Huawei
AP3x10xN&5x10xN&5x30xN&6x10xN&7x10xN

Hardware Installation and Maintenance Guide

Issue 11
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About This Document

Intended Audience

This document describes hardware features of AP3x10xN, 5x10xN, 5x30xN, 6x10xN and 7x10xN, and provides basic installation methods.

This document is intended for:

- Network planning engineers
- Hardware installation engineers
- Commissioning engineers
- Onsite maintenance engineers
- System maintenance engineers

Symbol Conventions

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

Symbol	Description
⚠ **DANGER**	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ **WARNING**	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ **CAUTION**	Indicates a potentially hazardous situation which, if not avoided, may 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	Description
📖 NOTE	Calls attention to important information, best practices and tips.
	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 changes made in previous issues.

Issue 11 (2015-05-18)

This version has the following updates:

The following information is modified:

- Added the command to check AP running status in V200R006C00.
- Added descriptions about PoE fault troubleshooting.

Issue 10 (2014-12-05)

This version has the following updates:

The following information is added:

- **1.4 Ordering Information**.

Issue 09 (2014-07-30)

This version has the following updates:

The following information is modified:

- Optimized the installation steps.

The following information is added:

- Logging in to the AP using STelnet.

Issue 08 (2013-04-10)

This version has the following updates:

The following information is added:

- AP5030DN and AP5130DN installation guide
- Note: The network cable cannot exceed 100 meters.

Issue 07 (2014-01-15)

This version has the following updates:

Optimized the manual.

Issue 06 (2013-09-30)

This version has the following updates:

The following information is modified:

- AP's default IP address and login password

Issue 05 (2013-06-29)

This version has the following updates:

The following information is modified:

- Figure for converting SMA connectors to type—N connectors

Issue 04 (2013-04-30)

This version has the following updates:

The following information is modified:

- Figure of the sheet metal mounting brackets delivered with APs

Issue 03 (2013-01-30)

This version has the following updates:

The following information is added:

- Descriptions about power adapters delivered with APs
- Section: Removing an AP

Issue 02 (2012-12-31)

This version has the following updates:

The following information is added:

- Power adapter cable connection figure

Issue 01 (2012-10-31)

Initial commercial release

Contents

1 Indoor AP Overview

1.1 Device Structure

Figures in **Table 1-1** show the appearance of indoor APs.
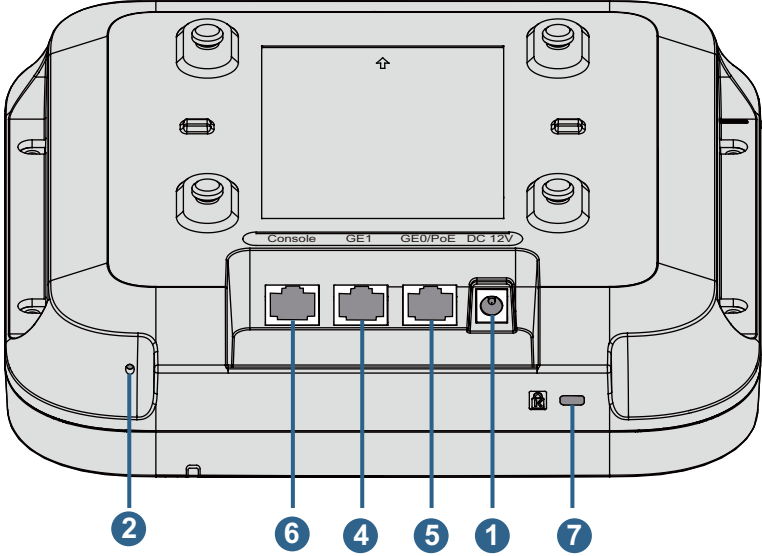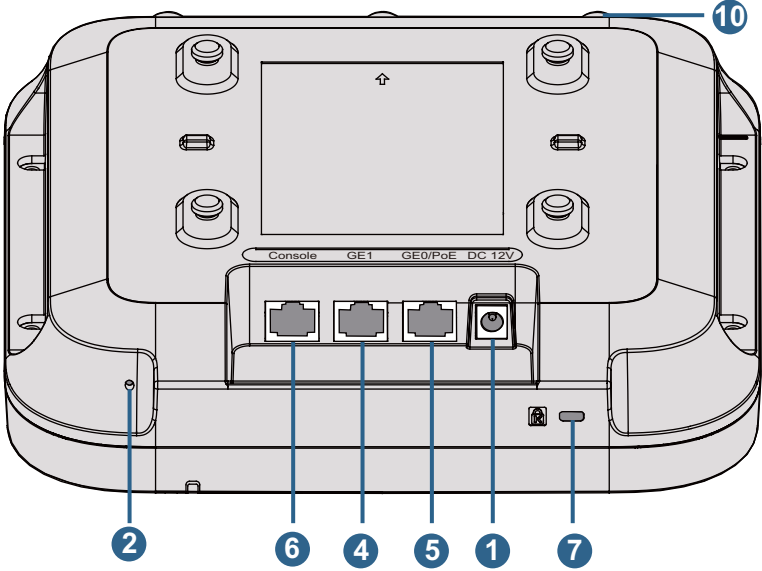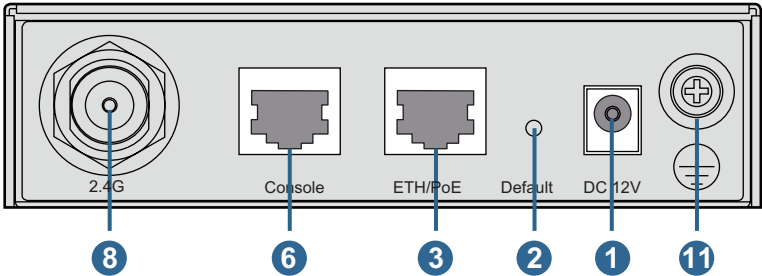
⚠ **CAUTION**

There is a scald warning label attached on the device, warning you not to touch the device after the device has been operating for a long time.

Table 1-1 Appearance of indoor APs

Product Model	Appearance
AP3010DN-AGN AP5010DN-AGN AP5010SN-GN AP6010DN-AGN AP6010SN-GN	

Product Model	Appearance
AP5030DN	
AP5130DN	
AP6310SN-GN	

Product Model	Appearance
AP7110DN-AGN	
AP7110SN-GN	

Table 1-2 describes interfaces on indoor APs.

Table 1-2 Interfaces on indoor APs

No.	Name	Description
1	DC 12 V	DC power socket: connects a 12 V power adapter to the AP.
2	Default	Reset button: restores factory settings if you hold down the button more than 3s.
3	ETH/PoE	10/100/1000M bit/s interface: connects to the wired Ethernet. The interface can connect to a PoE power supply to provide power for the AP.
4	GE1	10/100/1000M bit/s interface: connects to the wired Ethernet.
5	GE0/PoE	10/100/1000M bit/s interface: connects to the wired Ethernet. The interface can connect to a PoE power supply to provide power for the AP.
6	Console	Console interface: connects to a maintenance terminal for AP configuration and management.
7	Security slot	Connects to a security lock.
8	2.4 GHz antenna port	Connects a 2.4 GHz antenna to the AP.

No.	Name	Description
9	5 GHz antenna port	Connects a 5 GHz antenna to the AP.
10	Dual-band antenna port	Connects a dual-band antenna to the AP.
11	Device ground screw	Connects a ground cable to the AP.

1.2 Indicator Description

Indoor AP series products provide a single indicator or multiple indicators.

- The AP3010DN-AGN, AP5010DN-AGN, AP5010SN-GN, AP5030DN, AP5130DN, AP6010DN-AGN, and AP6010SN-GN provide only a single indicator.

- The AP6310SN-GN, AP7110DN-AGN, and AP7110SN-GN provide multiple indicators: SYS indicator, Link indicator, and Wireless indicator.

The following table describes indicators on indoor APs.

NOTE

- Indicator colors may vary slightly at different temperature.

- After a Fit AP is powered on, you can run the **led off** command on the AC to turn off all AP indicators. To restore the indicators to normal working status, run the **led on** command. Indicators on a Fat AP cannot be turned off using the **led off** command.

Single indicator and SYS indicator

Table 1-3 Descriptions about the single indicator and SYS indicator

Type	Color	Status	Description
Default status after power-on	Green	Steady on	The AP is just powered on and the software is not started yet.
Software startup status	Green	Steady on after blinking once	After the system is reset and starts uploading the software, the indicator blinks green once. Until the software is uploaded and started, the indicator remains steady green.
Running status	Green	Blinking once every 2s (0.5 Hz)	● The system is running properly, the Ethernet connection is normal, and STAs are associated with the AP. ● The system enters the Uboot CLI.
		Blinking once every 5s (0.2 Hz)	The system is running properly, the Ethernet connection is normal, and no STA is associated with the AP. The system is in low power consumption state.

Type	Color	Status	Description
Alarm	Green	Blinking once every 0.25s (4 Hz)	- The software is being upgraded. - After the software is uploaded and started, the AP working in Fit AP mode requests to go online on the AC and maintains this state until it goes online successfully on the AC (before the CAPWAP link is established). - The AP working in Fit AP mode fails to go online on the AC (the CAPWAP link disconnects).
Fault	Red	Steady on	A fault that affects services has occurred, such as a DRAM detection failure or system software loading failure. The fault cannot be automatically rectified and must be rectified manually.

Link indicator

Table 1-4 Descriptions about the Link indicator

Type	Color	Status	Description
LINK	Green	Steady on	The system is running properly, the Ethernet connection is normal, and no data is being transmitted.
ACT	Green	Blinking	The system is running properly, the Ethernet connection is normal, and the AP is transmitting data. The indicator blinks more quickly when more data is being transmitted.

Wireless indicator

Table 1-5 Traffic volume indicator

Color	Status	Description
Yellow/green	Off	Radios are disabled, and no STA is connected to the AP.
Yellow/green	Steady on	The AP has STAs connected to the 2.4 GHz radio or 5 GHz radio, but no data is being transmitted.

Color	Status	Description
Green	Blinking	The AP has STAs connected to the 2.4 GHz radio and is transmitting data. The indicator blinks more quickly when more data is being transmitted.
Yellow	Blinking	The AP has STAs connected to the 5 GHz radio and is transmitting data. The indicator blinks more quickly when more data is being transmitted.
Yellow/green	Blinking alternatively	The AP has STAs connected to both the 2.4 GHz radio and 5 GHz radio. The indicator blinks more quickly when more data is being transmitted.

Table 1-6 Wireless bridge indicator

Color	Status	Description
Yellow/green	Off	The AP is not transmitting or receiving data or the signal strength is extremely low.
	Blinking once every 2s (0.5 Hz)	The AP is transmitting or receiving data normally, and the signal strength is low.
	Blinking green once every 0.25 seconds (4 Hz)	The AP is transmitting or receiving data normally, and the signal strength is medium.
	Steady on	The AP is transmitting or receiving data normally, and the signal strength is high.

NOTE

When the WDS/mesh function is enabled on an AP, the blinking frequency of its Wireless LED indicates the receive signal strength on the WDS/mesh connection by default. After you connect an AP to a WDS/mesh network, you can run the **wifi-light** { **signal-strength** | **traffic** } command on the AC to make the Wireless LED blinking frequency indicate receive signal strength or service traffic rate.

- **wifi-light signal-strength**:
  - If the mesh function is enabled on the AP, the blinking frequency of the Wireless LED reflects the weakest signal strength of all neighboring APs.
  - If WDS is enabled on an AP, the blinking frequency of the Wireless LED reflects the strength of signals received from a WDS AP.
    - If the AP works in leaf mode, the blinking frequency of the Wireless LED reflects the strength of signals received from a middle AP.
    - If the AP works in middle mode, the blinking frequency of the Wireless LED reflects the strength of signals received from a root AP.
    - If the AP works in root mode, the blinking frequency of the Wireless LED reflects the weakest signal strength of middle APs.
- **wifi-light traffic**: allows the Wireless LED to reflect the service traffic volume on the radio.

The Fat AP does not support WDS/Mesh functions; therefore, the Wireless indicator of the Fat AP does not indicate the signal strength.

The AP6310SN-GN does not support WDS/mesh functions; therefore, the Wireless indicator of the AP6310SN-GN does not indicate the signal strength.

1.3 Basic Specifications

Table 1-7 Basic specifications of the AP3010DN-AGN, AP5010SN-GN, AP5010DN-AGN, AP6010DN-AGN, and AP6010SN-GN

Item		Description
Technical specifications	Dimensions (H x W x D)	50 mm x 180 mm x 180 mm
	Weight	0.4 kg
	System memory	● 256 MB DDR2 ● 32 MB flash memory
Power specifications	Power input	● DC 12 V ± 10% ● PoE power supply: -48 V DC (in compliance with IEEE 802.3af/at) **NOTE** The AP6010DN-AGN and AP6010SN-GN cannot use the PoE power supply and DC power supply simultaneously.

Item		Description
	Maximum power consumption	- AP3010DN-AGN: 9.5 W - AP5010DN-AGN: 9.5 W - AP5010SN-GN: 6.0 W - AP6010DN-AGN: 10.2 W - AP6010SN-GN: 6.5 W **NOTE** The actual maximum power consumption depends on local laws and regulations.
Environment specifications	Operating temperature and altitude	-60 m to +1800 m: -10°C to +50°C 1800 m to 5000 m: Temperature decreases by 1°C every time the altitude increases 220 m.
	Storage temperature	-40°C to +70°C
	Operating humidity	5% to 95% (non-condensing)
	IP grade	IP31
	Atmospheric pressure	70 kPa to 106 kPa

Table 1-8 Basic specifications of the AP5030DN and AP5130DN

Item		Description
Technical specifications	Dimensions (H x W x D)	53 mm x 220 mm x 220 mm
	Weight	1.0 kg
	System memory	256 MB DDR2 32 MB flash memory
Power specifications	Power input	- DC 12 V ± 10% - PoE power: -48 V DC (in compliance with IEEE 802.3af/at)
	Maximum power consumption	11.5 W **NOTE** The actual maximum power consumption depends on local laws and regulations.
Environment specifications	Operating temperature and altitude	-60 m to +1800 m: -10°C to +50°C 1800 m to 5000 m: Temperature decreases by 1°C every time the altitude increases 220 m.
	Storage temperature	-40°C to +70°C

Item		Description
	Operating humidity	5% to 95% (non-condensing)
	IP grade	IP41
	Atmospheric pressure	70 kPa to 106 kPa

Table 1-9 Basic specifications of the AP6310SN-GN

Item		Description
Technical specifications	Dimensions (H x W x D)	35 mm x 150 mm x 130 mm
	Weight	0.6 kg
	System memory	● 128 MB DDR2 ● 32 MB flash memory
Power specifications	Power input	● DC 12 V ± 10% ● PoE power supply: -48 V DC (in compliance with IEEE 802.3af/at) **NOTE** The AP6310SN-GN cannot use the PoE power supply and DC power supply simultaneously.
	Maximum power consumption	8.3 W **NOTE** The actual maximum power consumption depends on local laws and regulations.
Environment specifications	Operating temperature and altitude	-60 m to +1800 m: -10°C to +50°C 1800 m to 5000 m: Temperature decreases by 1°C every time the altitude increases 220 m.
	Storage temperature	-40°C to +70°C
	Operating humidity	5% to 95% (non-condensing)
	IP grade	IP31
	Atmospheric pressure	70 kPa to 106 kPa

Table 1-10 Basic specifications of the AP7110SN-GN and AP7110DN-AGN

Item		Description
Technical specifications	Dimensions (H x W x D)	45 mm x 200 mm x 200 mm
	Weight	1.0 kg
	System memory	● 256 MB DDR3 ● 32 MB flash memory

Power specifications	Power input	● DC 12 V ± 10%
		● PoE power: -48 V DC
		  – AP7110SN-GN: IEEE 802.3af/at
		  – AP7110DN-AGN: IEEE 802.3at

	Maximum power consumption	● AP7110DN-AGN: 15.7 W ● AP7110SN-GN: 8.7 W **NOTE** The actual maximum power consumption depends on local laws and regulations.
Environment specifications	Operating temperature and altitude	-60 m to +1800 m: -10°C to +55°C 1800 m to 5000 m: Temperature decreases by 1°C every time the altitude increases 220 m.
	Storage temperature	-40°C to +70°C
	Operating humidity	5% to 95% (non-condensing)
	IP grade	IP41
	Atmospheric pressure	70 kPa to 106 kPa

1.4 Ordering Information

To place an order, contact the Huawei local office.

Part Number	Description
2355829	Assembling Components,AP3010DN-AGN-CN,AP3010DN-AGN Mainframe(11n,General AP Indoor,2x2 Double Frequency,Built-in Antenna,AC/DC adapter(CN))
2356921	Assembling Components,AP-D4-FAT-S,AP-D4-FAT-S Bundle(Including AP3010DN-AGN-FAT-DC*4,AC/DC adapters(CN))

Part Number	Description
2355547	Assembling Components,AP5010DN-AGN,AP5010DN-AGN Mainframe (11n,General AP Indoor,2x2 Double Frequency,Built-in Antenna,No AC/DC adapter)
2355674	Assembling Components,AP5010SN-GN,AP5010SN-GN Mainframe (11n,General AP Indoor,2x2 Single Frequency,Built-in Antenna,No AC/DC adapter)
2356281	Assembling Components,AP5010DN-AGN-USA,AP5010DN-AGN Bundle(11n,General AP Indoor,2x2 Double Frequency,Built-in Antenna,AC/DC adapter(US),United States dedicated)
2357629	Assembling Components,AP5010DN-AGN-FAT-DC,AP5010DN-AGN Bundle(FAT AP,11n,General AP Indoor,2x2 Double Frequency,Built-in Antenna,AC/DC adapter)
2357632	Assembling Components,AP5010SN-GN-FAT-DC,AP5010SN-GN Bundle(FAT AP,11n,General AP Indoor,2x2 Single Frequency,Built-in Antenna,AC/DC adapter)
2358264	Assembling Components,AP5010DN-AGN-DC,AP5010DN-AGN Bundle (11n,General AP Indoor,2x2 Double Frequency,Built-in Antenna,AC/DC adapter)
2358263	Assembling Components,AP5010SN-GN-DC,AP5010SN-GN Bundle (11n,General AP Indoor,2x2 Single Frequency,Built-in Antenna,AC/DC adapter)
2358108	Assembling Components,AP5030DN,AP5030DN Mainframe (11ac,General AP Indoor,3x3 Double Frequency,Built-in Antenna,No AC/DC adapter)
2358109	Assembling Components,AP5030DN-DC,AP5030DN Bundle (11ac,General AP Indoor,3x3 Double Frequency,Built-in Antenna,AC/DC adapter)
02350CPM	Assembling Components,AP5030DN-USA,AP5030DN Bundle (11ac,General AP Indoor,3x3 Double Frequency,Built-in Antenna,AC/DC adapter(US),United States dedicated)
2358560	Assembling Components,AP5030DN-FAT-DC,AP5030DN Bundle(FAT AP,11ac,General AP Indoor,3x3 Double Frequency,Built-in Antenna,AC/DC adapter)
2358561	Assembling Components,AP5130DN,AP5130DN Mainframe (11ac,General AP Indoor,3x3 Double Frequency,External Antenna,No AC/DC adapter)
2358562	Assembling Components,AP5130DN-DC,AP5130DN Bundle (11ac,General AP Indoor,3x3 Double Frequency,External Antenna,AC/DC adapter)

Part Number	Description
2358563	Assembling Components,AP5130DN-FAT-DC,AP5130DN Bundle(FAT AP,11ac,General AP Indoor,3x3 Double Frequency,External Antenna,AC/DC adapter)
2354196	Assembling Components,AP6010DN-AGN,AP6010DN-AGN Mainframe(11n,General AP Indoor,2x2 Double Frequency,Built-in Antenna,No AC/DC adapter)
2354197	Assembling Components,AP6010SN-GN,AP6010SN-GN Mainframe(11n,General AP Indoor,2x2 Single Frequency,Built-in Antenna,No AC/DC adapter)
2354198	Assembling Components,AP6310SN-GN,AP6310SN-GN,AP6310SN-GN Mainframe(11n,Distributed AP Indoor,Single Frequency,No AC/DC adapter)
2356284	Assembling Components,AP6310SN-GN-USA,AP6310SN-GN Bundle(11n,Distributed AP Indoor,Single Frequency,AC/DC adapter(US),United States dedicated)
2356280	Assembling Components,AP6010DN-AGN-USA,AP6010DN-AGN Bundle(11n,General AP Indoor,2x2 Double Frequency,Built-in Antenna,AC/DC adapter(US),United States dedicated)
2357628	Assembling Components,AP6010DN-AGN-FAT-DC,AP6010DN-AGN Bundle(FAT AP,11n,General AP Indoor,2x2 Double Frequency,Built-in Antenna,AC/DC adapter)
2357631	Assembling Components,AP6010SN-GN-FAT-DC,AP6010SN-GN Bundle(FAT AP,11n,General AP Indoor,2x2 Single Frequency,Built-in Antenna,AC/DC adapter)
2358260	Assembling Components,AP6010DN-AGN-DC,AP6010DN-AGN Bundle(11n,General AP Indoor,2x2 Double Frequency,Built-in Antenna,AC/DC adapter)
2358259	Assembling Components,AP6010SN-GN-DC,AP6010SN-GN Bundle(11n,General AP Indoor,2x2 Single Frequency,Built-in Antenna,AC/DC adapter)
2358262	Assembling Components,AP6310SN-GN-DC,AP6310SN-GN Bundle(11n,Distributed AP Indoor,Single Frequency,AC/DC adapter)
2355553	Assembling Components,AP7110DN-AGN,AP7110DN-AGN Mainframe(11n,Enhanced AP Indoor,3x3 Double Frequency,External Antenna,No AC/DC adapter)
2355680	Assembling Components,AP7110SN-GN,AP7110SN-GN Mainframe(11n,Enhanced AP Indoor,3x3 Single Frequency,External Antenna,No AC/DC adapter)

Part Number	Description
02350CVQ	Assembling Components,AP7110DN-AGN-FAT-DC,AP7110DN-AGN Bundle(FAT AP,11n,Enhanced AP Indoor,3x3 Double Frequency,External Antenna,AC/DC adapter)
2356279	Assembling Components,AP7110DN-AGN-USA,AP7110DN-AGN Bundle(11n,Enhanced AP Indoor,3x3 Double Frequency,External Antenna,AC/DC adapter(US),United States dedicated)
2358266	Assembling Components,AP7110DN-AGN-DC,AP7110DN-AGN Bundle (11n,Enhanced AP Indoor,3x3 Double Frequency,External Antenna,AC/ DC adapter)
2358265	Assembling Components,AP7110SN-GN-DC,AP7110SN-GN Bundle (11n,Enhanced AP Indoor,3x3 Single Frequency,External Antenna,AC/DC adapter)

2 AP Installation

2.1 Preparing for Installation

This section describes safety precautions and tool preparations for AP installation.

Safety Precautions

- Take proper measures to prevent injuries and device damage.
- Place the device in a dry and flat position away from any liquid and prevent the device from slipping.
- Keep the device clean.
- Do not put the device and tools in the aisles.

⚠ **CAUTION**
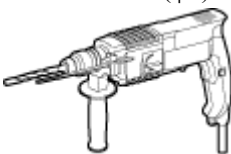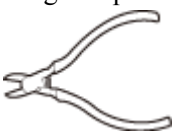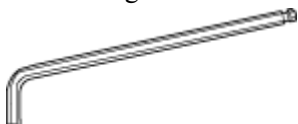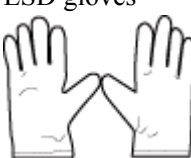
Only the qualified personnel are permitted to install and remove the device and its accessories. Before installation and operation, read the safety precautions carefully.

Tool Preparation

To install indoor APs, prepare tools listed in **Table 2-1**.

Table 2-1 Tools

Phillips screwdriver	Torque screwdriver	Marker
	  3mm/5mm (M3-M6)	

Hammer drill (φ6)	Utility knife	Cable cutter
Diagonal pliers	RJ45 crimping tool	Wire stripper
Network cable tester	Multimeter	Inner hexagon wrench
Ladder	Adjustable wrench	Rubber mallet
ESD gloves	Level	

2.2 Installation Flowchart

The following figure shows the process for installing an indoor AP.

Figure 2-1 Installation flowchart of the AP3010DN-AGN, AP5010DN-AGN, AP5010SN-GN, AP6010DN-AGN, AP6010SN-GN, AP6310SN-GN, AP7110SN-GN and AP7110DN-AGN
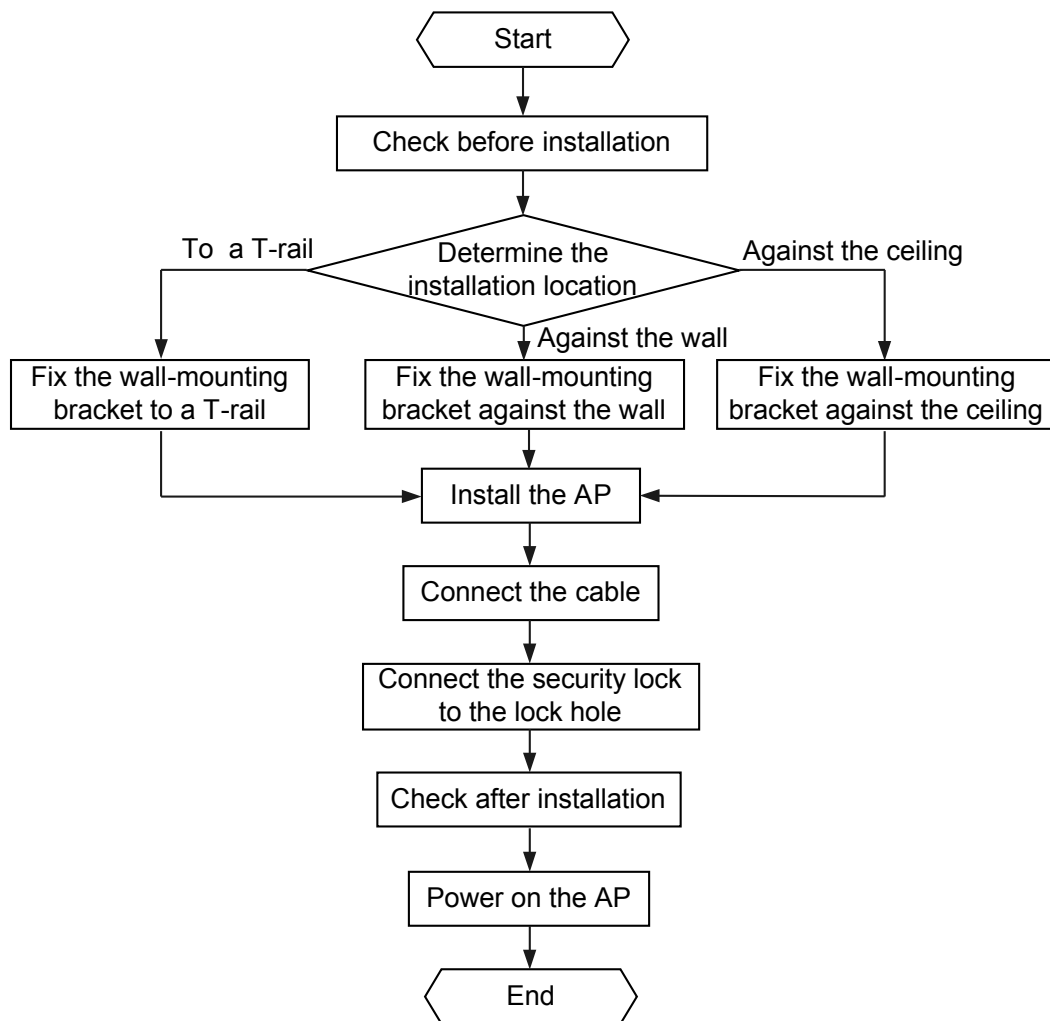
Figure 2-2 Installation flowchart of the AP5030DN and AP5130DN

```
                          ┌──────────┐
                          │  Start   │
                          └────┬─────┘
                               │
                    ┌──────────▼──────────┐
                    │ Check before installation │
                    └──────────┬──────────┘
                               │
                    ┌──────────▼──────────┐
                    │    Determine the    │
                    │ installation location │
                    └──────────┬──────────┘
                               │
   To a T-rail      ┌──────────▼──────────┐     Against the ceiling
        ┌───────────│   Connect the cable  │───────────┐
        │           └──────────┬──────────┘           │
        │            Against the wall                 │
        │                      │                       │
┌───────▼────────┐  ┌──────────▼─────────┐  ┌──────────▼─────────┐
│ Fix the wall-mounting │ Fix the wall-mounting │ Fix the wall-mounting │
│ bracket to a T-rail   │ bracket against the wall │ bracket against the ceiling │
└───────┬────────┘  └──────────┬─────────┘  └──────────┬─────────┘
        │                      │                       │
        └──────────────┐       │       ┌───────────────┘
                    ┌──▼───────▼───────▼──┐
                    │    Install the AP    │
                    └──────────┬──────────┘
                               │
                    ┌──────────▼──────────┐
                    │ Connect the security lock │
                    │   to the lock hole  │
                    └──────────┬──────────┘
                               │
                    ┌──────────▼──────────┐
                    │ Check after installation │
                    └──────────┬──────────┘
                               │
                    ┌──────────▼──────────┐
                    │   Power on the AP   │
                    └──────────┬──────────┘
                               │
                          ┌────▼─────┐
                          │   End    │
                          └──────────┘
```

2.3 Unpacking the Equipment

Before unpacking the carton, ensure that the packing carton is intact and not damaged or soaked. Stop unpacking if the equipment is rusted or soggy. Then, investigate causes and contact the supplier.

After unpacking, check items in the carton against the packing list. If any item is missing, contact the supplier or agent.

Usually, the packing carton contains all items listed in the packing list shown in **Table 2-2**.

Table 2-2 Packing list

No.	Item	Quantity
1	AP device	1
2	Power adapter (optional)	1

No.	Item	Quantity
3	Sheet metal mounting bracket[4]	1
4	2.4 GHz antenna[1]	3
5	5 GHz antenna[1]	3
6	Dual-band antenna port[2]	3
7	Expansion screws	3
8	OT terminal[3]	2
9	Quick Start Guide	1

Pay attention to the following:

1. Three 2.4 GHz antennas and three 5 GHz antennas are contained in the AP7110DN-AGN carton, and three 2.4 GHz antennas are contained in the AP7110SN-GN carton. Cartons of other models do not contain these two types of antennas.

2. Only the AP5130DN carton contains three dual-band antennas.

3. Only the AP6310SN-GN and AP7110 series have OT terminals delivered.

4. Currently, two types of sheet metal mounting brackets are available: sheet metal mounting bracket for the AP5030DN and AP5130DN, which has four mounting holes (see the left figure in **Figure 2-3**), and sheet metal mounting bracket for other indoor AP models, which has four mounting screws (see the right figure in **Figure 2-3**).

Figure 2-3 Sheet metal mounting brackets
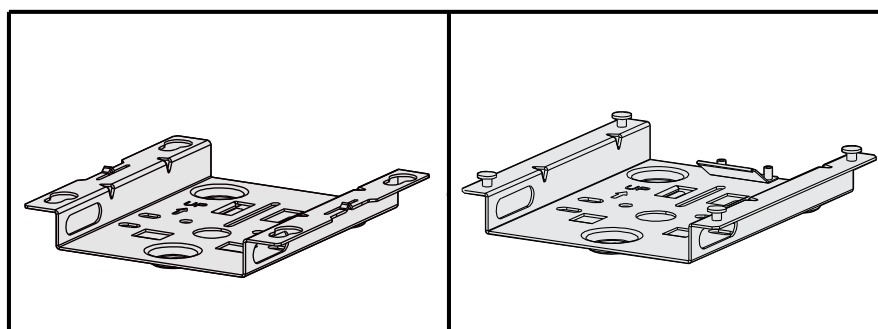
📖**NOTE**

Remove the protective film on the AP surface before installation to prevent electrostatic discharge.

2.4 Determining the Installation Position

When determining the AP installation position, comply with the following rules:

● Try to reduce the number of obstacles, such as walls, between the AP and user terminlas.

- Install the AP away from electronic devices that can cause radio interference, such as the microwave oven.

- Install the AP in a hidden position that does not affect daily lives and work of residents.

- Install the AP in a site that is free from leaking or dripping water, heavy dew, and humidity, and take protective measures to prevent water from flowing into the equipment along the cable.

Indoor APs are usually mounted on a wall or ceiling using sheet metal mounting brackets. The installation position is determined by the site survey. There must be at least 200 mm clearance between the cabling end of the AP and the wall. **Figure 2-4** shows space requirements.

Figure 2-4 Mounting an AP
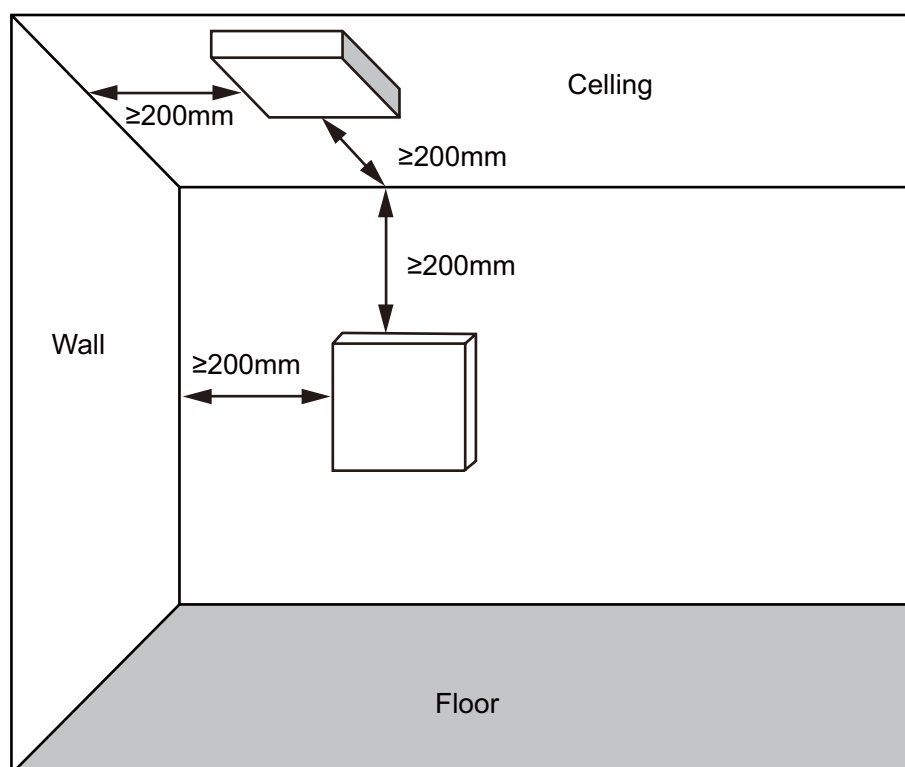
2.5 Installing the AP

All cables of the AP5030DN and AP5130DN, including network cables, power supply cables, and console cables are routed towards the same direction. Before installing an AP on the mounting bracket, connect cables to the AP first. **Figure 2-5** shows cable deployment and AP installation.

Figure 2-5 Cable deployment and AP installation
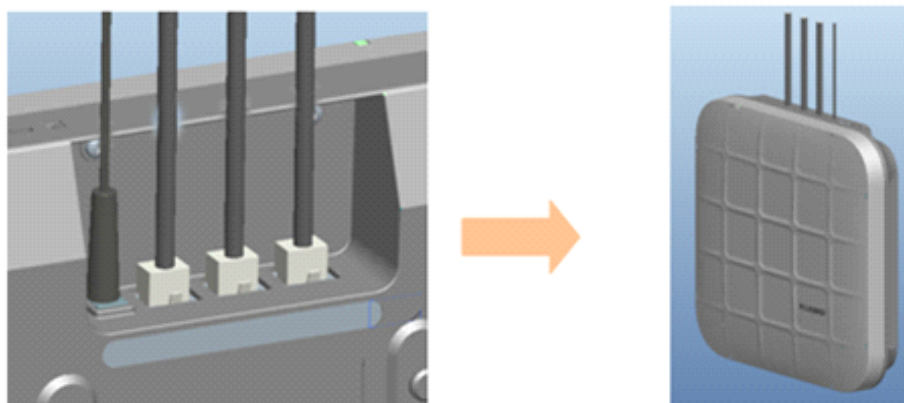
☐**NOTE**

- The AP5030DN and AP5130DN must have cables connected first before installation. Except the two models, the procedures for installing the other models of indoor APs are the same unless otherwise stated. The following figures use the AP7110DN-AGN as an example.
- If the AP surface is covered with protective film, remove it before installation.

2.5.1 Wall Mounting

Mounting APs on a wall requires sheet metal mounting brackets and expansion screws. The procedures are as follows:

1. Fix the mounting bracket to the wall, adjust the installation position, and use the marker to mark the drilling positions where expansion screws are installed.
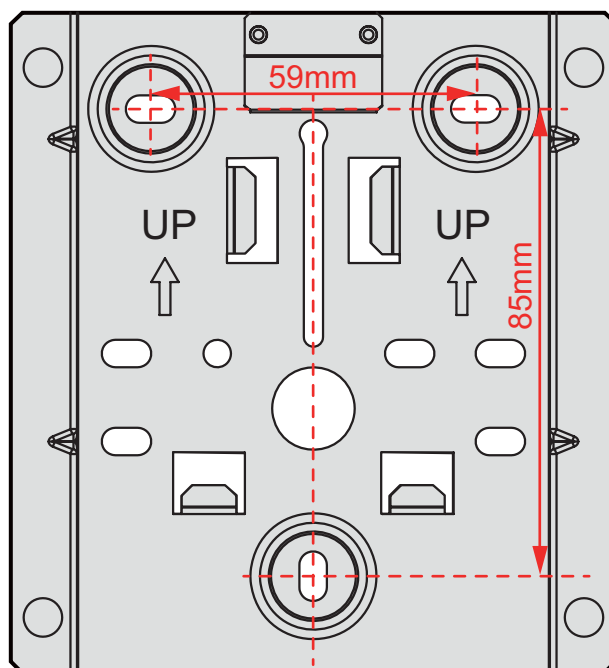
2. Use a 6 mm drill bit to drill 25 mm to 30 mm deep holes in the drilling positions. Hammer the expansion tubes into the holes until the expansion tubes are completely embedded into the wall.
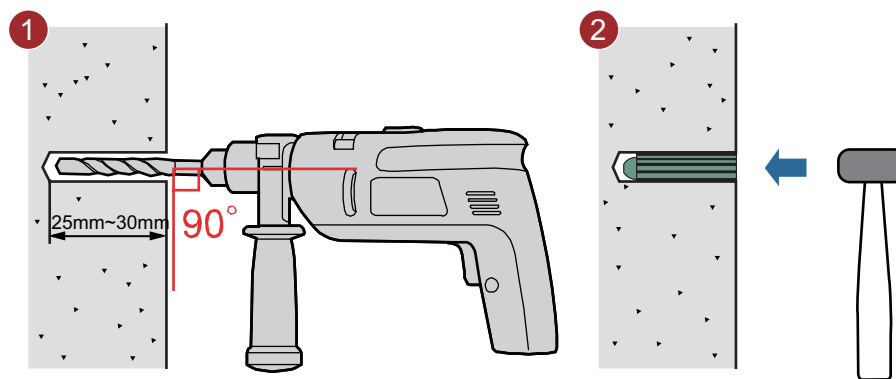
3. Fix the mounting bracket to the wall and use the Phillips screwdriver to fasten three expansion screws into the expansion tubes.
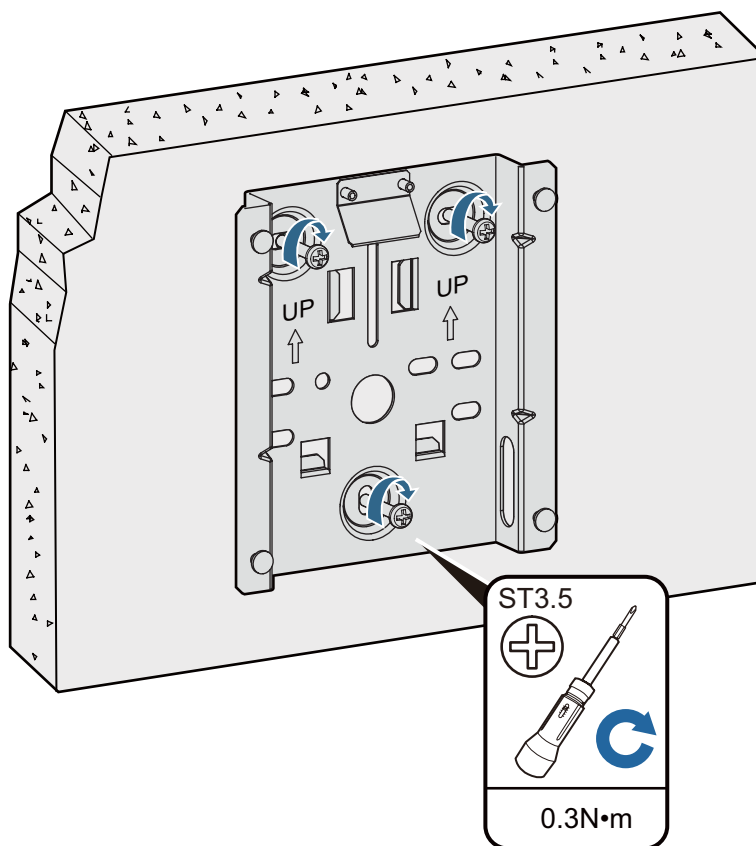
4. Align the mounting holes at the rear of the AP with the mounting screws on the mounting bracket and hang the AP on the bracket. Press the AP downwards to secure the AP on the wall.
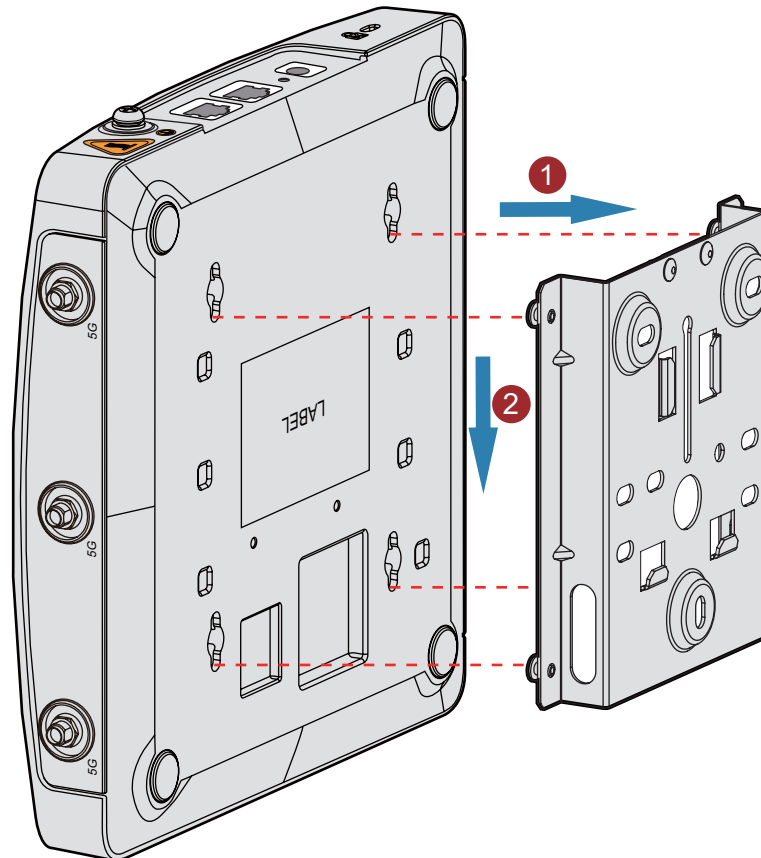
📖**NOTE**

The AP5030DN and AP5130DN use a different type of sheet metal mounting bracket than other APs. When installing an AP5030DN or AP5130DN, align the mounting screws at the rear of the AP with the mounting holes on the sheet metal mounting bracket and then press the AP downwards to secure the AP on the bracket.

2.5.2 Ceiling Mounting

1. Fix a locking clip at the rear of the AP with two M3x6 screws. The locking clip prevents the AP hung on the mounting bracket from swaying.

    📖**NOTE**

    Only the AP6310SN-GN and AP7110 series require the locking clip during their installation.
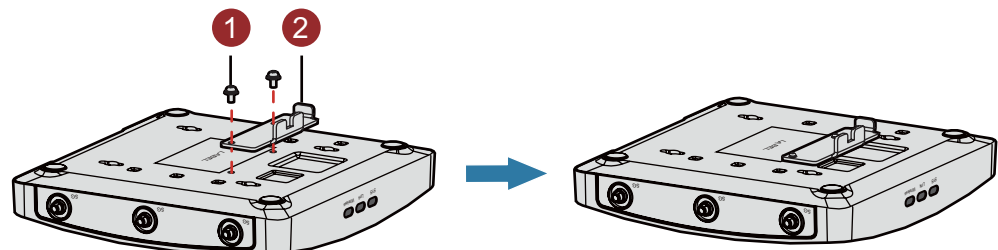
1. M3x6 screw	2. Locking clip

2. Remove a ceiling tile, determine locations of mounting holes based on the distance between two installation holes on the mounting bracket, use a hammer drill to drill holes on the ceiling tile, and fix the mounting bracket to the ceiling tile.
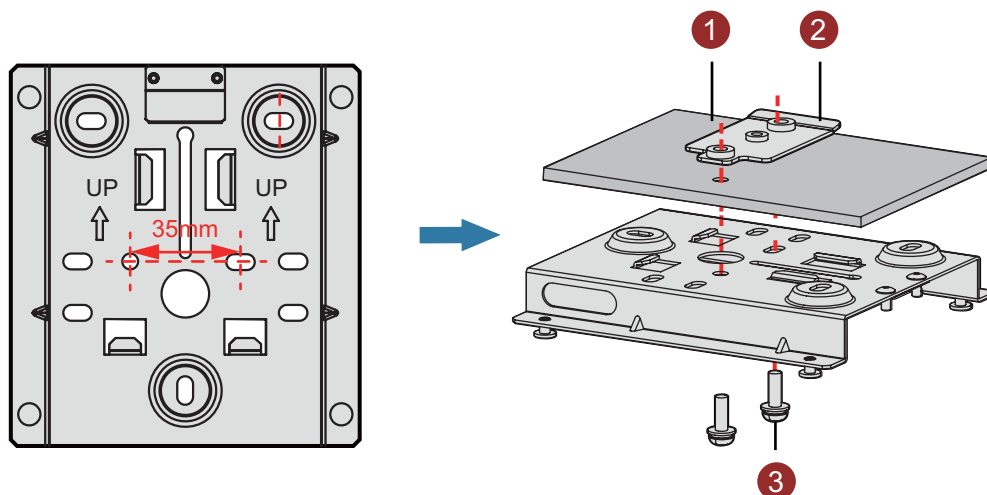
1. Ceiling tile	2. Adjustable buckle	3. M4x30 screw

⚠ NOTICE

The screws provided for ceiling-mounting of APs are 30 mm long and can be used to fix an AP on a ceiling not thicker than 15 mm. To install APs on thicker ceilings, you need to purchase longer screws.

3. Hang the AP on the mounting screws by aligning the mounting holes at the rear of the AP with the mounting screws on the bracket and push the AP horizontally to secure the AP.
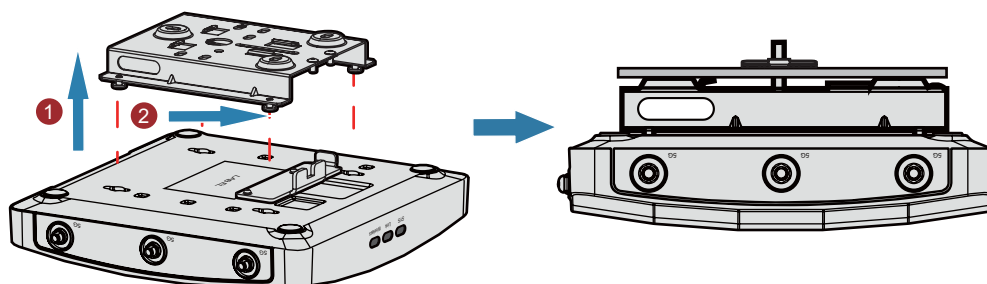
📖 **NOTE**

- Ensure that the AP is correctly installed on the mounting bracket and there must be 200 mm space above and around the AP for maintenance.

- The AP5030DN and AP5130DN use a different type of sheet metal mounting bracket than other APs. When installing an AP5030DN or AP5130DN, align the mounting screws at the rear of the AP with the mounting holes on the sheet metal mounting bracket and then press the AP downwards to secure the AP on the bracket.

2.5.3 T-rail Mounting

1. Fix a locking clip at the rear of the AP with two M3x6 screws. For installation methods, see step 1 in Ceiling Mounting.

NOTE

Only the AP6310SN-GN and AP7110 series require the locking clip during their installation.

2. Remove two ceiling tiles around the T-rail, use screws to fix the adjustable buckle to the mounting bracket, hook the adjustable buckle to the T-rail, and secure the screw on the adjustable buckle to fasten the mounting bracket and T-rail.
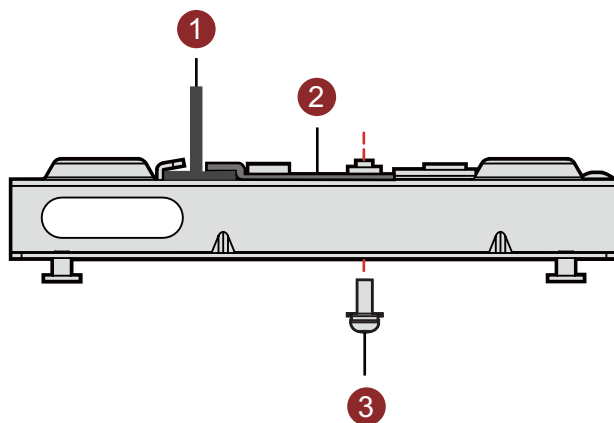
1. T-rail	2. Adjustable buckle	3. M3x6 screws

3. Align the mounting holes at the rear of the AP with the mounting screws on the sheet metal mounting bracket and secure the AP on the bracket.
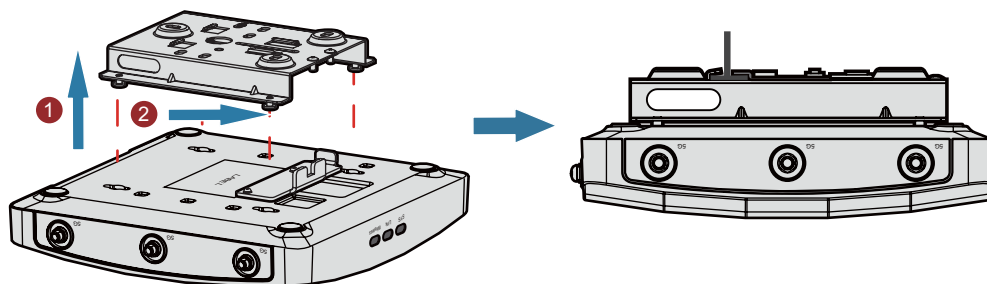
NOTE

- Ensure that the AP is correctly installed on the mounting bracket and there must be 200 mm space above and around the AP for maintenance.

- The AP5030DN and AP5130DN use a different type of sheet metal mounting bracket than other APs. When installing an AP5030DN or AP5130DN, align the mounting screws at the rear of the AP with the mounting holes on the sheet metal mounting bracket and then press the AP downwards to secure the AP on the bracket.

2.5.4 Removing an AP

To remove an AP, push the metal reed upward with a screwdriver and use the other hand to pull the AP horizontally (See **Figure 2-6**).

NOTE

Only the AP6310SN-GN and AP7110 series require the locking clip during their installation. Therefore, the method of removing an AP by pushing the metal reed upward applies only to the AP6310SN-GN and AP7010 series.

Figure 2-6 Removing an AP

metal sheet
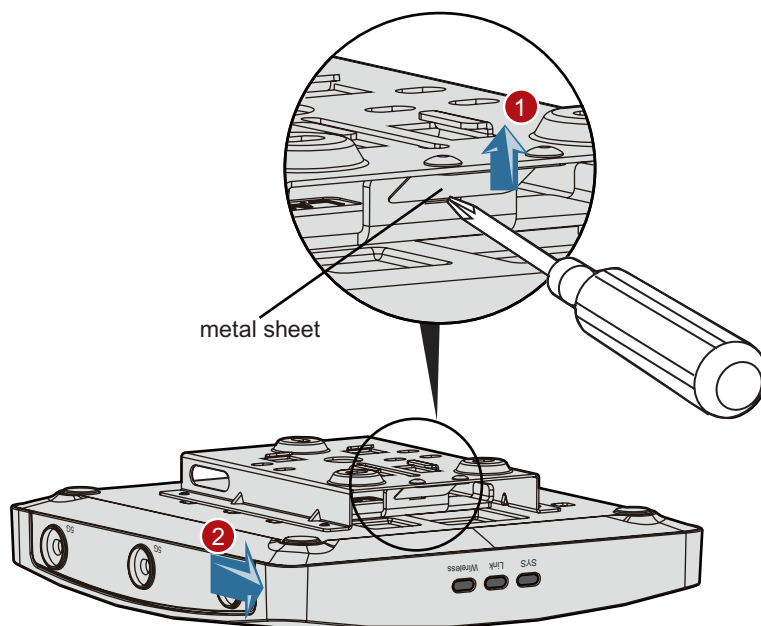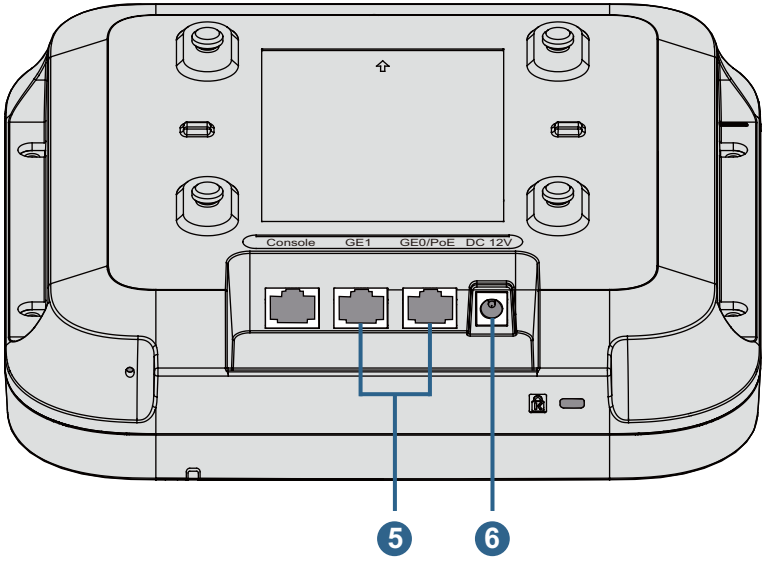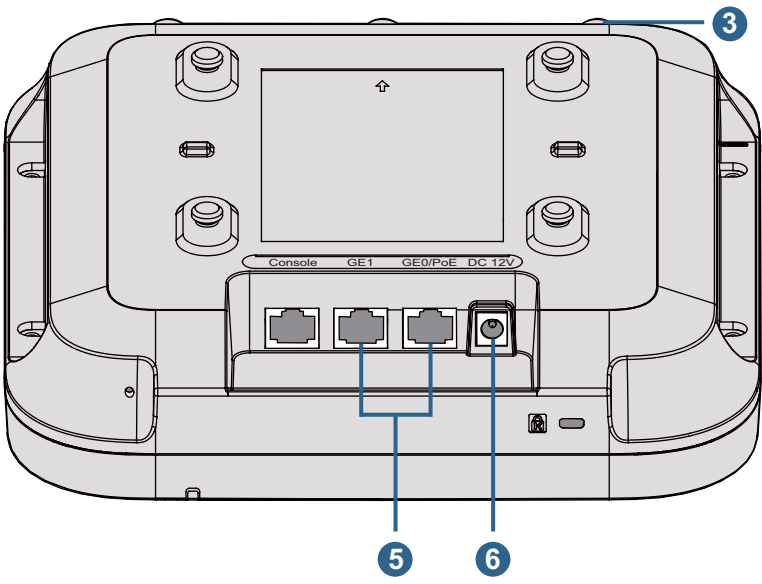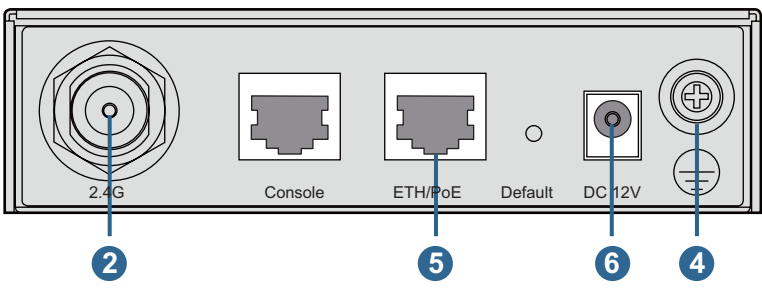
2.6 Connecting Cables

Figures in **Table 2-3** show the appearance of indoor APs.

Table 2-3 Appearance of indoor APs (front view)

Product Model	Appearance
AP3010DN-AGN AP5010DN-AGN AP5010SN-GN AP6010DN-AGN AP6010SN-GN	

Product Model	Appearance
AP5030DN	
AP5130DN	
AP6310SN-GN	

Product Model	Appearance
AP7110DN-AGN	
AP7110SN-GN	

Table 2-4 describes cable connections of indoor APs.

Table 2-4 Cable connections of indoor APs

No.	Cable	Description
1	5 GHz antenna cable	Connects a 5 GHz antenna to the AP to send and receive service signals.
2	2.4 GHz antenna cable	Connects a 2.4 GHz antenna to the AP to send and receive service signals.
3	Dual-band antenna	Connects a dual-band antenna to the AP to send and receive service signals.
4	Ground cable	Grounds the AP. The M4 connector of the ground cable is connected to the AP and the M6 connector is connected to the protection ground.
5	Network cable	● The network cables used are category-5 enhanced or higher twisted pairs. ● Ensure that the AP is connected to the Ethernet using the Ethernet cable that works properly. If the Ethernet cable is not working properly, for example, RJ45 connectors are short-circuited, the AP may fail to be powered on or fail to work. Before connecting an Ethernet cable to the AP, use the cable test tool to check whether the cable is qualified. If the cable is unqualified, replace it.

No.	Cable	Description
6	DC power adapter	- The AP supports the PoE power supply and DC power supply. - To connect the AP to a DC power source, use the power adapter delivered with the AP; otherwise, the AP maybe damaged.

📖**NOTE**

- Different power adapters are delivered with indoor AP products according to standards in the countries or regions where the AP products are delivered. These countries and regions are identified by the barcode on an AP's nameplate, including: EU (Europe), UK (United Kingdom), CN (China), AU (Australia), US (United States), and USA (the AP is sold only in the U.S).

- The AP products sold in the U.S have a fixed country code US, and the country code change function is disabled.

- When PoE and power adapter power supplies are available, the devices are preferentially powered by the power adapter.

Pay attention to the following points when installing antennas

- Antennas of the AP6310SN-GN, AP7110DN-AGN, AP7110SN-GN, and AP5130DN must comply with local laws and regulations.

- Antennas need to be installed by qualified personnel. An AP can only use the antennas delivered with it.

- You need to connect external antennas to the AP7110 series and AP5130DN. Exercise caution when bending the antennas. Misoperation may hurt your hands.

- When replacing WA633SNs with AP6310SN-GNs, you need to convert SMA connectors to Type N connectors (see Figure a and Figure b). You can also make new feeder lines matching the connectors of the AP6310SN-GNs (see Figure c).
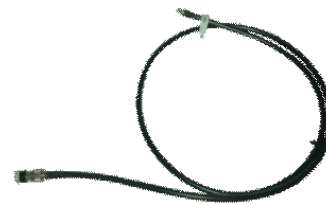
- When the RF connector of an AP becomes loose, tighten it with a maximum torque of 13 N•m.

Pay attention to the following points when installing network cables

- Before connecting an Ethernet cable to the AP, use the cable test tool to check whether the cable is qualified. If the cable is unqualified, replace it.

- Do not connect the service network cable to the console port. Otherwise, the AP may be damaged when the PoE power supply is used.

- Use standard RJ45 connectors on network cables for the AP5010 series.

- Before removing network cables or power cables from an AP5030DN or AP5130DN, remove the AP from the mounting bracket first to prevent damage to the network cables or power cables.

- The cable cannot exceed 100 meters.

2.7 Installing the Security Lock

There is a security slot on the AP. You can lock the AP to an immovable object to prevent the AP against theft. The detailed procedures are as follows:

1. Fasten the cable of the security lock to an immovable object around.
2. Insert the security lock into the security slot and lock it.

Lock hole
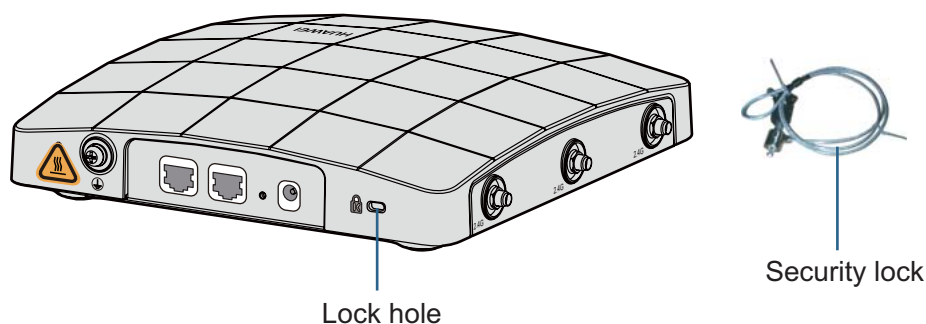
Security lock

NOTE

You need to purchase the security lock separately.

2.8 Checking the AP After Installation

Table 2-5 shows the items to be checked after AP installation is complete.

Table 2-5 AP installation checklist

No.	Check Item
1	The AP is installed by strictly following the design draft. The installation position meets space requirements, with maintenance space reserved.
2	The AP is securely installed.
3	The power cables and PGND cables are intact and not spliced.
4	Terminals of the power cables and PGND cables are welded or cramped firmly.
5	All power cables or PGND cables are not short-circuited or reversely connected and must be intact with no damage.
6	The power cables and ground cables are separated from other cables and bundled separately.

No.	Check Item
7	The working ground, protection ground, and surge protection ground share the same group of ground bars.
8	Connectors of signal cables are complete, intact, and tightly connected. The signal cables are not damaged or broken.
9	Labels on cables, feeders, or jumpers are clear and correct.

2.9 Powering on the AP

Indoor APs support the DC power supply and PoE power supply. You can select the power supply mode as required.

Checking Before Power-on

After the AP installation is complete, check the following items before powering on the AP:

- The AP is correctly connected to the power adapter if it uses the DC power supply.
- The PoE power supply device is well grounded if the AP uses the PoE power supply.

NOTE

- The AP6010DN-AGN, AP6010SN-GN, and AP6310SN-GN cannot use the PoE power supply and DC power supply simultaneously.
- Do not frequently power on and off an AP.

Indicator Status

You can check the power-on status by observing indicators on the AP. For details, see **1.2 Indicator Description**.

3 Logging In to the AP

3.1 Logging In to the AP Through the Console Port

This section describes how to log in to the AP through the console port. After logging in to the AP, you can configure the AP using commands.

1. Connect a PC to the AP using a console cable. Connect the RJ45 connector to the console port of the AP and the DB9 connector to the serial port of a PC.

   NOTE

   If your PC's operating system provides terminal simulation software (like HyperTerminal in Windows 2000/XP), you do not need to install additional terminal simulation software. If the PC runs on an operating system without terminal simulation software (like Windows 7), install third-party terminal simulation software on the PC by referring to user manual or online help.

2. Start the terminal simulation software, create a connection, select a serial port, and set communication parameters as follows.

   - Bits per second (B): 9600
   - Data bits (B): 8
   - Parity (P): None
   - Stop bits (S): 1
   - Flow control (F): None

3. Press **Enter** until the command line prompt of the user view, such as <Enterprise AP>, is displayed. Then, you enter the user configuration interface. You can run commands to configure the AP. Enter a question mark (?) whenever you need help.

3.2 Logging In to the AP Using STelnet

This section describes how to log in to the AP using STelnet. After logging in to the AP, you can configure the AP using commands.

Before logging in to the device through STelnet, complete the following tasks:

- Starting the device properly
- Preparing network cables used to connect device interfaces.

- Configuring the PC's IP address and subnet mask. The IP address must be on the network segment 169.254.0.0/16 but cannot be 169.254.1.1. 169.254.1.100 is recommended. The subnet mask is 255.255.0.0.

📖**NOTE**

- Ensuring that the IP address 169.254.1.1 and subnet mask 255.255.0.0 have been configured on VLANIF 1 of the device before the delivery, and GE0/0/0 has been added to VLAN 1 by default.

- Before the device is delivered, the STelnet service has been configured on the device. The STelnet interface number is 22, and the default user name and password are respectively **admin** and **admin@huawei.com**.

Use the SSH client software to log in to the device through STelnet from a terminal. The third-party software PuTTY is used as an example here.

1. After the device is powered on, connect the PC's network interface to GE0/0/0 of the device using network cables.

   📖**NOTE**

   Ping 169.254.1.1 from the PC to check whether the device can be pinged successfully. If the ping operation fails, check whether the PC's IP address is correct or replace the network cable.

2. Use the PuTTY software to log in to the device, enter the device IP address, and select the SSH protocol type.

Figure 3-1 PuTTY Configuration page
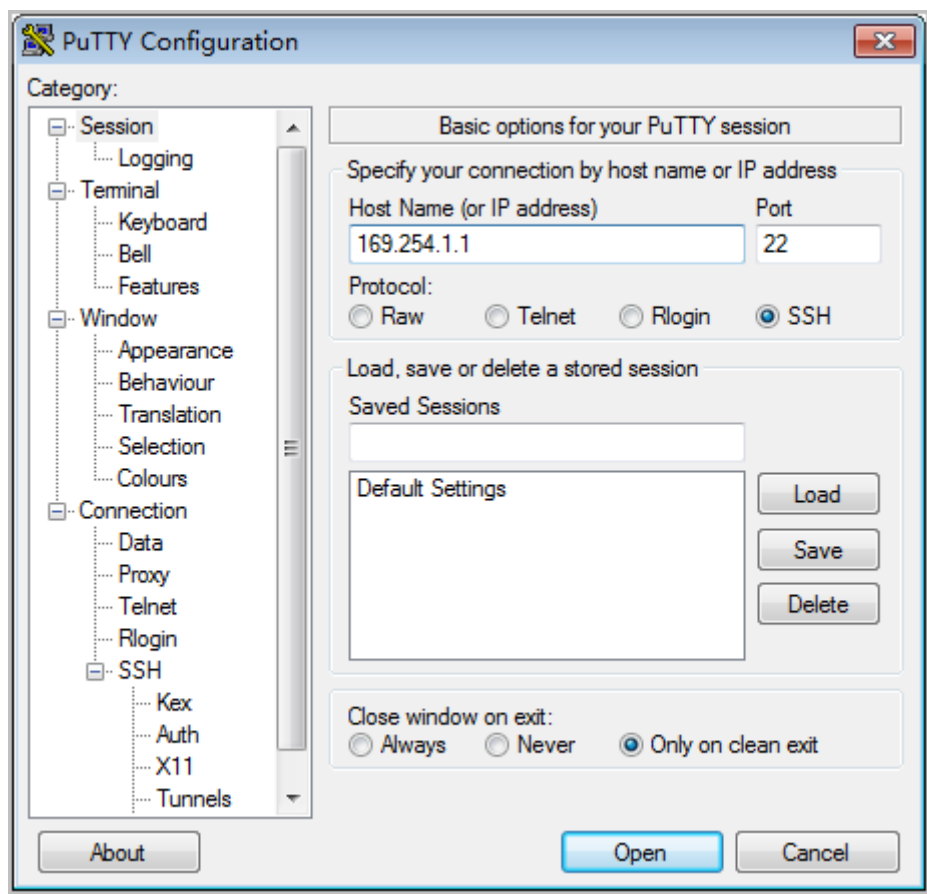
3. Click **Open**. Enter the user name and password at the prompt, and press **Enter**. You have logged in to the device. (The following information is only for reference.)

```
login as: admin
Sent username "admin"

admin@169.254.1.1's password:

<Huawei>
```

📖**NOTE**

It is recommended that you change the initial user name and password after login.

3.3 Logging In to the AP Using Telnet

This section describes how to log in to the AP using Telnet. After logging in to the AP, you can configure the AP using commands.

📖**NOTE**

- In V200R005C00 and later versions, upon factory delivery, the Telnet server is disabled. Before connecting to the device through Telnet from a user terminal, make sure that the Telnet service is enabled on the device by the STelnet service.

- The Telnet protocol poses a security risk, and therefore the STelnet protocol is recommended.

1. Connect a PC to the ETH/PoE interface of the AP using a network cable.

2. Configure a static IP address for the PC. The IP address must be in the same network segment as the AP's IP address. After completing the configuration, ping the AP's IP address from the PC. If the ping operation succeeds, the connection is set up successfully. If the ping operation fails, check whether the network cable is faulty.

   📖**NOTE**

   - In V200R002C00 and earlier versions, the IP address 192.168.0.1 and subnet mask 255.255.255.0 have been configured on VLANIF 1 of the AP before the delivery, and GE0/0/1 has been added to VLAN 1 by default.

   - In V200R003C00 and later versions, the IP address 169.254.1.1 and subnet mask 255.255.0.0 have been configured on VLANIF 1 of the AP before the delivery, and GE0/0/1 has been added to VLAN 1 by default.

   - If the AP working in Fit AP mode is online on the AC, the DHCP server automatically assigns an IP address to the AP. You can remotely log in to the AC on a local terminal and run the following command to check the AP's IP address:

     - For V200R005C30 and earlier versions: **display ap-run-info id** *ap-id*
     - For V200R006C00: **display ap run-info ap-name** *ap-name*

3. Enter the command line interface on the PC. For example, in Windows XP, choose **Start** > **Run** and enter **cmd** in the displayed dialog box.

4. Use Telnet to log in to the AP.

5. Enter the default user name **admin**. The initial password is **admin** in V200R002C00 and earlire versions and is **admin@huawei.com** in V200R003C00 and later versions. If the user view is displayed, you have logged in successfully. You are advised to change the user name and password on your first login.

NOTE

You can run the **quit** command to exit from the Telnet window. When the system fails to exit from the Telnet window:

- If you logged in to the AP from an AC or a switch, press **Ctrl+T** to return to the AC or switch view. This operation does not affect AP services.
- If you logged in to the AP from a PC, directly close the Telnet window. This operation does not affect AP services.

3.4 Logging In to the AP Using a Web Client

Pre-configuration Tasks

Before configuring users to log in to the AP using HTTP, complete the following task:

Configure reachable routes between the terminal and the AP.

NOTE

- The web management system is enabled on the AP before delivery. The default IP address of the web management system is 169.254.1.1 and the mask is 255.255.0.0. The web management system provides a default user account, with the user name **admin** and password **admin@huawei.com**. You are advised to change the user name and password on your first login. Assign your PC an IP address on the same network segment as the default IP address of the web management system, and connect the PC to the GE interface. Start the web browser on the PC and visit **http://*169.254.1.1*** to log in to the web management system.
- You can only log in to the FAT AP using the web platform.

Procedure

Step 1 Open a web browser on a PC, and enter the management address in the format of **http:// *169.254.1.1*** in the address bar. Ensure that the PC and AC can communicate with each other. Then press **Enter**. Set the language, user name, and password. The HTTPS login URL is displayed in the address box indicating that the system has gone to the HTTPS login page.

NOTE

You can also enter **https://***IP address* in the address box to log in to the AP using HTTPS. HTTPS ensures security of login information during login and security of data exchanged during subsequent operations.

Step 2 Click **Login** or press **Enter**. The web system home page is displayed. You can manage and maintain the equipment. For details, see the *Huawei Wireless Access Points Web-based Configuration*.

----End

4 Hardware Failures

4.1 A Device Fails to Be Powered On

Fault Description

The SYS indicator of a device is off.

Possible Causes

Power Supply Mode	Possible Cause
Power supply using a power module	- The power switch on the device is turned off. - The power cable is not securely connected to the device. - The power supply unit has failed. - If the device connects to an external power source, its power adapter may fail. - If the device has a built-in power supply, the device itself may be faulty.
PoE power supply	- The power sourcing equipment does not support the PoE function or is faulty. - The power sourcing equipment is incorrectly configured (the PoE function is disabled or the power-off time range is improperly set). - The line is faulty (the network cable or distribution frame is damaged). - The AP is faulty.

Troubleshooting Procedure

Power Supply Mode	Troubleshooting Procedure
Power supply using a power module	1. Check that the power switch is on. 2. Check that the power cable is securely connected to the device. 3. Check whether the power supply is normal. Replace the power adapter with a normal one. If the device is powered on, the original power adapter is faulty. Contact Huawei technical support or Huawei agent and ask them to replace the power adapter. 4. If the device still cannot be powered on, the device itself is faulty. Contact Huawei technical support or Huawei agent and ask them to replace the device.
PoE power supply	1. Check whether the power sourcing equipment supports PoE or is faulty. 2. Check whether the configuration on the power sourcing equipment causes PoE power supply errors, such as the PoE function is disabled or the power-off time range is incorrectly set. 3. Check whether the network cable or distribution frame is faulty. 4. If the device still cannot be powered on, the device itself is faulty. Contact Huawei technical support engineers or Huawei agent and ask them to replace the device.

4.2 An Optical Interface Cannot Turn Up

Fault Description

After an optical interface is connected to a remote device through an optical fiber, its LINK indicator is off.

Possible Causes

- The optical fiber is faulty.
- The optical module on the optical interface cannot meet the requirements.

Troubleshooting Procedure

1. Replace the optical fiber and optical module and check whether the optical interface can turn Up. Ensure that the optical module meets the following requirements.

2. Determine optical module attributes.

    ● The optical module has passed Huawei certification.

    ● The transmission speed of the optical module is the same as the interface speed.

    ● The wavelength of the optical module is the same as that of the remote optical module.

    ● The transmission distance of the optical module is suitable for the actual distance between the two devices.

    📖 **NOTE**

    ● The transmission distance of an optical module is 10 km, 15 km, 20 km, 40 km, or 80 km. The optical modules with a longer transmission distance have a higher transmit power. If an optical module with a long transmission distance is used for short-distance transmission, the optical interface cannot turn Up because the transmit power is too high. The high transmit power may even burn the receiver of the remote optical module. To reduce the transmit power in this situation, use an optical attenuator between the optical module and optical fiber.

    ● Optical modules with different speeds are available, for example, 155 Mbit/s, 622 Mbit/s, and 1.25 Gbit/s. It is recommended that you use an optical module with the same speed as the optical interface to ensure efficient optical transmission.

3. If the interface remains Down, contact Huawei technical support.

<div style="text-align: right;">

5 Appendix

</div>

5.1 On-site Cable Assembly and Installation

5.1.1 Cable Assembly Precautions

Checking the Appearance of Cables

- If the cable jacket or insulation is visibly dirty, clean it before assembly.
- If the jacket or insulation of a cable has visible damage, irreparable scuffing, or other defects, do not use the cable.
- If the shield layer of a cable is damaged, do not use the cable.
- If the cable jacket or insulation cracks after the cable is bent or twisted, discard this cable and check whether other cables have the same problem. If other cables have the same problem, replace these cables.

Checking the Appearance of Connectors

- Do not use connectors with visible defects, damage, rust or scuffing.
- Do not use connectors if their shells or pins have exposed part or uneven plating, or their pins are lost, broken, or bent.
- Do not use connectors that have dirt on their pins or in their jacks or if there are conductors between pins or between pins and the shell.

Precautions for Assembly

- Use dedicated tools or tools delivered by Huawei and follow the methods given here during assembly.
- Hold terminals of cables instead of pulling the cables when installing or removing cable components.
- Take the following precautions when cutting or stripping cables:
  - Make cables slightly longer than necessary.

－ Coil cables longer than 2 m (6.56 ft) after cutting. Bind and fasten the coils using bundling ropes. The inner diameters of the coils should be larger than 20 times the outer diameters of the cables.

－ When stripping the jackets of cables, avoid damaging the shield layers (braid or aluminum foil), insulation, core conductors, and other jackets that do not need to be stripped.

－ After assembling cables, cut all visible cross sections of jackets to ensure that the cross sections are arranged neatly.

－ Do not touch the core conductors of cables with your hands. Terminate exposed conductors in a timely way after stripping off insulation so that the surface of the conductors does not become oxidized.

● Take the following precautions when crimping and connecting cables or connectors:

－ The terminals and conductors should be connected tightly after they are crimped. They should not be moved or turned.

－ Cut all the exposed copper wires.

－ Try to avoid a second crimping of sleeves.

－ Keep all the conductors clean and aligned.

□NOTE

The connectors, cables, and tools provided by different vendors may be different. The figures in this document are only for your reference.

5.1.2 Assembling Power Cables

Assembling the OT Terminal and Power Cable

Context

Figure 5-1 shows the components of an OT terminal and a power cable.

Figure 5-1 Components of an OT terminal and a power cable
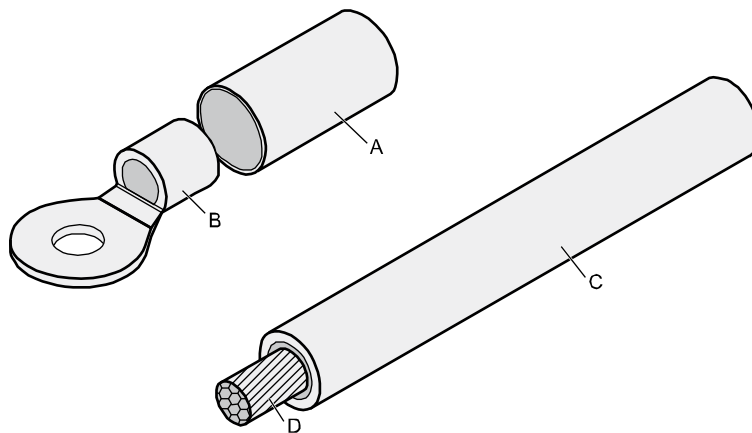
A Heat-shrinkable tubing   B. Bare crimping terminal   C. Insulation   D. Conductor

Procedure

Step 1 Based on the cross-sectional area of the cable conductor, strip a length of insulation coating C to expose the conductor D of length L1, as shown in **Figure 5-2**. The recommended values of L1 are listed in **Table 5-1**.

Figure 5-2 Stripping a power cable (OT terminal)
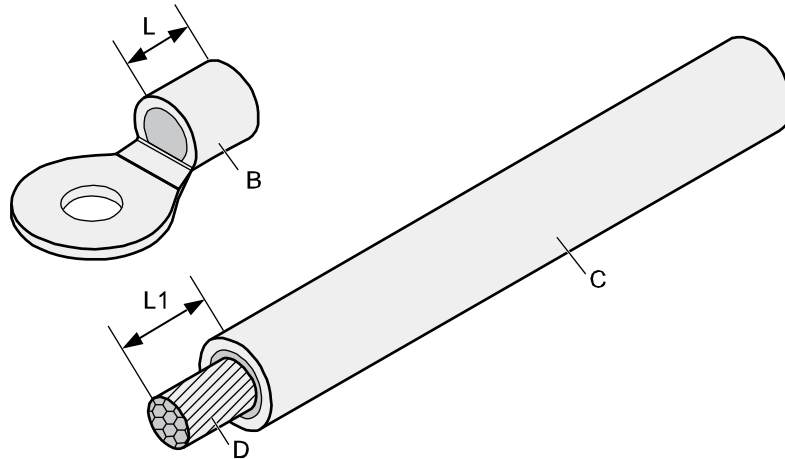
⚠ **NOTICE**

- When you strip a power cable, do not damage the conductor of the cable.

- If the bare crimping terminal is not provided by Huawei, the value of L1 is 1 mm (0.04 in.) to 2 mm (0.08 in.) greater than the value of L.

Table 5-1 Mapping between the cross-sectional area of the conductor and the value of L1

Cross-Sectional Area of Conductor (mm²(in.²))	Value of L1 (mm (in.))	Cross-Sectional Area of Conductor (mm²(in.²))	Value of L1 (mm (in.))
1 (0.002)	7 (0.28)	10 (0.015)	11 (0.43)
1.5 (0.002)	7 (0.28)	16 (0.025)	13 (0.51)
2.5 (0.004)	7 (0.28)	25 (0.039)	14 (0.55)
4 (0.006)	8 (0.31)	35 (0.054)	16 (0.63)
6 (0.009)	9 (0.35)	50 (0.077)	16 (0.63)

If you are proficient in assembling OT terminals and power cables, you can obtain the value of L1 by comparing the part to be crimped with the power cable.

Step 2 Put the heat-shrinkable (A) tubing onto the bare crimping terminal, as shown in **Figure 5-3**.

Figure 5-3 Putting the heat shrink tubing onto the bare crimping terminal
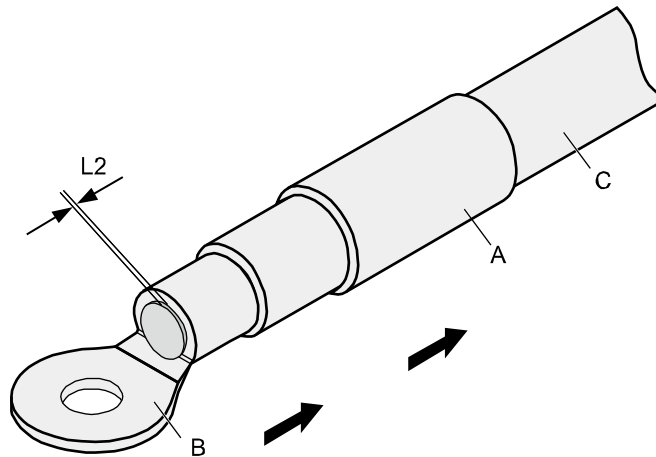
Step 3 Put the OT terminal B onto the exposed conductor, and ensure that the OT terminal is in good contact with the insulation coating C, as shown in **Figure 5-3**.

⚠ **NOTICE**

After the conductor is fed into the OT terminal, the protruding part of the conductor, or L2 in **Figure 5-3**, must not be longer than 2 mm (0.08 in.).

Step 4 Crimp the joint parts of the bare crimping terminal and the conductor, as shown in **Figure 5-4**.

📖 **NOTE**

The shapes of crimped parts may vary with the crimping dies.

Figure 5-4 Crimping the joint parts of the bare crimping terminal and the conductor (OT terminal)
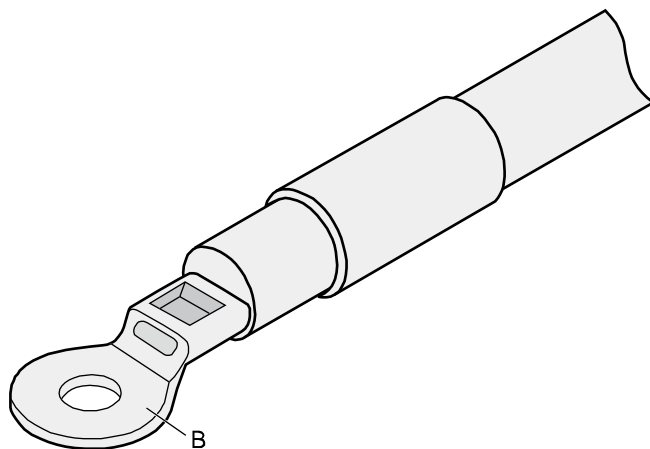
Step 5 Push the heat shrink tubing (A) towards the connector until the tube covers the crimped part, and then heat the tube by using a heat gun, as shown in **Figure 5-5**.

Figure 5-5 Heating the heat shrink tubing (OT terminal)
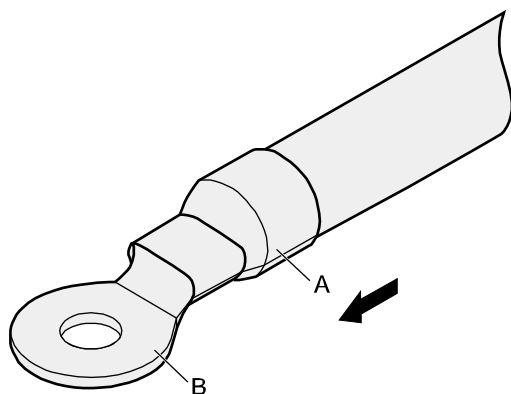
⚠ **NOTICE**

Stop heating the shrink tubing when the connector is securely locked in the shrink tubing. Do not heat the shrink tubing too long to damage the insulation coating.

----**End**

Assembling the JG Terminal and Power Cable

Context

Figure 5-6 shows the components of a JG terminal and a power cable.

Figure 5-6 Components of a JG terminal and a power cable
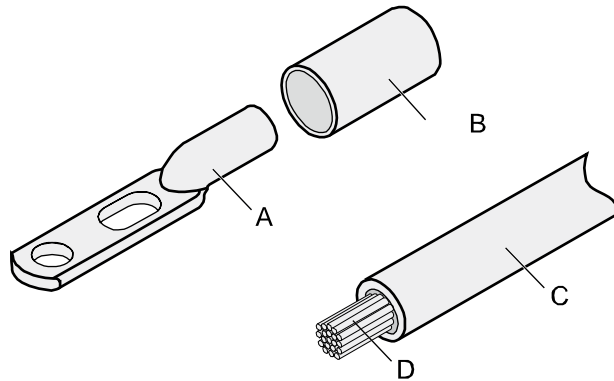
A. JG terminal B. Heat-shrinkable tube C. Insulation layer of a power cable D. Conductor of a power cable

Procedure

Step 1 Based on the cross-sectional area of the cable conductor, strip a part of the cable. The L-long conductor is exposed, as shown in **Figure 5-7**. The recommended values of L are listed in **Table 5-2**.

⚠ **NOTICE**

- When you strip a power cable, do not damage the conductor of the cable.
- If the bare crimping terminal is not provided by Huawei, you can adjust the value of L as required.

Figure 5-7 Stripping a power cable (JG terminal)

Table 5-2 Mapping between the cross-sectional area of the conductor and the value of L

Cross-Sectional Area of Conductor (mm^2(in.^{2}))	Value of L (mm(in.))
16 (0.025)	13 (0.51)
25 (0.039)	14 (0.55)
35 (0.054)	16 (0.63)
50 (0.077)	16 (0.63)

Step 2 Put the heat shrink tubing onto the bare crimping terminal, as shown in **Figure 5-8**.

Figure 5-8 Putting the heat shrink tubing onto the bare crimping terminal
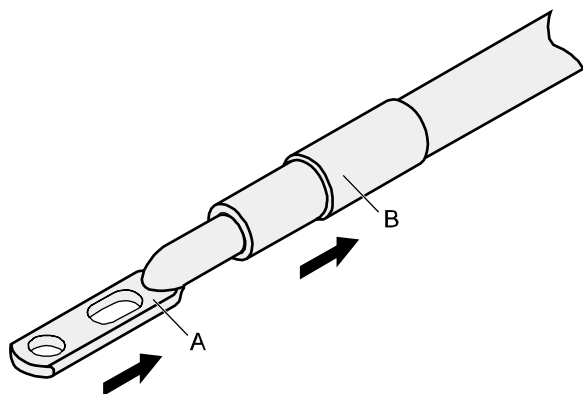
Step 3 Put the bare crimping terminal onto the exposed conductor, and ensure that the bare crimping terminal is in good contact with the insulation of the power cable, as shown in **Figure 5-8**.

Step 4 Crimp the joint parts of the bare crimping terminal and the conductor, as shown in **Figure 5-9**.

Figure 5-9 Crimping the joint parts of the bare crimping terminal and the conductor (JG terminal)
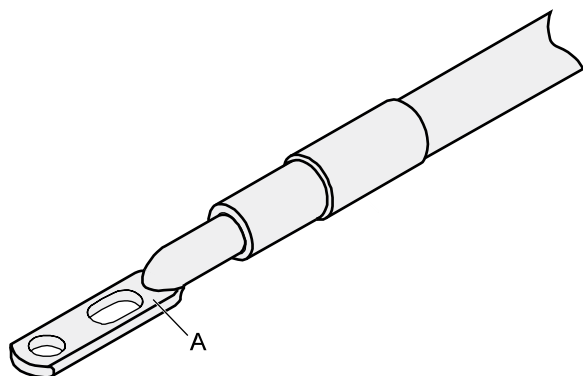
Step 5 Push the heat shrink tubing towards the connector until the tube covers the crimped part, and then heat the tube by using a heat gun, as shown in **Figure 5-10**.

Figure 5-10 Heating the heat shrink tubing (JG terminal)
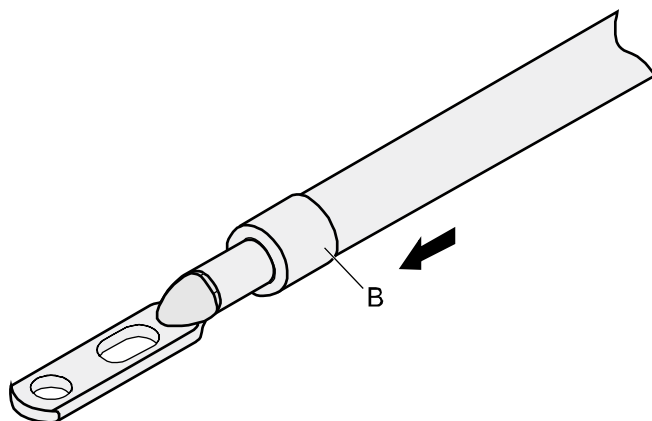
----End

Assembling the Cord End Terminal and the Power Cable

Context

Figure 5-11 shows the components of a cord end terminal and a power cable.

Figure 5-11 Components of a cord end terminal and a power cable
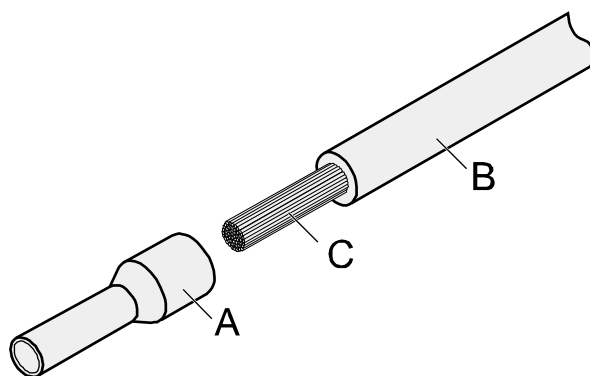
A. Cord end terminal   B. Insulation layer of a power cable   C. Conductor of a power cable

Procedure

Step 1 Based on the cross-sectional area of the cable conductor, strip a part of the insulation. The L1-long conductor is exposed, as shown in **Figure 5-12**. The recommended values of L1 are listed in **Table 5-3**.

⚠ **NOTICE**

When you strip a power cable, do not damage the conductor of the cable.

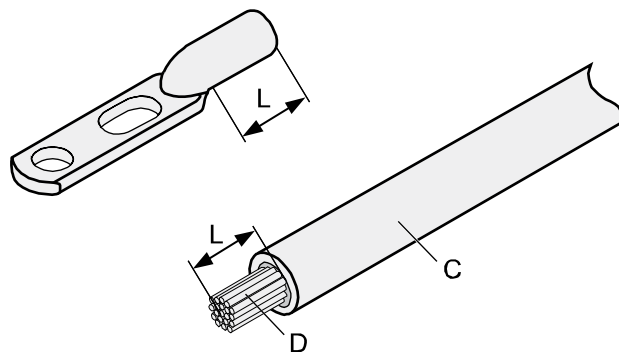**Figure 5-12** Stripping a power cable (cord end terminal)
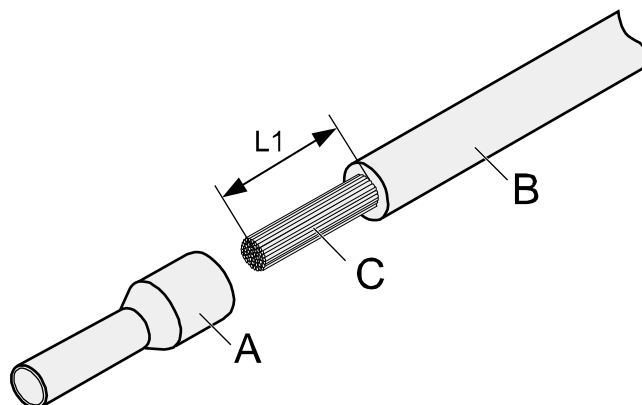
Table 5-3 Mapping between the cross-sectional area of the conductor and the value of L1

Cross-Sectional Area of Conductor (mm^2(in.^{2}))	Value of L1 (mm (in.))	Cross-Sectional Area of Conductor (mm^2(in.^{2}))	Value of L1 (mm (in.))
1 (0.002)	8 (0.31)	10 (0.015)	15 (0.59)
1.5 (0.002)	10 (0.39)	16 (0.025)	15 (0.59)
2.5 (0.004)	10 (0.39)	25 (0.039)	18 (0.71)
4 (0.006)	12 (0.47)	35 (0.054)	19 (0.75)
6 (0.009)	14 (0.55)	50 (0.077)	26 (1.02)

Step 2 Putting the cord end terminal onto the conductor, and ensure that the conductor is aligned with the edge of the cord end terminal, as shown in **Figure 5-13**.

⚠ **NOTICE**

After the conductor is fed into the cord end terminal, the protruding part of the conductor must not be longer than 1 mm (0.04 in.).

Figure 5-13 Put the cord end terminal onto the conductor
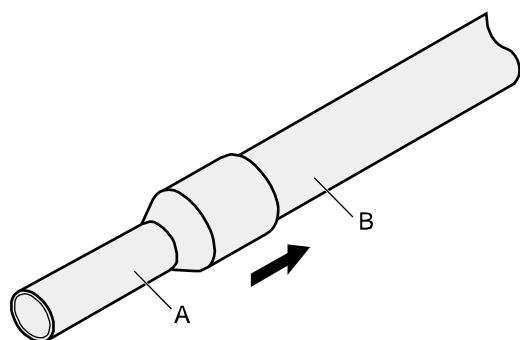
Step 3 Crimp the joint parts of the cord end terminal and the conductor, as shown in **Figure 5-14**.

Figure 5-14 Crimping the cord end terminal and the conductor
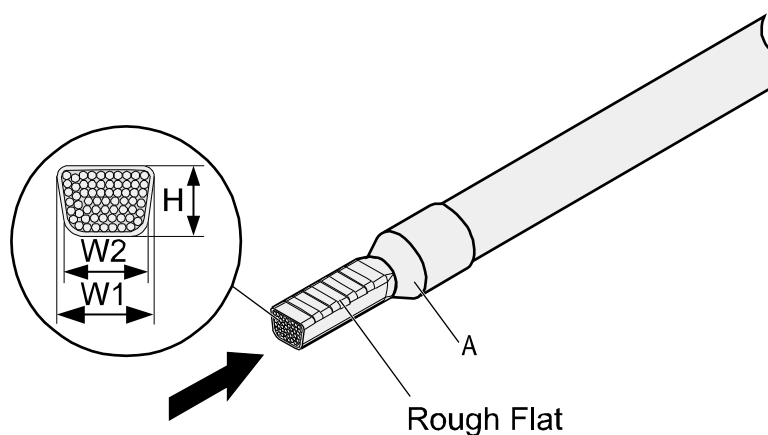
Step 4 Check the maximum width of the tubular crimped terminal. The maximum width of a tubular crimped terminal is listed in **Table 5-4**.

Table 5-4 Maximum width of a tubular crimped terminal

Cross-Sectional Area of Tubular Terminal (mm^2(in.^{2}))	Maximum Width of Crimped Terminal W1 (mm(in.))
0.25 (0.0004)	1 (0.04)
0.5 (0.0008)	1 (0.04)
1.0 (0.0015)	1.5 (0.06)
1.5 (0.0023)	1.5 (0.06)
2.5 (0.0039)	2.4 (0.09)
4 (0.006)	3.1 (0.12)

Cross-Sectional Area of Tubular Terminal (mm^2(in.^{2}))	Maximum Width of Crimped Terminal W1 (mm(in.))
6 (0.009)	4 (0.16)
10 (0.015)	5.3 (0.21)
16 (0.025)	6 (0.24)
25 (0.039)	8.7 (0.34)
35 (0.054)	10 (0.39)

----End

5.1.3 Assembling Ethernet Cables

Assembling the Shielded RJ45 Connector and Ethernet Cable

Context

Figure 5-15 shows the components of an RJ45 connector and a shielded Ethernet cable.

Figure 5-15 Shielded RJ45 connector and cable
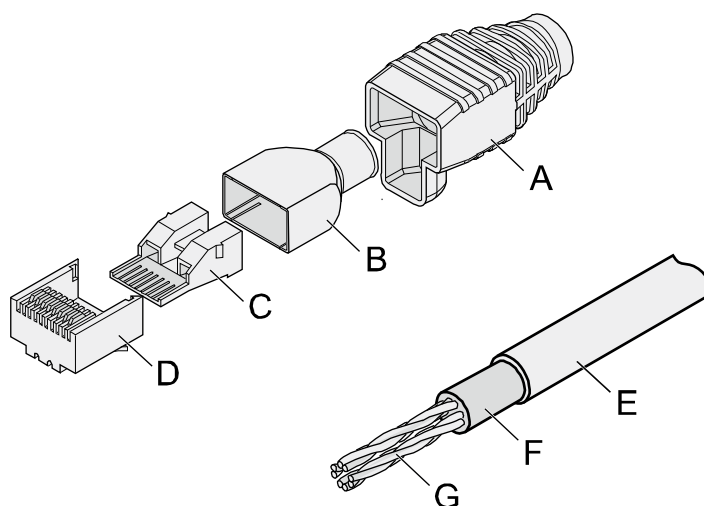
A. Jacket of connector   B. Metal shell of connector   C. Wire holder of connector D. Plug of connector

E. Jacket of Ethernet cable F. Shield layer of Ethernet cable G. Twisted-pair wires   -

Procedure

Step 1 Fit the jacket of the connector onto the Ethernet cable, as shown in **Figure 5-16**.

Figure 5-16 Fit the jacket of the connector onto the Ethernet cable
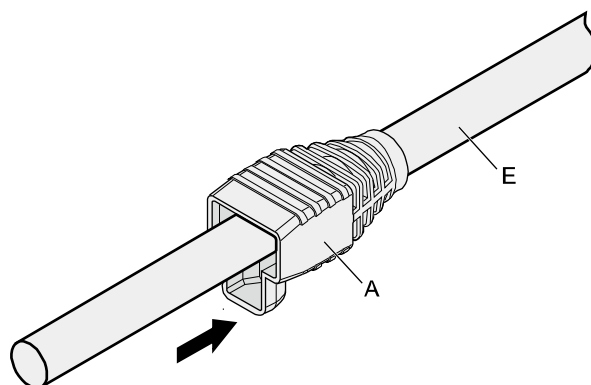
Step 2 Remove a 30 mm (1.18 in.) long section of the jacket, cut off the nylon twine inside the jacket, and cut a no more than 5 mm (0.20 in.) cleft in the jacket, as shown in **Figure 5-17**.

![NOTICE icon] **NOTICE**

- When you remove a section of the jacket, do not damage the shield layer of the twisted-pair cable.

- When you remove the shield layer, do not damage the insulation of the twisted-pair cable.

Figure 5-17 Removing the jacket of a twisted-pair cable (unit: mm (in.))
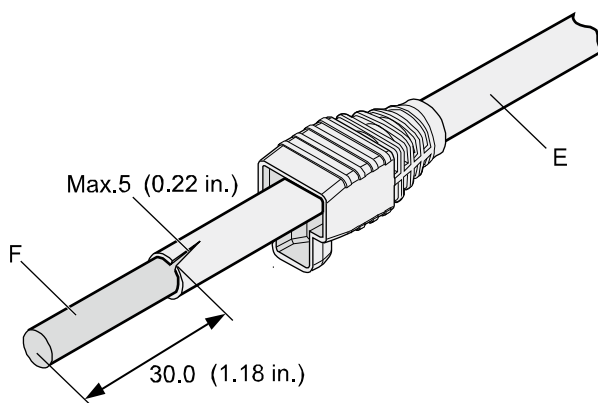
Step 3 Fit the metal shell onto the twisted-pair cable. The shield layer is covered by the metal shell, as shown in **Figure 5-18**.

Figure 5-18 Fitting the metal shell onto the twisted-pair cable
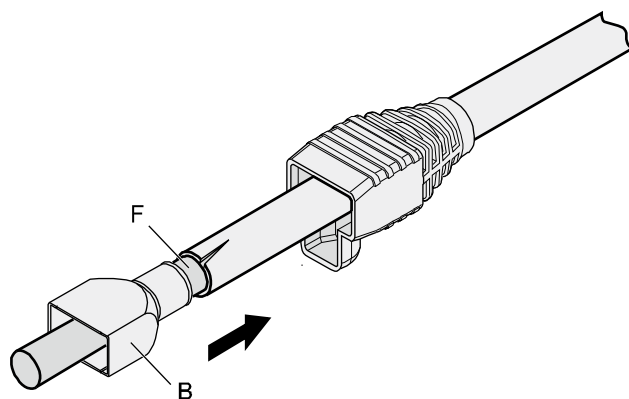
Step 4 Fit the metal shell onto the twisted-pair cable until the shield layer is covered completely. Along the edge of the metal shell, cut off the aluminum foil shield layer and ensure that there is no surplus copper wire. The exposed twisted-pair cable is about 20 mm (0.79 in.) long, as shown in **Figure 5-19**.

Figure 5-19 Removing the shield layer of a twisted-pair cable (unit: mm (in.))
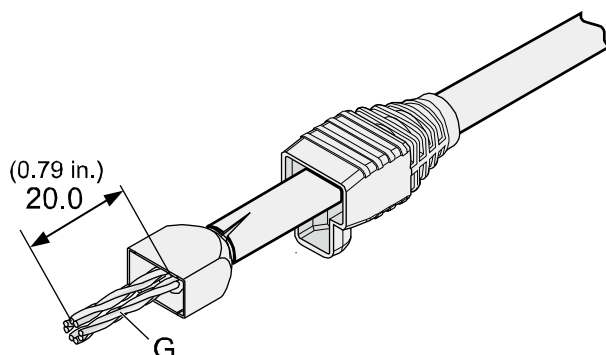
Step 5 Based on the colors, lead the four pairs of twisted-pair wires through the wire holder, as shown in **Figure 5-20** and **Figure 5-21**.

Figure 5-20 Leading wires through the wire holder
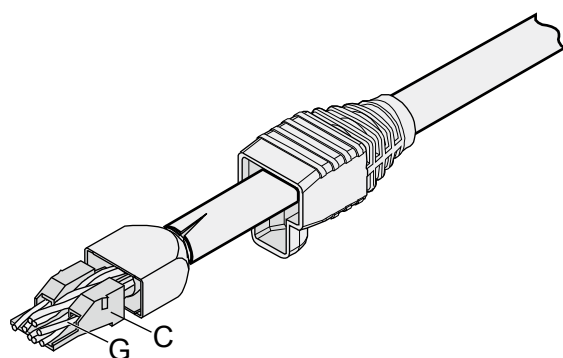
Figure 5-21 Cable locations in a wire holder
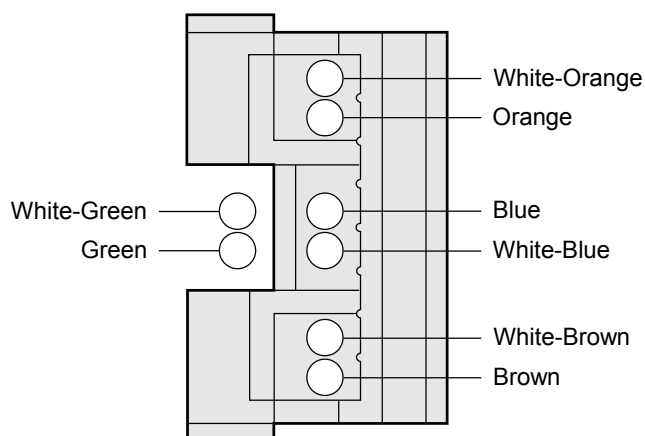
Step 6 Align the four pairs of cables in the holder, as shown in **Figure 5-22**. The connections between the wires and the pins are shown in **Figure 5-23** and listed in **Table 5-5**.

Figure 5-22 Four pairs of cables on a wire holder
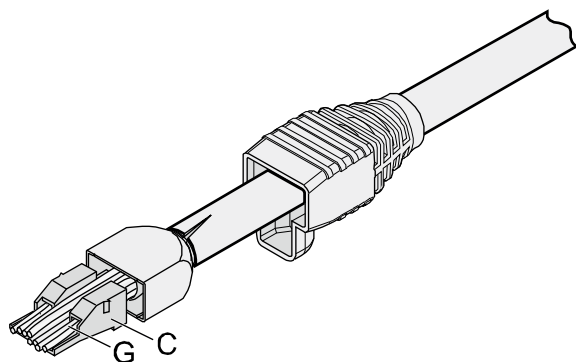
Figure 5-23 Connections between wires and pins
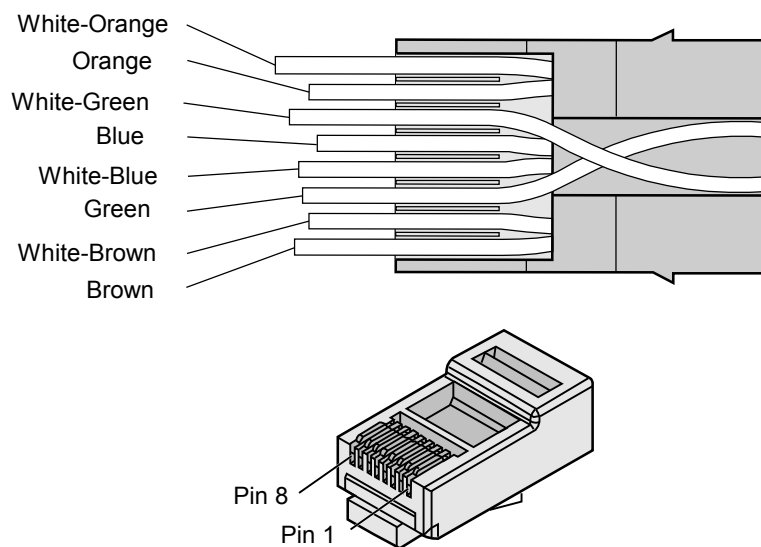
Table 5-5 Connections between wires and pins (using a straight-through cable as an example)

Matching Pins of Wires	Wire Color
1	White-Orange
2	Orange
3	White-Green
4	Blue
5	White-Blue
6	Green
7	White-Brown
8	Brown

Step 7 Cut off the surplus cables along the lower edge of the wire holder, as shown in **Figure 5-24**.

Figure 5-24 Cutting off surplus cables
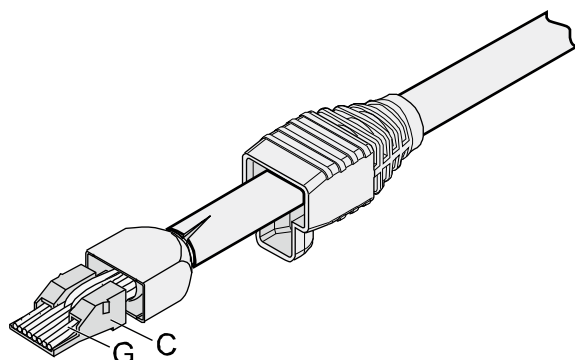
Step 8 Put the connector body onto the wire holder and turn the metal shell by 90°, as shown in **Figure 5-25**.

☷**NOTE**

    Ensure that the wire holder is in good contact with the connector body.

Figure 5-25 Put the connector body onto the wire holder
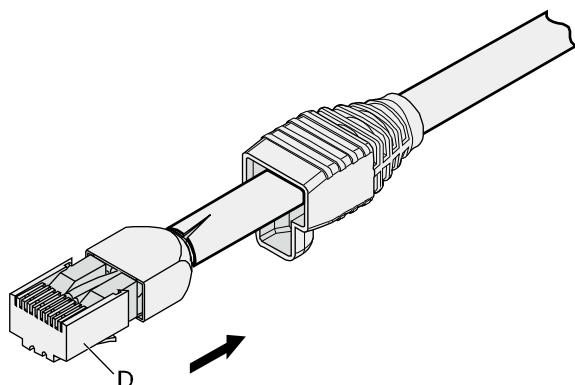
Step 9 Push the metal shell towards the connector body until the wire holder and the connector body are engaged completely. Crimp the connector, as shown in **Figure 5-26**.

Figure 5-26 Crimping the connector
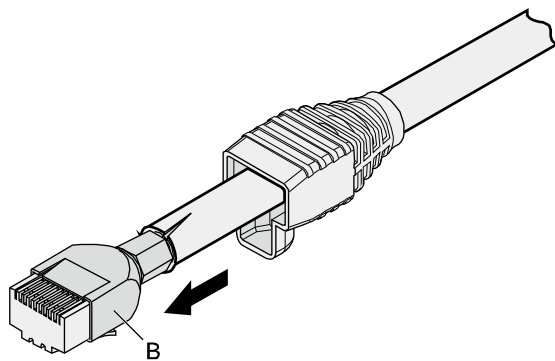
Step 10 Push the jacket towards the metal shell until the metal shell is covered. This completes the assembly of one end of the cable, as shown in **Figure 5-27**.

Figure 5-27 Pushing the metal shell
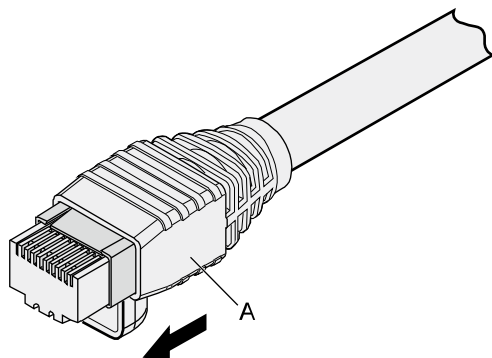
Step 11 To complete the assembly of the other end, repeat **Step 1** through **Step 10**.

----End

Assembling an Unshielded RJ45 Connector and Ethernet Cable

Context

Figure 5-28 shows the components of an unshielded RJ45 connector and cable.

Figure 5-28 Components of an unshielded RJ45 connector and cable
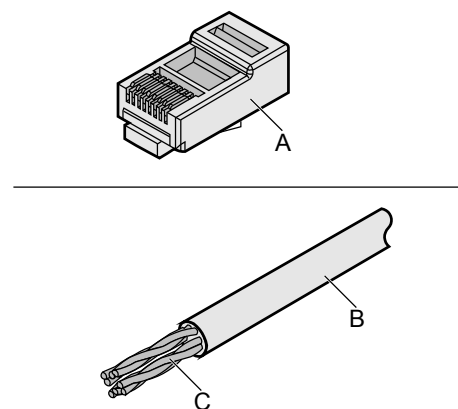
A. Plug of connector   B. Jacket   C. Twisted-pair wires

Procedure

Step 1 Remove a 16-mm (0.63 in.) long section of the jacket, as shown in **Figure 5-29**.

⚠ **NOTICE**

When you remove the shield layer, do not damage the insulation of the twisted-pair cable.

**Figure 5-29** Removing the jacket of a twisted-pair cable (unit: mm (in.))
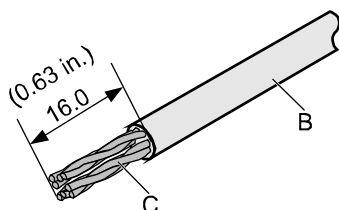
Step 2 Align the four pairs of wires and cut the ends neatly, as shown in **Figure 5-30**. The connections between the wires and the pins are listed in **Table 5-6**.

Figure 5-30 Connections between wires and pins (unit: mm (in.))
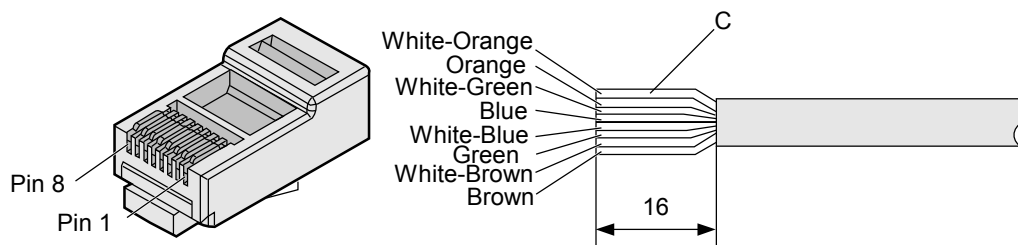
Table 5-6 Connections between wires and pins (using a straight-through cable as an example)

Matching Pins of Wires	Wire Color
1	White-Orange
2	Orange
3	White-Green
4	Blue
5	White-Blue
6	Green
7	White-Brown

Matching Pins of Wires	Wire Color
8	Brown

Step 3 Feed the cable into the plug, and crimp the connector, as shown in **Figure 5-31**.

☐**NOTE**

> When inserting the cable, check from the side or bore of the plug to ensure that the cable is completely seated in the plug.

Figure 5-31 Crimping the connector
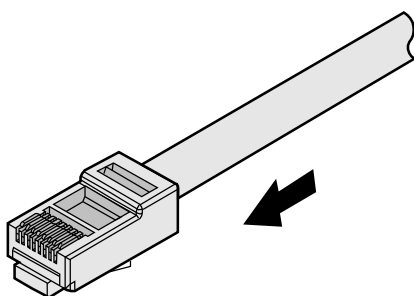
Step 4 To complete the assembly of the other end, repeat **Step 1** through **Step 3**.

----End

Checking the Appearance of Contact Strips

Context

- To ensure proper contact between the crimped wires and the wire conductors, the heights and sizes of the contact strips must be standard and the same.

- The contact strips must be parallel to each other, with an offset less than ± 5°. The top margin of a strip must be parallel to the axis of the connector, with an offset less than ± 10°.

- To ensure conduction, the surface of the contact strips must be clean.

- The contact strips must be in good contact with the RJ45 socket. The plastic separators must remain intact and be aligned.

- The contact strip blade must extend beyond the ends of the wires. The ends of the wires must be in contact with the edge of the RJ45. The distance between them must be less than 0.5 mm (0.02 in.).

Procedure

Step 1 Hold the crimped connector, with the front side facing you, and check whether the contact strips are of the same height. The height should be 6.02 ± 0.13 mm (0.237 ± 0.005). If a measuring tool is not available, you can compare the connector with a standard connector. **Figure 5-32** shows an unqualified piece, and **Figure 5-33** shows a qualified piece.

📖**NOTE**

All unqualified pieces must be crimped again.

Figure 5-32 Contact strips of different heights

Figure 5-33 Contact strips of the same height

Step 2 Hold an RJ45 connector and turn it 45°. Observe the top edges of the metal contact strips. **Figure 5-34** shows an unqualified piece.

Figure 5-34 Unparallel contact strips of different heights

Step 3 Check whether the contact strips are clean. If they are not clean and the dirt cannot be removed, replace it with a new RJ45 connector. **Figure 5-35** shows an unqualified piece.

Figure 5-35 Dirt on a contract strip
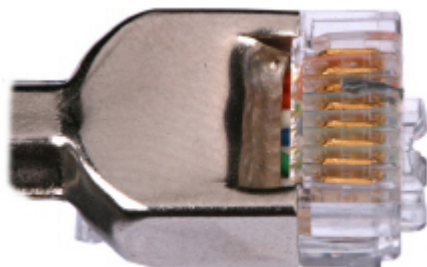
Step 4 Check whether the contact strips and the plastic separators are well aligned and intact. If a separator is skew and cannot be fixed, replace it with a new RJ45 connector. **Figure 5-36** shows an unqualified piece.

Figure 5-36 Skew plastic separators
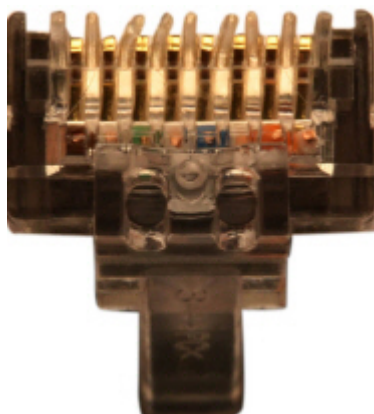
Step 5 Hold the connector with the side facing towards you, and check whether you can see the cross-sections of the wires. Ensure that the ends of the wires are in good contact with the edge of the RJ45, and that the contact strip blade extends beyond the ends of the wires and is crimped with the wires. If not, replace the connector. **Figure 5-37** shows an unqualified piece.

Figure 5-37 Wires not in good contact with the edge of the RJ45

Not in good contact with the edge of the RJ45 trough

----End

Testing the Connection of Assembled Cables

Context

Huawei provides two types of Ethernet cables: straight-through cables and crossover cables.

- Straight-through cables are connected in a one-to-one manner. They are used to connect terminals such as a computer or switch to network devices. **Table 5-7** lists the connections of core wires in a straight-through cable.

Table 5-7 Connections of core wires in a straight-through cable

RJ45 Connector 1	RJ45 Connector 2	Core Wire Color	Twisted or Not
2	2	Orange	Twisted
1	1	Orange-White	
6	6	Green	Twisted
3	3	Green-White	
4	4	Blue	Twisted
5	5	Blue-White	
8	8	Brown	Twisted
7	7	Brown-White	

- Crossover cables are connected in a crossover manner. They are used to connect terminals such as two computers or switches. **Table 5-8** lists the connections of core wires in a crossover cable.

Table 5-8 Connections of core wires in a straight crossover cable

RJ45 Connector 1	RJ45 Connector 2	Core Wire Color	Twisted or Not
6	2	Orange	Twisted
3	1	Orange-White	
2	6	Green	Twisted
1	3	Green-White	
4	4	Blue	Twisted
5	5	Blue-White	
8	8	Brown	Twisted

RJ45 Connector 1	RJ45 Connector 2	Core Wire Color	Twisted or Not
7	7	Brown-White	

Figure 5-38 shows the pins of an RJ45 connector.

Figure 5-38 Pins of an RJ45 connector
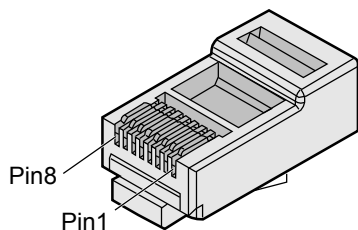
Procedure

Step 1 Feed both connectors of the cable into the ports of the cable tester.

Step 2 After the connectors are properly inserted, turn on the tester. If the indicators from 1 to G turn on simultaneously, you can infer that the pins work normally and the wires are correctly connected.

☉**NOTE**

Turn the switch to the S position to slow down lighting of the indicators so that you can see the indicators more clearly, as shown in **Figure 5-39**.

Figure 5-39 Testing the conduction and connections of wires

Step 3 Gently shake the connector and repeat **Step 2** to check whether the metal contact strips are in good contact with the core wires and Ethernet ports, as shown in **Figure 5-40**.

Figure 5-40 Checking the reliability

The procedure for testing a crossover cable is the same as that for testing a straight-through cable except for the sequence in which the indicators turn on. You need to refer to the wire connections of a crossover cable.

The Ethernet cable is qualified if the indicators turn on in the following sequence:

At the master (left) section of the tester, the indicators turn on in the sequence of 1-8-G. At the slave (right) section of the tester, the indicators turn on in the sequence of 3-6-1-4-5-2-7-8-G.

Otherwise, the Ethernet cable is unqualified.

⚲**NOTE**

> If a tester is not available, you can use a multimeter to perform a simple test, as shown in **Figure 5-41**.

Figure 5-41 Testing the connection of an Ethernet cable
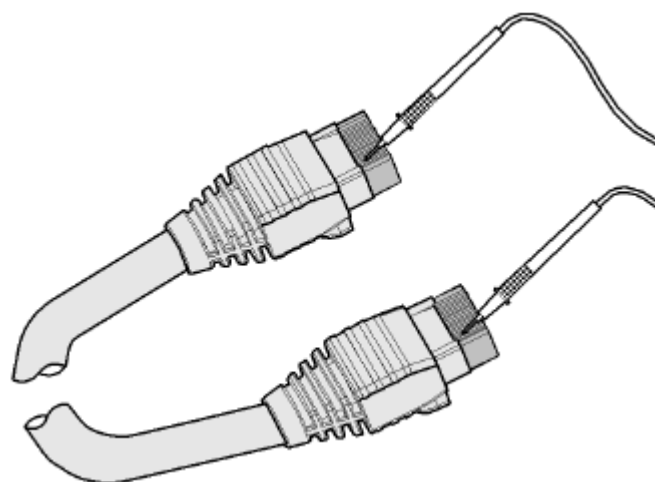
----End

5.1.4 Installing Cable Accessories

Precautions for Installing Cable Accessories

Tools

NOTE

> The illustrations in this document may differ from actual situations, but the installation methods remain the same. For example, in this document, the adapters of cable connectors have separate interfaces. In the actual situation, the adapters may have interfaces fixed on equipment.

Use dedicated tools provided or specified by Huawei and follow the installation procedure described here.

Bending Radius

Unless otherwise specified, bending radiuses (R) of cables or fibers must meet the requirements listed in **Table 5-9**.

Table 5-9 Bending radiuses of cables or fibers

Cable or Fiber	Bending Radius (R)
Ordinary cable	In normal cases, R $\geqslant$ 2d. When the cable is connected with a connector, R $\geqslant$ 5d.
Fiber	R $\geqslant$ 40 mm (1.57 in.); Bending angle > 90°

NOTE

> The letter d indicates the diameter of a cable or fiber.

Precautions for Installation

- Hold the terminals of cables instead of pulling the cables when installing or removing the cable components.

- Do not insert a connector forcibly when the connector is blocked. Pull out the connector by using a dedicated tool. Install the connector again after you check that the pins are inserted properly.

- Before tightening screws on cable connectors, ensure that the connectors are properly connected to their adapters. Tighten the screw with appropriate force using a flat-head or Phillips screwdriver instead of bare hands or an electric screwdriver. If the screw cannot be screwed into the tapped hole, find out the reason and try again. Do not screw it with too much force, or the screw or adapter may be damaged.

- When removing densely aligned cables or fiber connectors, use dedicated pliers such as cable-pulling pliers and fiber-pulling pliers.

- Do not twist, bend, stretch, or extrude fibers during installation.

- Cover the fiber connectors that are not in use by using dustproof caps. Remove the dustproof caps before using the fiber connectors.

Requirements for Cable Routing

- To protect cables, remove the burrs in the cable through-holes or install protective rings in the holes.

- To ease the connection and to avoid stress, keep slack at cable joints. After connecting multiple cables to a connector that has multiple interfaces, keep the cables slack to avoid stress generation.

- Bind or clean cables gently because cable distortion affects signal quality.

- Keep cables away from moveable components such as doors.

- Sharp objects must not be touched in cable wiring to ensure that cables are not damaged.

- To protect power cables, power cables of the active and standby power modules are laid separately.

Installing Power Adapters

Installing the OT Terminal

Procedure

- Install an OT terminal.

  1. Align the hole of the OT terminal (conductor upward) with a connecting hole, as shown in **Figure 5-42**.

  Figure 5-42 Aligning the OT terminal with a connecting hole
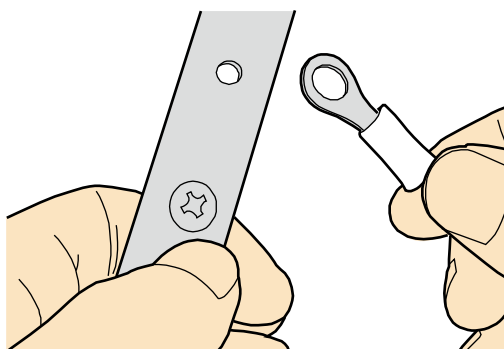
  NOTE

  When you install an OT terminal, the crimping sleeve is installed as shown in **Figure 5-43**, where A is correct and B is wrong.

Figure 5-43 Installing an OT terminal, showing the orientation of crimping sleeve
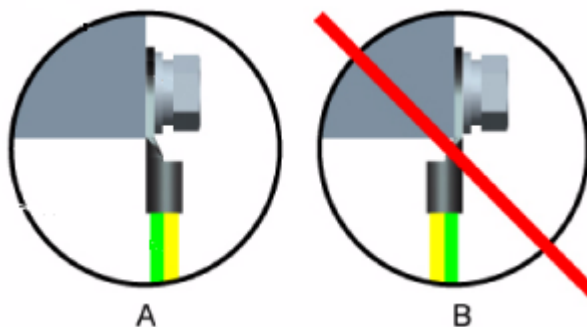
2. Place the spring washer and flat washer in turn, mount a matching screw, and fasten it clockwise, as shown in **Figure 5-44**.

Figure 5-44 Installing two terminals back to back
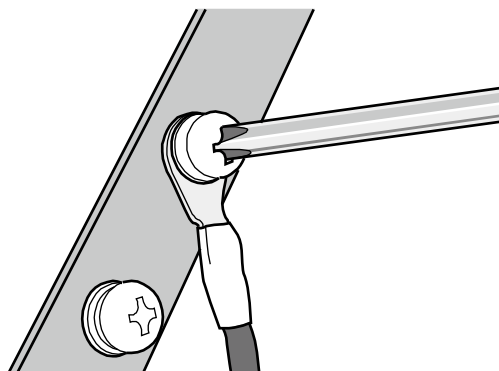
> ⚠ **NOTICE**
>
> Ensure that the OT terminal is not in contact with other terminals or metal components.

3. Move the cable slightly and ensure that it is securely connected, as shown in **Figure 5-45**.

Figure 5-45 Installed OT terminal
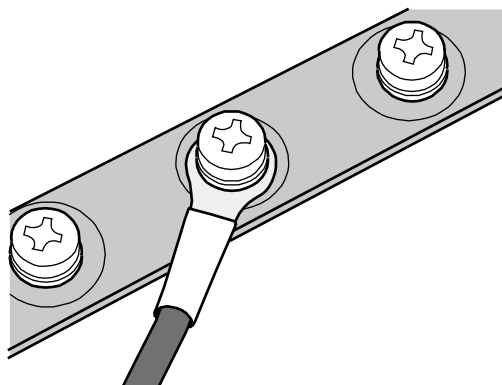
- Install two OT terminals on a post.

    Before you install two OT terminals on a post, ensure that the two terminals can be installed on the post and that the electrical connecting pieces have a large contact area. Two OT terminals can be installed using any of these methods:

    – Bend the upper OT terminal at a 45- or 90-degree angle, as shown in **Figure 5-46**.
    – Cross the two terminals, as shown in **Figure 5-47**.

Figure 5-46 Bending the upper OT terminal at a 45- or 90-degree angle
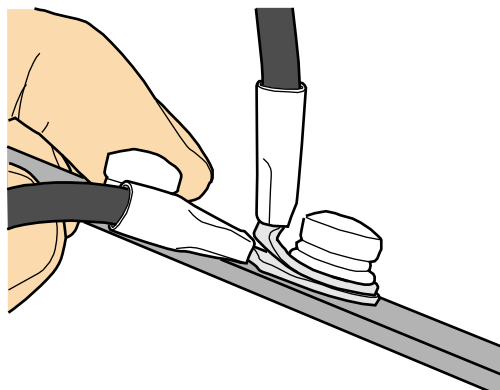
Figure 5-47 Crossing two terminals
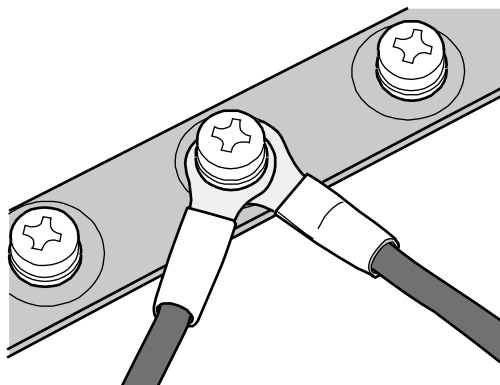
⚠ **NOTICE**

If the two terminals are different in size, place the smaller one above the bigger one. A maximum of two terminals can be installed on a post.

● To remove an OT terminal, loosen the screw in the counterclockwise direction.

----End

Installing the Cord End Terminal

Procedure

Step 1 Hold a cord end terminal upright and place it on a terminal jack, as shown in **Figure 5-48**. To ensure bump contact and dense connection, place the plain side of the terminal outwards.

Figure 5-48 Placing a terminal on a terminal jack vertically
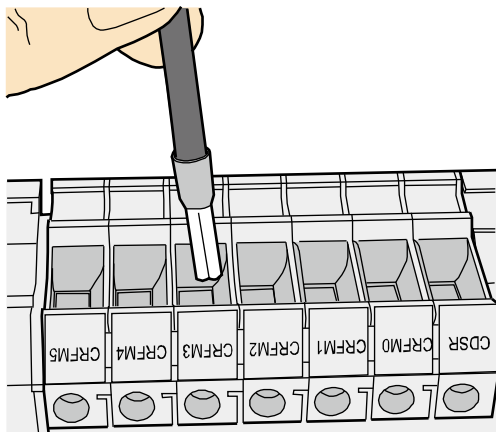
Step 2 Insert the terminal into the jack vertically, and fasten the terminal by turning the matching screw in the clockwise direction, as shown in **Figure 5-49**.

Figure 5-49 Feeding the terminal into the jack
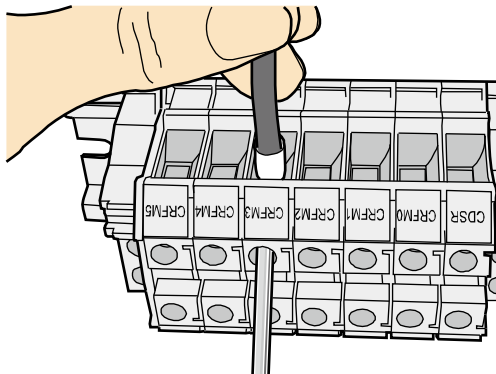
⚠ **NOTICE**

- Ensure that the exposed section of the terminal should be less than 2 mm (0.079 in.) in length.
- Do not press the insulation of the terminal.
- Insert only one terminal into one jack.

Step 3 Move the cable slightly and ensure that it is securely connected.

Step 4 Before you remove a cord end terminal, loosen the screw in the counterclockwise direction.

----End

Installing Ethernet Adapters

Installing a Shielded Ethernet Connector

Procedure

Step 1 Hold the male and female connectors, with the male connector facing the female connector, as shown in **Figure 5-50**.

Figure 5-50 Holding the male and female shielded connectors
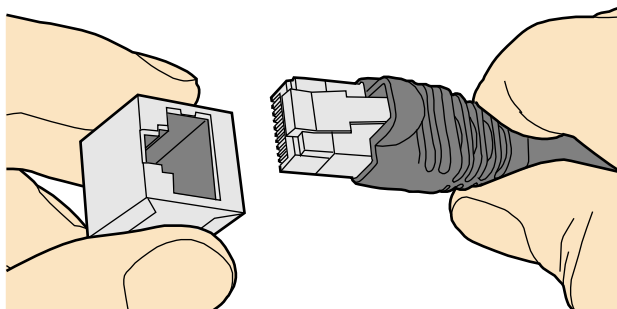
Step 2 Insert the male connector into the female connector, as shown in **Figure 5-51**.

Figure 5-51 Feeding the male shielded connector into the female shielded connector
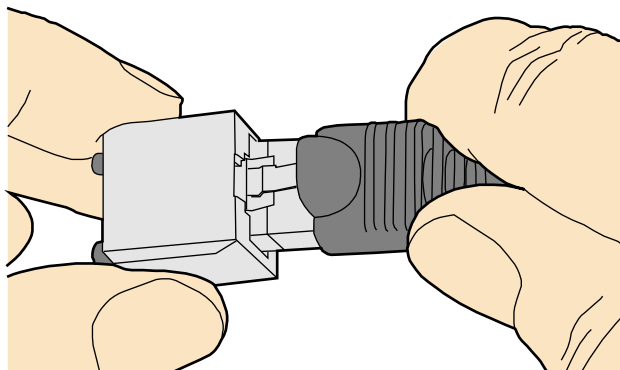
Step 3 When you hear a click, the cable connector is completely inserted in the port. (The clip on the cable connector pops up to fix the connector in the port.) Pull the connector slightly and ensure that it is securely connected, as shown in **Figure 5-52**.

Figure 5-52 Installed shielded Ethernet connector
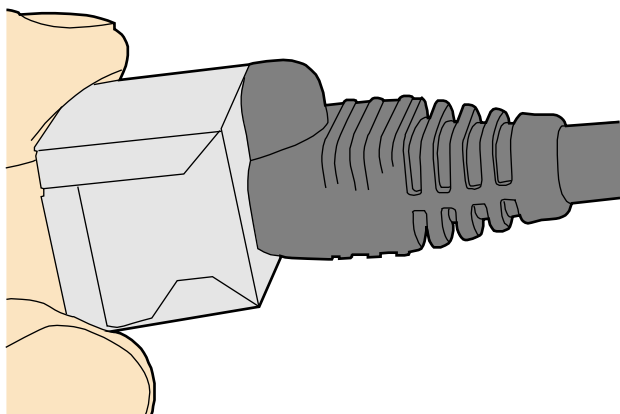
Step 4 To remove an Ethernet connector, press the locking key and pull out the connector, as shown in **Figure 5-53**.

Figure 5-53 Removing an shielded Ethernet connector
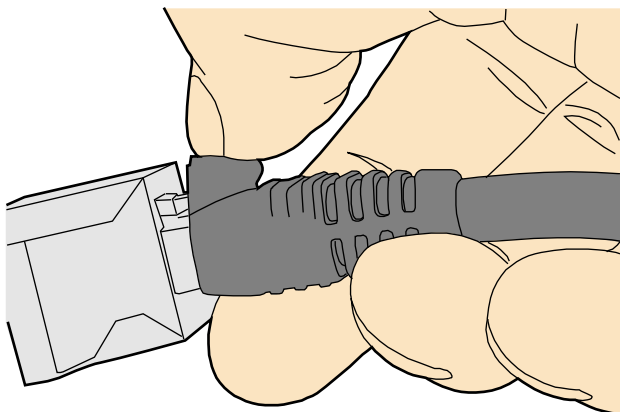
----End

Installing an Unshielded Ethernet Connector

Procedure

Step 1 Hold the male and female connectors, with the male connector facing the female connector, as shown in **Figure 5-54**.

Figure 5-54 Holding the male and female unshielded connectors
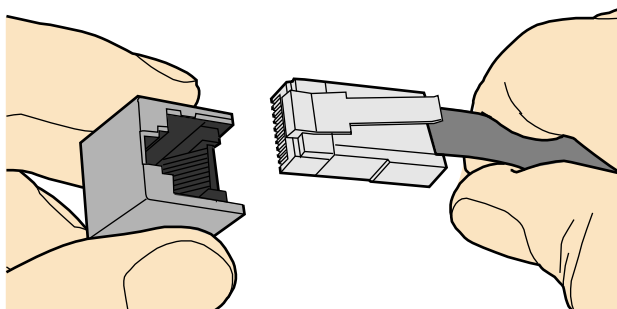
Step 2 Feed the male connector into the female connector, as shown in **Figure 5-55**.

Figure 5-55 Feeding the male connector into the female unshielded connector
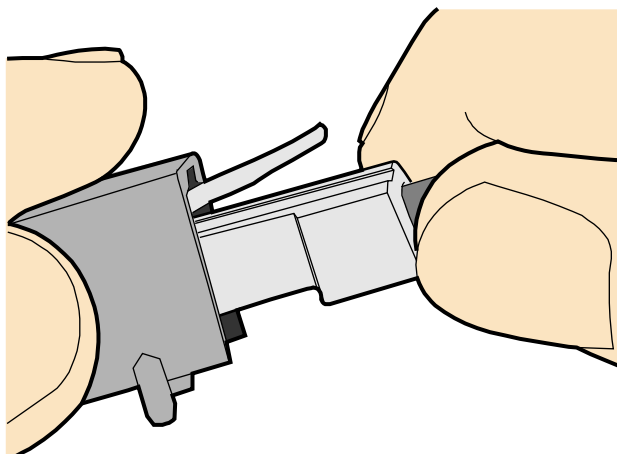
Step 3 A crisp click indicates that the connector is locked by the locking key. Pull the connector slightly and ensure that it is securely connected. **Figure 5-56** shows an installed Ethernet connector.

Figure 5-56 Installed unshielded Ethernet connector
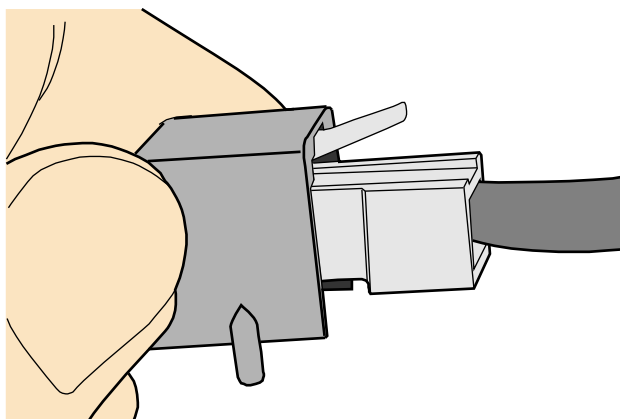
Step 4   To remove an Ethernet connector, press the locking key and pull out the connector, as shown in **Figure 5-57**.

Figure 5-57 Removing an unshielded Ethernet connector
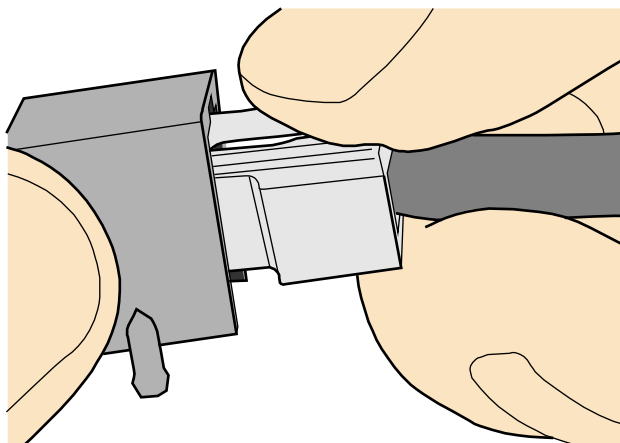
----End

Installing Fiber Connectors

Context

⚠ **NOTICE**

- After you remove the dustproof cap, ensure that the fiber pins are clean and install them as soon as possible.
- When you disassemble fiber connectors, you must use a dedicated tool if the connectors are densely installed.

Cleaning Fiber Connectors

Procedure

Step 1 Clean the pins of a fiber connector by using lint-free cotton and alcohol.

Step 2 Clean the pins again by using dust-free cotton. If necessary, clean the pins by using an air gun. Ensure that the pins are free from any fiber or debris.

----End

Installing an FC Fiber Connector

Procedure

Step 1 Remove the dustproof cap of the FC connector and store it for future use.

Step 2 Align the core pin of the male connector with that of the female connector, as shown in **Figure 5-58**.

Figure 5-58 Aligning the male connector with the female connector
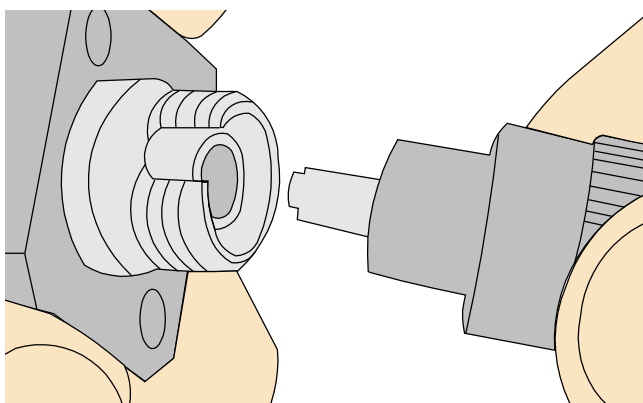
Step 3 Align the male connector with the female connector and gently push the male connector until it is completely seated in the female connector, as shown in **Figure 5-59**.

Figure 5-59 Feeding the male connector into the female connector
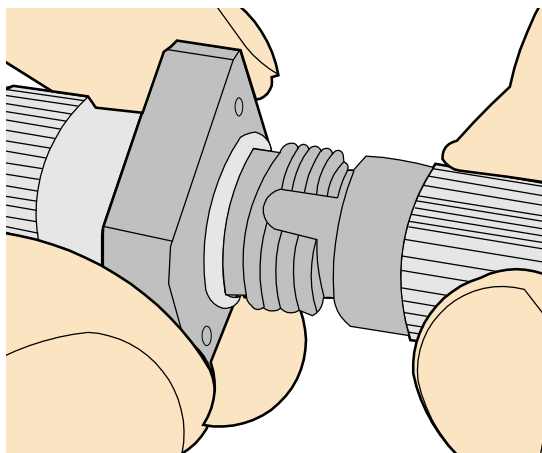
Step 4 Fasten the locking nut in the clockwise direction and ensure that the connector is securely installed, as shown in **Figure 5-60**.

Figure 5-60 Fastening the locking nut
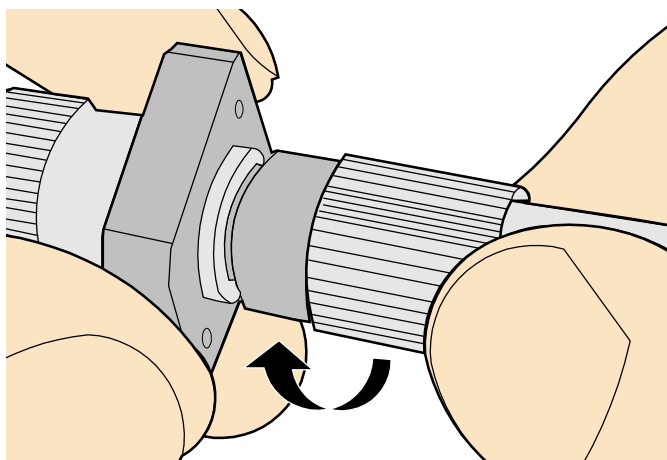
Step 5 To disassemble an FC fiber connector, loosen the locking nut counterclockwise, and gently pull the male connector, as shown in **Figure 5-61**.

Figure 5-61 Disassembling an FC fiber connector
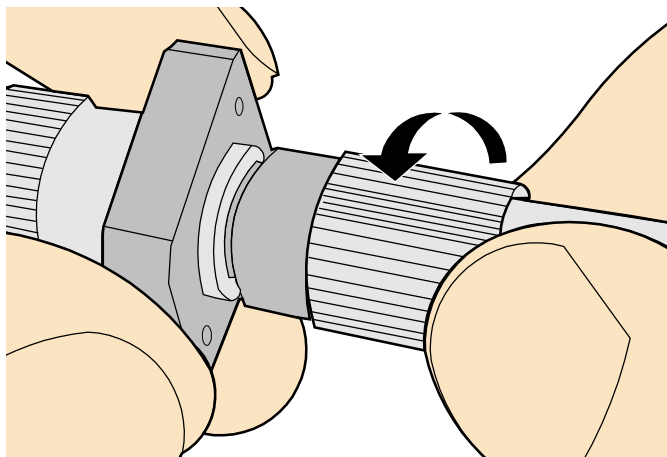
----End

Installing an LC Fiber Connector

Procedure

Step 1 Remove the dustproof cap of the LC fiber connector and store it for future use.

Step 2 Align the core pin of the male connector with that of the female connector, as shown in **Figure 5-62**.

Figure 5-62 Aligning the male connector with the female connector
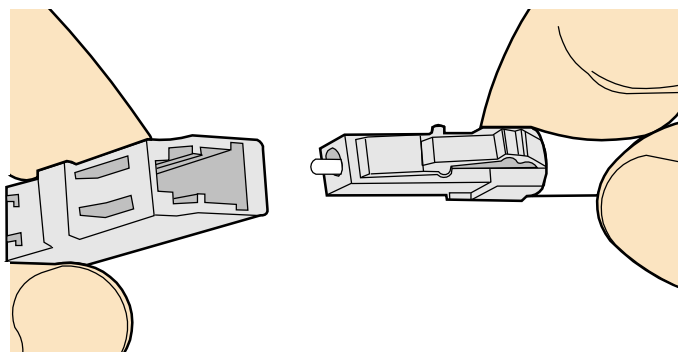
Step 3 Align the male connector with the fiber adapter and gently push the male connector until it is completely seated in the fiber connector, as shown in **Figure 5-63**.

Figure 5-63 Feeding the male connector into the female connector
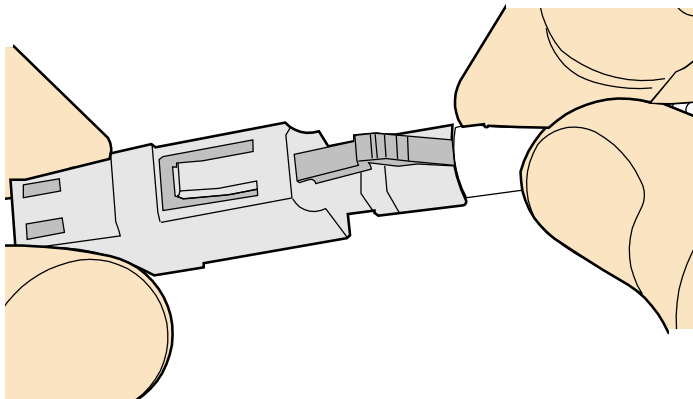
Step 4 A clicking sound indicates that the male connector is locked, as shown in **Figure 5-64**.

Figure 5-64 Installed LC connector
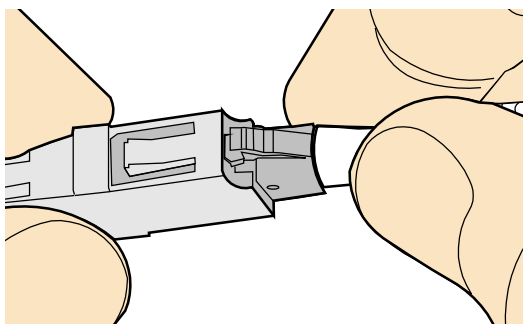
Step 5 To disassemble an LC fiber connector, press the locking nut to release the locking clips from the bore, and gently pull the male connector, as shown in **Figure 5-65**.

Figure 5-65 Disassembling an LC fiber connector
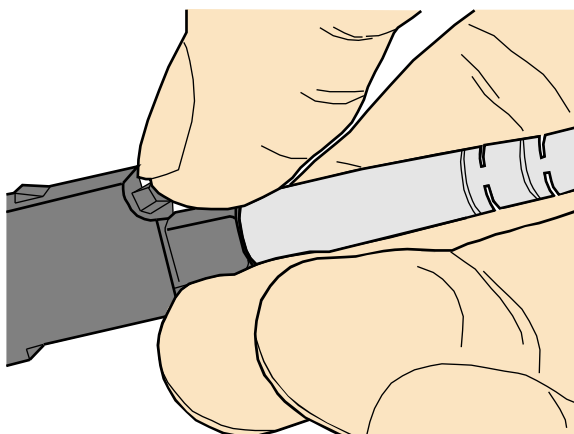
----End

Installing the SC Fiber Connector

Procedure

Step 1 Remove the dustproof cap of the SC fiber connector and store it for future use.

Step 2 Align the core pin of the male connector with that of the female connector, as shown in **Figure 5-66**.

Figure 5-66 Aligning the male connector with the female connector
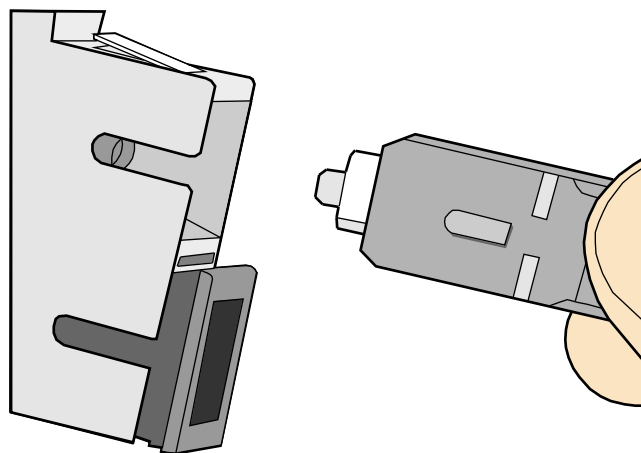
Step 3 Feed the fiber connector into the female connector, with your fingers holding the shell of the fiber connector (not the pigtail). When you hear a click, the fiber connector is secured by the clips (internal parts, not illustrated in the figure). Pull the fiber connector gently. If the connector does not loosen, the installation is complete. See **Figure 5-67**.

Figure 5-67 Installed SC fiber connector
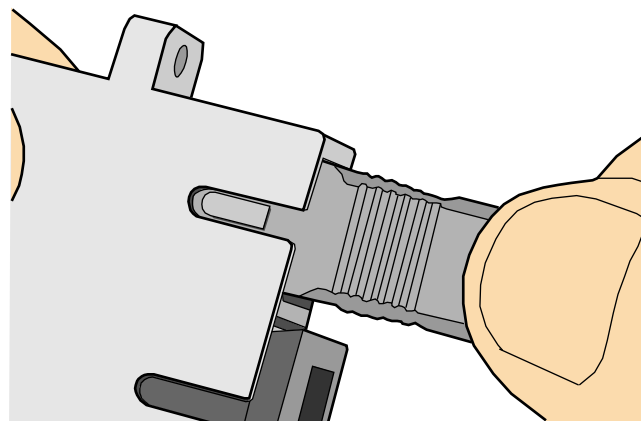
Step 4 To disassemble an SC fiber connector, hold the shell of the connector (do not hold the fiber) and gently pull the connector in the direction vertical to the adapter. Unlock the male connector, and then separate it from the shell, as shown in **Figure 5-68**.

Figure 5-68 Disassembling an SC fiber connector
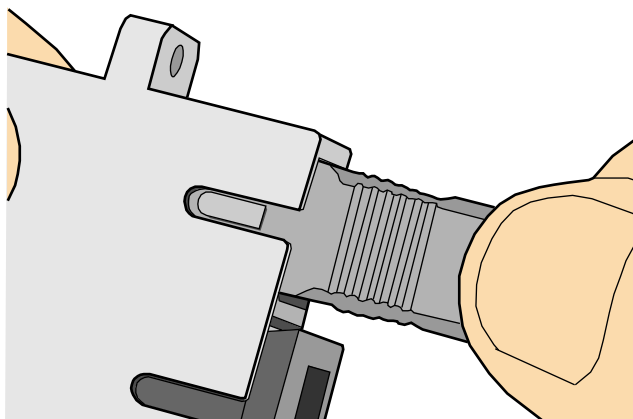
----End

Installing an MPO Connector

Procedure

Step 1 Remove the dustproof cap of the MPO fiber connector and store it for future use.

Step 2 Align the core pin of the male connector with that of the female connector, as shown in **Figure 5-69**.

Figure 5-69 Aligning the male connector with the female connector
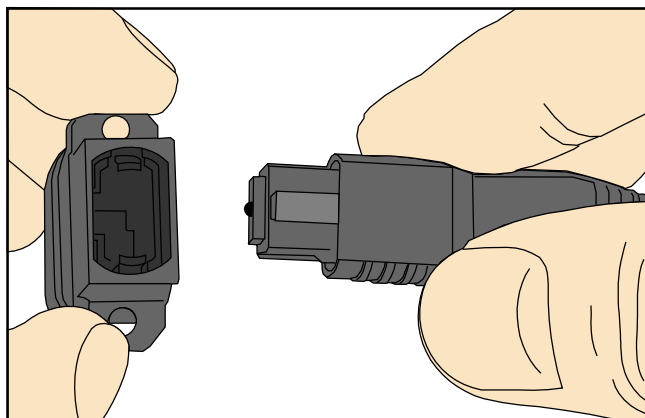
Step 3 Hold the shell labeled "PUSH" and feed the male connector into the female connector until you hear a clicking sound. The male and female connectors are securely installed, as shown in **Figure 5-70**.

Figure 5-70 Installed MPO fiber connector
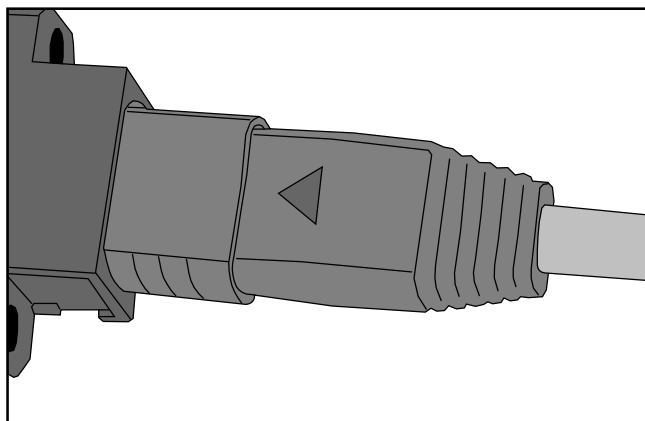
Step 4 To disassemble an MPO fiber connector, hold the shell labeled "PULL" and remove the male connector, as shown in **Figure 5-71**.

Figure 5-71 Disassembling an MPO fiber connector
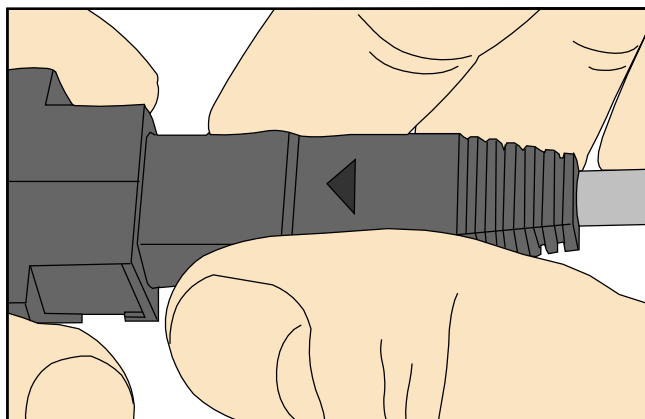
----End

5.1.5 Replacing the Mold of the Crimping Pliers

Procedure

Step 1 Hold the handles of a pair of COAX crimping tools. Loosen the two fastening screws in the counterclockwise direction, as shown in **Figure 5-72**.

Figure 5-72 Loosening two fastening screws
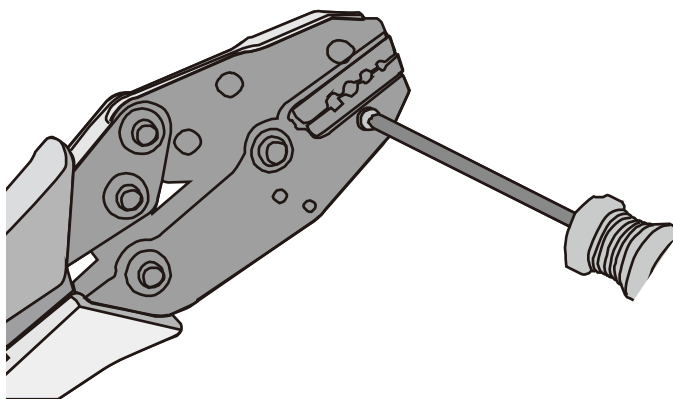
Step 2 Hold the handles of the COAX crimping tools to open the self-locking mechanism. The jaw of the COAX crimping tools opens automatically, as shown in **Figure 5-73**.

Figure 5-73 Pliers jaw opening automatically
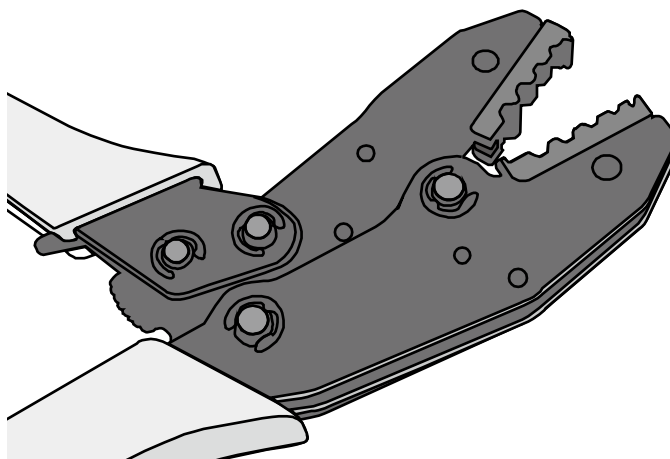
Step 3 Remove the mould from the COAX crimping tools, as shown in **Figure 5-74**.

Figure 5-74 Removing the mould from the COAX crimping tools
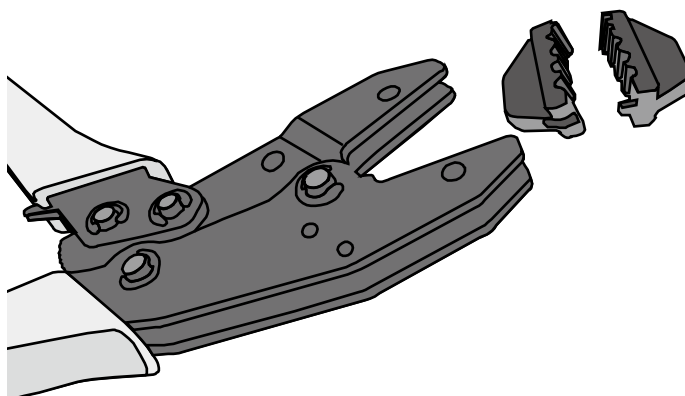
Step 4 Place the mould to be installed into the jaw of the COAX crimping tools and align the screw holes, as shown in **Figure 5-75**.

Figure 5-75 Installing a new mould in the COAX crimping tools
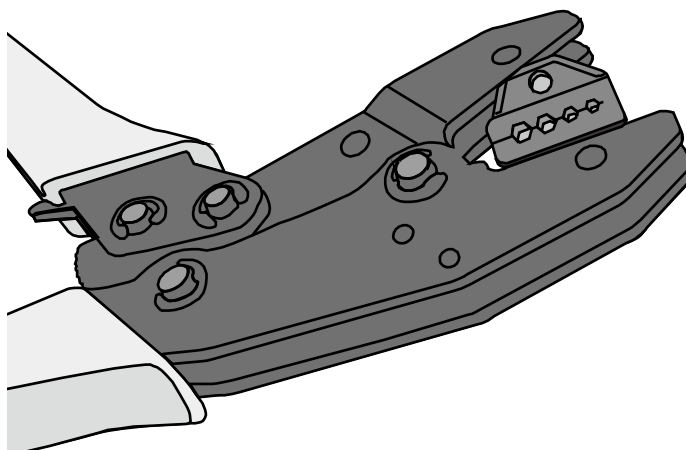
⚠ **NOTICE**

Keep the short side of the mould inwards and the long side outwards, with the teeth of the mould aligning from the larger size to the smaller size.

Step 5 Hold the handles of the COAX crimping tools tightly to match the mould and the jaw completely. Align the screw holes, as shown in **Figure 5-76**.

Figure 5-76 Aligning the screw holes
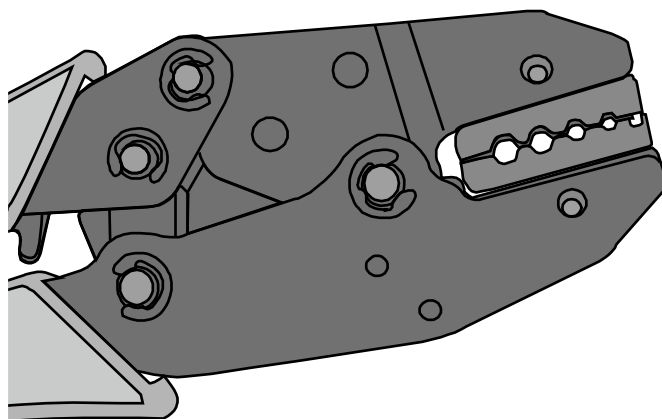
Step 6 Hold the handles of the COAX crimping tools with one hand. Tighten the two fastening screws in the clockwise direction. **Figure 5-77** and **Figure 5-78**shows the mould installed in the COAX crimping tools.

Figure 5-77 Mold installed in the COAX crimping tools
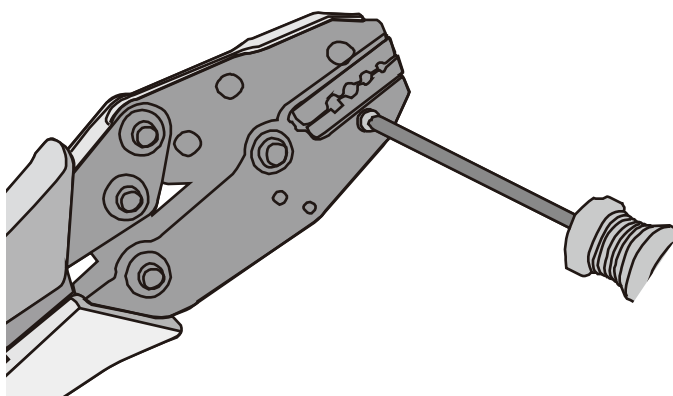
Figure 5-78 An installed mold
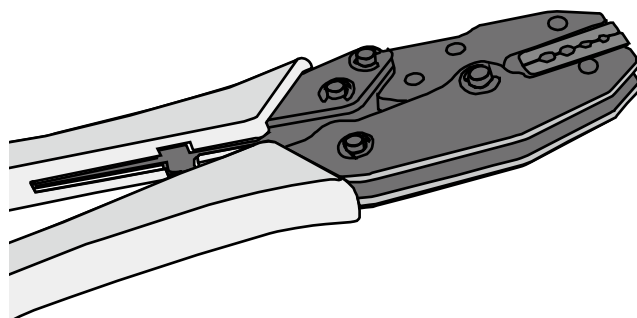
----End

5.2 Environmental Requirements for Device Operation

5.2.1 Environmental Requirements for an Equipment Room

Requirements for Selecting a Site for an Equipment Room

When designing a project, consider the communication network planning and technical requirements of the equipment. Also consider hydrographic, geological, seismic, power supply, and transportation factors.

Construction, structure, heating and ventilation, power supply, lighting and fire fighting of the equipment room should be designed by specialized construction designers to suit the environmental requirements of devices. The equipment room should also follow local regulations concerning the industrial construction, environmental protection, fire fighting, and civil air defense. Construction must conform to government standards, regulations, and other requirements.

The equipment room should be located at a place free from high temperature, dust, toxic gases, explosive materials, or unstable voltage. Keep the equipment room away from significant vibrations or strong noises, as well as power transformer stations.

The specific requirements for selecting a site for equipment room are as follows:

- The room should be located at a distance of at least 5 km (3.11 mi.) from heavy pollution sources such as smelting and coal mines. It should be located at a distance of at least 3.7 km (2.30 mi.) from moderate pollution sources such as chemical, rubber, and galvanization factories. It should be located at a distance of at least 2 km (1.24 mi.) from light pollution sources such as packinghouses and tanyards. If these pollution sources cannot be avoided, ensure that the equipment room is upwind of the pollution sources. In addition, adopt a high-quality equipment room or protection products.

- The room should be located away from livestock farms, or in the upwind of the livestock farms. Do not use an old livestock room or fertilizer warehouse as the equipment room.

- The equipment room must be far away from the residential areas. The equipment room that is not far away from the residential areas must comply with equipment room construction standards to avoid noise pollution.

- The doors and windows of the equipment room must be closed to keep an airtight room.

- Using steel doors to ensure sound insulation is recommended.

- No cracks or openings are allowed on the walls or floors. The outlet holes on the walls or windows must be sealed. Walls must be constructed in the smooth, wear-resistant, dustproof principles and produce the effect of flame retardant, sound insulation, heat absorption, dust decrease, and electromagnetic shielding.

- The air vent of the room should be far from the exhaust of city waste pipes, big cesspools and sewage treatment tanks. The room should be in the positive pressure state to prevent

corrosive gases from entering the equipment room and corroding components and circuit boards.

- The room should be located far away from industrial and heating boilers.
- It is recommended that the room be on or above the second floor. If this requirement cannot be met, the ground for equipment installation in the room should be at least 600 mm (23.62 in,) above the maximum flood level.
- The room should be at least 3.7 km (2.30 mi.) away from the seaside or salt lake. Otherwise, the equipment room should be airtight with cooling facilities. In addition, alkalized soil cannot be used as the construction material. Otherwise, equipment suitable for wet conditions must be used.
- The equipment room should be strong enough to resist winds and downpours.
- The room should be located away from dusty roads or sand. If this is unavoidable, the doors and windows of the equipment room must not face pollution sources.
- Do not place air conditioning vents near the equipment so that they blow directly on the equipment because condensation may be blown into the equipment.
- Do not use decorative materials that contain sulfur in the equipment room.

Equipment Room Layout

The equipment room is usually used to install mobile switching equipment, telecom transmission equipment and power supply equipment as well as other auxiliary equipment. To ensure easy maintenance and management, place the telecom equipment in different rooms. **Figure 5-79** shows the layout of the equipment room.

Figure 5-79 Layout of the equipment room
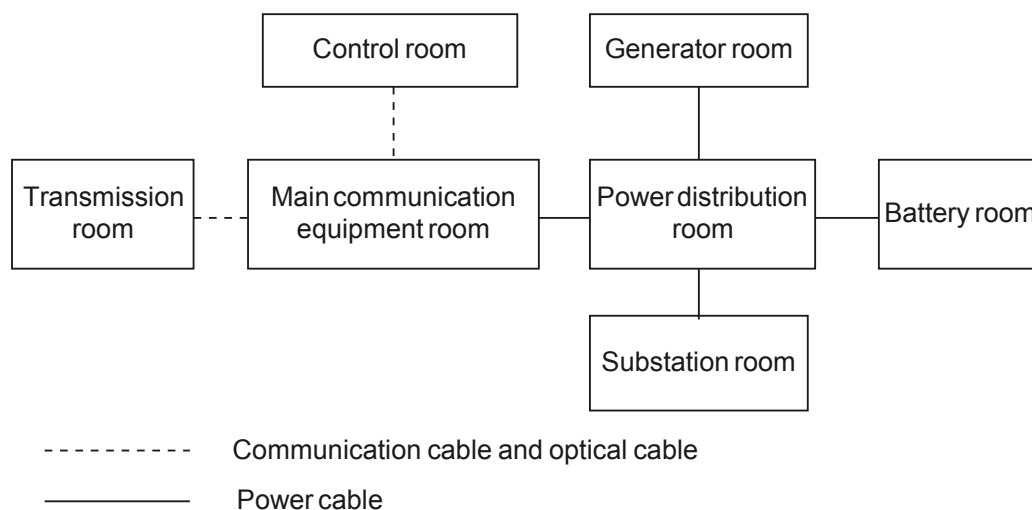
The general layout principles of the equipment room are as follows:

- It should meet requirements for laying out and maintaining communication cables and power cables.
- It should reduce the cabling distance, which eases cable maintenance, reduces potential communication faults, and maximizes efficiency.

Construction Requirements for the Equipment Room

Table 5-10 shows the construction requirements for the equipment room.

Table 5-10 Construction requirements for the equipment room

Item	Requirements
Area	The smallest area of the equipment room can accommodate the equipment with the largest capacity.
Net height	The minimum height of the equipment room should not be less than 3 m (9.84 ft). The minimum height of the equipment room is the net height below overhead beams or ventilation pipes.
Floor	The floor in the equipment room should be semi-conductive and dustproof. A raised floor with an ESD covering is recommended. Cover the raised floor tightly and solidly. The horizontal tolerance of each square meter should be less than 2 mm (0.08 in.). If raised floors are unavailable, use a static-electricity-conductive floor material, with a volume resistivity of 1.0 x 107 ohms to 1.0 x 1010 ohms. Ground this floor material or raised floor. You can connect them to ground using a one megohm current-limiting resistor and connection line.
Load-bearing capacity	The floor must bear loads larger than 150 kg/m^2 (0.21 bf/in.^{2}).
Door and windows	The door of the equipment room should be 2 m (6.56 ft) high and 1 m (3.28 ft) wide. One door is enough. Seal the doors and windows with dustproof plastic tape. Use double-pane glass in the windows and seal them tightly.
Wall surface treatment	Paste wallpaper on the wall or apply flat paint. Do not use pulverized paint.
Cable trays	Use cable trays to arrange cables. The inner faces of the cable trays must be smooth. The reserved length and width of the cable trays, and the number, position and dimensions of the holes must comply with the requirements of device arrangement.
Water pipe	Do not pass service pipes, drainpipes, and storm sewers through the equipment room. Do not place a fire hydrant in the equipment room, but place it in the corridor or near the staircase.
Internal partition wall	Separate the area where the equipment is installed from the equipment room door. The partition wall can block some outside dust.
Installation position of the air conditioner	Install air conditioner vents so that the air does not blow directly on equipment.
Other requirements	Avoid the proliferation of mildew, and keep out rodents (like mice).

Figure 5-80 Internal partition wall inside the equipment room
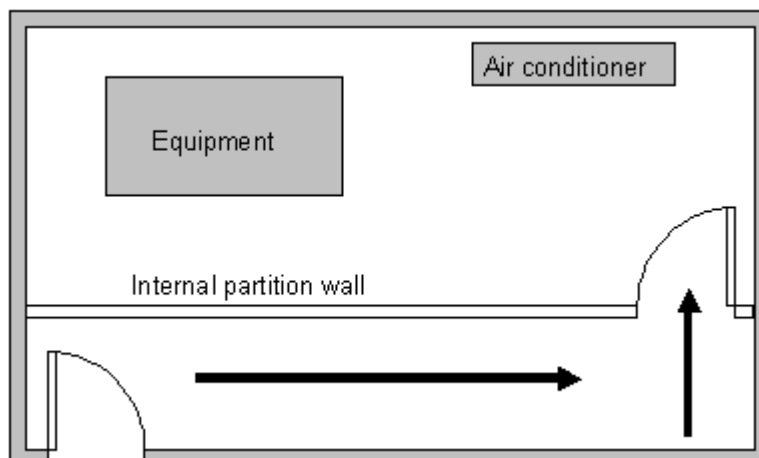
Equipment Room Environment

Dust on devices may cause electrostatic discharge and result in poor contact for connectors or metal connection points. This problem can shorten the life span of devices and cause faults.

The equipment room must be free from explosive, conductive, magnetically-permeable, and corrosive dust. **Table 5-11** shows the requirement for dust concentration in the equipment room.

Table 5-11 Requirements for dust particles in the equipment room

Mechanical active material	Unit	Concentration
Dust particle	Particle /m^3	$\leqslant$ 3x 10^4 (no visible dust accumulated on a workbench in three days)
Suspending dust	mg/m^3	$\leqslant$0.2
Precipitable dust	mg/m^2·h	$\leqslant$1.5
Description ● Dust particle diameter $\geqslant$ 5 μm ● Suspending dust diameter $\leqslant$ 75 μm ● 75 μm $\leqslant$ precipitable dust diameter $\leqslant$ 150 μm		

Take the following measures to meet the requirements:

● Use dustproof materials for ground, wall, and ceiling construction.

- Use screens on the door and windows facing outside. The outer windows should be dust-proof.
- Clean the equipment room regularly and clean the air filter monthly.
- Wear shoe covers and ESD clothes before entering the equipment room.

Requirements for Corrosive Gases

The room should be free from dusts and corrosive gases, such as SO_2, H_2S, and NH_3. **Table 5-12** shows the requirements for the corrosive gas concentration.

Table 5-12 Requirements for corrosive gas concentration

Chemical active material	Unit	Concentration
SO_2	mg/m³	≤0.20
H_2S	mg/m³	≤0.006
NH_3	mg/m³	≤0.05
Cl_2	mg/m³	≤0.01

Take the following measures to meet the requirements:

- Avoid constructing the room near a place where the corrosive gas concentration is high, such as a chemical plant.
- Ensure the air intake vent of the room is in the prevailing upwind direction from the pollution source.
- Place batteries in different rooms.
- A professional service should monitor the corrosive gas conditions regularly.

Requirements for ESD Prevention

The absolute value of electrostatic voltage is less than 1000 V.

Take the following measures to meet the requirements:

- Train operators about ESD prevention.
- Keep the correct humidity level in the equipment room to reduce the impact of static electricity.
- Lay out an ESD floor in equipment rooms.
- Wear ESD shoes and clothing before entering equipment room.
- Use ESD tools, such as wrist straps, tweezers, and pullers.
- Ground all conductive materials in the room, including computer terminals. Use ESD worktables.
- Keep non-ESD materials (such as common bags, foams, and rubbers) at least 30 cm (11.81 in.) away from boards and ESD-sensitive components.

Electromagnetism Requirements for the Equipment Room

All interference sources, inside or outside the equipment room, can cause equipment problems with capacitive coupling, inductive coupling, electromagnetic wave radiation, and common impedance (including grounding system) coupling. Prevent the interference using these approaches:

- Take effective measures against electrical interference from the power supply system.
- Do not use the working ground of the equipment as the same ground for surge protection. Separate them as far as possible.
- Keep the equipment far away from strong power radio transmitters, radar units, and high-frequency and high-current equipment.
- Use electromagnetic shielding if necessary.

Requirements for Lightning Proof Grounding

Table 5-13 shows the requirements for lightning proof grounding.

Table 5-13 Requirements for lightning proof grounding

Item	Requirements
Capital construction	- Use the reinforced concrete structure for the construction of the equipment room. - Install the lightning proof device like a lighting rod in the room. - The lightning proof ground shares the same grounding body with the protection ground of the room.
Power cables leading in the equipment room need to be equipped with a surge arrester	- After the low-voltage power cables are led into the room, install the surge arrester for the power cables in the AC voltage stabilizer and the AC power distribution panel (box). Ground the arrester nearby and correctly. - For the equipment room in the city, install the power supply arrester with the nominal discharging current no less than 20 kA. For the equipment room built in the suburbs subject to lightning strike, install the power supply arrester with the nominal discharging current larger than 60 kA. For the equipment room in the mountain areas easily subject to lightning strike, or in the separate high-rise buildings in the city, install the power supply arrester with the nominal discharging current larger than 100 kA. - The ground cable of the surge arrester should be a maximum of 1 m (3.28 ft) long.

Item	Requirements
Grounding of DC power distribution	• Connect the DC working ground (positive pole of the -48 V DC power supply or the negative pole of the 24 V DC power supply) with the indoor collective ground cable nearby. The total ground cable should meet the maximum load of the equipment. • The power equipment must have the DC working ground cable, which can connect the power equipment to the collective ground cable of the telecommunication site (or the protection ground bar of the equipment room).
Equipotential connection	• Ground the devices and auxiliary devices in the room such as mobile base station, transmission, switching equipment, power supply equipment, and cable distribution frame properly. Connect all PGND cables to the collective protection ground bar. Connect all PGND cables in one equipment room to one protection ground bar. • Apply joint grounding to the working ground and protection ground of devices, which means the two share one grounding network. • The cable tray, rack or shell, metal ventilation pipe, metal door or window of the equipment should be grounded for protection.
General requirements for grounding	• Do not connect the neutral line of the AC power cable with the protection ground of any telecom equipment in the equipment room. • Do not install the fuse or switch on the ground cable. • All ground cables should be as short as possible, and arranged directly.
Grounding resistance	• The grounding resistance must be lower than 1 ohm. • The upper end of the grounding body should be at least 0.7 m (2.30 ft) over the ground. In cold areas, bury the grounding body below the frozen ground. • Measure the grounding resistance periodically to ensure effective grounding.
Routing of signal cable	• Do not arrange the signal cables overhead in the equipment room. All signal cables must be led into the site underground. • Use the cables with metal jacket or place them into the metal pipe if they come out/in the equipment room. • Ground the idle lines inside the cable in the equipment room. • Signal cables should be deployed on internal walls. Do not deploy outdoor aerial cables. • Keep signal cables away from power cables and surge protection devices.

Item	Requirements
Collective ground cable	- Use the grounding ring or ground bar for the collective ground cable. - Do not use aluminum cables as ground cables. Adopt measures to prevent electrification corrosion when connecting different metal parts together. - Use the copper busbar as the collective ground cable with the cross-sectional area not less than 120 mm^2 (0.19 in.^{2}), or use the galvanized flat steel of the same resistance. Insulate the collective ground cable from the reinforcing steel bars of the building.
Grounding lead-in	The grounding lead-in should be a maximum of 30 m (98.42 ft) long. Use the galvanized flat steel with cross-sectional area of 40 mm x 4 mm (1.58 in. x 0.158 in.) or 50 mm x 5 mm (1.97 in. x 0.197 in.).
Grounding of the cabinet	- All the devices including the surge protection device in the cabinet must be connected in an equipotential manner. The ground cables can be aggregated to the ground bar or surge protector socket first, and then the ground bar or surge protector socket is connected to the ground. - The resistance tested using a multimeter between the device ground terminals and ground bar cannot exceed 0.1 ohm. - The cabinet can be grounded using the protecting earthing (PE) wire of the electrical network in the building, zinc-coated angle steel, or main steel bar of the building. - If the cabinet is grounded using the PE wire of the electrical network, the grounding status can be checked using a multimeter. If the voltage between the PE wire and neutral wire is lower than 5 V and the voltage between the PE wire and live wire is about 220 V, the PE wire is grounded well. If the tested AC voltages are not within the ranges, the cabinet must be grounded in other ways. - The yellow-green ground cable contains multiple copper wires. The diameter is no smaller than 6 mm^2 (0.0093 in.^{2}) and the length cannot exceed 3 m (9.84 ft.). - Ground cables cannot be twisted with signal cables. - Antirust and anticorrosion measures must be taken on the ground terminals. - The fiber reinforcing rib can be directly connected to the ground bar of the cabinet. Before wrapping the reinforcing rib with insulation tape, cut a 0.5 m (1.64 ft.) segment from the reinforcing rib. Wrap the reinforcing rib with at least five layers of insulation tape. Keep the reinforcing rib at least 5 cm (1.969 in.) from the cabinet surface.

5.2.2 Requirements for Power Supply

Requirements for AC Power Supply

The AC power supply consists of power mains, uninterruptable power supply (UPS), and self-supplied electric generator. In addition to meeting the requirements of the server load, the AC power supply must have a simple connection line, safe operation, flexible scheduling, and easy maintenance.

The low-voltage power supply should have 3-phase, 5-wire mode or monophase 3-wire mode. This AC power supply should be 110 V/220 V, and the frequency is 50 Hz.

The UPS should supply the same power and operate at the same phase as the power mains. The switching time between the UPS and mains should be less than 10 ms; otherwise, the networking devices will reboot or reset.

For power distribution capacity in the equipment room, both the working current and fault current of the devices should be considered. Ensure that independent AC power supplies protect independent devices. Configure the current-carrying capacity of the protection switch of the equipment room for more than that of the devices.

Table 5-14 shows the voltage range of the AC power supply for the devices.

Table 5-14 Voltage range of AC power supply

Item	Requirements
AC power capacity to support the devices	-10% to +5% of the rated voltage
AC power capacity to support the power modules and important buildings	-15% to +10% of the rated voltage
Frequency of alternating current	-4% to +4% of the rated value
Voltage wave shape sine distortion	Within 5% of the rated voltage

The automated electric generator must have a standard interface that supports telecommunication protocol, remote telecommunication, monitoring, and control.

AC power cables should meet the following specifications:

- AC neutral should have a conductor with the same cross section as the phase line.
- AC cables should have non-flammable insulation. The layout of AC cables should comply with local regulations. Low-voltage power distribution rooms should comply with local regulations.

Recommendations for AC Power Supply

The following shows recommendations for the AC power supply.

- If the voltage of the power mains that supply power directly to devices exceeds the rated voltage by -10% to 5%, or exceeds the voltage range that devices can support, a voltage regulating device or voltage stabilizing device is required.

- If the mains do not supply power for the device directly, or if the mains voltage exceeds the rated voltage by -15% to 10% or exceeds the input voltage range of the DC power supply, a voltage regulating device or voltage stabilizing device is required.

- An UPS or inverter power supply system is required to provide uninterrupted AC power to support the telecommunication load.

- If abnormalities occur on the mains, telecommunication servers should be equipped with a self-supplied electric generator to support the key telecommunication load. The capacity should be not less than 150% to 200% of the total uninterruptable power supply.

- Storage batteries are usually installed in a parallel connection of two groups. UPS storage batteries are generally installed in one group. The redundancy required for the UPS can rely on concatenation or parallel connection. When an inverter or a UPS is used, the active inverter is determined by the maximum power and a backup inverter is required.

Requirements for DC Power Supply

The equipment room should receive stable and reliable DC power. Deploy the power equipment near the telecommunications equipment to make the DC feeder as short as possible. To reduce power consumption and installation cost, the loop voltage drop from the battery port to the equipment port should be less than 3.2 V.

- A large-scale enterprise can deploy an independent power supply system on each floor to supply power to the telecommunications equipment room on the respective floor.

- A medium-scale enterprise can use a power room and a battery room for centralized power supply or use distributed power supply systems.

- A small-scale enterprise can deploy an integrated power supply system in its equipment room but must take measures to prevent corrosive gases released from batteries from eroding circuit boards of telecommunications equipment.

Table 5-15 shows the specifications for the DC power supply.

Table 5-15 Specifications for the DC power supply

Item	Requirements
DC power capacity to support the surge current	Greater than 1.5 times the rated current
Regulated voltage precision	If the AC input voltage is in the range of 85% to 110% of the rated value, and the load current is in the range of 5% to 100% of the rated value, the output voltage of the rectifier ranges from -46.0 V to -56.4 V, with the regulated voltage precision less than or equal to 1%.
Overshoot amplitude of switch on/off	Integral value of the DC output voltage ±5%

Item	Requirements
Peak noise voltage	≤200 mV
Dynamic response	The recovery time is less than 200 ms. The overshoot is in the range of the integral value of the DC output voltage ±5%.

Recommendations for DC Power Supply

The following shows recommendations for the DC power supply.

- Use distributed power supply mode. Use multiple DC power supply systems and put power equipment in multiple locations.
- Adopt a standard DC power supply system, and set the output voltage to the communications equipment within the required range.
- Improving the reliability of the AC power supply system reduces the necessary capacity of storage batteries. For small offices, increase the capacity of storage batteries if it is difficult to enhance the reliability of the AC power supply system.
- The total capacity of the high-frequency switching rectifier must satisfy the power of the communication loading and battery charging. If there are 10 or fewer active rectifier modules, configure one backup module. If there are more than 10 active modules, configure one backup module for every 10 active modules.
- Install storage batteries in two or more groups. The capacity is determined by the duration for which the storage batteries must supply power. For most offices, the batteries should be able to supply power for at least one hour.

5.3 Equipment Grounding Specifications

5.3.1 General Grounding Specifications

Table 5-16 shows the general grounding specifications.

Table 5-16 General grounding specifications

No.	Description
1	The working grounding and protection grounding, including the shielded grounding and the lightning-proof grounding of the cable distribution frame should share the same grounding conductor.
2	The cable trays, shells, metal ventilation pipes, metal doors and windows in the equipment room should be grounded for protection.
3	The metal parts of the equipment which are electrically floating in normal conditions should be grounded for protection.

No.	Description
4	The ground cable must be connected securely to the protection ground bar of the equipment room.
5	Do not use other equipment as part of the ground cable or electrical connection.

5.3.2 Grounding Specifications for an Equipment Room

The grounding resistance of a comprehensive communication building should be less than or equal to one ohm. The grounding resistance of an ordinary communication office should be less than five ohms. The grounding resistance in an area where the earth resistance rate is high should be less than 10 ohms.

5.3.3 Grounding Specifications for Devices

Table 5-17 shows the equipment grounding specifications.

Table 5-17 Equipment Grounding Specifications

No.	Description
1	All communication devices and auxiliary devices (such as mobile base stations, transmission and switching devices, power supply devices) in the equipment room should be grounded for protection. Connect all protection grounding for various devices jointly to a general ground bar, and then to the same protection ground bar in the room together with the protection ground (PGND) of the device.
2	The PGND of the equipment is shorted to the copper protection ground bar provided by the user. The short-circuiting cable used should be an alternating yellow and green plastic insulating one with copper core, with cross-sectional area greater than 25 sq. mm (0.039 sq. in.).
3	There are grounding terminals and grounding lugs at the lower part of the front door, rear door and side panel of the cabinet, connected to the grounding terminals of the cabinet framework through connection cables with cross-sectional area no less than 1.6 sq. mm (0.002 sq. in.).
4	Ensure that all metal components of the cabinet conduct well. No insulating coating should be sprayed on the connection part of the metal components.
5	Connect the cabinets in the same row by fastening captive screws and gaskets on the top of the cabinets. Do not spray any coating into a rectangular area measuring 30 mm x 50 mm (1.18 in. x 1.97 in.) around the connection hole for a captive bolt. Measures to prevent rust and corrosion must be taken for this area. Zinc electroplating with iridescent yellow chromate conversion coating should be applied to the gasket and nut to ensure good electrical contact.

No.	Description
6	When combining cabinets of the same type, short-circuiting cables are required to connect the ground busbars (if any) of the cabinets. The cross-sectional area of the short-circuiting cable is 6 sq. mm (0.009 sq. in.) and is no more than 300 mm (11.8 in.) long. Connect the two ends of the short-circuiting cable to the ground busbar terminals of neighboring cabinets and fix them firmly.

5.3.4 Grounding Specifications for Communications Power Supply

Table 5-18 shows the grounding specifications for communication power supplies.

Table 5-18 Grounding specifications for communication power supplies

No.	Description
1	The inlet for the AC power cable at the equipment room should be equipped with a surge protection device (C-level) with a nominal discharge current no less than 20 kA.
2	The protection ground for the power supply and that for communication equipment share the same grounding conductor. If the power supply and the equipment are in the same equipment room, use the same protection ground bar for them if possible.
3	Use a surge protection circuit on the AC power interface.
4	The positive of the -48 V DC power supply or negative pole of the 24 V DC power supply should be grounded at the output of the DC power supply.
5	The working ground and protection ground of the DC power supply equipment should use the same grounding conductor with the protection ground of the switching equipment. If the power supply and equipment are in the same equipment room, use the same protection ground bar for them if possible.
6	Add surge protection on the DC power interface.

5.3.5 Grounding Specifications for Signal Cables

Grounding specifications for signal cables are shown in **Table 5-19**.

Table 5-19 Grounding specifications for signal cables

No.	Description
1	Equip the cable outdoors with a metal jacket, well grounded at both ends, or connect the ends of the metal jacket to the protection ground bar of the equipment room. For cables inside the equipment room, install surge protection devices at the interface to the equipment. The PGND cable for the surge protection devices should be as short as possible.
2	The incoming and outgoing signal cables to and from the office and unused wires inside the cable should be grounded for protection.
3	The Tone & Data Access (TDA) cable must pass through the Main Distribution Frame (MDF) with surge protective device (SPD) when going out of the office. The cable's shield layer should be connected to the protection ground of the MDF. The MDF should use the same grounding conductor with the cabinet.
4	The signal cables should not be routed overhead.

5.3.6 Specifications for Laying Out Grounding Cables

Table 5-20 shows the specifications for the ground cable.

Table 5-20 Specifications for laying out ground cables

No.	Description
1	The grounding wire should not run parallel to or twist around the signal cable.
2	The ground cable cannot be routed overhead, but should be buried in the earth or arranged indoors.
3	Do not connect two cables together to extend the PGND cable, or add any switch or fuse.
4	The PGND cable should be an alternating yellow and green plastic insulating one with copper core.
5	The neutral line of the AC power cable cannot be connected to the protection ground of transmission and communication equipment in the equipment room.
6	The length of the PGND cable should not exceed 45 m (147.64 ft). The PGND cable should be as short as possible.

5.4 Engineering Labels for Cables

An engineering label serves as an identifier for on-site installation and maintenance after the installation. Labels on the cables facilitate correct and orderly connection of cables, and easy maintenance after installation.

Specialized for power cables and signal cables, the types of engineering labels are as follows:

- The signal cables include network cables, optical fibers, and user cables.

- The power cables include the AC power cables and DC power cables.

□NOTE

Fill in the label according to the user's requirements if the user needs an integrated description of the label. Make a relevant statement in the self-check report.

5.4.1 Introduction to Labels

Label Materials

Features:

- Thickness: 0.09 mm (0.004 in.)

- Color: chalk white

- Material: polyester (PET)

- Ambient temperature: -29°C (-20.2°F) to +149°C (300.2°F)

- Compatible with laser printing and handwriting with markers

- Pass UL and CSA authentication

Type and Structure

Label for Signal Cables

The label for signal cables is L-shaped with fixed dimensions, as shown in **Figure 5-81**.

Figure 5-81 Label for signal cables
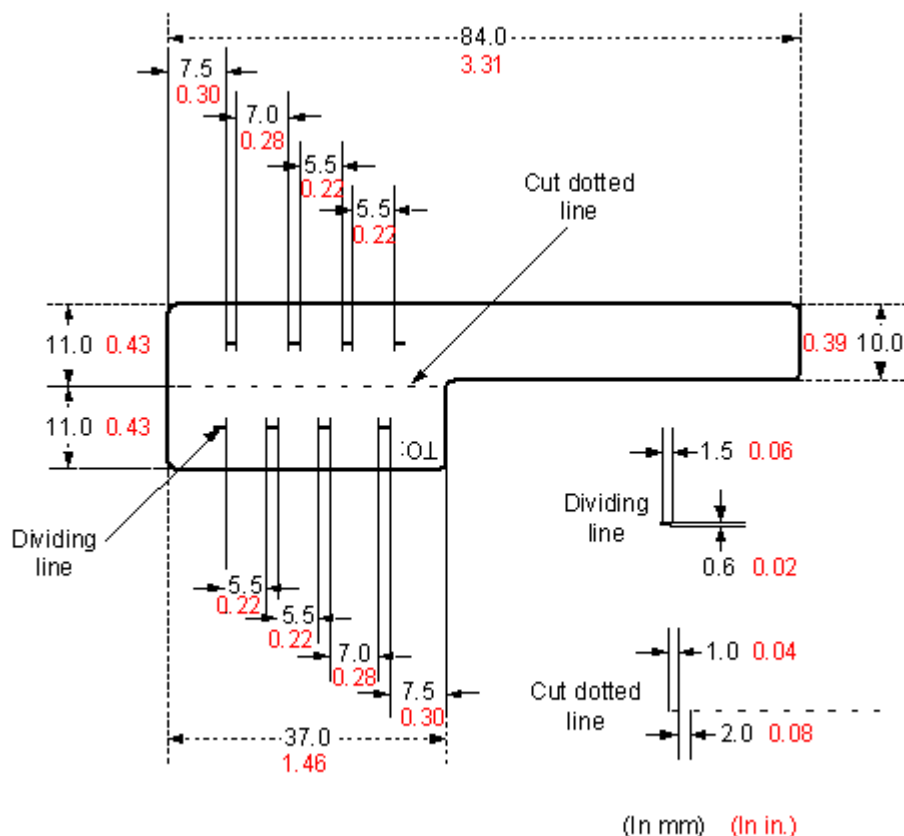
To specify more clearly the position of a cable, use the dividing lines on the label. For example, there is a dividing line between the cabinet number and the chassis number, and another one between the chassis number and the slot number. The dividing line is 1.5 mm x 0.6 mm (0.06 in. x 0.02 in.) with the color of Pantone 656c (light blue).

The cut dotted line helps to fold the label when affixed to the cable, and its size is 1 mm x 2 mm (0.04 in. x 0.08 in.).

There is a mark "TO:" (upside down in the figure) at the lower right corner of the label. The mark is used to identify the opposite end of the cable on which the label is affixed.

Power Cable Label

The label for power cables should be attached to the identification plate on the cable ties that are attached to the cable. The identification plate has an embossed area 0.2 mm x 0.6 mm (0.008 in. x 0.02 in.) around (symmetric on both sides), and the area in the middle is for affixing the label, as shown in **Figure 5-82**.

Figure 5-82 Power cable label
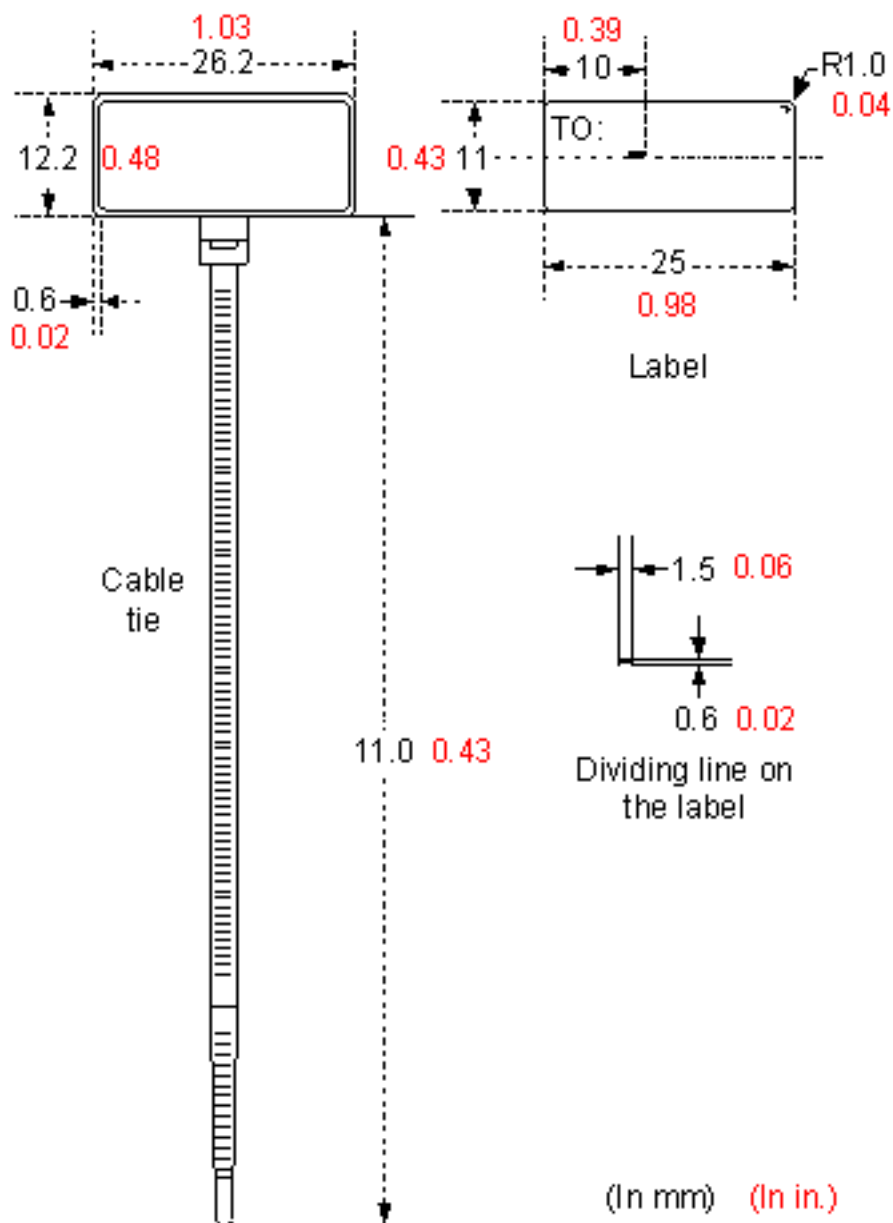
Label Printing

The contents can be printed or written on the labels. Printing is recommended for the sake of high efficiency and eye-pleasant layout.

Template for Printing

Use a template to print labels. You can obtain the template from the Huawei local office.

The templates are made in Microsoft Word and the following requirements should be met:

- When using the template, you can directly modify the contents of the template. The settings of centered characters, direction, and fonts should not be changed.

- When there are too many characters to be filled in, zoom out the characters, but make sure that the printouts are clear and legible.

Merging Cells in the Template

To merge two or more cells, do as follows:

1. Select **Edit**/**Select All**.

2. Select **Format**/**Borders and Shading**/**Borders**. Select **Box** tab and click **OK**.

3. Drag the mouse to select cells to be merged and select the **Table**/**Merge Cells**.

Requirements on the Printer

To print the labels, a laser jet printer must be used, although there is no restriction on the model of the printer. Before printing the label, set up the page and try printing.

1. Try printing on ordinary paper with both sides blank. Place the blank paper over the whole page of label paper, and check whether the page setup conforms to the label layout.

2. Make sure the printer properties, such as "paper size" and "direction", have been set correctly.

   - If the printout conforms to the sheet of labels, print the labels on the label paper.

   - If the printout does not conform, adjust the page setup and try printing again until the correct printout is produced.

The method of adjusting the page setup is as follows.

1. Select **File**/**Page Setup**.

2. Select **Layout** and set Header and Footer as 0.

3. Select the **Margins** tab page. Select Left for Gutter Position and adjust the values of Top, Bottom, Left, and Right.

  📖**NOTE**

    If the warning prompt as shown in **Figure 5-83** appears before printing, click **Ignore** to continue the printing.

Figure 5-83 Warning prompt before printing
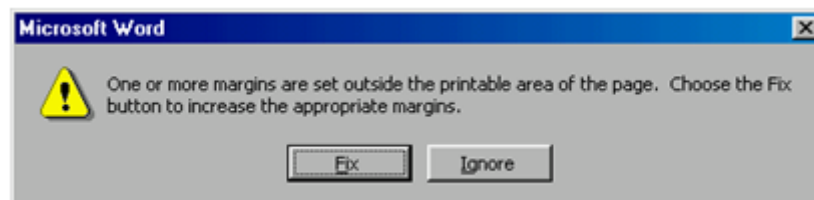
After the page setup has been made correctly, save it for future use. This page setup is only necessary the first time you use the template to print the labels.

Requirements for Feeding the Printer

The label paper consists of two layers and has undergone multiple processing procedures such as printing and cutting. No matter what model of printer you use, feed in the labels one page at a time. To avoid jamming the labels, never use the auto-feed mode.

Feed in the label paper in the correct direction to ensure that the text is printed in a correct position.

Requirements for the Printed Label

Make sure that the printed labels satisfy the following requirements:

- All the printouts must be on the label, and nothing should be printed on the backing layer of the label page.
- Contents in the cells should be aligned in the center. In a single-line printout, the dividing lines and the mark "TO:" should not be covered by the printed characters.
- When the cells are merged and the printouts are made in multiple lines, avoid covering the mark "TO:" when printing the texts. Use the space bar to move the text to the next line.

Writing Labels

Writing Tools

To make sure the printouts are clear and legible, use the black markers instead of ball-point pens to write the labels.

In special cases, black ball-pens are allowed, although not recommended. Compared with ball-point pens, water-proof markers are better. When writing with a ball-point pen, do not leave the oil on the label, which may contaminate the label and blur the words.

□□**NOTE**

The delivered marker has two nibs. Make sure to use the smaller nib to write the labels.

Font

For the sake of easy recognition and good appearance, the font in handwriting should be as close to a standard typeface (such as Times New Roman) as possible. **Table 5-21** shows the standard typeface.

Table 5-21 Standard typeface for handwriting

0	1	2	3	4	5	6	7	8
9	A	B	C	D	E	F	G	H
I	J	K	L	M	N	O	P	Q
R	S	T	U	V	W	X	Y	Z

Determine the size of characters based on the number of letters or digits and ensure that the characters are clear, distinct, and tidy.

Writing direction: The direction is shown in **Figure 5-84**:

Figure 5-84 Writing direction of the characters on the label
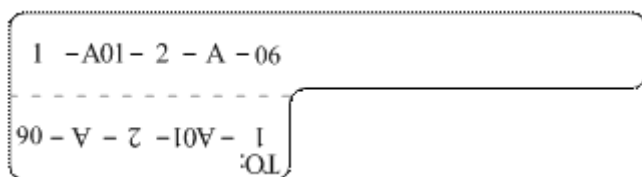
Attaching Labels

After printing or writing the label, remove the label from the page and attach it to the signal cable, or the identification plate of the power cable. The methods for attaching labels are described in the following sections.

Label for Signal Cables

● Choose the place to attach labels.

The label is attached 2 cm (0.79 in.) from the connector on a signal cable. In special cases (for example, to avoid cable bending or affecting other cables), other positions are allowed to attach the labels. The rectangle part with characters is attached facing right or downward, as shown in **Figure 5-85**. The details are as follows:

– The identification card is to the right of the cable in vertical cabling.

– The identification card should be downward when you lay out the cable horizontally.

Figure 5-85 Text area of the label
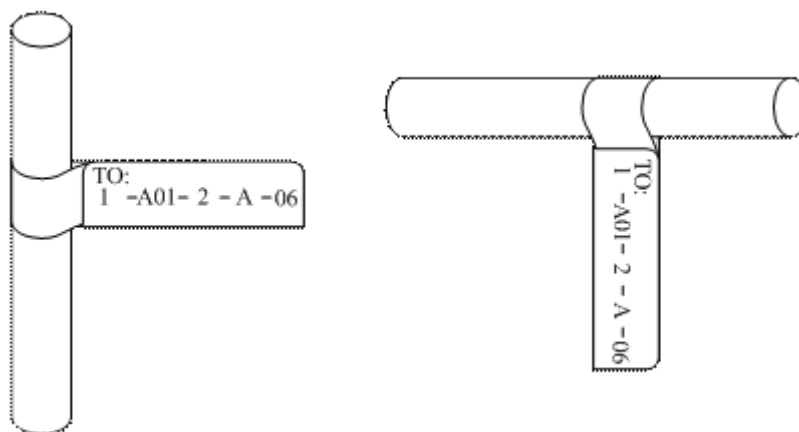
● Procedure for attaching labels

Figure 5-86 shows the methods and procedures for attaching labels.

Figure 5-86 Label for signal cables
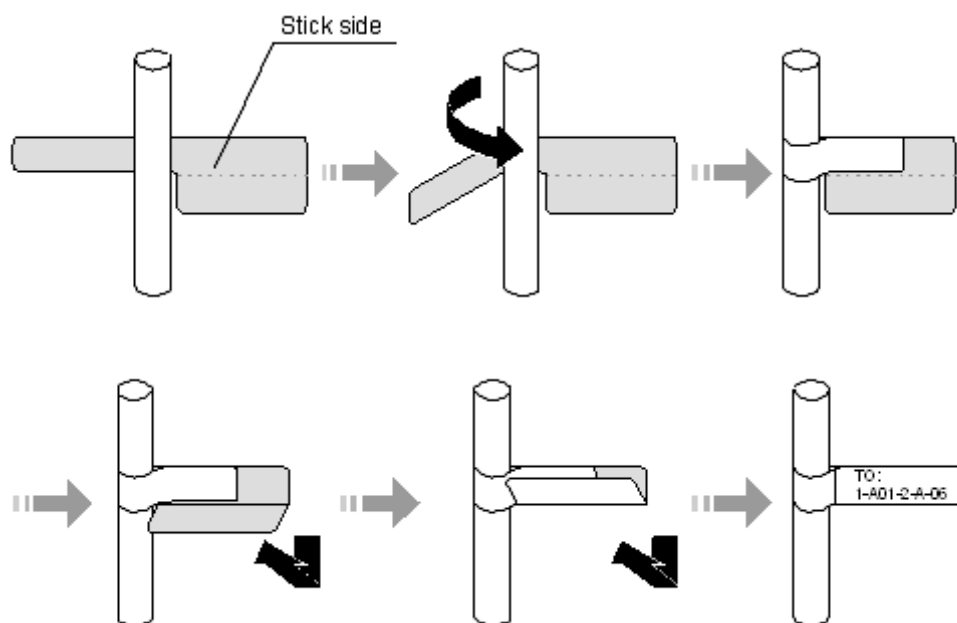
Power Cable Label

Remove the label from the backing page, and attach it to the identification plate on the cable tie. The label should be attached to the rectangular flute on the identification plate, and attached to only one side of the identification plate. The cable ties are bundled at 2 cm (0.79 in.) from the connectors, and other positions are allowed in special circumstances.

Cable ties should be bound on both ends of a cable. After the bundling, the finished identification plate should be on top of the cable in horizontal cabling, or on the right side of the cable in vertical cabling, as shown in **Figure 5-87**. The details are as follows:

- The identification card is to the right of the cable in vertical cabling.
- The identification card is on the top of the cable in horizontal cabling. Make sure that the label is facing out.

Figure 5-87 Binding the label for the power cable

The identification card is on the top of the cable in horizontal cabling.

The identification card is to the right of the cable in vertical cabling.
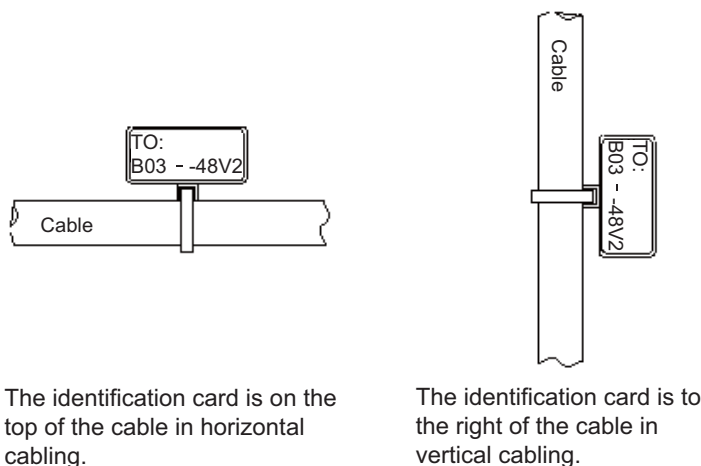
Contents of Engineering Labels

Contents of Labels for Power Cables

Labels for power cables are only affixed on one side of the identification plates. On the labels, there is information (the part after the mark "TO:") about the location of the device on the other end of the cable, like the location of control cabinet, distribution box or power socket.

Contents of Labels for Signal Cables

The two sides of the label affixed on the signal cable carry information about the location of the ports connected to both ends of the cable. **Figure 5-88** shows the information on both sides of the labels affixed to the signal cables.

● Area 1 contains the location information of the local end of the cable.

● Area 2 (with the mark "TO:") contains the location information of the opposite end of the cable.

● Area 3 has been folded up inside the label.

Figure 5-88 Printed parts on the label for signal cables
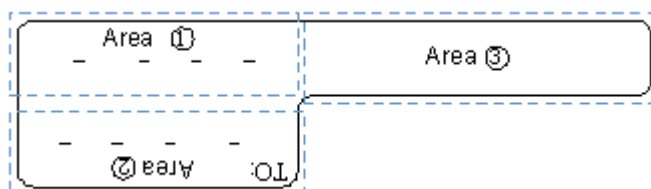
Seen from the cabling end of the equipment, the text part of the label is on the right side of the cable. The side with "TO:" that is facing outside carries the location information of the opposite end; and the other side carries the location information of the local end.

Therefore, the information in Area 1 at one end is the same as the information in Area 2 at the other end of the cable. In other words, the local information at one end is called the opposite information at the other end.

Precautions for Using Engineering Labels

When using labels, pay attention to the following points:

- When printing, writing, or attaching labels, keep the labels clean.

- Since the label paper is made of moistureproof and waterproof material, ink-jet printers and ink pens are forbidden for printing and writing labels.

- Labels should be attached tidily. New-type labels are L-shaped. If they are pasted at incorrect locations or in wrong directions, the appearance of the device is affected.

- Power cable ties should be attached in the same positions on power cables, with identification plates on the same side.

- The positions of "up", "down", "left" or "right" are all based on the viewpoint of the engineering person who works on the label.

5.4.2 Engineering Labels for Optical Fibers

These labels are affixed to the optical fibers that connect the optical interfaces on the boards in a chassis, or on the device boxes. There are two types of labels for optical cables:

- One is for the fiber that connects the optical interfaces on two devices.

- The other is for the fiber that connects the device and the ODF.

Labels for the Optical Fibers Connecting Devices

Meaning of the Label

Table 5-22 lists information on both sides of the labels affixed to the optical fibers that connect two devices.

Table 5-22 Information on labels affixed to the fiber between two devices

Content	Meaning	Example
MN-B-C-D-R/T	MN: cabinet number	M: The cabinet rows from front to back are numbered from A to Z. N: The cabinet columns from left to right are numbered from 01 to 99. For example, A01 is the cabinet in Row A and Column 01.
	B: chassis number	Numbered in bottom-up order with two digits, for example, 01.
	C: physical slot number	Numbered in the top-down and left-right order starting from 01. For example, 01 is the slot with number 1.

Content	Meaning	Example
	D: optical interface number.	Numbered in a top-bottom and left-right order, consistent with the port sequence number on the device.
	R: Receiving interface T: optical transmitting interface	-

Example of the Label

Figure 5-89 shows the label on the cable.

Figure 5-89 Example of the label on the optical fiber between two devices
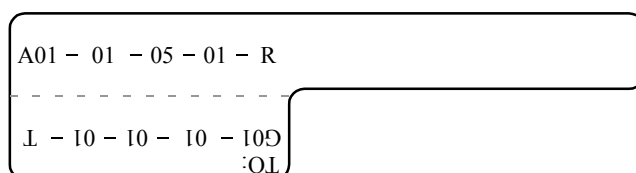
The meaning of the labels is listed in **Figure 5-89**.

- "A01-01-05-01-R" indicates that the local end of the optical fiber is connected with the optical receiving interface 01 on slot 5, chassis 01 in the cabinet on row A, column 01 in the machine room.

- "G01-01-01-01-T" indicates that the opposite end of the optical fiber is connected with Optical Transmitting Interface 01 on Slot 01, Chassis 01 in the cabinet on Row G, Column 01 in the machine room.

Labels for the Optical Fibers Connecting the Device and an ODF

Meaning of the Labels

Table 5-23 shows the information on both sides of the labels attached to the optical fiber that connects the device and the ODF.

Table 5-23 Information on labels affixed to the fiber between the device and the ODF

Content	Meaning	Example
MN-B-C-D-R/T	MN: cabinet number	For example, A01.

Content	Meaning	Example
	B: chassis number	Numbered in bottom-up order with two digits, for example, 01.
	C: physical slot number	Numbered in the top-down and left-right order starting from 01. For example, 01 is the slot with number 1.
	D: optical interface number.	Numbered in a top-down and left-right order, consistent with the port sequence number on the device.
	R: Optical receiving interface T: optical transmitting interface	-
ODF-MN-B-C-R/T	MN: row number and column number of an ODF	M: The cabinet rows from front to back are numbered from A to Z. N: The cabinet columns from left to right are numbered from 01 to 99. For example, G01 is the ODF of Row G and Column 01.
	B: row number of the terminal device	Range from 01 to 99, for example, 01-01.
	C: column number of the terminal device	
	R: Optical receiving interface T: optical transmitting interface	-

Example of the Label

Figure 5-90 shows the label on the cable.

Figure 5-90 Example of the label on the optical fiber between the device and the ODF
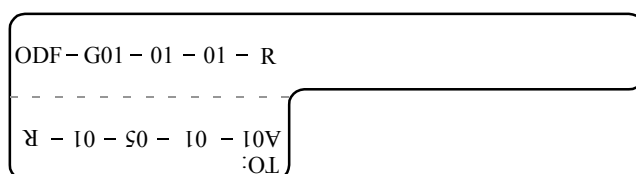
Meaning of the label in **Figure 5-90**

- "ODF-G01-01-01-R" indicates that the local end of the optical fiber is connected to the optical receiving terminal on row 01, column 01 of the ODF in row G, column 01 in the machine room.

- "A01-01-05-01-R" indicates that the opposite end of the optical fiber is connected to Optical Receiving Interface 1 on Slot 05, chassis 01 in the cabinet on Row A, Column 01 in the machine room.

5.4.3 Engineering Labels for Network Cables

Applicable Ranges

The labels can be applied to Ethernet cables.

Label Content

Table 5-24 shows the information on both sides of the labels affixed to Ethernet cables.

You can also decide the label content according to the actual environment. If the device is not installed in the cabinet, for example, you can remove the cabinet number.

Table 5-24 Information on the Ethernet cables

Content	Meaning	Example
MN-B-C-D	MN: cabinet number	For example, A01 is the first cabinet in row A.
	B: chassis number	Numbered in the bottom-up order with two digits, for example, 01.
	C: physical slot number	Numbered with two digits in top-down and left-right order. For example, 01.
	D: network port number	Numbered in the top-down and left-right orders. For example, 01.
MN-Z	MN: cabinet number	For example, B02 is the second cabinet in Row B.
	Z: Location number	Fill in the location number of the terminal device on site. If the cable is connected to a device in a cabinet, the serial numbers of the cabinet, the chassis, and the Ethernet interface of the device should be specified. For example, B02-03-12. If the cable is connected to the Network Management Station (NMS), the specific location of the NMS should be given.

The contents of the labels for network cables connecting hubs and devices or agents and the network cables for other purposes should be specified according to actual connections. The details are as follows:

- For a network cable connecting a hub and device, the label on the hub end should indicate the numbers of the chassis and cabinet where the hub resides, and the serial number on the hub. The label on the device end should indicate the number of the chassis and cabinet where the device is located. If the device is a stand-alone device, the specific position of the device should be provided.

- For a network cable connecting a hub and an agent or terminal, the label on the agent or terminal end should contain the serial number of the network interface. The definitions of the cabinet number and chassis number are the same as those described in **Table 5-24**.

- If the hub is a stand-alone device without cabinet or chassis, the label should contain specific location information that identifies the hub.

The serial number on the hub, the network interface number of the agent or terminal, and the location of the stand-alone device should be specified according to actual connections.

Label Example

Figure 5-91 shows the label on the cable.

Figure 5-91 Example of the label on network cables
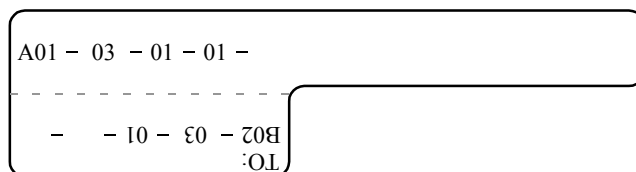
Meaning of the label in **Figure 5-91**.

- "A01-03-01-01" indicates that one end of the network cable is connected to network interface 01 of slot 01, chassis 03 of the cabinet on row A, column 01 in the equipment room.

- "B02-03-01" indicates that another end of the network cable is connected to network interface 01, chassis 03 of the cabinet on row B, column 02 in the equipment room. No slot number is given.

5.4.4 Engineering Labels for User Cables

Attach labels to both ends of the cable to indicate the locations of the cable on the device and MDF.

Meaning of the Engineering Labels for User Cables

**Table 5-25** shows the contents of the labels.

Table 5-25 Contents of the engineering labels for user cables

Content	Meaning	Example
MN-B-C-D	MN: cabinet number	For example, A01 is the first cabinet in row A.
	B: frame number	Numbered in the bottom-up order with two digits, for example, 03.
	C: physical slot number	Numbered with two digits in the top-down and left-right order. For example, 01.
	D: cable number	Numbered with two digits in the top-down and left-right order. For example, 01.
MDF-MN-B-C	MN: row number and column number of the MDF	M: The rows of cabinets from front to back are numbered from A to Z. N: The columns of cabinets from left to right are numbered from 01 to 99. For example, G01 is the MDF of row G and column 01.
	B: row number of the terminal device	Ranges from 01 to 99, for example, 01-01.
	C: column number of the terminal device	

Example of the Label

Figure 5-92 shows an example.

Figure 5-92 Example of labels for user cables
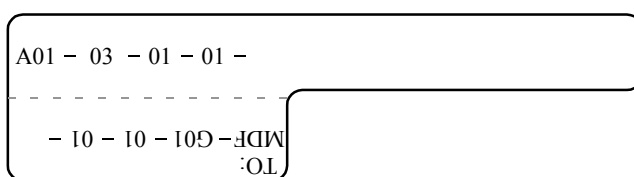
The meaning of the label in **Figure 5-92** is as follows:

- "A01-03-01-01" indicates that the local end of the user cable is connected to port 1 of on slot 1, chassis 03 of the cabinet on row A, column 01 in the equipment room.

- "MDF-G01-01-01" indicates that the opposite end of the user cable is connected to the terminal on row 01, column 01 of the MDF in row G, column 01 in the equipment room.

5.4.5 Engineering Labels for Power Cables

Engineering Labels for DC Power Cables

The labels are affixed to the DC power cables that provide power supply for cabinets, including the -48 V, PGND, and BGND cables. Here, the DC power cables also include power cables and PGND cables.

The labels for DC power cables are affixed to one side of the identification plates on cable ties. For details of the labels, see **Table 5-26**.

Table 5-26 Contents of the label

Content	Meaning
MN(BC)-B--48Vn	MN(BC): BC is written right under MN.
MN(BC)-B-BGND	B: chassis number, numbered in the bottom-up order with two digits, for example, 01. N: power socket number, numbered as 1 to 3 in the bottom-up and left-to-right orders. On the loaded cabinet side, only MN is used to identify the cabinet.
MN(BC)-B-PGND	On the power cabinet side, MN identifies the row and column number of the power distribution equipment like a control cabinet and distribution box, and BC identifies the row and column number of the -48 V connector. If there is no row number or column number, or the connector can be identified without them, BC can be omitted. It is unnecessary for BGND and PGND to identify the row and column number.

The label only carries location information about the destination direction of the power cable while information of the local end is not necessary. That is, the label only carries location information about the opposite equipment, the control cabinet, or the distribution box. **Table 5-26** lists the information on two -48 V power supplies on the label. The information on other DC voltages, such as 24 V and 60 V should be given in similar methods.

Make sure that labels are affixed in the correction direction. That is, after the cable ties are bundled onto the cable, the identification plates with the labels should face up, and the text on the labels in the same cabinet should be in the same direction. For details, see **Figure 5-93**.

Figure 5-93 Example of the labels for DC power cables
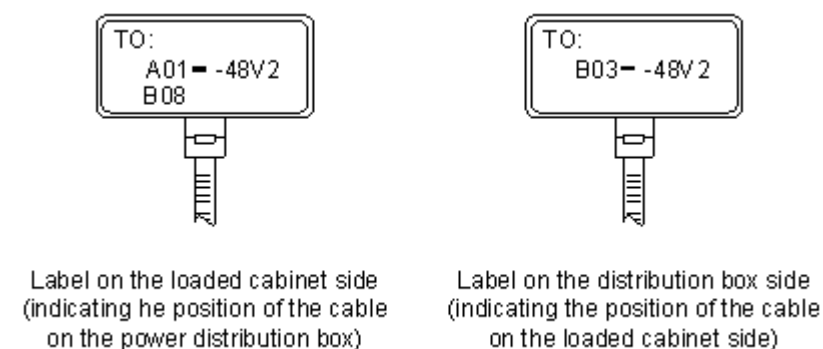
The meaning of the label in **Figure 5-93** is as follows:

- On the loaded cabinet side, the label "A01/B08--48V2" on the cable indicates that the cable is -48 V DC supply, which is from the eighth connector on row B of -48 V bus bar in the cabinet on row A, and column 1 in the equipment room.

- On the distribution box side, the label "B03--48V2" indicates that the cable is -48 V DC supply, connected to DC power socket 2 on row B, column 03 in the equipment room.

☷**NOTE**

> In the power distribution box or the first power cabinet of a row in a transmission equipment room, every terminal block on the -48 V connector bar has a numeric identification. For example, in the above label of "A01/B08--48V2", "08" (or sometimes "8") is the numeric identification of the terminal block.

PGND and BGND are two copper bars, on which the terminal blocks are short-circuited, therefore which terminal is connected makes no difference. It is only necessary to give the row and column of the power distribution box, instead of giving the specific serial number of the terminal block on the copper bar. For example, if the label on the loaded cabinet side is "A01-BGND", it means that the power cable is a BGND that connects BGND copper bar in the power distribution box on Row A, Column 01 in the machine room. Information on the labels for PGND cables should be given in a similar way.

Engineering Labels for AC Power Cables

The labels are affixed to both ends of an AC power cable that provides AC power supply to cabinets, including 110/220 V, PGND, and BGND cables. The 110/220 V AC cables and related PGND and BGND cables are covered with an insulating sheath, so the labels need to contain only the word "AC" and the cabinet numbers.

The labels for AC power cables are affixed to one side of the identification plates on cable ties. For details, see **Table 5-27**.
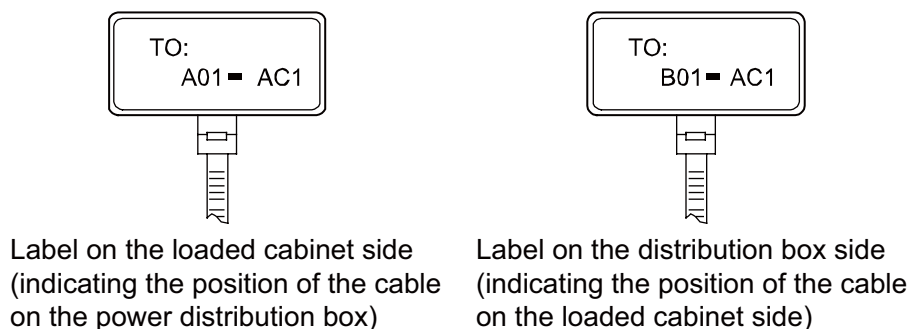
Table 5-27 Label content

Content	Meaning
MN-(B)-ACn	MN: serial number of the cabinet or the socket where the power is led in
	B: chassis number, numbered in the bottom-up order with two digits, for example, 01.
	n: power port number, numbered as 1 to 3 in bottom-up and left-to-right order.
	Serial number of the socket where the power is led in: the location of the socket is marked according to the actual situation. If the sockets can be identified by row numbers and column numbers, they can be numbered following the same rule for the cabinets. If the sockets cannot be identified by rows and columns, specify the detailed locations to avoid confusion with other sockets.

The label only carries location information about the opposite equipment and the power socket; information about the local end is not necessary.

Make sure that labels are affixed in correct direction. That is, after the cable ties are bundled onto the cable, the identification plates with the labels should face up, and the text on the labels in the same cabinet should be in the same direction, as shown in **Figure 5-94**.

Figure 5-94 Labels for AC power cables

```
  TO:                           TO:
    A01 ▬ AC1                     B01 ▬ AC1
```

Label on the loaded cabinet side (indicating the position of the cable on the power distribution box)

Label on the distribution box side (indicating the position of the cable on the loaded cabinet side)

Meaning of the label in **Figure 5-94**.

- On the equipment cabinet side, the label marked with "A01-AC1" indicates that the power cable is connected to the first AC power socket of Row A and Column 01 in the equipment room.

- On the power socket side, the label marked with "B01-AC1" indicates that the power cable is connected to the first AC power socket in the cabinet of Row B and Column 01 in the equipment room.

5.5 Guide to Using Optical Modules

Common Faults of an Optical Module

1. An optical module is not completely installed in position.

   If the optical module is not completely installed in position and the latch boss is not secured, the device cannot identify the optical module. After the optical module works for a long time, it will be ejected under external stress.

2. The optical receptacle on an optical module is contaminated.

   If an optical module is not cleaned or protected properly, contaminants may accumulate on the fiber pin in the optical module. As a result, the coupling efficiency is reduced, optical signals are cut off, or even worse, the surface of the fiber pin is damaged permanently.

3. An optical module is burnt.

   If large-power optical signals (caused by the OTDR or self-loop test) are transmitted through an optical module that is used for long-distance transmission but no optical attenuator is used, the optical power will exceed the overload power of the APD pipe. Then the optical module is burnt.

The preceding faults lead to temporary or long-term cut-off of optical signals; or even cause permanent damages to the optical module, affecting communication services.

Measures to Prevent Loosened Optical Module

1. When installing an optical module, insert it into position. If you hear a click or feel a slight shake, it indicates that the latch boss is secured.

   If the latch boss is not secured, the gold finger of the optical module is not in good contact with the connector on the board. In this case, the link may be connected but optical signals will be cut off or the optical module will be loosened when the optical module is shook or crashed.

2. **Figure 5-95** shows the release handle on an optical module when it is open and closed. When inserting the optical module, make sure that the release handle is closed. At this time, the latch boss locks the optical module. After the optical module is inserted, try pulling it out to see if it is installed in position. If the optical module cannot be pulled out, it is secured.

Figure 5-95 State of the release handle

Close the release handle   Open the release handle
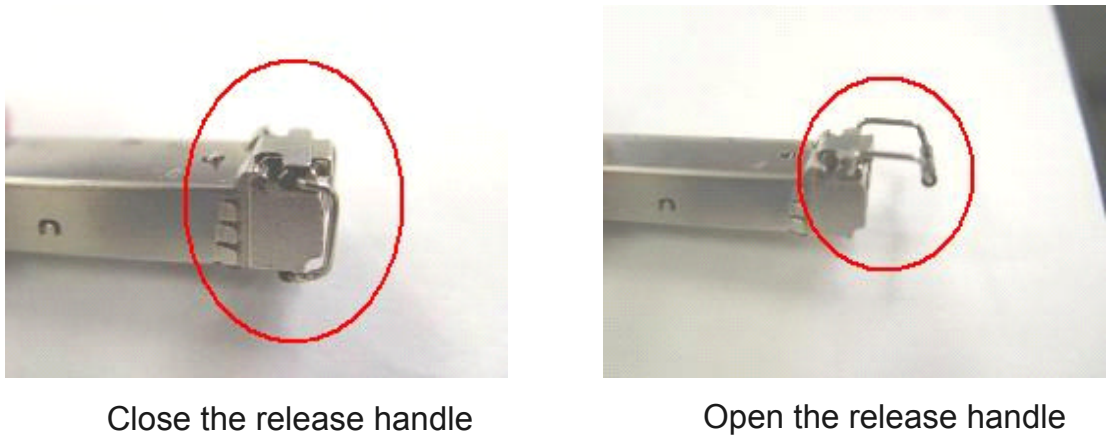
Measures to Prevent Receptacle Contamination

1. Cleaning tissues must be prepared on site. You need to clean the optical connector before inserting it in the receptacle. This protects the receptacle against the contamination on the surface of the optical connector.

Figure 5-96 Cleaning optical fibers with special cleaning tissues

📖**NOTE**

Place at least three cleaning tissues on the work bench. As shown in **Figure 5-96**, wipe the end of an optical connector from left to right or from right to left on a cleaning tissue, and then move the connector end to the unused part of the cleaning tissue to continue.

2. Cover an unused optical module with a protective cap to prevent dust, as shown in **Figure 5-97**.

Figure 5-97 Installing a protective cap
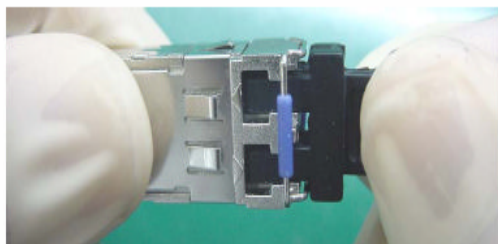
If no protective cap is available, use fibers to protect the optical module, as shown in **Figure 5-98**.

**Figure 5-98** Using fibers to protect an optical module

3. Cover unused optical connectors with protective caps, as shown in **Figure 5-99**, and then lay out fibers on the fiber rack or coil them in a fiber management tray to prevent fibers from being squeezed.

Figure 5-99 Installing a protective cap on a fiber
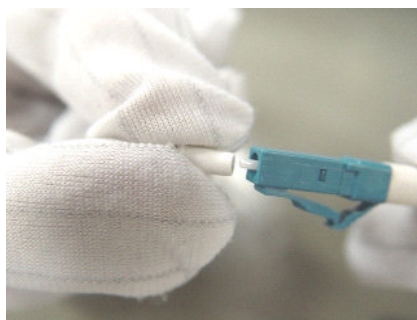
4. If a receptacle or an optical connector has not been used for a long time and is not covered with a protective cap, you need to clean it before using it. Clean a receptacle with a cotton swab, as shown in **Figure 5-100**. Clean an optical connector with cleaning tissues.

Figure 5-100 Cleaning a receptacle with a cotton swab
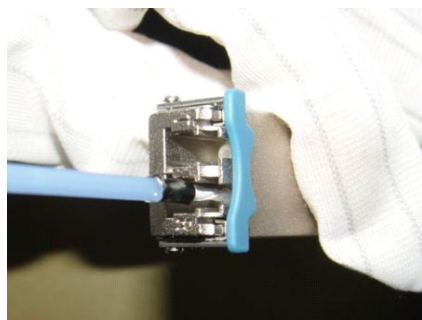
⚠ **NOTICE**

When cleaning a receptacle, insert the cotton swab and turn it slowly in the receptacle. Do not use too much strength because the receptacle may be damaged.

5. If optical signals are lost during the operation of a device, use the preceding method to clean the receptacle or the optical connector. In this manner, the possibility of contamination can be excluded.

Measures to Prevent an Optical Module from Being Burnt

1. Before using an optical time-domain reflectometer (OTDR) to test the connectivity or the attenuation of optical signals, disconnect the optical fibers from the optical module. Otherwise, the optical module will be burnt.

2. When performing a self-loop test, use an optical attenuator. Do not loosen the optical connector instead of the optical attenuator.

Precautions

1. The optical connector should be vertically inserted in the receptacle to avoid damages to the receptacle.

2. Fibers must be inserted into optical modules of the corresponding type. That is, multimode fibers must be inserted into multimode optical modules, and single mode fibers must be inserted into single mode optical modules. If a fiber is inserted into an optical module of a different mode, faults may occur. For example, optical signals will be lost.

5.6 Fault Tag

*Customer name:	
Address:	
Contact person:	
Tel.:	Fax:
Category*: ☐ RMA ☐ Return ☐ Analysis	

BOM Code	Product Description	Bar Code*	Fault Occurring Date*	Description of the Fault Phenomena*	Category No.*	Software Version*

Reasons for Repairing (Category No.):

Category No. includes the following eight types:
F001 - Wear out damaged (◊ In warranty Period ◊ Out of warranty period)

F002 - Deployment damaged

F003 - Intransit damaged

F004 - Version upgrade

F005 - Batch replace

F007 - Overdue spare parts inspecting

F008 - Others

F011 - Running circumstance change

Note:

- For optical interface cards returned, the optical interfaces should be covered with protection caps.
- In general, the analysis card will not be returned to you. If you have any special requirements, please contact Huawei.
- One *Fault Tag* should be adapted in one return category, such as RMA/Return/Analysis.
- The items marked with "*" are the mandatory fields that you must fill in.