

# 11 Appendix

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## 11.1 Appendix A Indicators

### NOTE

This section only provides the status and meanings of some indicators for quick query. To check detailed status and meanings of indicators on modules, see the *CloudEngine 16800 Series Switches Hardware Description*.

### Power Module Indicators

**Table 11-1** describes the status and meanings of indicators on a 3000 W AC power module.

**Table 11-1** Description of indicators on a 3000 W AC power module

Silkscreen	Name	Color	Description
Input	Power indicator	Green	<ul style="list-style-type: none"> <li>Steady on: The input power of the power module is in the normal range.</li> <li>Fast blinking (4 Hz): The input voltage of the power module is out of the normal range.</li> <li>Off: The power module receives no input power.</li> </ul>
Output	Alarm indicator	Green	<ul style="list-style-type: none"> <li>Steady on: The output power of the power module is in the normal range.</li> <li>Off: The power module has no output power or the output power is abnormal.</li> </ul>
Alarm	Fault indicator	Red	<ul style="list-style-type: none"> <li>Off: The power module is working properly.</li> <li>Steady on: The power module has failed. Possible causes include internal short circuit, fan failure, output overvoltage, overtemperature-triggered shutdown, system loading failure, communication failure, and severely uneven current.</li> </ul>

**Table 11-2** describes the status and meanings of indicators on a 2200 W DC power module.

**Table 11-2** Description of indicators on a 2200 W DC power module

Silkscreen	Name	Color	Description
INPUT	Power indicator	Green	<ul style="list-style-type: none"> <li>Steady on: The input power of the power module is in the normal range.</li> <li>Fast blinking (4 Hz): The input voltage of the power module is out of the normal range.</li> <li>Off: The power module receives no input power.</li> </ul>
OUTPUT	Alarm indicator	Green	<ul style="list-style-type: none"> <li>Steady on: The output power of the power module is in the normal range.</li> <li>Off: The power module has no output power or the output power is abnormal.</li> </ul>

Silkscreen	Name	Color	Description
ALARM	Fault indicator	Red	<ul style="list-style-type: none"> <li>Off: The power module is working properly.</li> <li>Steady on: The power module has failed. Possible causes include internal short circuit, fan failure, output overvoltage, overtemperature-triggered shutdown, communication failure, and severely uneven current.</li> </ul>

## MPU Indicators

[Table 11-3](#) describes the status and meanings of indicators on MPUs.

**Table 11-3** Description of indicators on MPUs

Silkscreen	Name	Color	Description
RUN(G) )/ ALM(R) /OFL(Y)	Running status indicator  <b>NOTE</b> This indicator only shows the running status of the local card.	Green	<ul style="list-style-type: none"> <li>Steady on: The card has been powered on but the system software is not running.</li> <li>Slow blinking (0.5 Hz): The card is running properly.</li> <li>Fast blinking (4 Hz): The card is loading the system software or is resetting.</li> </ul>
		Red	<ul style="list-style-type: none"> <li>Steady on: A fault that affects services has occurred and it cannot be rectified automatically (critical alarm about hardware), or the card has generated an alarm because the memory size is not equal to the standard specification.</li> <li>Fast blinking (4 Hz): The system power is insufficient.</li> </ul>
		Yellow	Steady on: The card is in power-off state. (For example, the card has been forcibly powered off using the <b>power off</b> command or is about to start.)
ACT	Active/ Standby status indicator	Green	<ul style="list-style-type: none"> <li>Steady on: The card is the active MPU.</li> <li>Off: The card is the standby MPU.</li> </ul>

Silkscreen	Name	Color	Description
M/S	Stack status indicator	Green	<ul style="list-style-type: none"> <li>Steady on: The stacking function is enabled, and the card is the active MPU of the stack.</li> <li>Slow blinking (0.5 Hz): The stacking function is enabled, and the card is not the active MPU of the stack.</li> <li>Off: The stacking function is disabled.</li> </ul>

## LPU Indicators

[Table 11-4](#) describes the status and meanings of indicators on LPUs.

**Table 11-4** Description of indicators on LPUs

Silkscreen	Name	Color	Description
RUN/ALM	Running status indicator	Green	<ul style="list-style-type: none"> <li>Steady on: The card has been powered on but the system software is not running.</li> <li>Slow blinking (0.5 Hz): The card is running properly.</li> <li>Fast blinking (4 Hz): The card is loading the system software or is resetting.</li> </ul>
		Red	Steady on: The card has a fault that affects services and cannot be rectified automatically (critical alarm about hardware).
		Yellow	Steady on: The card is in power-off state. (For example, the card has been forcibly powered off using the <b>power off</b> command or is about to start.)

## SFU Indicators

[Table 11-5](#) describes the status and meanings of indicators on SFUs.

**Table 11-5** Description of indicators on SFUs

Silkscreen	Name	Color	Description
RUN(G) ALM(R) OFL(Y)	Running status indicator	Green	<ul style="list-style-type: none"> <li>Steady on: The card has been powered on but the system software is not running.</li> <li>Slow blinking (0.5 Hz): The card is running properly.</li> <li>Fast blinking (4 Hz): The card is loading the system software or is resetting.</li> </ul>
		Red	Steady on: The card has a fault that affects services and cannot be rectified automatically (critical alarm about hardware).
		Yellow	Steady on: The card is in power-off state. (For example, the card has been forcibly powered off using the <b>power off</b> command or is about to start.)

## Fan Module Indicators

**Table 11-6** describes the status and meanings of indicators on fan modules.

**Table 11-6** Description of indicators on fan modules

Silkscreen	Name	Color	Description
	Fan status indicator	Green	<ul style="list-style-type: none"> <li>Fast blinking (4 Hz): The fan module has not established communication with the MPU or communication loss occurs.</li> <li>Slow blinking (0.5 Hz): The fan module is working properly and communicating with the MPU normally.</li> </ul>
		Red	Slow blinking (0.5 Hz): An alarm is generated, and the fan module is faulty.
		Yellow	Steady on: The fan module is abnormal. The possible cause is that the software of the fan monitoring unit (FMU) on the fan module is abnormal or the fan module fails.

Silkscreen	Name	Color	Description
SFU	SFU status indicator	Green	Steady on: The SFU is working properly.
		Red	Steady on: A fault that affects services has occurred. The fault cannot be rectified automatically and requires manual intervention.
		Yellow	Steady on: The fan module software is not loaded, or the communication fails, and the SFU indicator cannot be properly displayed.

## 11.2 Appendix B On-site Cable Assembly and Installation

### 11.2.1 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 themselves 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 for your reference only.

## 11.2.2 Assembling Power Cables

### 11.2.2.1 Assembling the OT Terminal and Power Cable

#### Context

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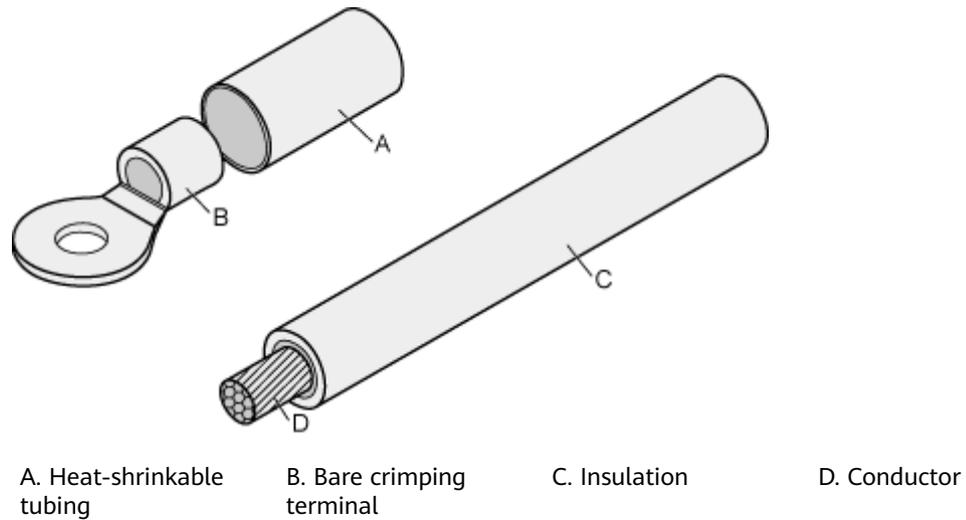
**NOTICE**

Do not bend OT terminals to 90 degrees onsite.

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**Figure 11-1** shows the components of an OT terminal and a power cable.

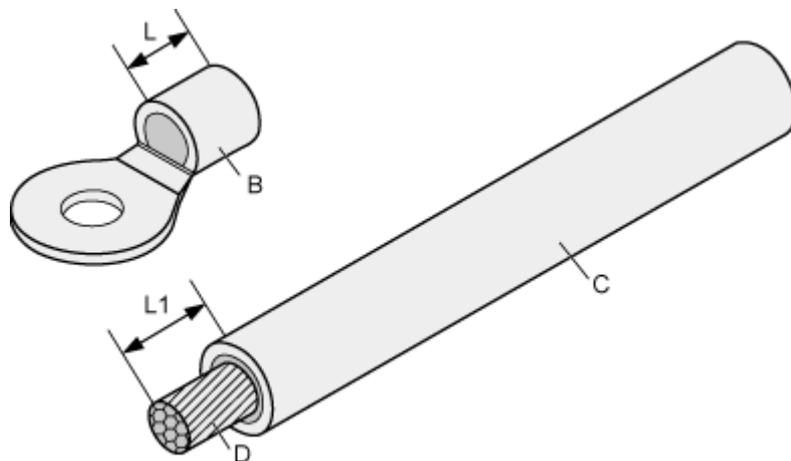
**Figure 11-1** Components of an OT terminal and a power cable



## 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 11-2](#). The recommended values of L1 are listed in [Table 11-7](#).

**Figure 11-2** 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 11-7** Mapping between the cross-sectional area of the conductor and the value of L1

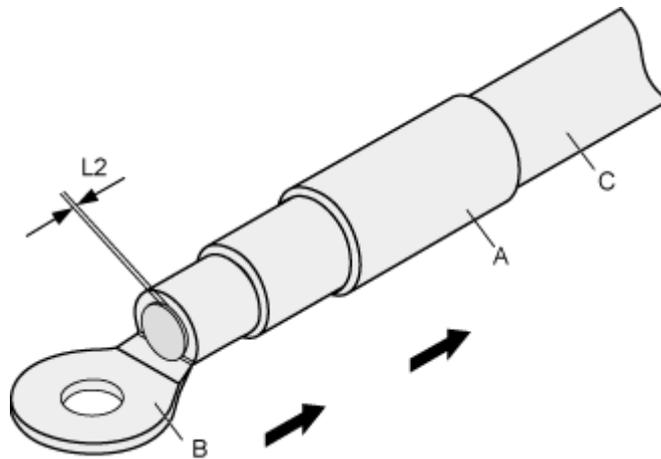
Cross-Sectional Area of Conductor (mm <sup>2</sup> (in. <sup>2</sup> ))	Value of L1 (mm (in.))	Cross-Sectional Area of Conductor (mm <sup>2</sup> (in. <sup>2</sup> ))	Value of L1 (mm (in.))
1 (0.002)	7 (0.28)	10 (0.015)	11 (0.43)
1.5 (0.002)	7 (0.28)	16 (0.025)	13 (0.51)
2.5 (0.004)	7 (0.28)	25 (0.039)	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)

**NOTE**

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 11-3](#).

**Figure 11-3** 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 11-3](#).

**NOTICE**

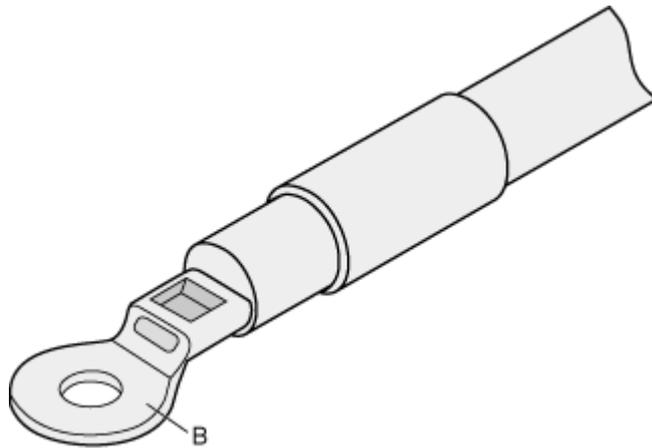
After the conductor is fed into the OT terminal, the protruding part of the conductor, or L2 in [Figure 11-3](#), must not be longer than 2 mm (0.08 in.).

**Step 4** Crimp the joint parts of the bare crimping terminal and the conductor, as shown in [Figure 11-4](#).

 **NOTE**

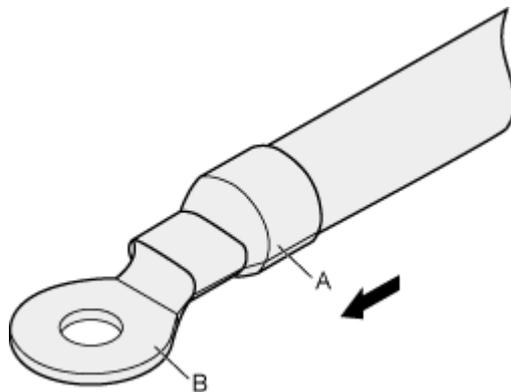
The shapes of crimped parts may vary with the crimping dies.

**Figure 11-4** Crimping the joint parts of the bare crimping terminal and the conductor (OT terminal)



**Step 5** Push the heat shrink tubing (A) toward the connector until the tube covers the crimped part, and then use a heat gun to heat the tube, as shown in [Figure 11-5](#).

**Figure 11-5** Heating the heat shrink tubing (OT terminal)



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**NOTICE**

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

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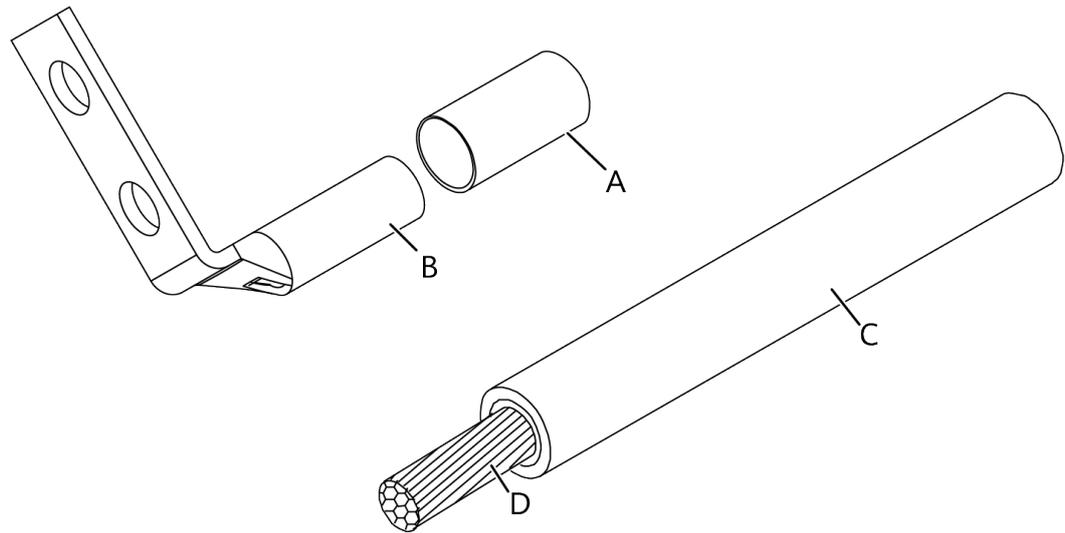
----End

## 11.2.2.2 Assembling the JG2 Terminal and Power Cable

### Context

**Figure 11-6** shows the components of a JG2 terminal and a power cable.

**Figure 11-6** Components of a JG2 terminal and a power cable



A. Heat shrink tubing    B. JG2 terminal    C. Insulation layer of a power cable    D. Conductor of a power cable

### Procedure

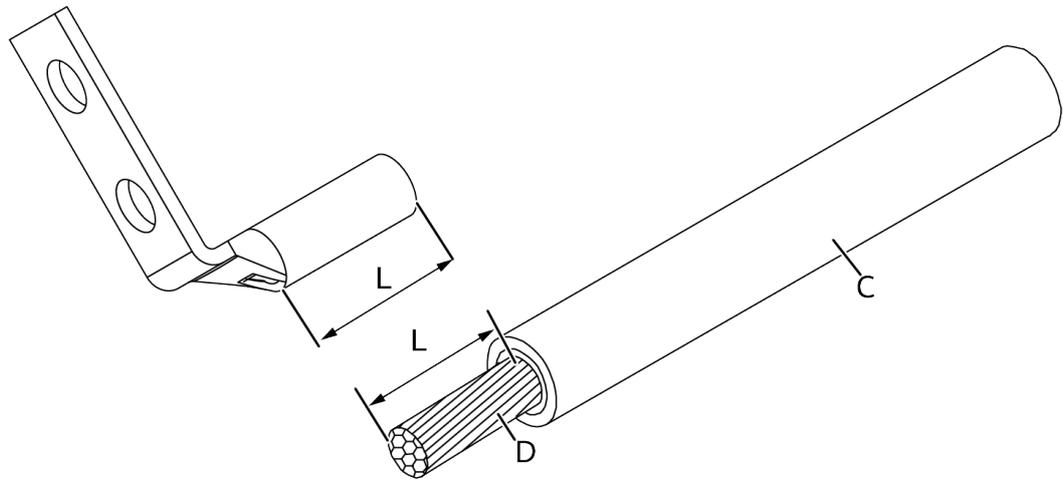
- Step 1** Strip a part of the insulation to expose the cable conductor with a length of L, as shown in **Figure 11-7**. The recommended values of L are listed in **Table 11-8** 1.

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#### 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 11-7** Stripping a power cable (JG2 terminal)

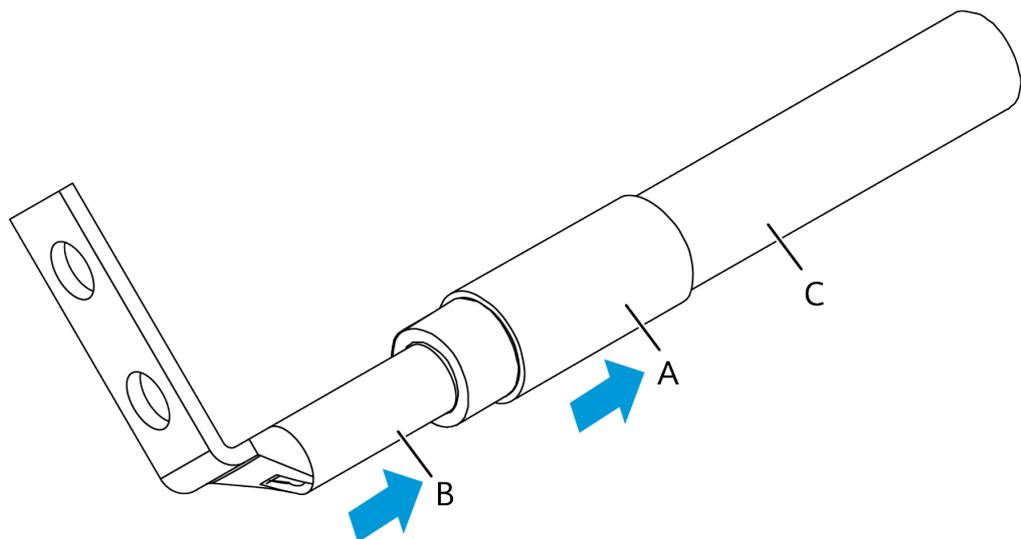


**Table 11-8** Mapping between the cross-sectional area of the conductor and the value of L

Cross-Sectional Area of Conductor (mm <sup>2</sup> (in. <sup>2</sup> ))	Value of L (mm (in.))
25 (0.039)	21~23 (0.83~0.91)
35 (0.054)	30~32 (1.18~1.26)

**Step 2** Put the heat shrink tubing onto the bare crimping terminal, as shown in [Figure 11-8](#).

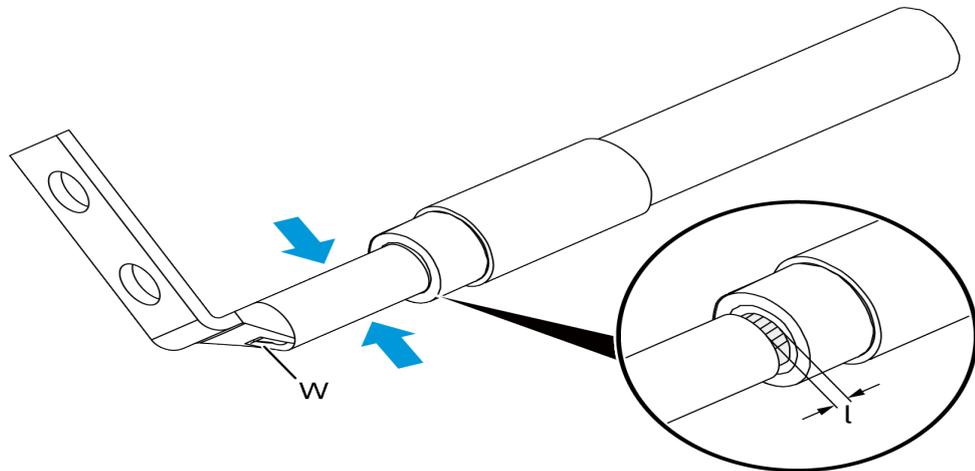
**Figure 11-8** Putting the heat shrink tubing onto the bare crimping terminal



**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 11-8](#).

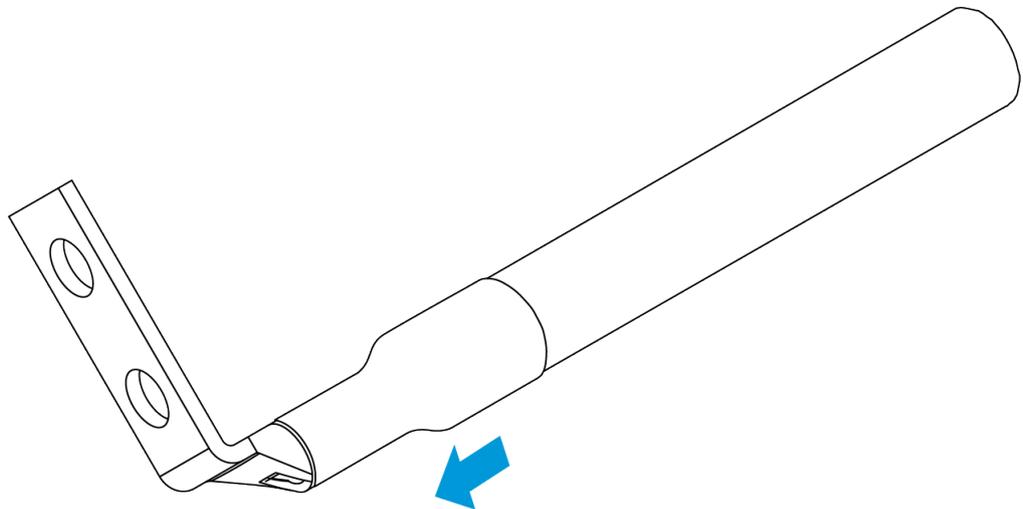
- Step 4** Crimp the joint parts of the bare crimping terminal and the conductor, as shown in [Figure 11-9](#).

**Figure 11-9** Crimping the joint parts of the bare crimping terminal and the conductor (JG2 terminal)



- Step 5** Push the heat shrink tubing toward the connector until the tube covers the crimped part, and then use a heat gun to heat the tube, as shown in [Figure 11-10](#).

**Figure 11-10** Heating the heat shrink tubing (JG2 terminal)



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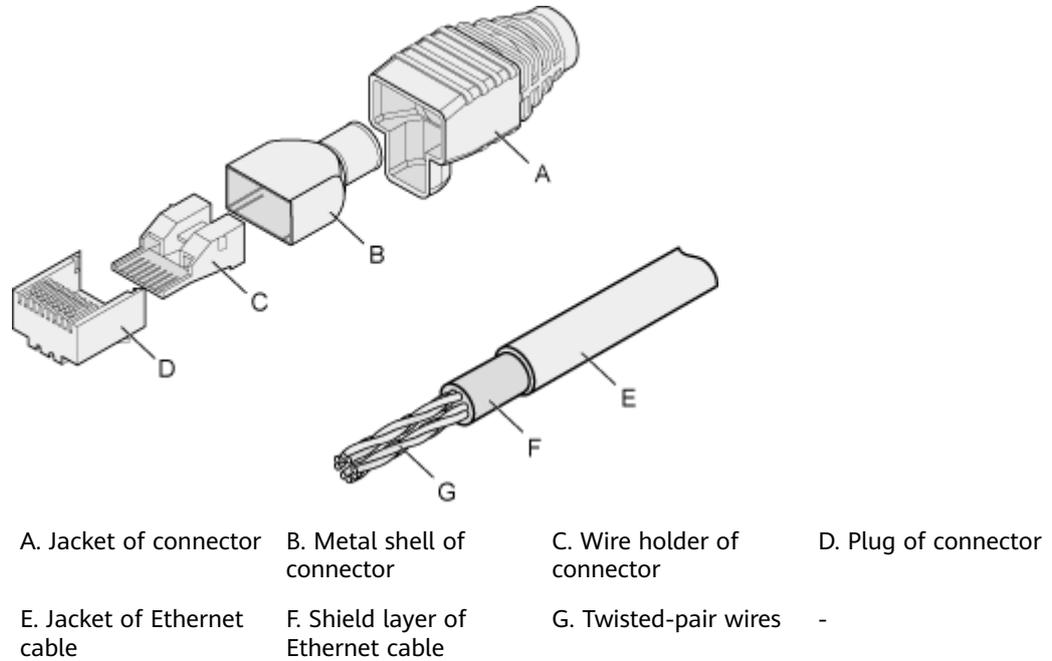
## 11.2.3 Assembling Ethernet Cables

### 11.2.3.1 Assembling the Shielded RJ45 Connector and Ethernet Cable

## Context

**Figure 11-11** shows the components of an RJ45 connector and a shielded Ethernet cable.

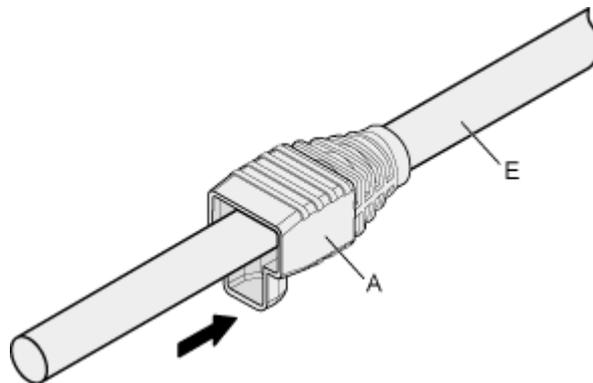
**Figure 11-11** Shielded RJ45 connector and cable



## Procedure

**Step 1** Fit the jacket of the connector onto the Ethernet cable, as shown in **Figure 11-12**.

**Figure 11-12** Fitting the jacket of the connector onto the Ethernet cable

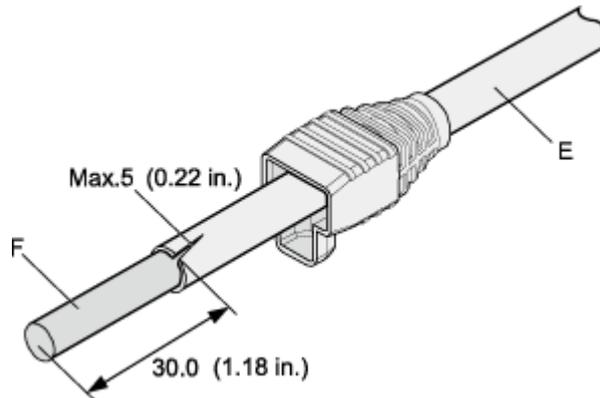


**Step 2** Remove a 30 mm (1.18 in.) long section of the jacket, cut off the nylon twine inside the jacket, and cut a no more than 5 mm (0.20 in.) cleft in the jacket, as shown in **Figure 11-13**.

**NOTICE**

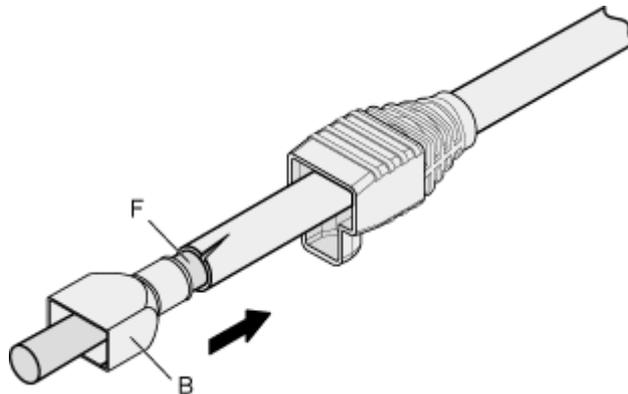
- When you remove a section of the jacket, do not damage the shield layer of the twisted-pair cable.
- When you remove the shield layer, do not damage the insulation of the twisted-pair cable.

**Figure 11-13** Removing the jacket of a twisted-pair cable (unit: mm (in.))



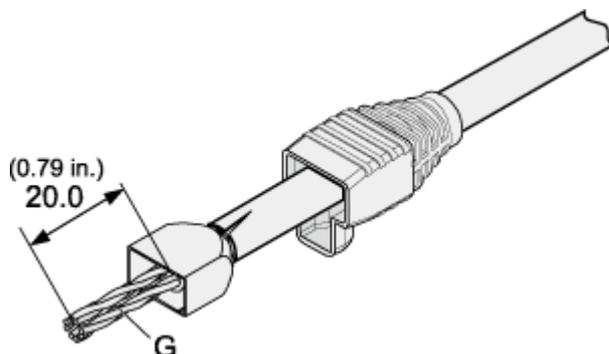
- Step 3** Fit the metal shell onto the twisted-pair cable. The shield layer is covered by the metal shell, as shown in [Figure 11-14](#).

**Figure 11-14** Fitting the metal shell onto the twisted-pair cable



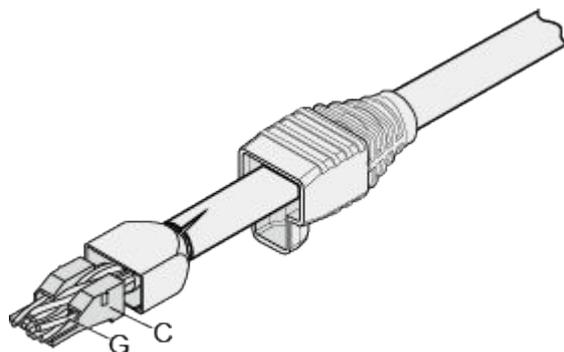
- Step 4** Fit the metal shell onto the twisted-pair cable until the shield layer is covered completely. Along the edge of the metal shell, cut off the aluminum foil shield layer and ensure that there is no surplus copper wire. The exposed twisted-pair cable is about 20 mm (0.79 in.) long, as shown in [Figure 11-15](#).

**Figure 11-15** Removing the shield layer of a twisted-pair cable (unit: mm (in.))

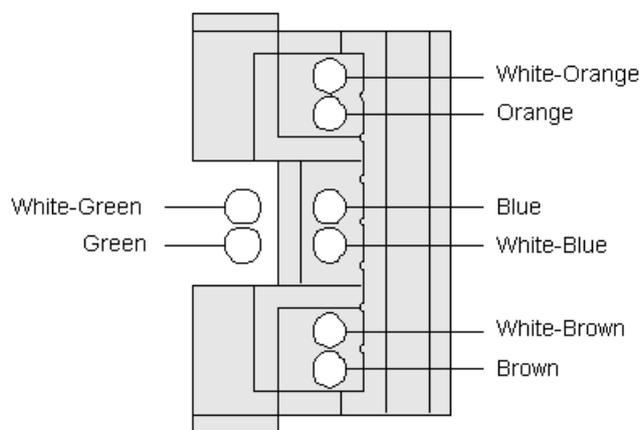


**Step 5** Lead the four pairs of twisted-pair wires through the wire holder, as shown in [Figure 11-16](#) and [Figure 11-17](#). Ensure that the colored wires are in the correct location in the cable.

**Figure 11-16** Leading wires through the wire holder

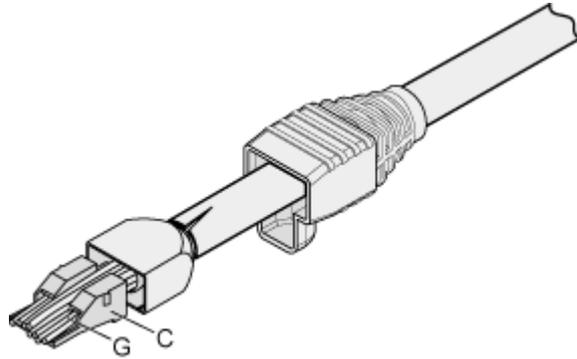


**Figure 11-17** Cable locations in a wire holder

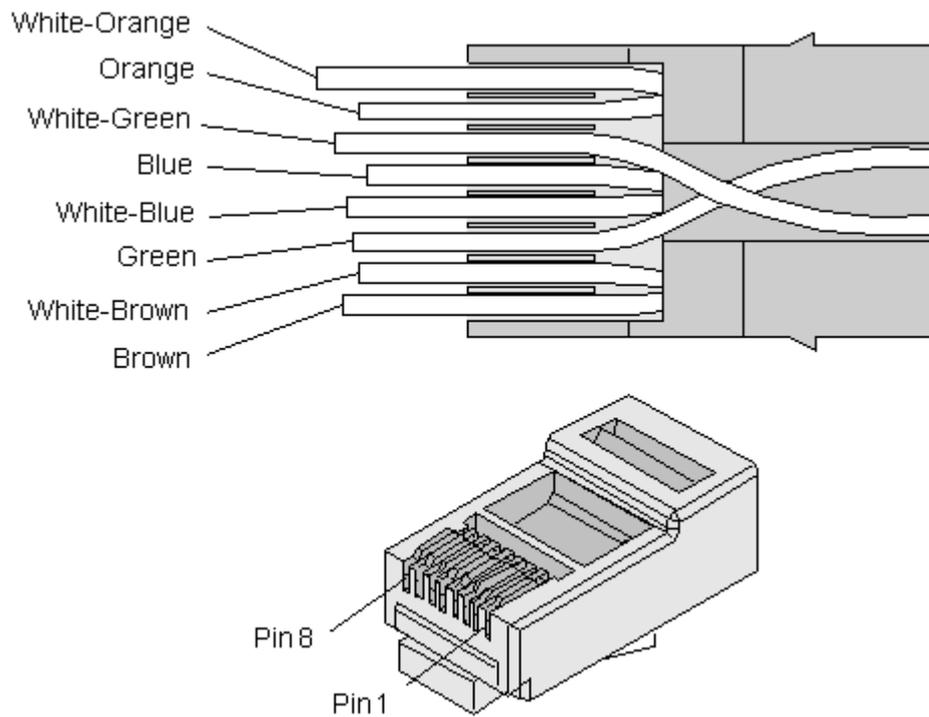


**Step 6** Align the four pairs of cables in the holder, as shown in [Figure 11-18](#). The connections between the wires and the pins are shown in [Figure 11-19](#) and listed in [Table 11-9](#).

**Figure 11-18** Four pairs of cables on a wire holder



**Figure 11-19** Connections between wires and pins



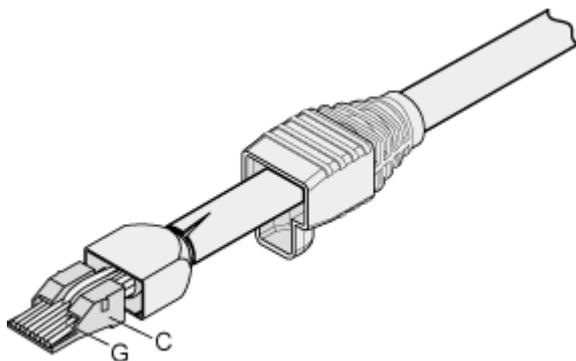
**Table 11-9** Connections between wires and pins (using a straight-through cable as an example)

Matching Pins of Wires	Wire Color
1	White-Orange

Matching Pins of Wires	Wire Color
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 11-20](#).

**Figure 11-20** Cutting off surplus cables

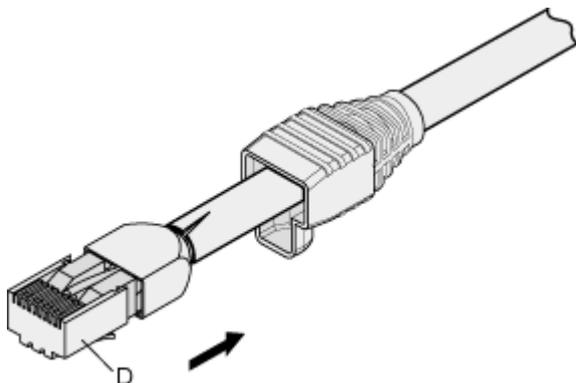


**Step 8** Put the connector body onto the wire holder and turn the metal shell by 90°, as shown in [Figure 11-21](#).

**NOTE**

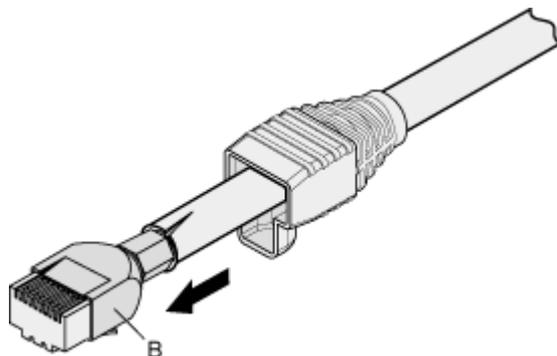
Ensure that the wire holder is in good contact with the connector body.

**Figure 11-21** Putting the connector body onto the wire holder



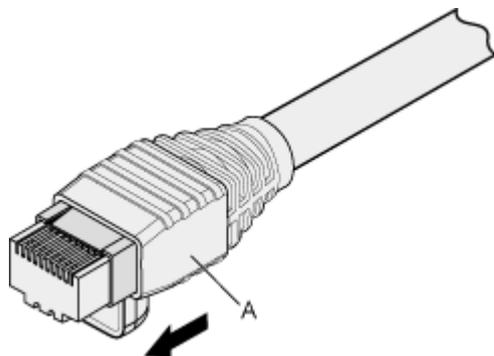
- Step 9** Push the metal shell toward the connector body until the wire holder and the connector body are engaged completely. Crimp the connector, as shown in [Figure 11-22](#).

**Figure 11-22** 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 11-23](#).

**Figure 11-23** Pushing the metal shell



- Step 11** To complete the assembly of the other end, repeat steps 1 to 10.

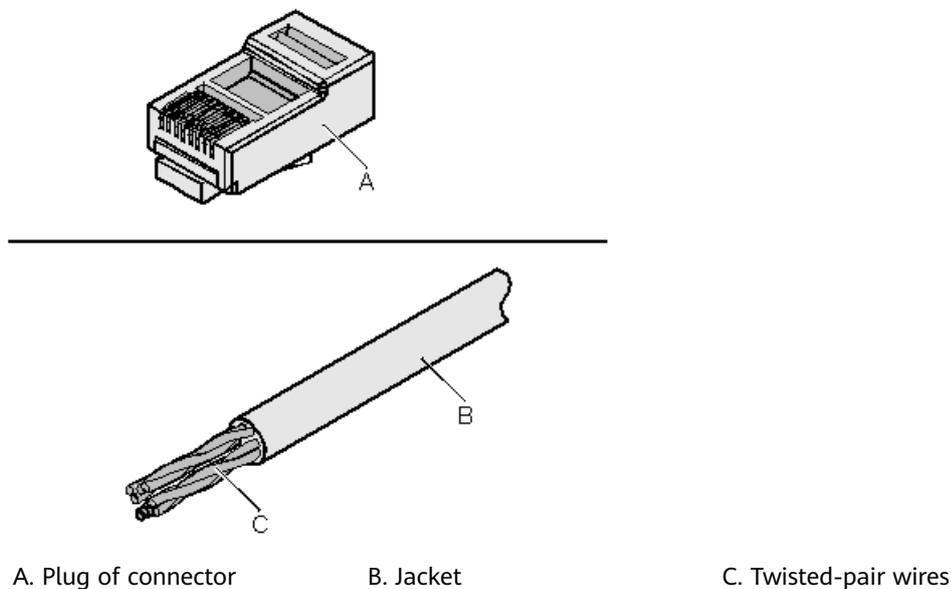
----End

### 11.2.3.2 Assembling an Unshielded RJ45 Connector and Ethernet Cable

#### Context

[Figure 11-24](#) shows the components of an unshielded RJ45 connector and cable.

**Figure 11-24** Components of an unshielded RJ45 connector and cable



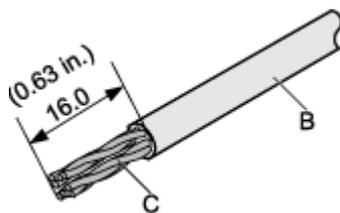
## Procedure

- Step 1** Remove a 16-mm (0.63 in.) long section of the jacket, as shown in [Figure 11-25](#).

### NOTICE

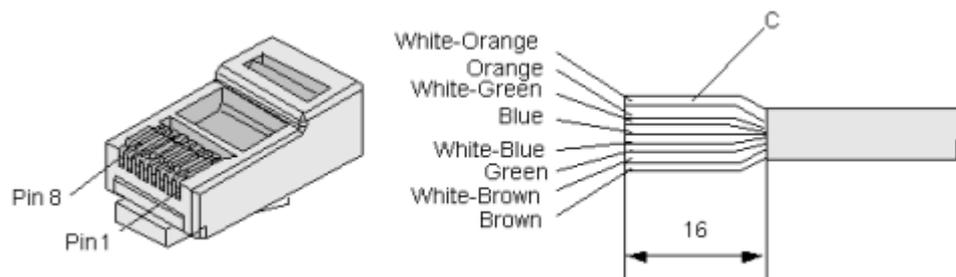
When you remove the shield layer, do not damage the insulation of the twisted-pair cable.

**Figure 11-25** 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 11-26](#). The connections between the wires and the pins are listed in [Table 11-10](#).

**Figure 11-26** Connections between wires and pins (unit: mm (in.))



**Table 11-10** Connections between wires and pins (using a straight-through cable as an example)

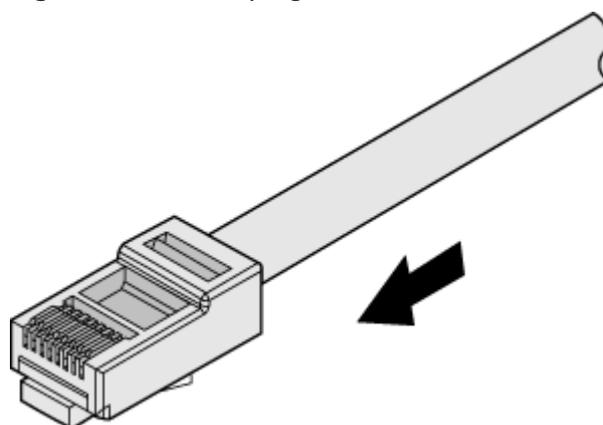
Matching Pins of Wires	Wire Color
1	White-Orange
2	Orange
3	White-Green
4	Blue
5	White-Blue
6	Green
7	White-Brown
8	Brown

**Step 3** Feed the cable into the plug, and crimp the connector, as shown in [Figure 11-27](#).

**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 11-27** Crimping the connector



**Step 4** To complete the assembly of the other end, repeat steps 1 to 3.

----End

### 11.2.3.3 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 of less than  $\pm 5^\circ$ . The top margin of a strip must be parallel to the axis of the connector, with an offset of less than  $\pm 10^\circ$ .
- To ensure conductivity, 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  $6.02 \pm 0.13$  mm ( $0.237 \pm 0.005$ ). If a measuring tool is not available, you can compare the connector with a standard connector. [Figure 11-28](#) shows an unqualified piece, and [Figure 11-29](#) shows a qualified piece.

#### NOTE

All unqualified pieces must be crimped again.

**Figure 11-28** Contact strips of different heights



**Figure 11-29** Contact strips of the same height



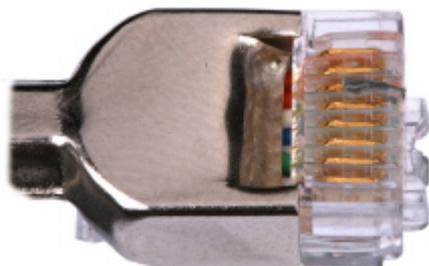
**Step 2** Hold an RJ45 connector and turn it 45°. Observe the top edges of the metal contact strips. **Figure 11-30** shows an unqualified piece.

**Figure 11-30** 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 11-31** shows an unqualified piece.

**Figure 11-31** Dirt on a contact strip



**Step 4** Check whether the contact strips and the plastic separators are well aligned and intact. If a separator is skewed and cannot be fixed, replace it with a new RJ45 connector. **Figure 11-32** shows an unqualified piece.

**Figure 11-32** Skewed 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 11-33](#) shows an unqualified piece.

**Figure 11-33** Wires not in good contact with the edge of the RJ45



Not in good contact with the edge of the RJ45 trough

----End

### 11.2.3.4 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 11-11](#) lists the connections of core wires in a straight-through cable.

**Table 11-11** 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	

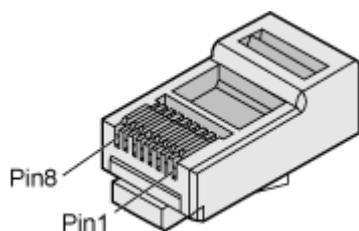
- Crossover cables are connected in a crossover manner. They are used to connect terminals such as two computers or switches. [Table 11-12](#) lists the connections of core wires in a crossover cable.

**Table 11-12** 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
7	7	Brown-White	

[Figure 11-34](#) shows the pins of an RJ45 connector.

**Figure 11-34** 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 11-35](#).

**Figure 11-35** 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 11-36](#).

**Figure 11-36** 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, which depends on the wire connections of a crossover cable.

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

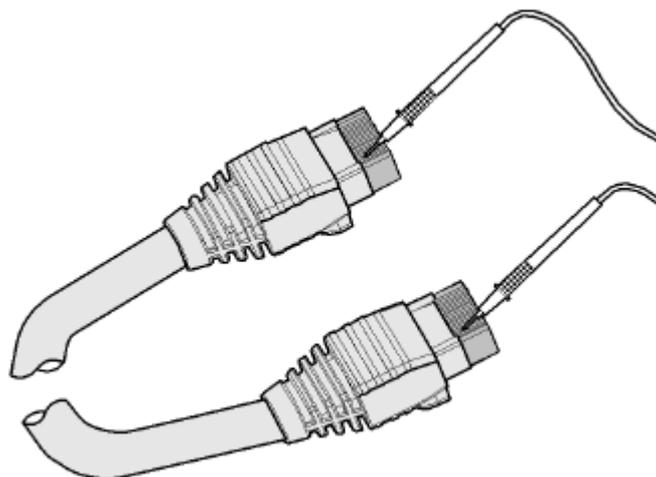
At the master (left) section of the tester, the indicators turn on in the sequence of 1-8-G. At the slave (right) section of the tester, the indicators turn on in the sequence of 3-6-1-4-5-2-7-8-G.

If the indicators do not come on in this sequence, 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 11-37](#).

**Figure 11-37** Testing the connection of an Ethernet cable



----End

## 11.2.4 Installing Cable Accessories

### 11.2.4.1 Precautions for Installing Cable Accessories

#### NOTE

The illustrations in this document may differ from actual situations, but the installation methods are 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.

### Tools

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

### Bending Radius

Unless otherwise specified, bending radius (R) of cables or fibers must meet the requirements listed in [Table 11-13](#).

**Table 11-13** Bending radius of cables or fibers

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

#### NOTE

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

### Precautions for Installation

- Hold terminals of cables instead of pulling the cables themselves when installing or removing cable components.
- Do not insert a connector forcibly when the connector is blocked. Use a dedicated tool to pull out the connector. 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, determine

the reason and try again. Do not apply 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 idle fiber connectors with dust caps. Remove the dust 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 cable joints slack. After connecting multiple cables to a connector that has multiple interfaces, keep the cables slack to avoid generating stress.
- Bind or clean cables gently because cable distortion affects signal quality.
- Keep cables away from moveable components such as doors.
- Sharp objects must not touch cable wiring to prevent damage to cables.
- To protect power cables, route power cables of the active and standby power modules separately.

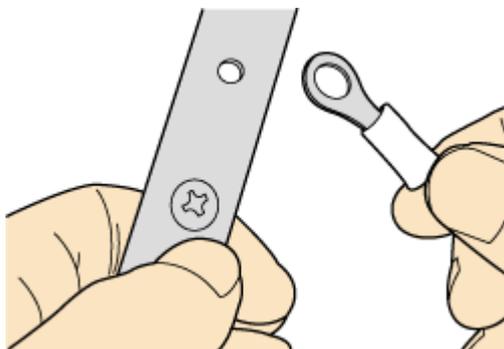
## 11.2.4.2 Installing Power Adapters

### 11.2.4.2.1 Installing the OT Terminal

#### Procedure

- Install an OT terminal.
  - a. Align the hole of the OT terminal (conductor upward) with a connecting hole, as shown in [Figure 11-38](#).

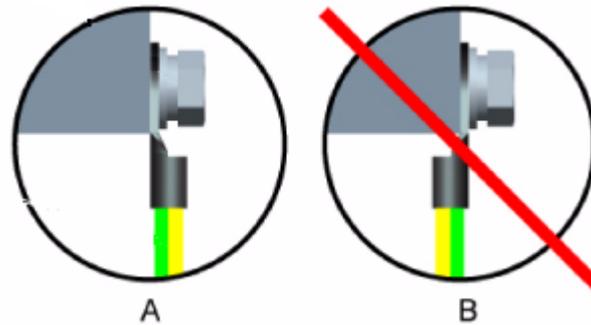
**Figure 11-38** Aligning the OT terminal with a connecting hole



 NOTE

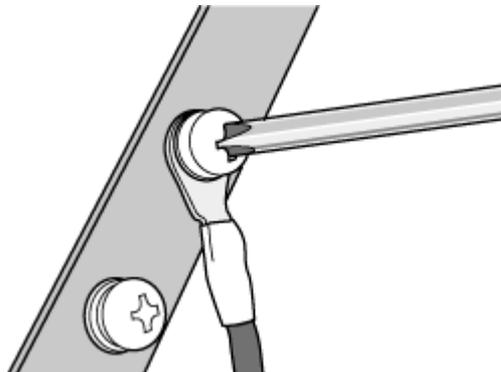
When you install an OT terminal, the crimping sleeve is installed as shown in [Figure 11-39](#), where A is correct and B is incorrect.

**Figure 11-39** Installing an OT terminal, showing the orientation of crimping sleeve



- b. Place the spring washer and flat washer in turn, mount a matching screw, and fasten it clockwise, as shown in [Figure 11-40](#).

**Figure 11-40** Installing two terminals back to back



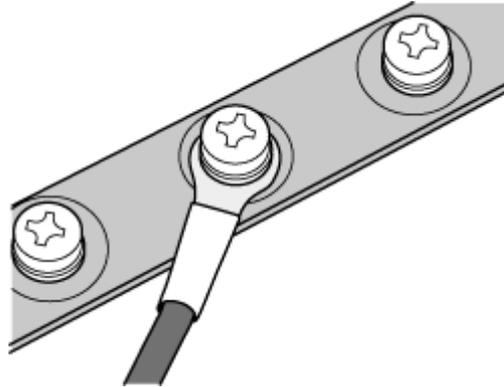
---

**NOTICE**

Ensure that the OT terminal is not in contact with other terminals or metal components.

- c. Move the cable slightly and ensure that it is securely connected, as shown in [Figure 11-41](#).

**Figure 11-41** Installed OT terminal

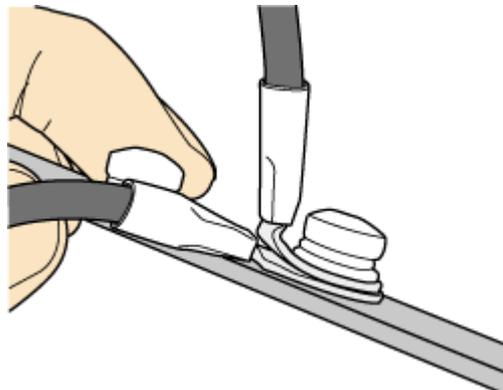


- Install two OT terminals on a post.

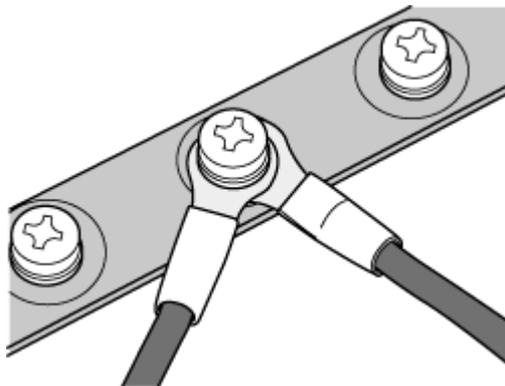
Before you install two OT terminals on a post, ensure that the two terminals can be installed on the post and that the electrical connecting pieces have a large contact area. Two OT terminals can be installed using any of these methods:

- Bend the upper OT terminal at a 45- or 90-degree angle, as shown in [Figure 11-42](#).
- Cross the two terminals, as shown in [Figure 11-43](#).

**Figure 11-42** Bending the upper OT terminal at a 45- or 90-degree angle



**Figure 11-43** Crossing two terminals



---

**NOTICE**

If the two terminals are different sizes, 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 counterclockwise.

----End

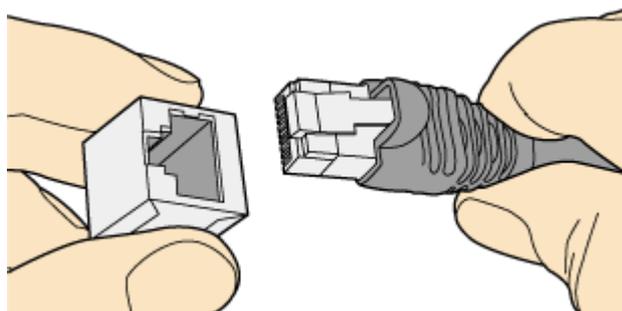
### 11.2.4.3 Installing Ethernet Adapters

#### 11.2.4.3.1 Installing a Shielded Ethernet Connector

##### Procedure

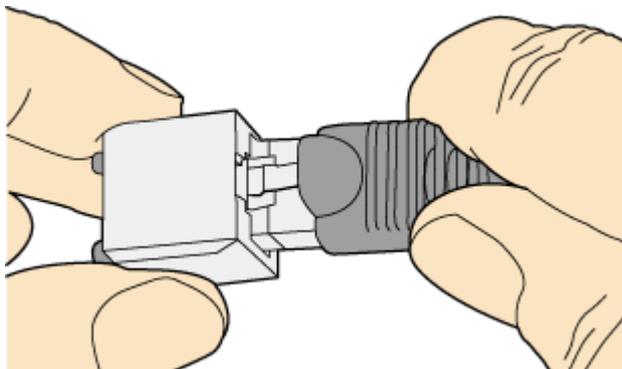
- Step 1** Hold the male and female connectors, with the male connector facing the female connector, as shown in [Figure 11-44](#).

**Figure 11-44** Holding the male and female shielded connectors



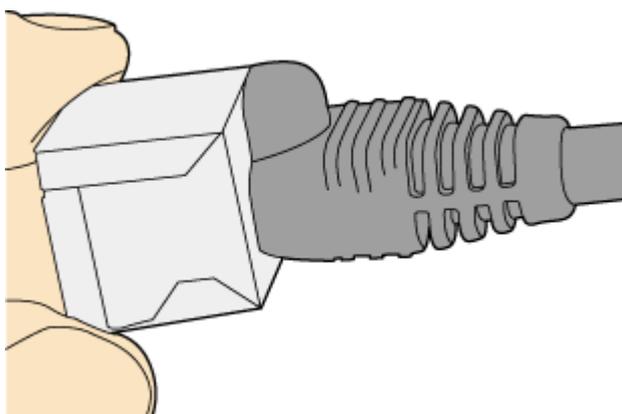
- Step 2** Insert the male connector into the female connector, as shown in [Figure 11-45](#).

**Figure 11-45** Feeding the male shielded connector into the female shielded connector



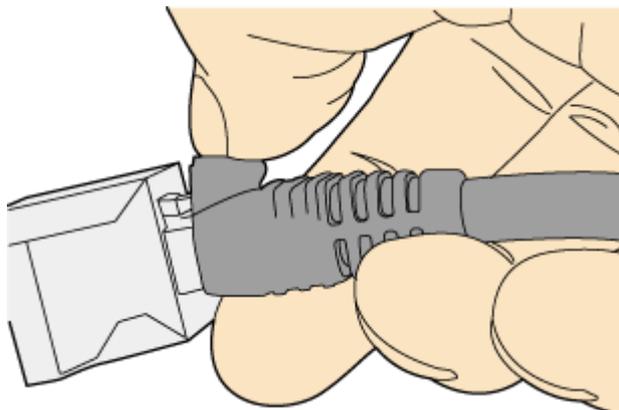
**Step 3** When you hear a click, the cable connector is completely inserted in the port. (The clip on the cable connector pops up to fix the connector in the port.) Pull the connector slightly and ensure that it is securely connected, as shown in [Figure 11-46](#).

**Figure 11-46** Installed shielded Ethernet connector



**Step 4** To remove an Ethernet connector, press the locking key and pull out the connector, as shown in [Figure 11-47](#).

**Figure 11-47** Removing a shielded Ethernet connector



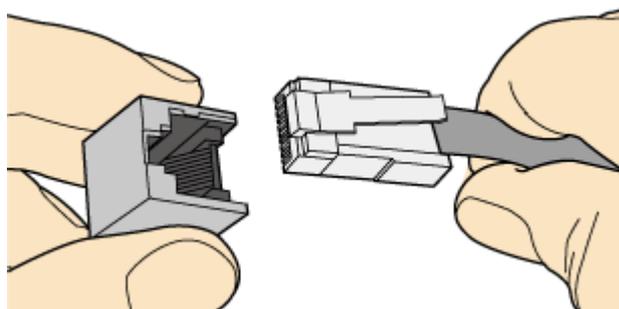
----End

### 11.2.4.3.2 Installing an Unshielded Ethernet Connector

#### Procedure

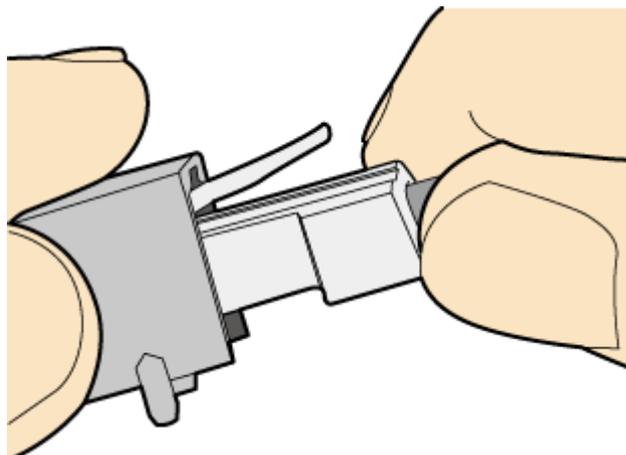
- Step 1** Hold the male and female connectors, with the male connector facing the female connector, as shown in [Figure 11-48](#).

**Figure 11-48** Holding the male and female unshielded connectors



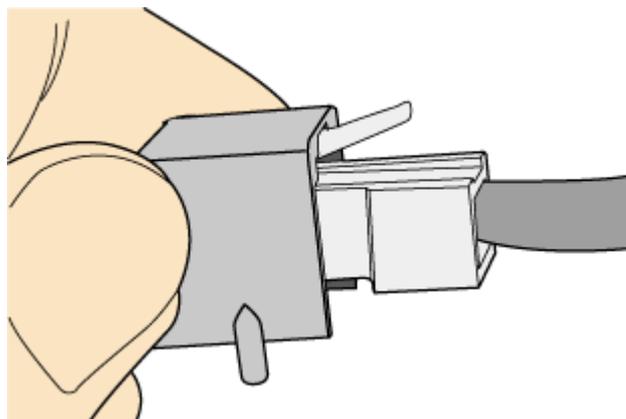
- Step 2** Feed the male connector into the female connector, as shown in [Figure 11-49](#).

**Figure 11-49** Feeding the male connector into the female unshielded connector



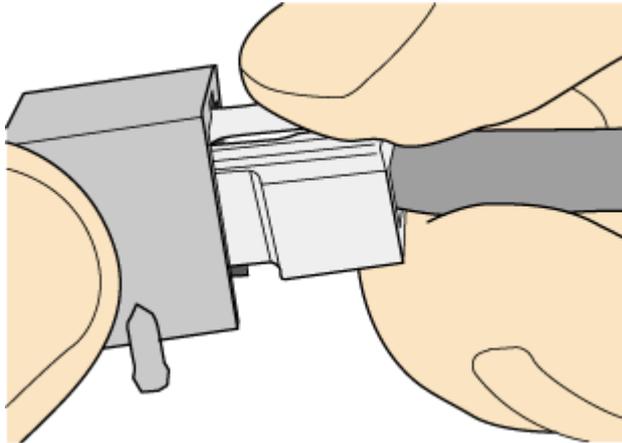
**Step 3** A crisp click indicates that the connector is locked by the locking key. Pull the connector slightly and ensure that it is securely connected. [Figure 11-50](#) shows an installed Ethernet connector.

**Figure 11-50** Installed unshielded Ethernet connector



**Step 4** To remove an Ethernet connector, press the locking key and pull out the connector, as shown in [Figure 11-51](#).

**Figure 11-51** Removing an unshielded Ethernet connector



----End

#### 11.2.4.4 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. Do not pull fiber protection pipes to remove fiber connectors.
- 

##### 11.2.4.4.1 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

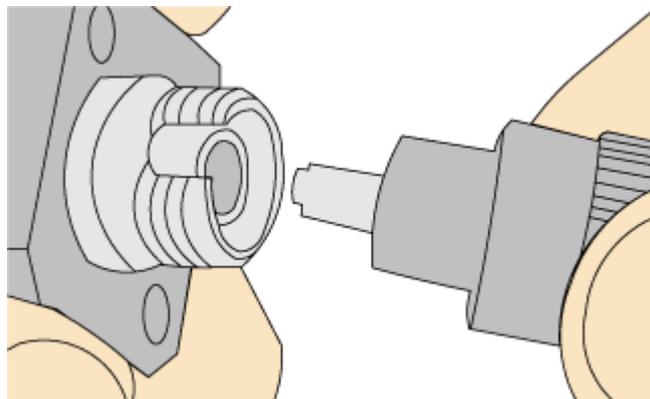
##### 11.2.4.4.2 Installing an FC Fiber Connector

###### Procedure

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

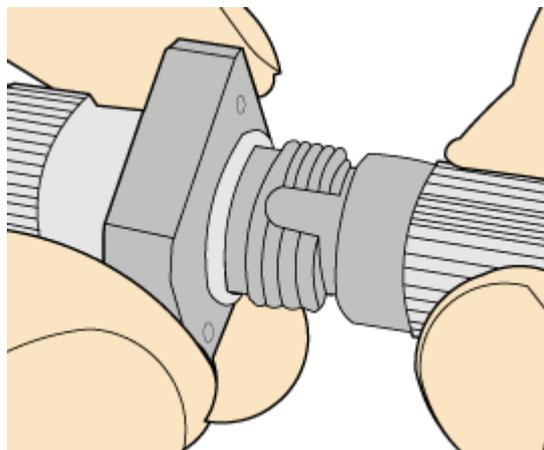
- Step 2** Align the core pin of the male connector with that of the female connector, as shown in [Figure 11-52](#).

**Figure 11-52** Aligning the male connector with the female connector



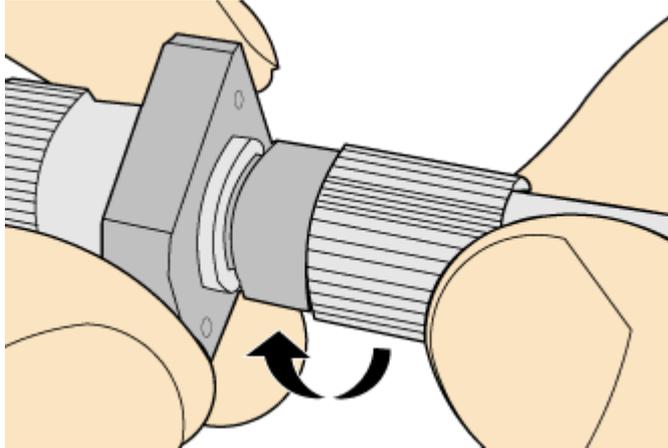
- Step 3** Align the male connector with the female connector and gently push the male connector until it is completely seated in the female connector, as shown in [Figure 11-53](#).

**Figure 11-53** Feeding the male connector into the female connector



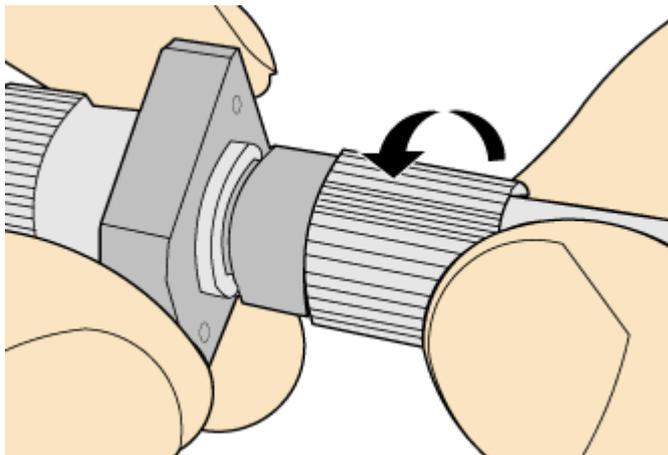
- Step 4** Fasten the locking nut clockwise and ensure that the connector is securely installed, as shown in [Figure 11-54](#).

**Figure 11-54** 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 11-55](#).

**Figure 11-55** Disassembling an FC fiber connector



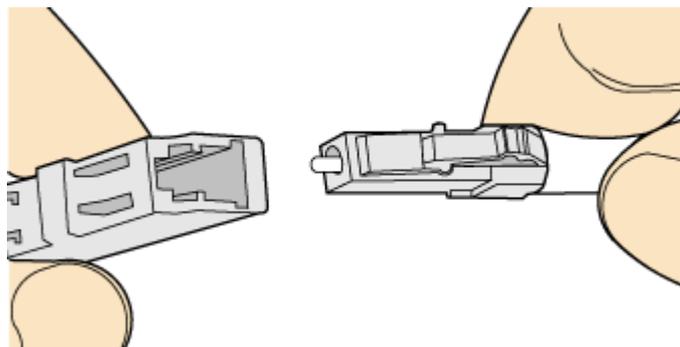
----End

#### 11.2.4.4.3 Installing an LC Fiber Connector

##### Procedure

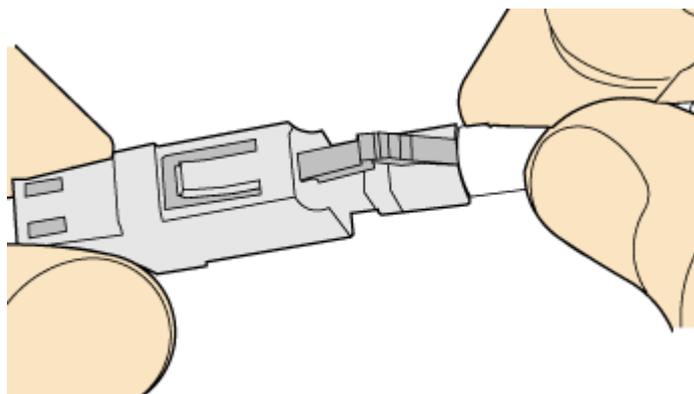
- Step 1** Remove the dustproof cap of the LC fiber connector and store it for future use.
- Step 2** Align the core pin of the male connector with that of the female connector, as shown in [Figure 11-56](#).

**Figure 11-56** Aligning the male connector with the female connector



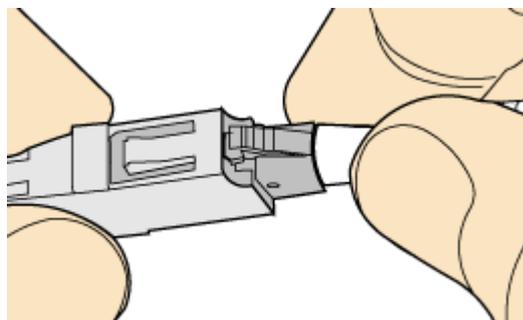
**Step 3** Align the male connector with the fiber adapter and gently push the male connector until it is completely seated in the fiber connector, as shown in [Figure 11-57](#).

**Figure 11-57** Feeding the male connector into the female connector



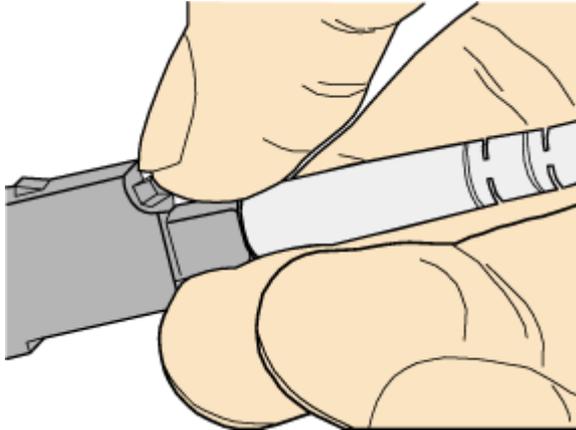
**Step 4** A clicking sound indicates that the male connector is locked, as shown in [Figure 11-58](#).

**Figure 11-58** 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 11-59](#).

**Figure 11-59** Disassembling an LC fiber connector



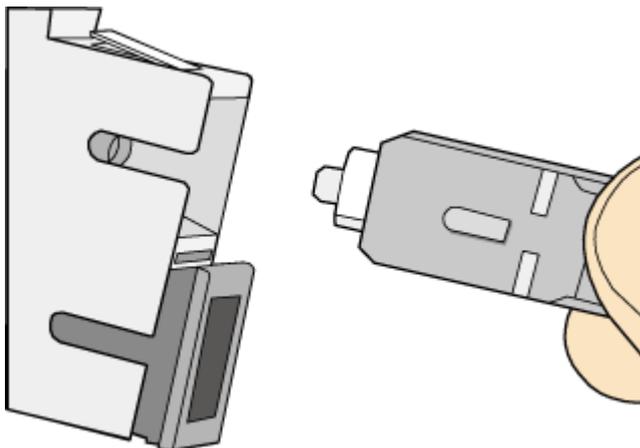
----End

#### 11.2.4.4.4 Installing the SC Fiber Connector

##### Procedure

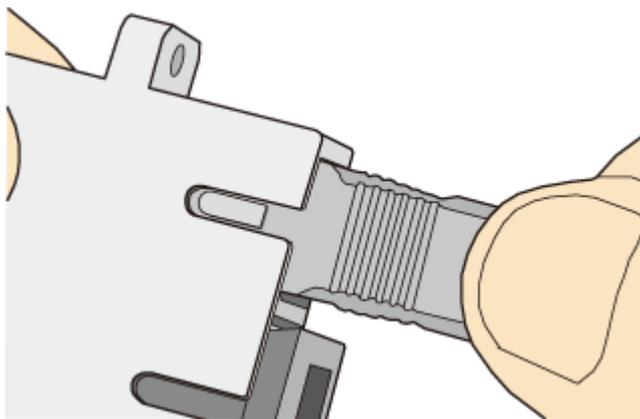
- Step 1** Remove the dustproof cap of the SC fiber connector and store it for future use.
- Step 2** Align the core pin of the male connector with that of the female connector, as shown in [Figure 11-60](#).

**Figure 11-60** Aligning the male connector with the female connector



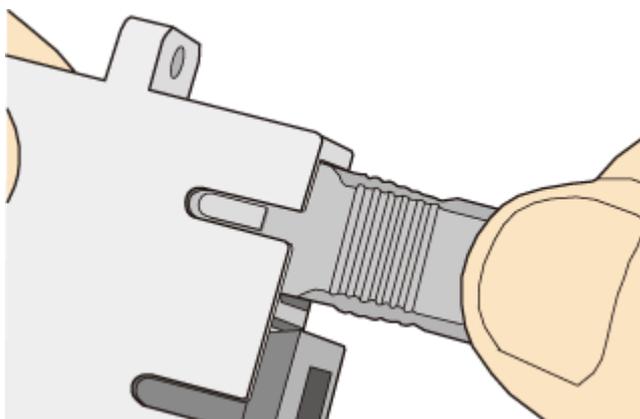
- Step 3** Feed the fiber connector into the female connector, with your fingers holding the shell of the fiber connector (not the pigtail). When you hear a click, the fiber connector is secured by the clips (internal parts, not illustrated in the figure). Pull the fiber connector gently. If the connector does not loosen, the installation is complete. See [Figure 11-61](#).

**Figure 11-61** 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 11-62](#).

**Figure 11-62** Disassembling an SC fiber connector



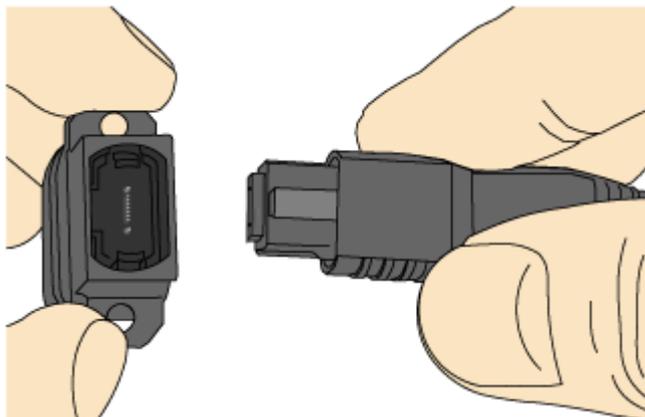
----End

#### 11.2.4.4.5 Installing an MPO Connector

##### Procedure

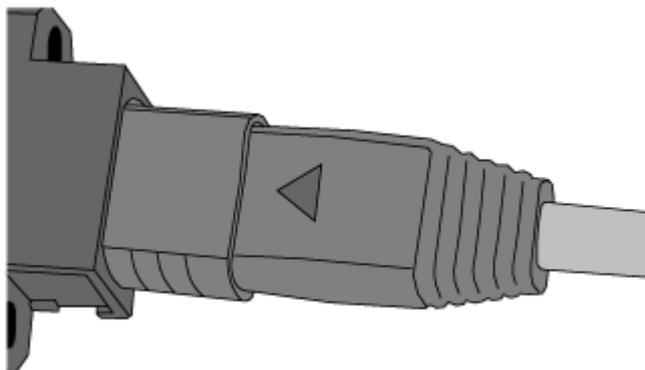
- Step 1** Remove the dustproof cap of the MPO fiber connector and store it for future use.
- Step 2** Align the core pin of the male connector with that of the female connector, as shown in [Figure 11-63](#).

**Figure 11-63** Aligning the male connector with the female connector



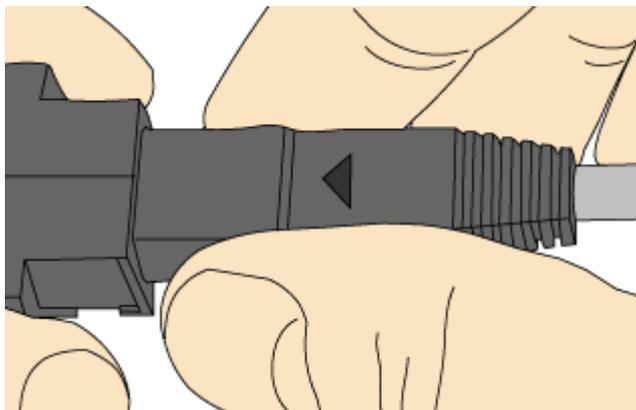
- Step 3** Hold the shell labeled "PUSH" and feed the male connector into the female connector until you hear a clicking sound. The male and female connectors are securely installed, as shown in [Figure 11-64](#).

**Figure 11-64** 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 11-65](#).

**Figure 11-65** Disassembling an MPO fiber connector



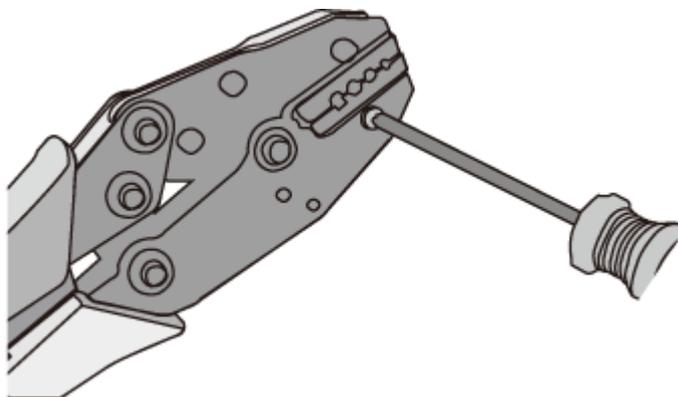
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## 11.2.5 Replacing the Mold of the Crimping Tool

### Procedure

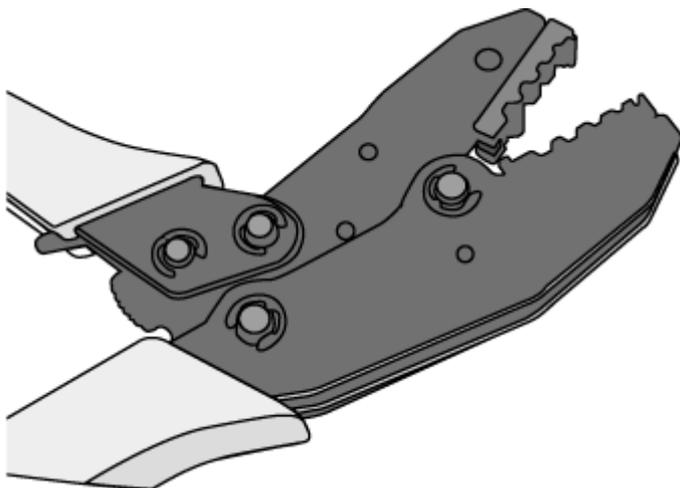
- Step 1** Hold the handles of a pair of COAX crimping tools. Loosen the two fastening screws counterclockwise, as shown in [Figure 11-66](#).

**Figure 11-66** Loosening two fastening screws



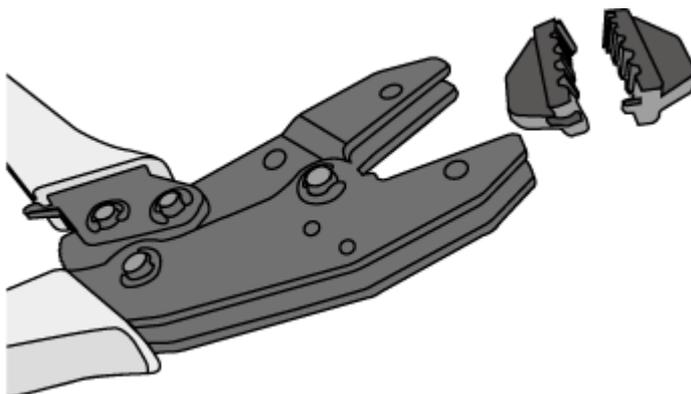
- Step 2** Hold the handles of the COAX crimping tools to open the self-locking mechanism. The jaw of the COAX crimping tools opens automatically, as shown in [Figure 11-67](#).

**Figure 11-67** Pliers jaw opening automatically



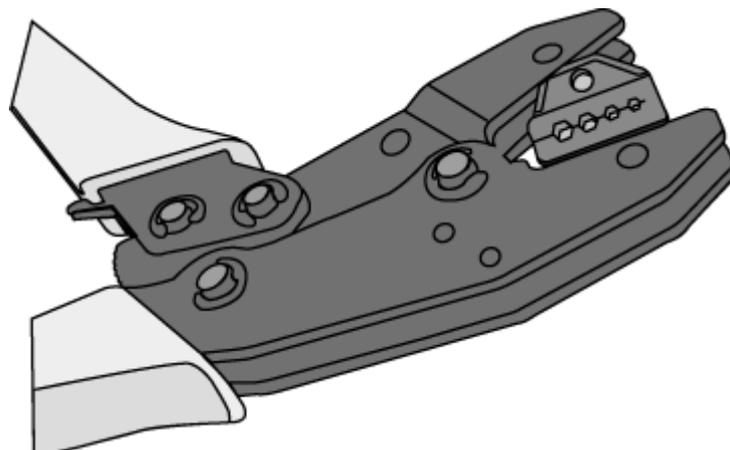
**Step 3** Remove the mold from the COAX crimping tools, as shown in [Figure 11-68](#).

**Figure 11-68** Removing the mold from the COAX crimping tools



**Step 4** Place the mold to be installed into the jaw of the COAX crimping tools and align the screw holes, as shown in [Figure 11-69](#).

**Figure 11-69** Installing a new mold in the COAX crimping tool



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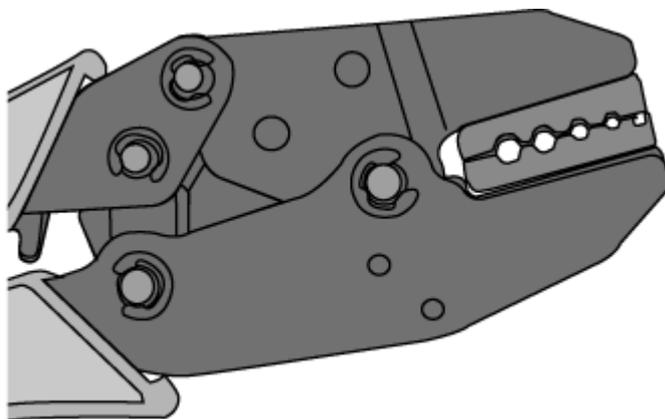
**NOTICE**

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

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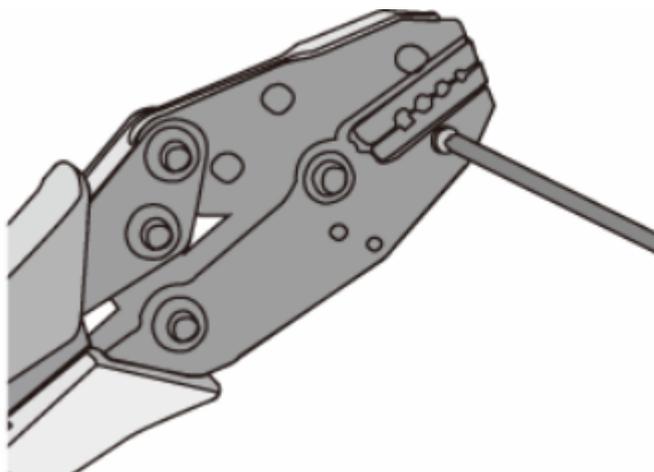
- Step 5** Hold the handles of the COAX crimping tools tightly to match the mold and the jaw completely. Align the screw holes, as shown in [Figure 11-70](#).

**Figure 11-70** Aligning the screw holes

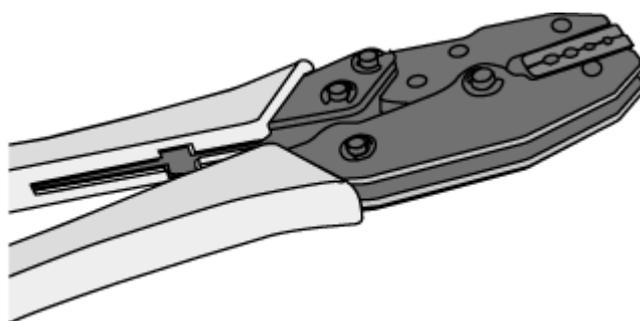


- Step 6** Hold the handles of the COAX crimping tools with one hand. Tighten the two fastening screws clockwise. [Figure 11-71](#) and [Figure 11-72](#) shows the mold installed in the COAX crimping tool.

**Figure 11-71** Mold installed in the COAX crimping tool



**Figure 11-72** An installed mold



----End

## 11.3 Appendix C Environmental Requirements for Device Operation

### 11.3.1 Environmental Requirements for an Equipment Room

#### 11.3.1.1 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-proof construction 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 safety, and civil air defense. Construction must conform to government standards, regulations, and other requirements.

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

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

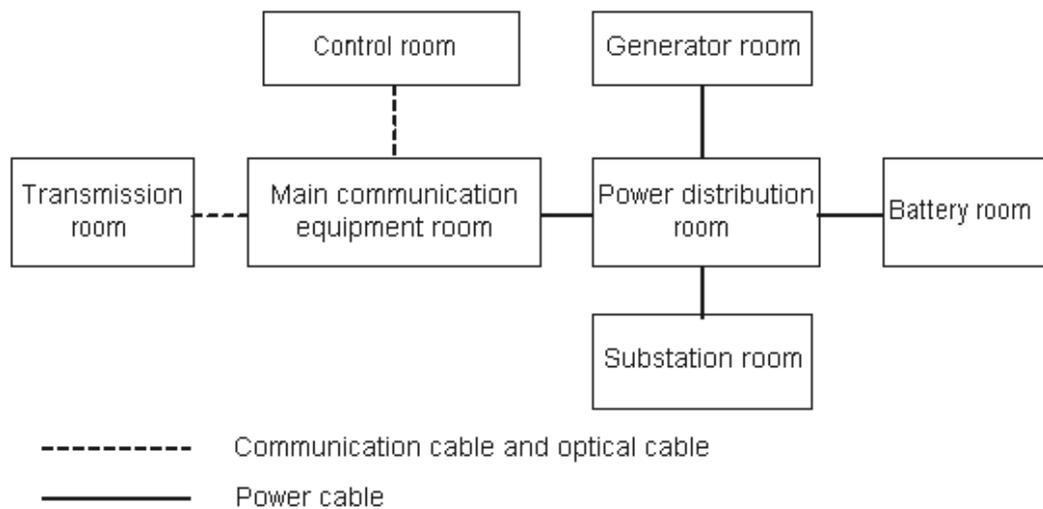
- The room should be located at a distance of at least 5 km (3.11 mi.) from heavy pollution sources such as smelting and coal mines. It should be located at a distance of at least 3.7 km (2.30 mi.) from moderate pollution sources such as chemical, rubber, and galvanization factories. It should be located 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, use a high-quality equipment room or protection products.
- The room should be located away from livestock farms, or be 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 residential areas. An equipment room that is not far away from residential areas must comply with equipment room construction standards to avoid noise pollution.
- The room should be located far away from industrial and heating boilers.
- 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 doors and windows of the equipment room must be kept closed to maintain 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 such that they are smooth, wear-resistant, dustproof, flame retardant, sound insulated, heat absorptive, and have 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.
- 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 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.

### 11.3.1.2 Equipment Room Layout

An equipment room usually contains mobile switching equipment, telecommunications equipment, power supply equipment, and other auxiliary equipment. To ensure easy maintenance and management, place the equipment in different rooms. **Figure 11-73** shows the layout of the equipment room.

**Figure 11-73** 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 facilitates cable maintenance, reduces potential communication faults, and maximizes efficiency.

### 11.3.1.3 Construction Requirements for the Equipment Room

**Table 11-14** describes the construction requirements for the equipment room.

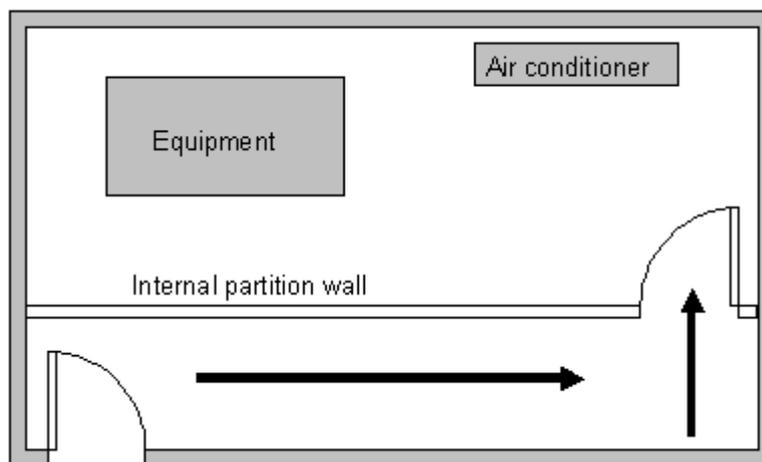
**Table 11-14** Construction requirements for the equipment room

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.

Item	Requirements
Floor	<p>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 <math>1.0 \times 10^7</math> ohms to <math>1.0 \times 10^{10}</math> ohms. Ground this floor material or raised floor. You can connect them to ground using a one megohm current-limiting resistor and connection line.</p>
Load-bearing capacity	<p>Evaluate whether the load bearing capacity of the floor in the equipment room meets the deployment requirements based on the model and number of devices to be housed in each cabinet. If it is uncertain whether the load bearing capacity of the floor in the equipment room meets the device installation requirements, you are advised to contact a local professional architecture design institute for further evaluation and hardening solution formulation.</p> <ul style="list-style-type: none"> <li>• When one device is installed in each cabinet, the minimum load bearing capacity of the equipment room is <math>200 \text{ kg/m}^2</math> (CloudEngine 16804), <math>450 \text{ kg/m}^2</math> (CloudEngine 16816), and <math>300 \text{ kg/m}^2</math> (CloudEngine 16808).</li> <li>• When multiple devices are installed in each cabinet, the minimum load bearing capacity of the equipment room is <math>450 \text{ kg/m}^2</math> (CloudEngine 16804) and <math>450 \text{ kg/m}^2</math> (CloudEngine 16808).</li> </ul>
Door and windows	<p>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.</p>
Wall surface treatment	<p>Paste wallpaper on the wall or apply flat paint. Do not use pulverized paint.</p>
Cable trays	<p>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.</p>
Water pipe	<p>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.</p>
Internal partition wall	<p>Separate the area where the equipment is installed from the equipment room door. The partition wall can block some outside dust.</p>

Item	Requirements
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 11-74** Internal partition wall inside the equipment room



### 11.3.1.4 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 11-15](#) lists the requirement for dust concentration in the equipment room.

**Table 11-15** Requirements for dust particles in the equipment room

Mechanical active material	Unit	Concentration
Dust particle	Particle /m <sup>3</sup>	≤ 3x 10 <sup>4</sup> (no visible dust accumulated on a workbench in three days)
Suspending dust	mg/m <sup>3</sup>	≤0.2

Mechanical active material	Unit	Concentration
Precipitable dust	mg/m <sup>2</sup> ·h	≤1.5
Description <ul style="list-style-type: none"> <li>• Dust particle diameter ≥ 5 μm</li> <li>• Suspending dust diameter ≤ 75 μm</li> <li>• 75 μm ≤ precipitable dust diameter ≤ 150 μm</li> </ul>		

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 and clean devices' air filters monthly.
- Wear shoe covers and ESD clothing before entering the equipment room.

### 11.3.1.5 Requirements for Corrosive Gases

The room should be free from dusts and corrosive gases, such as SO<sub>2</sub>, H<sub>2</sub>S, and NH<sub>3</sub>. [Table 11-16](#) lists the requirements for the corrosive gas concentration.

**Table 11-16** Requirements for corrosive gas concentration

Chemical active material	Unit	Concentration
SO <sub>2</sub>	mg/m <sup>3</sup>	≤0.30
H <sub>2</sub> S	mg/m <sup>3</sup>	≤0.10
NO <sub>x</sub>	mg/m <sup>3</sup>	≤0.50
NH <sub>3</sub>	mg/m <sup>3</sup>	≤1.00
Cl <sub>2</sub>	mg/m <sup>3</sup>	≤0.10
HCl	mg/m <sup>3</sup>	≤0.10
HF	mg/m <sup>3</sup>	≤0.01
O <sub>3</sub>	mg/m <sup>3</sup>	≤0.05

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 any pollution source.

- Place batteries in different rooms.
- A professional service should monitor the corrosive gas conditions regularly.

### 11.3.1.6 Requirements for ESD Prevention

The absolute value of electrostatic voltage must be less than 1000 V.

Take the following measures to meet this requirement:

- 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, foam, and rubber) at least 30 cm (11.81 in.) away from boards and ESD-sensitive components.

### 11.3.1.7 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 high-power radio transmitters, radar units, and high-frequency and high-current equipment.
- Use electromagnetic shielding if necessary.

### 11.3.1.8 Requirements for Lightning Proof Grounding

[Table 11-17](#) lists the requirements for lightning proof grounding.

**Table 11-17** Requirements for lightning proof grounding

Item	Requirements
Capital construction	<ul style="list-style-type: none"><li>• Use reinforced concrete to construct the equipment room.</li><li>• Install a lightning proof device like a lightning rod outside the room.</li><li>• The lightning proof ground shares the same grounding body with the protective ground of the room.</li></ul>

Item	Requirements
Power cables leading in the equipment room need to be equipped with a surge protector	<ul style="list-style-type: none"> <li>● After the low-voltage power cables are led into the room, install the surge protector for the power cables in the AC voltage stabilizer and the AC power distribution panel (box). Correctly ground the surge protector nearby.</li> <li>● For an equipment room in urban area, install a power supply surge protector with the nominal discharge current of no less than 20 kA. For an equipment room that is built in a suburb and subject to lightning strikes, install a power supply surge protector with the nominal discharge current of more than 60 kA. For an equipment room that is built in a mountain area and subject to frequent lightning strikes, or in a separate high-rise building in a city, install a power supply surge protector with the nominal discharge current of more than 100 kA.</li> <li>● The ground cable of the surge protector should be no longer than 1 m (3.28 ft).</li> </ul>
Grounding for DC power distribution	<ul style="list-style-type: none"> <li>● 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.</li> <li>● The power equipment must have a DC working ground cable, which can connect the power equipment to the collective ground cable of the telecommunication site (or the protective ground bar of the equipment room).</li> </ul>
Equipotential connection	<ul style="list-style-type: none"> <li>● Properly ground the devices and auxiliary devices in the room such as mobile base station, transmission, switching equipment, power supply equipment, and cable distribution frame. Connect all PGND cables to the collective protective ground bar. Connect all PGND cables in one equipment room to one protective ground bar.</li> <li>● Apply joint grounding to the working ground and protective ground of devices, which means the two share one grounding network.</li> <li>● The cable tray, rack or shell, metal ventilation pipe, metal door or window of the equipment should be grounded for protection.</li> </ul>
General requirements for grounding	<ul style="list-style-type: none"> <li>● Do not connect the neutral line of the AC power cable with the protective ground of any telecom equipment in the equipment room.</li> <li>● Do not install a fuse or switch on the ground cable.</li> <li>● All ground cables should be as short as possible, and arranged in a straight line.</li> </ul>

Item	Requirements
Grounding resistance	<ul style="list-style-type: none"> <li>• The grounding resistance must be lower than 1 ohm.</li> <li>• 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.</li> <li>• Measure the grounding resistance periodically to ensure effective grounding.</li> </ul>
Routing of signal cable	<ul style="list-style-type: none"> <li>• Do not arrange the signal cables overhead in the equipment room. All signal cables must be led into the site underground.</li> <li>• Use the cables with a metal jacket or place them into a metal pipe if they come out/in the equipment room.</li> <li>• Ground the idle lines inside the cable in the equipment room.</li> <li>• Signal cables should be deployed on internal walls. Do not deploy outdoor aerial cables.</li> <li>• Keep signal cables away from power cables and surge protection devices.</li> </ul>
Collective ground cable	<ul style="list-style-type: none"> <li>• Use a ground ring or ground bar for the collective ground cable.</li> <li>• Do not use aluminum cables as ground cables. Adopt measures to prevent electrification corrosion when connecting different metal parts together.</li> <li>• Use a copper busbar as the collective ground cable with a cross-sectional area of no less than 120 mm<sup>2</sup> (0.19 in.<sup>2</sup>), or use the galvanized flat steel of the same resistance. Insulate the collective ground cable from the reinforcing steel bars of the building.</li> </ul>
Grounding lead-in	<p>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.).</p>
Leakage current test	<p>A 100 mA residual-current circuit breaker (RCCB) is recommended for a leakage current test.</p>

## 11.3.2 Requirements for Power Supply

### 11.3.2.1 Requirements for AC Power Supply

An AC power supply system consists of power mains, uninterruptible power supplies (UPSs), and self-supplied electric generators, and should use a centralized power supply mode. 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 be 3-phase, 5-wire mode or monophas 3-wire mode. This AC power supply should be 110 V/220 V, with a frequency of 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 11-18** lists the voltage range of the AC power supply for the devices.

**Table 11-18** 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 protocols, 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.

### 11.3.2.2 Recommendations for AC Power Supply

The following are 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.
- A 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 uninterruptible 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.

### 11.3.2.3 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 11-19** lists the specifications for the DC power supply.

**Table 11-19** 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 $\pm 5\%$

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%.

### 11.3.2.4 Recommendations for DC Power Supply

The following are 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.
- Improve reliability of the AC power supply system to reduce the necessary capacity of storage batteries. For small offices, increase the capacity of storage batteries if it is difficult to enhance 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.

## 11.4 Appendix D Equipment Grounding Specifications

### 11.4.1 General Grounding Specifications

[Table 11-20](#) shows the general grounding specifications.

**Table 11-20** General grounding specifications

No.	Description
1	The working ground and protective ground, including the shielded ground and the lightning-proof ground 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 protective ground bar of the equipment room.
5	Do not use other equipment as part of the ground cable or electrical connection.

## 11.4.2 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.

## 11.4.3 Grounding Specifications for Devices

[Table 11-21](#) lists the equipment grounding specifications.

**Table 11-21** 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 protective ground for various devices jointly to a general ground bar, and then to the same protective ground bar in the room together with the protective ground (PGND) of the device.
2	The PGND of the equipment is shorted to the copper ground bar provided by the customer. The short-circuiting cable used should be a yellow-green plastic insulated cable with a copper core and a 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 of 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.

No.	Description
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.
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.

## 11.4.4 Grounding Specifications for Communications Power Supply

**Table 11-22** shows the grounding specifications for communication power supplies.

**Table 11-22** 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 protective 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 protective 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 protective ground of the DC power supply equipment should use the same grounding conductor with the protective 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.

## 11.4.5 Grounding Specifications for Signal Cables

**Table 11-23** lists the grounding specifications for signal cables.

**Table 11-23** 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 protective 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 protective ground of the MDF. The MDF should use the same grounding conductor as the cabinet.
4	Do not route signal cables overhead.

## 11.4.6 Specifications for Laying Out Grounding Cables

**Table 11-24** shows the specifications for the ground cable.

**Table 11-24** Specifications for laying out ground cables

No.	Description
1	The grounding wire should not run parallel to or twist around the signal cable.
2	Bury ground underground or arrange them indoors. Do not route ground cables overhead.
3	Do not connect two cables together to extend the PGND cable, or add any switches or fuses.
4	The PGND cable should be an alternating yellow and green plastic insulated one with a copper core.
5	The neutral line of the AC power cable cannot be connected to the protective ground of transmission and communication equipment in the equipment room.
6	A PGND cable should be as short as possible, with a length of no more than 45 m (147.64 ft).

## 11.5 Appendix E 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.

Engineering labels are specialized for power cables and signal cables:

- Signal cables include network cables, optical fibers, and user cables.
- Power cables include the AC power cables and DC power cables.

### NOTE

Fill in labels according to specified requirements to keep consistency of labels in the equipment room. Make a relevant statement in the self-check report.

### 11.5.1 Introduction to Labels

#### 11.5.1.1 Label Materials

Features:

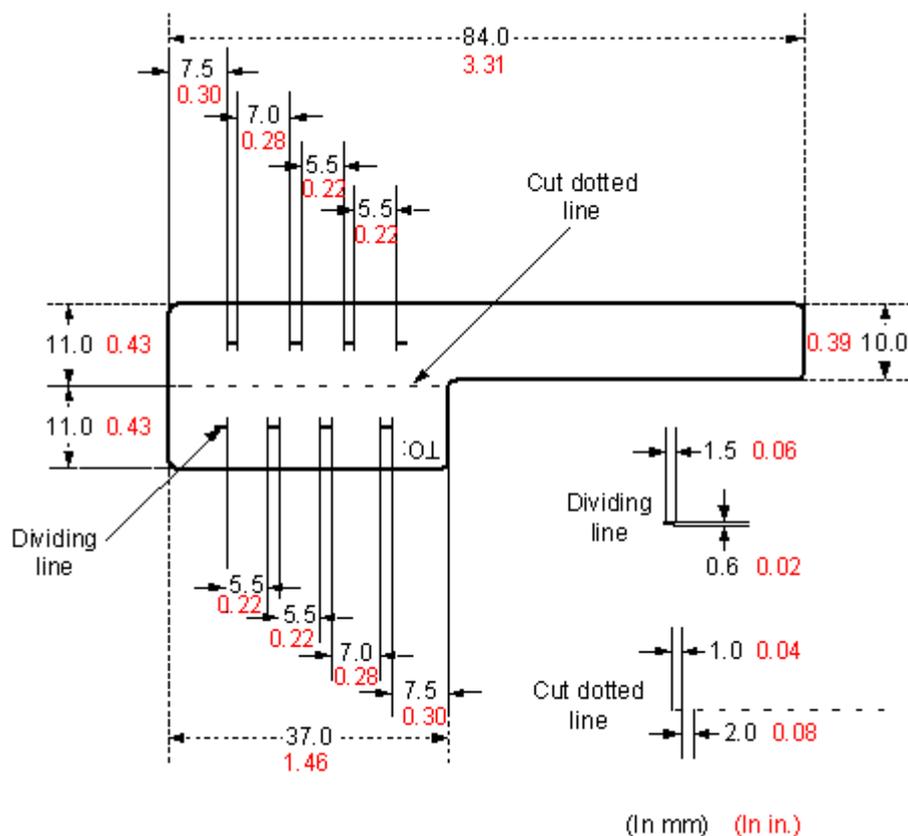
- Thickness: 0.09 mm (0.004 in.)
- Color: chalk white
- Material: polyester (PET)
- Ambient temperature: -29°C (-20.2°F) to +149°C (300.2°F)
- Printed by a laser printer and written with a marker
- Pass UL and CSA authentication

#### 11.5.1.2 Type and Structure

##### Label for Signal Cables

The label for signal cables is L-shaped with fixed dimensions, as shown in [Figure 11-75](#).

Figure 11-75 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. Each dividing line is light blue (Pantone 656c) and 1.5 mm x 0.6 mm (0.06 in. x 0.02 in.).

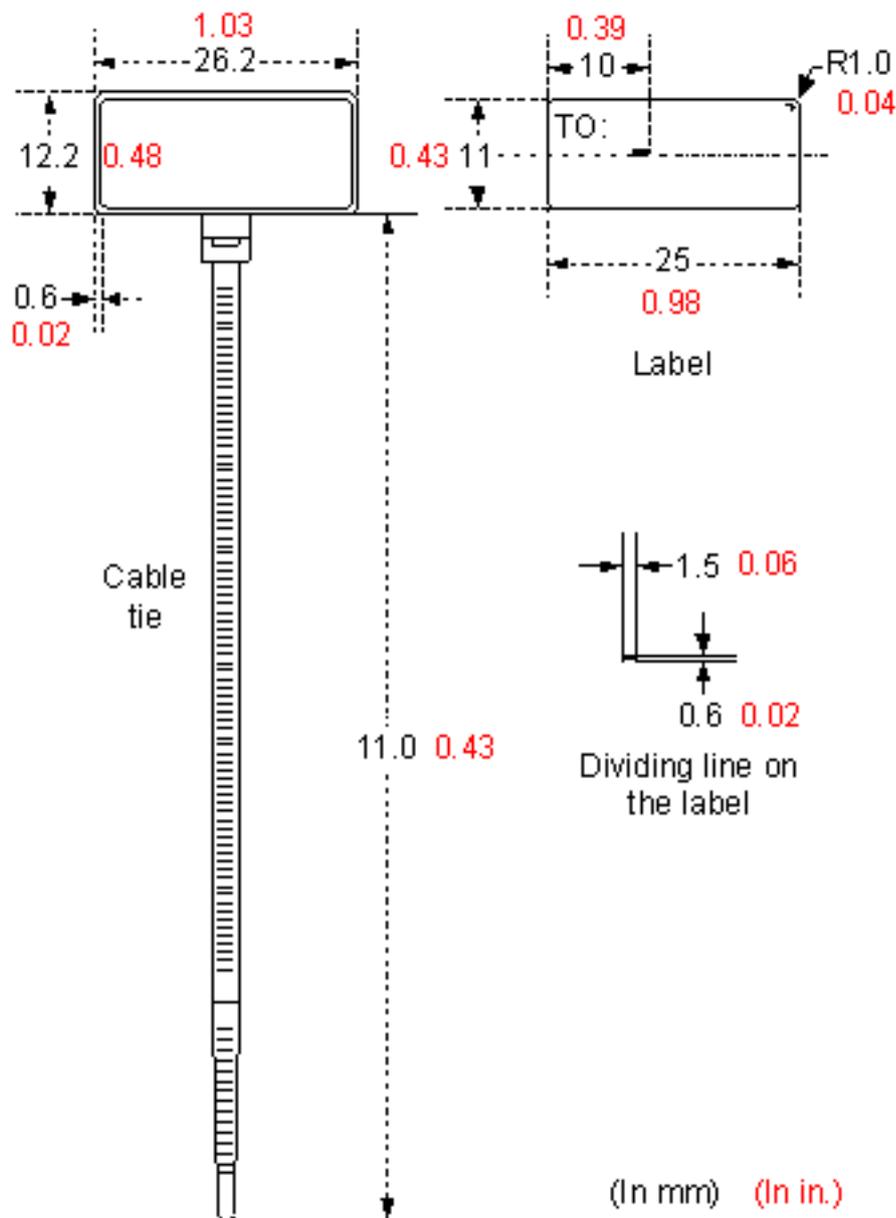
The cut dotted line helps to fold the label when affixed to the cable, and its size is 1 mm x 2 mm (0.04 in. x 0.08 in.).

The word "TO:" (upside down in the figure) at the lower right corner of the label 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 11-76](#).

Figure 11-76 Power cable label



### 11.5.1.3 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

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

The template is made in Microsoft Word. Follow these instructions to use the template:

- You can modify the contents of the template. Do not change settings of centered characters, direction, and fonts.
- If many characters need to be filled in, decrease the font size, 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 labels, use a laser jet printer of any model. Before printing labels, 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 the 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.

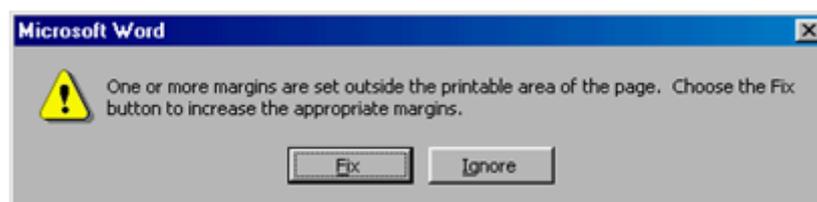
The method for adjusting the page setup is as follows.

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 11-77](#) appears before printing, click **Ignore** to continue the printing.

**Figure 11-77** 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 word "TO:" should not be covered by printed characters.
- When the cells are merged and the printouts are made in multiple lines, avoid covering the word "TO:" when printing the text. Use the space bar to move the text to the next line.

### 11.5.1.4 Writing Labels

#### Writing Tools

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

If no marker is available, black ball-point pens are allowed, although not recommended. Compared with ball-point pens, waterproof 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. Use the smaller nib to write the labels.

#### Font

For the sake of legibility, use standard block letters and numbers as shown in [Table 11-25](#) (Times New Roman).

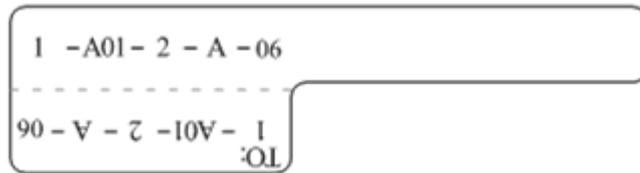
**Table 11-25** Standard typeface for handwriting

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 distinct and tidy.

Placement of text on a label is shown in [Figure 11-78](#).

**Figure 11-78** Placement of text on a label



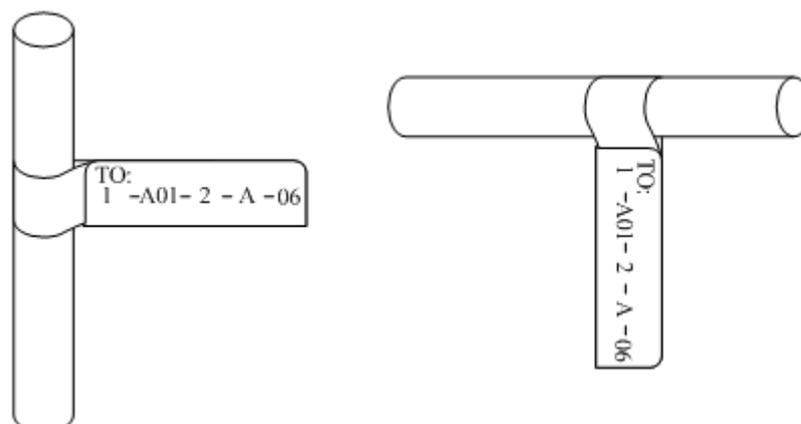
### 11.5.1.5 Attaching Labels

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

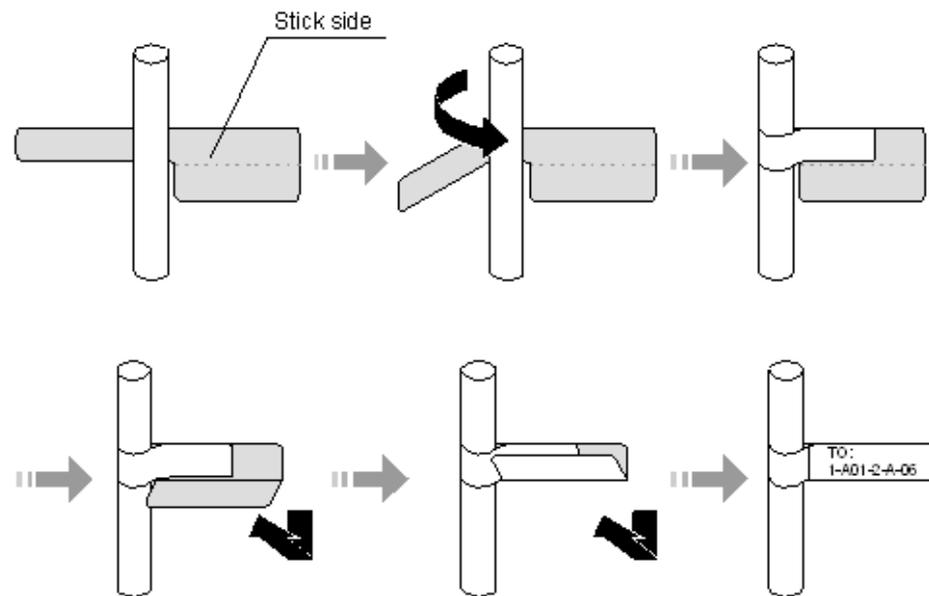
- Choose the place to attach labels.  
The label is attached 2 cm (0.79 in.) from the connector on a signal cable. In special cases (for example, to avoid cable bending or affecting other cables), other positions are allowed to attach the labels. The rectangular part with text is attached facing right or downward, as shown in [Figure 11-79](#). 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 11-79** Text area of the label



- Procedure for attaching labels  
[Figure 11-80](#) shows the methods and procedures for attaching labels.

**Figure 11-80** Label for signal cables



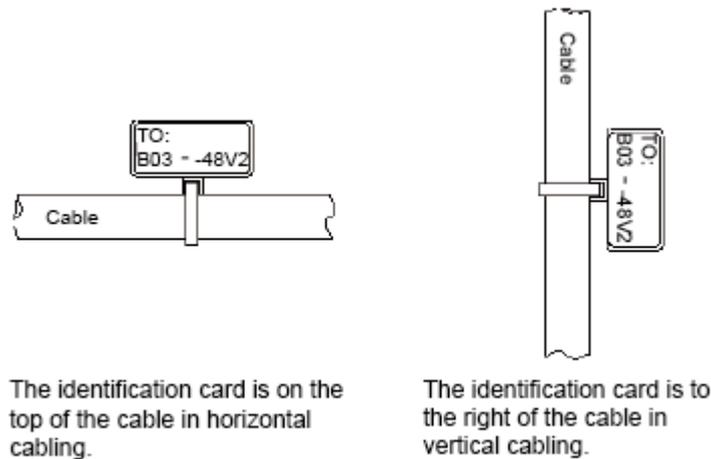
## Power Cable Label

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. In an equipment room, all labels should be attached in the same way. 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 11-81](#). 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 11-81** Binding the label for the power cable



### 11.5.1.6 Contents of Engineering Labels

#### Contents of Labels for Power Cables

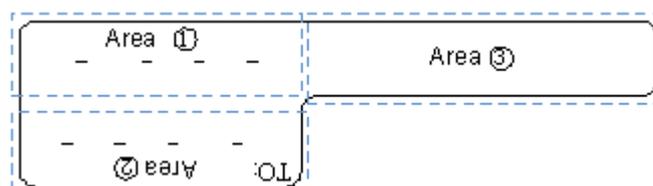
Labels for power cables are affixed on only one side of the identification plates. On the labels, there is information (the part after the word "TO:") about the location of the device on the other end of the cable, like the location of control cabinet, distribution box or power socket.

#### 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 11-82](#) 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 word "TO:") contains the location information of the opposite end of the cable.
- Area 3 has been folded up inside the label.

**Figure 11-82** 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.

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

### 11.5.1.7 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 material, ink-jet printers and ink pens cannot be used to print and write labels.
- Labels should be attached neatly. New-type labels are L-shaped. If they are pasted at incorrect locations or in the incorrect direction, 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 is working on the label.

## 11.5.2 Engineering Labels for Optical Fibers

These labels are affixed to the optical fibers that connect the optical interfaces. 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.

### 11.5.2.1 Labels for the Optical Fibers Connecting Devices

#### Meaning of the Label

**Table 11-26** lists information on both sides of the labels affixed to the optical fibers that connect two devices.

**Table 11-26** Information on labels affixed to the fibers between two devices

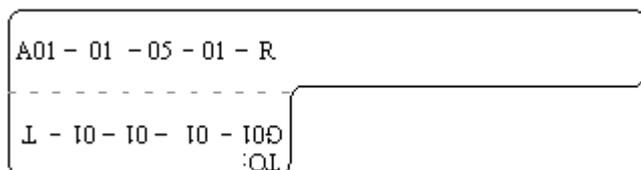
Content	Meaning	Example
MN-B-C-D-R/T	MN: cabinet number	M: The cabinet rows from front to back are numbered from A to Z. N: The cabinet columns from left to right are numbered from 01 to 99. For example, A01 is the cabinet in row A and column 01.
	B: chassis number	Numbered in bottom-up order with two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

Content	Meaning	Example
	C: physical slot number	Numbered in top-down and left-right order starting from 01. For example, 01 is the first slot at the top left of the chassis.
	D: optical interface number.	Numbered in top-down 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 11-83 shows a sample label on an optical fiber.

Figure 11-83 Sample label on an optical fiber between two devices



The meaning of the label is listed in Figure 11-83.

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

### 11.5.2.2 Labels for the Optical Fibers Connecting the Device and an ODF

#### Meaning of the Labels

Table 11-27 shows information on both sides of labels attached to an optical fiber between a device and an optical distribution frame (ODF).

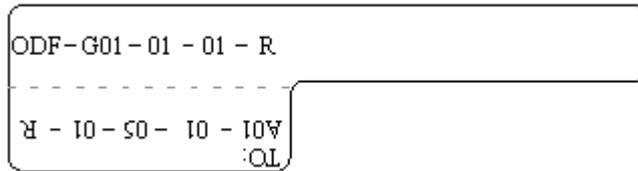
**Table 11-27** Information on labels affixed to a fiber between a device and an ODF

Content	Meaning	Example
MN-B-C-D-R/T	MN: cabinet number	For example, A01.
	B: chassis number	Numbered in bottom-up order with two digits, for example, 01.
	C: physical slot number	Numbered in top-down and left-right order starting from 01. For example, 01 is the first slot at the top left of the chassis.
	D: optical interface number.	Numbered in 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 11-84](#) shows a sample label on an optical fiber.

**Figure 11-84** Sample label on an optical fiber between the device and the ODF



Meaning of the label in [Figure 11-84](#)

- "ODF-G01-01-01-R" indicates that the local end of the optical fiber is connected to the optical receiving terminal in 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 in slot 05, chassis 01 in the cabinet in row A, column 01 in the machine room.

## 11.5.3 Engineering Labels for Network Cables

### Applicable Ranges

The labels can be applied to Ethernet cables.

### Label Content

[Table 11-28](#) shows the information on both sides of the labels affixed to Ethernet cables.

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

**Table 11-28** 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 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 top-down and left-right orders. For example, 01.
MN-Z	MN: cabinet number	For example, B02 is the second cabinet in row B.

Content	Meaning	Example
	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, specify the serial numbers of the cabinet, the chassis, and the Ethernet interface of the device. For example, B02-03-12. If the cable is connected to the Network Management Station (NMS), specify the specific location of the NMS.

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:

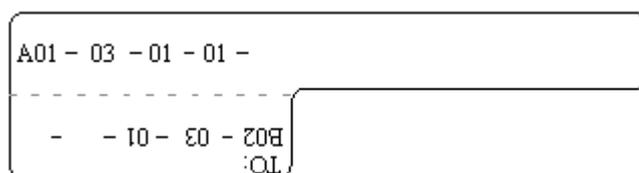
- For a network cable connecting a hub and device, the label on the hub end should indicate the numbers of the chassis and cabinet where the hub resides, and the serial number on the hub. The label on the device end should indicate the number of the chassis and cabinet where the device is located. If the device is a standalone device, provide the specific position of the device.
- 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 11-28](#).
- If the hub is a standalone device without a 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 standalone device should be specified according to actual connections.

## Label Example

[Figure 11-85](#) shows a sample label on an Ethernet cable.

**Figure 11-85** Sample label on an Ethernet cable



Meaning of the label in [Figure 11-85](#).

- "A01-03-01-01" indicates that one end of the network cable is connected to network interface 01 in slot 01, chassis 03 of the cabinet in 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 in chassis 03 of the cabinet on row B, column 02 in the equipment room. No slot number is given.

## 11.5.4 Engineering Labels for User Cables

Attach labels to both ends of a user cable to indicate the locations of the cable on the device and main distribution frame (MDF).

### Meaning of the Engineering Labels for User Cables

**Table 11-29** shows the contents of the labels.

**Table 11-29** 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 top-down and left-right order. For example, 01.
	D: cable number	Numbered with two digits in 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 11-86** shows a sample label on a user cable.

**Figure 11-86** Sample label on a user cable



The meaning of the label in [Figure 11-86](#) is as follows:

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

## 11.5.5 Engineering Labels for Power Cables

### 11.5.5.1 Engineering Labels for DC Power Cables

These 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 11-30](#).

**Table 11-30** Contents of the label

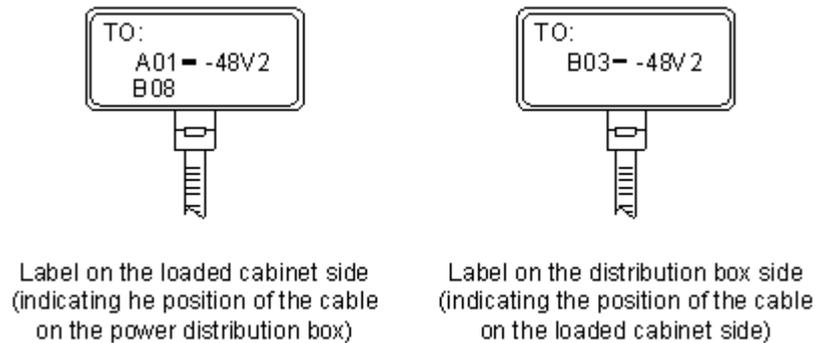
Content	Meaning
MN(BC)- B--48Vn	MN(BC): BC is written right under MN. B: chassis number, numbered in bottom-up order with two digits, for example, 01.
MN(BC)-B- BGND	N: power socket number, numbered as 1 to 3 in the bottom-up and left-to-right orders.
MN(BC)-B- PGND	On the loaded cabinet side, only MN is used to identify the cabinet. 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 to identify the row and column number for BGND and PGND.

The label only carries location information about the destination direction of the power cable whereas information about the local end is unnecessary. That is, the label only carries location information about the opposite equipment, the control cabinet, or the distribution box. [Table 11-30](#) 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 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. For details, see [Figure 11-87](#).

**Figure 11-87** Example of the labels for DC power cables



The meaning of the label in [Figure 11-87](#) 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 in row B of -48 V bus bar in the cabinet in 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 in 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, it makes no difference which terminal is connected to them. 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 in row A, column 01 in the machine room. Information on the labels for PGND cables should be given in a similar way.

### 11.5.5.2 Engineering Labels for AC Power Cables

These 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 11-31](#).

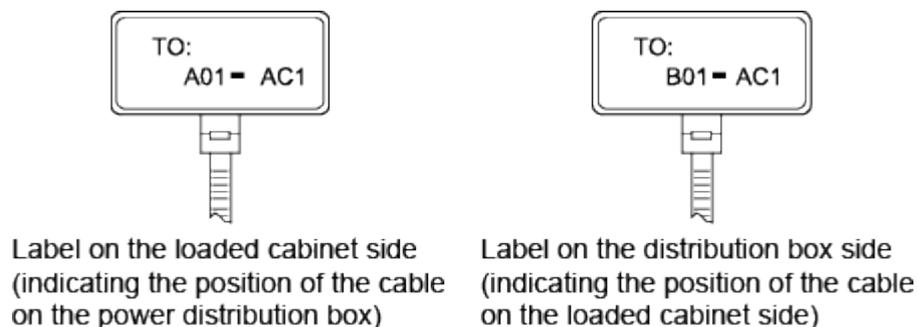
**Table 11-31** Label content

Content	Meaning
MN-(B)-ACn	<p>MN: serial number of the cabinet or the socket where the power is led in</p> <p>B: chassis number, numbered in bottom-up order with two digits, for example, 01.</p> <p>n: power port number, numbered as 1 to 3 in bottom-up and left-to-right order.</p> <p>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.</p>

The label only carries location information about the opposite equipment and the power socket; information about the local end is unnecessary.

Make sure that labels are affixed in the 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 11-88](#).

**Figure 11-88** Labels for AC power cables



Meaning of the label in [Figure 11-88](#).

- On the equipment cabinet side, the label marked "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 "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.

## 11.6 Appendix F Guide to Using Optical Modules

### Common Faults of an Optical Module

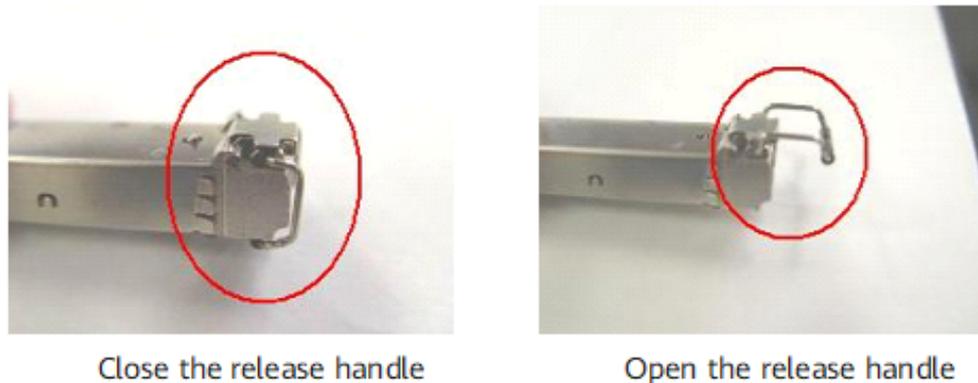
1. An optical module is not completely installed in position.  
If the optical module is not completely installed in position and the latch boss is not secured, the device cannot identify the optical module. After the optical module works for a long time, it will be ejected under external stress.
2. 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 high-power optical signals 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 avalanche photodiode (APD). 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 a Loosened Optical Module

1. When installing an optical module, insert it in 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 shaken or hit.
2. **Figure 11-89** 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.

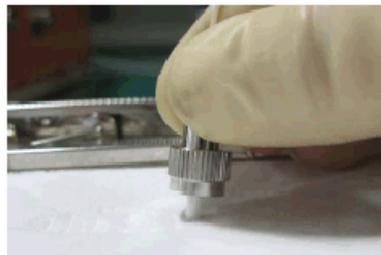
**Figure 11-89** State of the release handle



## 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 contamination on the surface of the optical connector.

**Figure 11-90** Cleaning optical fibers with special cleaning tissues

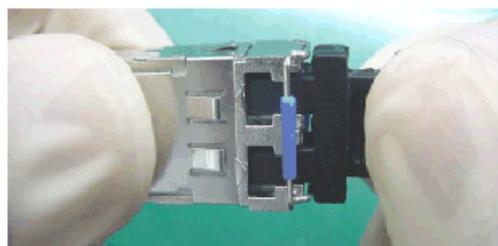


### NOTE

Place at least three cleaning tissues on the work bench. As shown in [Figure Cleaning optical fibers with special cleaning tissues](#), 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.

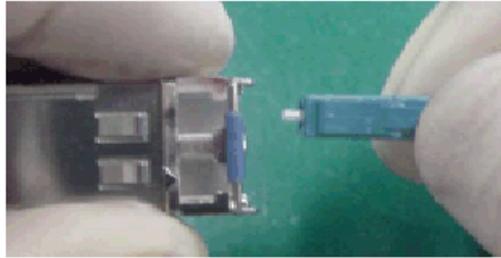
2. Cover an unused optical module with a protective cap to prevent dust, as shown in [Figure 11-91](#).

**Figure 11-91** Installing a protective cap



If no protective cap is available, use fibers to protect the optical module, as shown in [Figure 11-92](#).

**Figure 11-92** Using fibers to protect an optical module



3. Cover unused optical connectors with protective caps, as shown in [Figure 11-93](#), and then lay out fibers on the fiber rack or coil them in a fiber management tray to prevent fibers from being squeezed.

**Figure 11-93** 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 11-94](#). Clean an optical connector with cleaning tissues.

**Figure 11-94** Cleaning a receptacle with a cotton swab



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#### 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 an optical fiber from an optical module, and connect both ends of the optical fiber to the OTDR. 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.

## 11.7 Appendix G Fault Tag

*Customer name:						
Address:						
Contact person:						
Tel.:			Fax:			
Category*: <input type="checkbox"/> RMA <input type="checkbox"/> Return <input type="checkbox"/> 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.