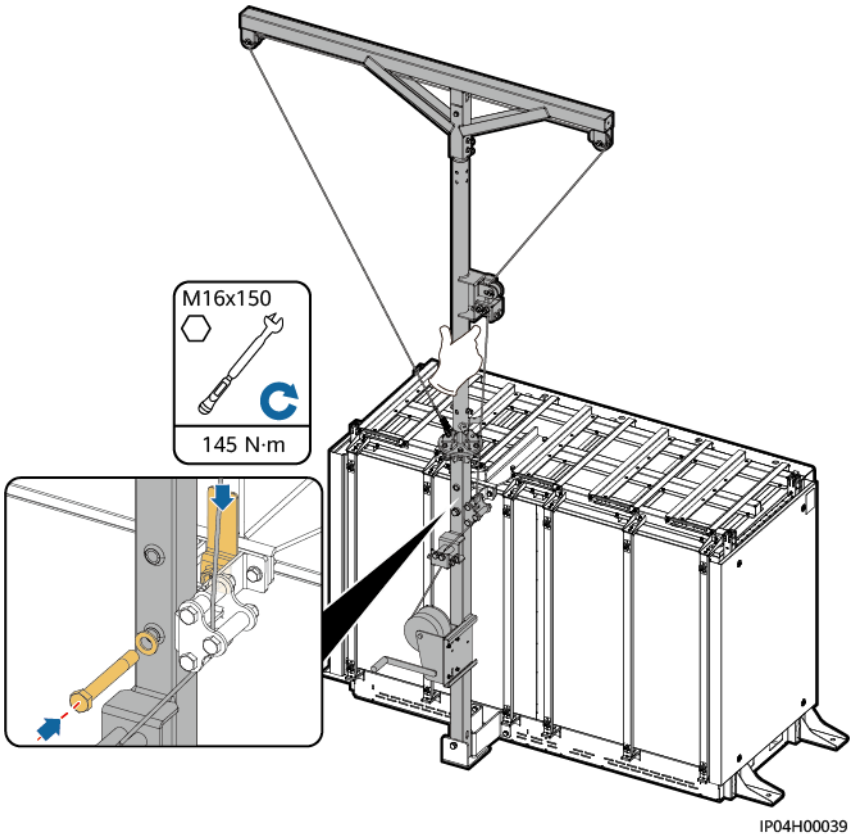


Step 7 Secure the manual jib crane to the DCBOX.

NOTICE

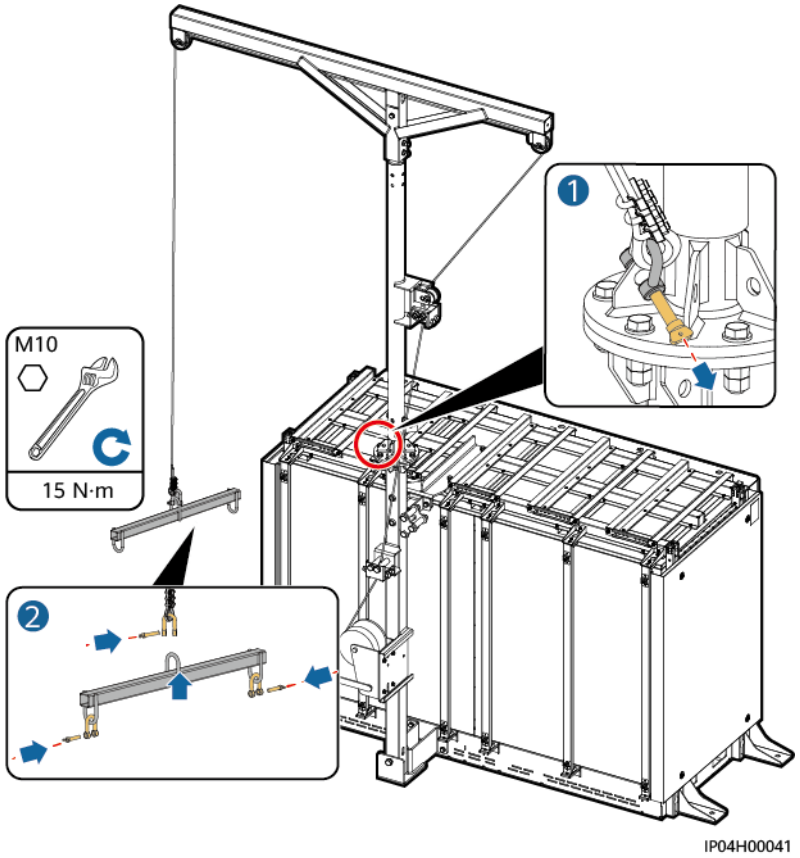
When tightening the screws, keep the manual jib crane upright and prevent it from falling over.

Figure 8-9 Secure the manual jib crane to the DCBOX



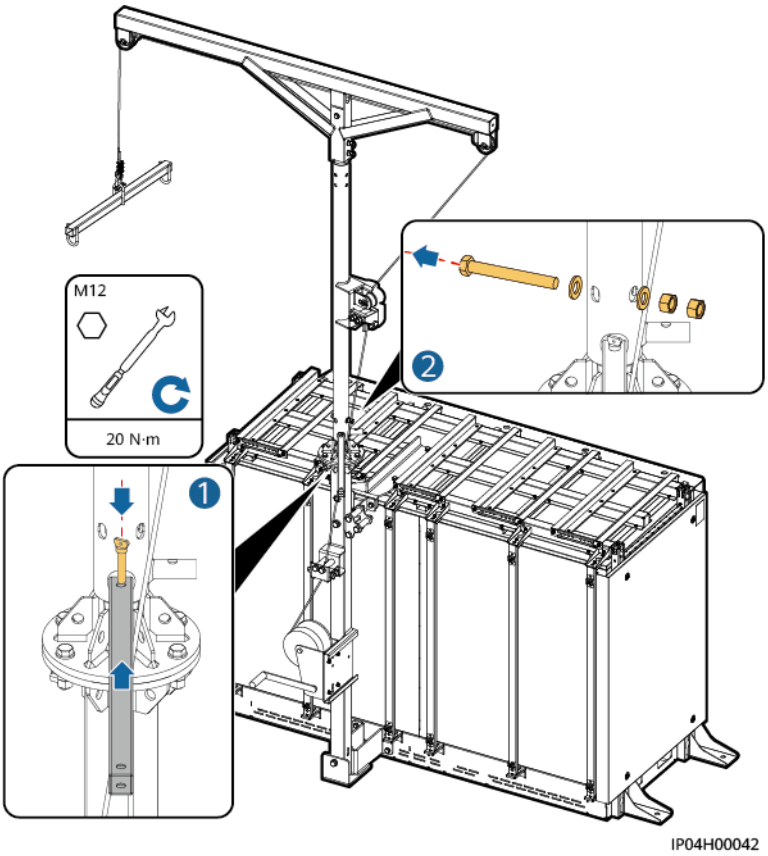
Step 8 Installing a Movable Hoist.

Figure 8-10 Installing a Movable Hoist



Step 9 Installing an Operating Rod.

Figure 8-11 Installing an Operating Rod



----End

8.3.1.2 Replacing a Smart PCS

CAUTION

- Before replacing the Smart PCS, turn off the AC and DC external switches.
- Do not stand under the Smart PCS.
- Steady the Smart PCS with a rope during hoisting to prevent collision with other Smart PCSs.
- Ensure that the Smart PCS is turned and lifted slowly.

NOTE

- Before replacing the Smart PCS, ensure that the DC power cables, AC power cables, communications cables, and ground cable of the Smart PCS have been removed.
- Install a new Smart PCS, and then connect the ground cable, DC power cables, AC power cables, and communications cables in sequence. For details, see LUNA2000-200KTL-H0 Smart Power Control System User Manual.

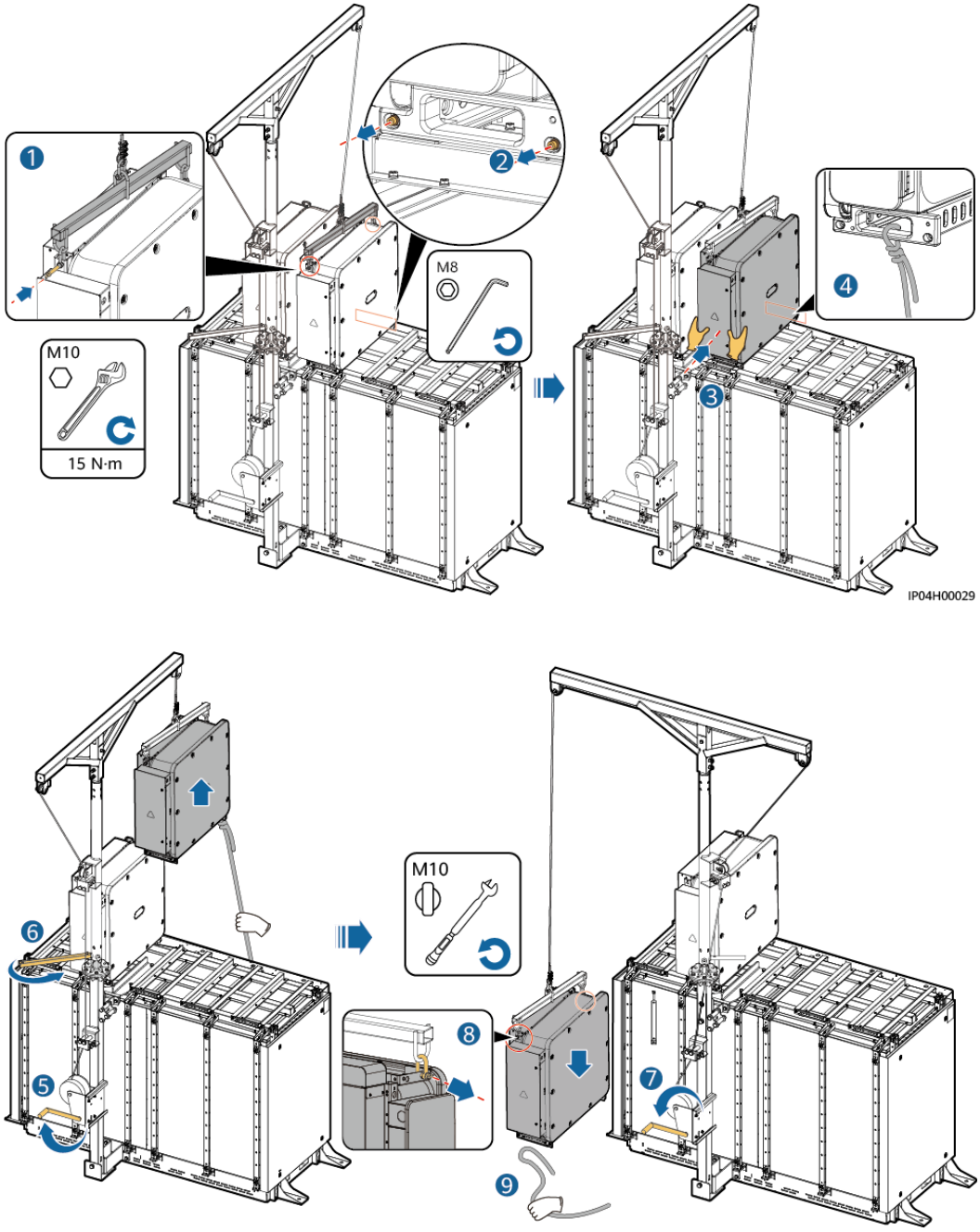
Procedure

Step 1 Removing a Faulty Smart PCS.

NOTE

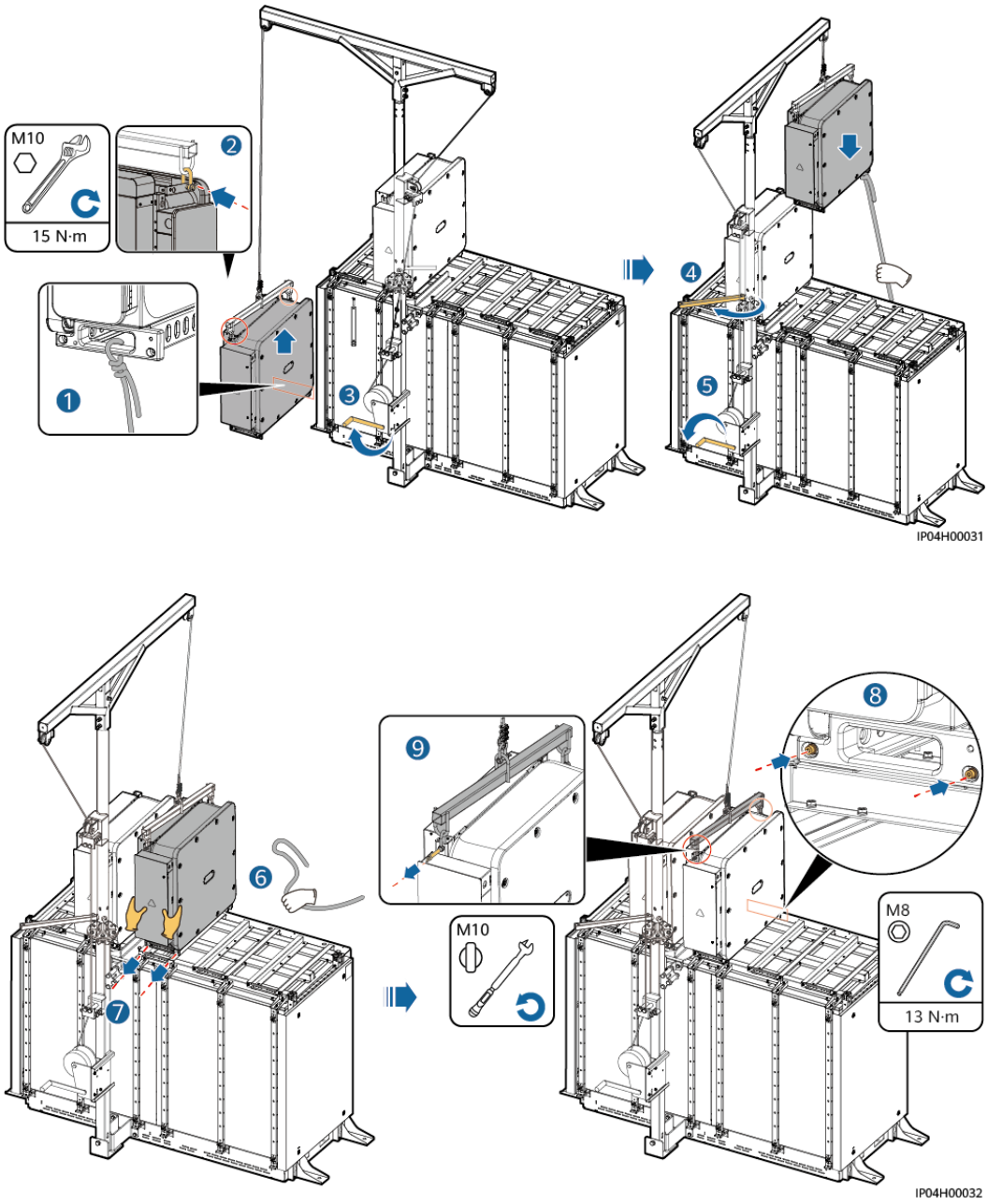
Move the Smart PCS outwards for 3 cm to 10 cm to separate the dowel pins on the Smart PCS from the holes on the base.

Figure 8-12 Removing a Faulty Smart PCS



Step 2 Installing a New Smart PCS.

Figure 8-13 Installing a New Smart PCS



----End

8.3.2 Replacing an MCCB

Prerequisites

Locate the faulty MCCB and power off the equipment.

- The MCCB between the Smart PCS and the DCBOX is faulty. (For details about the MCCB number, see **2.5 Typical Cable Connections**.)
  a. Switch off the MCCB between the Smart PCS and the STS.
  b. Switch off all MCCBs in the DCBOX.

c. Before removing cables, measure the AC and DC voltages using a voltmeter to ensure that the power supply has been disconnected.

- The MCCB between the Smart Rack Controller and the DCBOX is faulty.
  a. Switch off all MCCBs in the DCBOX.
  b. Turn off the Smart Rack Controller switches in the ESS.

NOTE

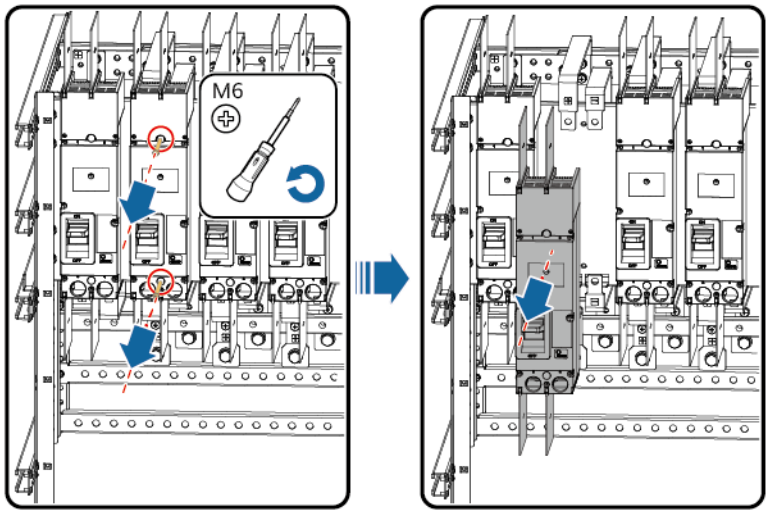
The methods for replacing all MCCBs are the same. This section uses one MCCB as an example.

Procedure

Step 1 Remove the cables that are connected to the MCCB and label them properly.

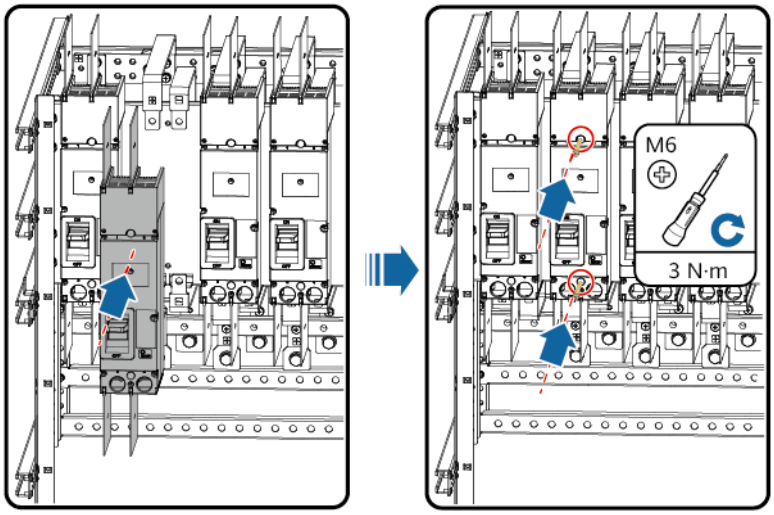
Step 2 Remove the faulty MCCB.

Figure 8-14 Removing the MCCB



Step 3 Install a new MCCB and reconnect the cables according to the labels.

Figure 8-15 Installing the MCCB



----End

8.3.3 Replacing a Lock Cylinder

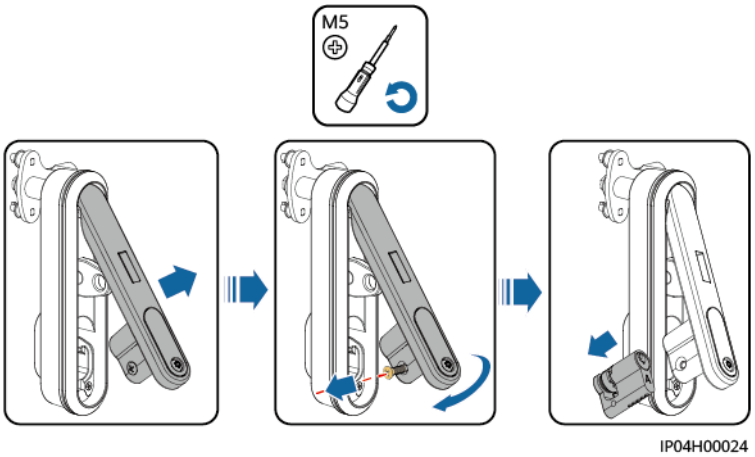
Prerequisites

The lock cylinder of the cabinet door lock is damaged.

Procedure

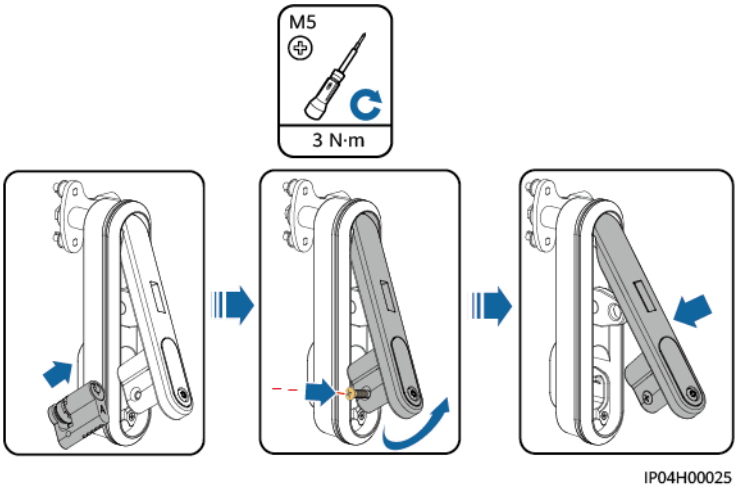
Step 1 Open the door lock and remove the damaged lock cylinder.

Figure 8-16 Removing the lock cylinder



Step 2 Install a new lock cylinder.

Figure 8-17 Installing the lock cylinder



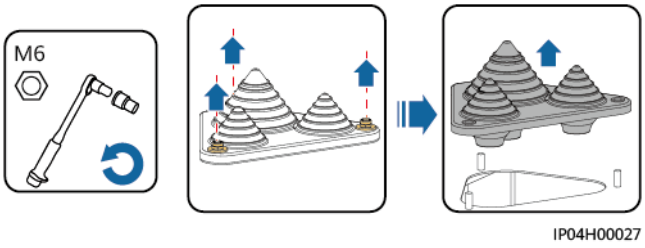
----End

8.3.4 Replacing the Pagoda Connector

Procedure

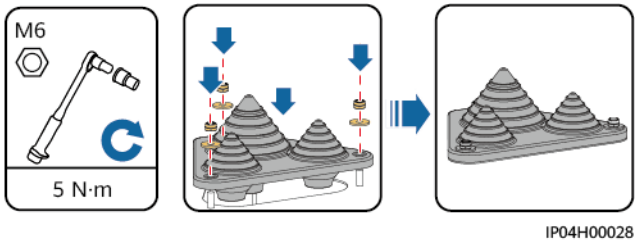
Step 1 Remove the old pagoda connector.

Figure 8-18 Removing the pagoda connector



Step 2 Install a new pagoda connector.

Figure 8-19 Installing the pagoda connector



----End

9 Technical Specifications

Rated operating voltage	1500 V DC
Maximum input current of the Smart PCS (System overload protection)	193 A, @ 40°C; 168 A, @ 50°C
Number of Smart PCSs	1–5
Maximum input current of the Smart Rack Controller	321 A
Number of Smart Rack Controllers	1–9
MCCB breaking capacity	15 kA/1500 V DC/10 ms/two-pole
	2.5 kA/1500 V DC/5 ms/one-pole
Dielectric strength	3820 V DC for one minute
Impulse withstand voltage	8 kV
IP rating	IP55
Pollution level	Level 2 inside the cabinet; level 3 outside the cabinet
Electrical protection	Class I
Cabling mode	Smart Rack Controller inlet cables routed from the bottom Smart PCS inlet cables routed from the top
Dimensions (H x W x D)	1415 mm x 2040 mm x 975 mm
Installation mode	Floor-mounted installation
Net weight	≤ 750 kg

Operating temperature range	–30°C to +60°C (The equipment cannot operate properly at over 60°C.)
Storage temperature range	–40°C to +70°C
Relative humidity range	0°C to 100°C
Maximum altitude	4000 m

A Crimping an OT or DT Terminal

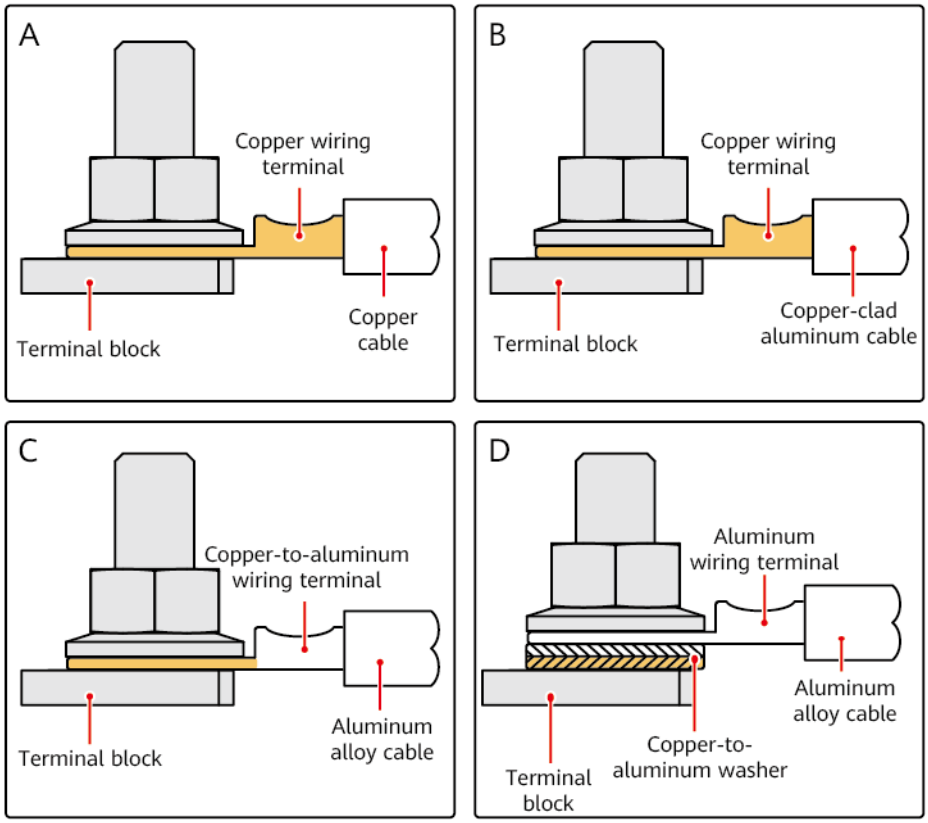
Requirements for OT/DT Terminals

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

NOTICE

- Do not connect aluminum wiring terminals to the terminal block. Otherwise electrochemical corrosion may occur, affecting the reliability of cable connections.
- Comply with the IEC 61238-1 requirements when using copper-to-aluminum wiring terminals, or aluminum wiring terminals with copper-to-aluminum washers.
- Ensure that the aluminum side of the washer contacts the aluminum wiring terminal, and the copper side contacts the terminal block.

Figure A-1 Requirements for OT/DT terminals

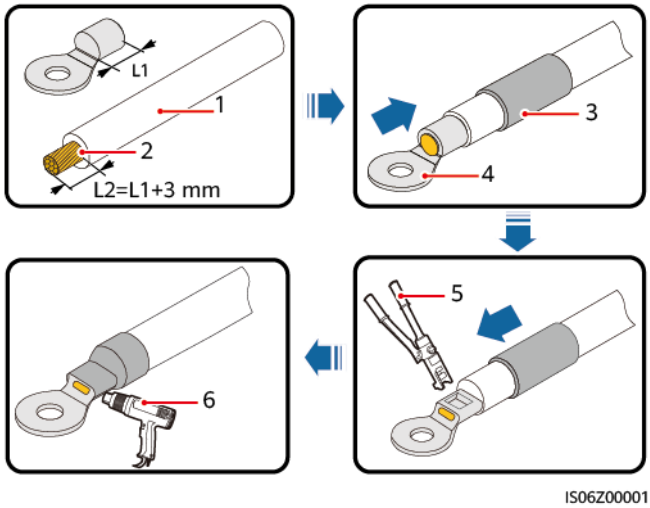


Crimping an OT or DT Terminal

NOTICE

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

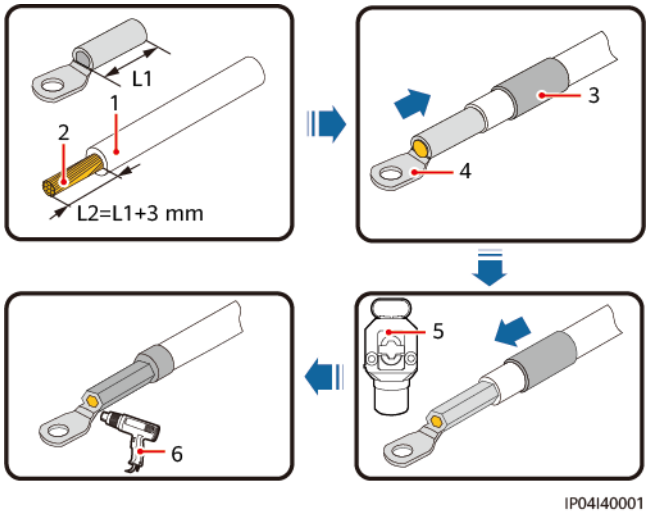
Figure A-2 Crimping an OT terminal



(1) Cable (2) Core (3) Heat-shrink tubing

(4) OT terminal (5) Hydraulic pliers (6) Heat gun

Figure A-3 Crimping a DT terminal



(1) Cable (2) Core (3) Heat-shrink tubing

(4) DT terminal (5) Hydraulic pliers (6) Heat gun

B Repainting the Equipment

Prerequisites

- Do not repaint the equipment under poor weather conditions, such as rain, snow, strong winds, and sandstorms, when there is no shelter outdoors.
- You have prepared the paint according to the color palette included with the equipment.

Repainting Description

The equipment should be intact. If the paint peels, repaint the area.

NOTE

Check the damaged area and prepare the appropriate tools and materials.

Table A-1 Repainting description

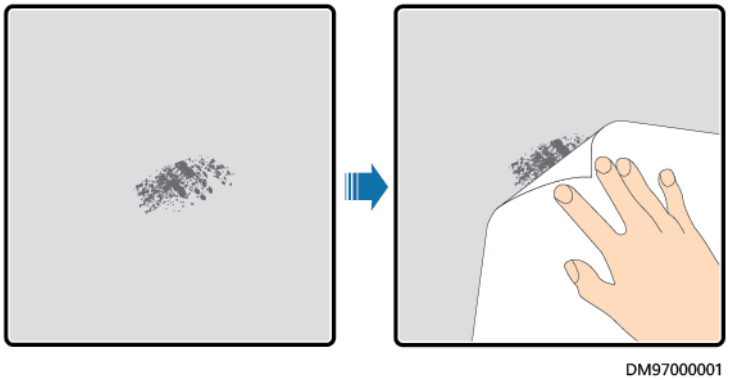
Paint Damage	Tools and Materials	Procedure	Description
Slight scratch (steel base material is intact)	Spray paint or paint, fine sandpaper, anhydrous alcohol, cotton cloth, and brush (required for repainting a small area) or paint gun (required for repainting a large area)	Steps 1, 2, 4, and 5	1. For the color of the finish coat (acrylic acid paint), see the included color palette and the Pantona number. 2. For a few smudges, scratches, or rust, manual paint spraying or brushing is recommended. 3. For many scratches or
Smudges and rust that cannot be removed			

Paint Damage	Tools and Materials	Procedure	Description
Deep scratch (primer damaged, steel base material exposed)	Spray paint or paint, zinc-rich primer, fine sandpaper, anhydrous alcohol, cotton cloth, and brush (required for repainting a small area) or paint gun (required for repainting a large area)	Steps 1, 2, 3, 4, and 5	large-area smudges and rust, use a paint gun to spray paint the area. 4. The paint coating should be thin and even. The surface should be smooth. There must not be any paint drops on the coating. 5. Leave the repainted area for about 30 minutes before performing any further operation.
Logo and pattern damage	If a logo or pattern has been damaged, obtain the logo size and color number and contact a local advertisement coating supplier to formulate a repair solution based on the logo size, color, and damage.		
Dent	1. If a dent is less than 100 mm^2 in area and 3 mm in depth, fill the dent with Poly-Putty base and then perform the same operations as those for fixing deep scratches. 2. If a dent is greater than 100 mm^2 in area or greater than 3 mm in depth, contact the local supplier for an appropriate repainting solution.		

Procedure

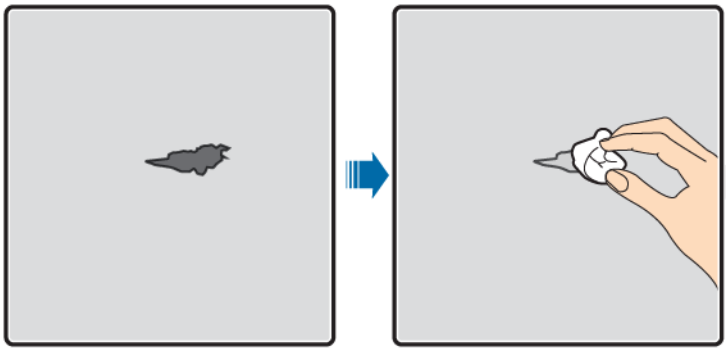
Step 1 Gently polish the damaged areas using fine sandpaper to remove smudges or rust.

Figure B-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 dirt or dust. Then wipe off the alcohol with a clean and dry cotton cloth.

Figure B-2 Wiping a polished or damaged area using anhydrous alcohol



Step 3 Paint zinc-rich primer on the damaged coat.

NOTICE

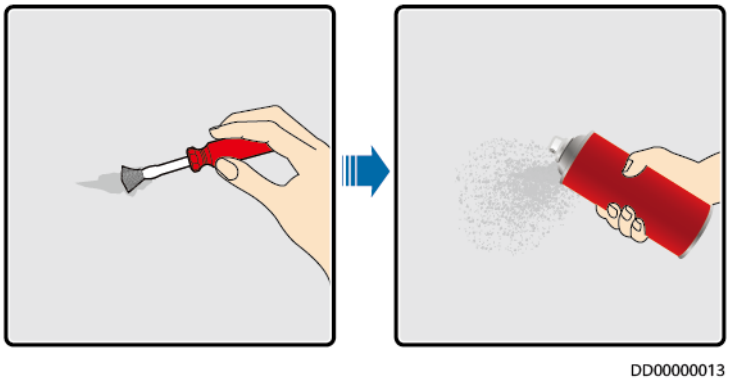
- If the base material is exposed, apply epoxy zinc-rich primer, wait until the paint has dried, and then apply an acrylic acid top coating.
- Select an epoxy zinc-rich primer or acrylic acid top coating with the same color as that of the equipment's surface coating.

Step 4 Apply paint evenly to the damaged area based on the damage degree until all damage traces are no longer visible.

NOTICE

- Ensure that the painting is thin, even, and smooth. There must not be any paint drops on the coating.
- 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 polluted during repainting, cover such areas using white paper and adhesive tape before repairing paint.

Figure B-3 Repainting a damaged area



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

NOTE

- The color of the repainted area must be consistent with that of the surrounding area. Use a colorimeter to measure the color difference (Δ_E), which should 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 should also be free of bulges, scratches, peeling, 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 B-1 Painting requirements

Item	Specification
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
Color number of the top coat	Obtain the color number based on the color palette included with the equipment.

NOTE

The following paint model list provided by Huawei is subject to change and for reference only. The price of paint and technical services are subject to local pricing.

Supplier	Location	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 painting	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 painting	Red: UNYMARINE SC MARKING RAL-3020 Black: UNYMARINE SC MARKING RAL-9005

C Can a Surge Protective Device (SPD) Be Installed in the DCBOX?

- A position is reserved for installing an SPD in the DCBOX in case surge protection is required. You can select and install an SPD.
- You need to prepare the SPD cables and screws.

Figure C-1 Installing an SPD